8.6 Heritage Impact Assessment

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A PHASE I HERITAGE IMPACT ASSESSMENT (HIA) STUDY FOR THE PROPOSED VANDYKSDRIFT CENTRAL (VDDC) MINING AND INFRASTRUCTURAL DEVELOPMENT IN THE MPUMALANGA PROVINCE

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EXECUTIVE SUMMARY

A Phase I Heritage Impact Assessment (HIA) study as required in terms of Section 38 of the National Heritage Resources Act (Act No 25 of 1999) was done for the proposed Vandyksdrift Central (VDDC) mining infrastructural development project (VDDC Project) on the Eastern Highveld in the Mpumalanga Province of South Africa. The aims with the heritage survey and impact assessment for the VDDC Project were the following:

- To establish whether any of the types and ranges of heritage resources as outlined in Section 38 of the National Heritage Resources Act (No 25 of 1999) (NHRA) do occur in the project area.
- To establish the significance of the heritage resources in the project area and the level of significance of any possible impact on any of these heritage resources.
- To propose mitigation measures for those types and ranges of heritage resources that may be affected by the proposed VDDC Project.

The heritage survey revealed that the following heritage resources as outlined in Section 38 of the NHRA still occur in the project area, namely:

- Historical structures consisting of rail infrastructure and pump stations.
- Two graveyards.

The heritage resources were geo-referenced and mapped; their significance is indicated whilst the significance of the impact of the development on these remains is also outlined.

THE SIGNIFICANCE OF THE HERITAGE RESOURCES

The significance of the historical remains

The historical structures comprise remains which are older than sixty years or which are approaching this age and which therefore are protected by theNHRA.

The historical remains are rated as of medium significance. This rating is based on the use of two rating (grading) schemes, namely:

- A scheme of criteria which outlines places and objects as part of the national estate as they have cultural-historical significance or other special value (outlined in Section 3 of the NHRA).
- A field rating scheme according to which heritage resources are graded in three tiers (levels) of significance based on the regional occurrence of heritage resources (Section 7 of the NHRA).

The significance of the graveyards

All graveyards and graves can be considered to be of high significance and are protected by various laws. Legislation with regard to graves includes Section 36 of the NHRA in instances where graves are older than sixty years. Other legislation with regard to graves includes those which apply when graves are exhumed and relocated, namely the Ordinance on Exhumations (No 12 of 1980) and the Human Tissues Act (No 65 of 1983 as amended). Municipal laws with regard to graves and graveyards may differ and professionals involved with the exhumation and relocation of graves and graveyards must adhere to these laws.

Possible impact on the heritage resources

According to the layout plan for the VDDC Project the following can be noted:

- The historical structures consisting of pump stations and a railway siding will not be affected by the proposed VDDC Project.
- GY02 will be affected by the section of the opencast pit that has not been authorised (Figure 9).

THE SIGNIFICANCE OF THE IMPACT ON THE HERITAGE RESOURCES

The significance of the impact on the historical remains

None of the historical remains will be affected by the proposed VDDC Project. The significance of the impact on these remains therefore is very low.

The significance of the impact on the graveyards

GY01 will not be affected by the VDDC Project. The significance of the impact on GY01 therefore is very low and will remain very low if management measures as outlined in the report are implemented.

GY02 will be affected by open cast mining activities. The significance of the impact on GY02 therefore is very high, but will be low if mitigation measures as outlined in the report be implemented.

Mitigating the graveyard (GY02) that will be affected

GY02 must be exhumed and relocated. The exhumation of human remains and the relocation of graveyards are regulated by various laws, regulations and administrative procedures. This task is undertaken by forensic archaeologists or by reputed undertakers who are acquainted with all the administrative procedures and relevant legislation that have to be adhered to whenever human remains are exhumed and relocated. This process also includes social consultation with a 60 days statutory notice period for graves older than sixty years. Permission for the exhumation and relocation of human remains have to be obtained from the descendants of the deceased (if known), the National Department of Health, the Provincial Department of Health, the Premier of the Province and the local police. Municipal laws with regard to graves and graveyards may differ and professionals involved with the exhumation and relocation of graves and graveyards must adhere to these laws.

Managing the graveyard (GY01) that remains unaffected

GY01 in the VDDC project area must be managed in order to ensure its future unaffected existence in the project area, namely:

- The graveyard must be demarcated with a fence or with walls and should be fitted with an access gate. Relatives of the deceased must be located by means of social consultation and to obtain permission for fencing or walling the cemetery.

- Regulated visitor hours must be implemented that is compatible with safety rules. This will not be necessary if the graveyard is located next to a public or national road which can provide direct access to the graveyard.
- Corridors of at least 100 m should be maintained between the graveyard's border fences and any developmental components such as roads or other infrastructure that may be developed in the future. This buffer zone must be maintained at all times.
- The graveyard should be inspected every three months. Inspections should be noted in an inspection register. The register should outline the state of the graveyard during each inspection. Reports on damages to any of the graves or to the graveyards (fences, walls, gates) should be followed with the necessary maintenance work. Maintenance work should be recorded in the inspection register.
- The graveyards should be kept tidy from any invader weeds and any other refuse.

Chance-find procedures

Chance-find Procedures are applicable during the construction, operation or closure phases of the VDDC Project and apply to all contractors, subcontractors, subsidiaries or service providers. If any of these institutions' employees find any heritage resources during any developmental activity all work at the site must be stopped and kept on hold. Chance finds must be reported to supervisors and through supervisors to the senior manager on site. Chance find procedures for heritage resources and graveyards are outlined in the report.

General (disclaimer)

It is possible that this Phase I HIA study may have missed heritage resources in the Project Area. If any heritage resources of significance is exposed during the coal mining project the South African Heritage Resources Authority (SAHRA) should be notified immediately, all development activities must be stopped and an archaeologist accredited with the Association for Southern African Professional Archaeologist (ASAPA) should be notify in order to determine appropriate mitigation measures for the discovered finds. This may include obtaining the necessary authorisation (permits) from SAHRA to conduct the mitigation measures.

ACRONYMS AND ABBREVIATIONS

ASAPA	Association of South African Professional Archaeologists
BP	Before Present
EA	Environmental Authorisation
EAP	Environmental Assessment Practitioner
EIA	Environmental Impact Assessment
EIA	Early Iron Age
EMPr	Environmental Management Programme
EMPR	Environmental Management Programme Report
ESA	Early Stone Age
GPS	Global Positioning System
GY	Graveyard
HIA	Heritage Impact Assessment
LIA	Late Iron Age
LSA	Late Stone Age
MIA	Middle Iron Age
MPRDA	Mineral and Petroleum Resources Development Act, Act No 28 of 2002
MSA	Middle Stone Age
NEMA	National Environmental Management Act, Act No 107 of 1998
NEM:WA	National Environmental Management: Waste Act, Act No 59 of 2008
NHRA	National Heritage Resources Act, Act No 25 of 1999
No	Number
NWA	National Water Act, Act No 36 of 1998
PHRA	Provincial Heritage Resource Agency
SAHRA	South African Heritage Resources Agency
SAHRIS	South African Heritage Resources Information System
South32	South32 SA Coal Holdings (Pty) Ltd
ToR	Terms of Reference
VDDC	Vandyksdrift Central
WUL	Water use licence

TERMINOLOGY

Terms that may be used in this report are briefly outlined below:

- Conservation: The act of maintaining all or part of a resource (whether renewable or non-renewable) in its present condition in order to provide for its continued or future use. Conservation includes sustainable use, protection, maintenance, rehabilitation, restoration and enhancement of the natural and cultural environment.

- Cultural resource management: A process that consists of a range of interventions and provides a framework for informed and value-based decision-making. It integrates professional, technical and administrative functions and interventions that impact on cultural resources. Activities include planning, policy development, monitoring and assessment, auditing, implementation, maintenance, communication, and many others. All these activities are (or will be) based on sound research.

- Cultural resources: A broad, generic term covering any physical, natural and spiritual properties and features adapted, used and created by humans in the past and present. Cultural resources are the result of continuing human cultural activity and embody a range of community values and meanings. These resources are non-renewable and finite. Cultural resources include traditional systems of cultural practice, belief or social interaction. They can be, but are not necessarily identified with defined locations.

- Heritage resources: The various natural and cultural assets that collectively form the heritage. These assets are also known as cultural and natural resources. Heritage resources (cultural resources) include all human-made phenomena and intangible products that are the result of the human mind. Natural, technological or industrial features may also be part of heritage resources, as places that have made an outstanding contribution to the cultures, traditions and lifestyles of the people or groups of people of South Africa.

- In-Situ Conservation: The conservation and maintenance of ecosystems, natural habitats and cultural resources in their natural and original surroundings.

- Iron Age: Refers to the last two millennia and ‘Early Iron Age’ to the first thousand years AD. ‘Late Iron Age' refers to the period between the 16th century and the 19th century and can therefore include the Historical Period.

- Maintenance: Keeping something in good health or repair.

- Pre-historical: Refers to the time before any historical documents were written or any written language developed in a particular area or region of the world. The historical period and historical remains refer, for the Project Area, to the first appearance or use of ‘modern’ Western writing brought to the Eastern Highveld by the first Colonists who settled here from the 1840’s onwards.

- Preservation: Conservation activities that consolidate and maintain the existing form, material and integrity of a cultural resource.

- Recent past: Refers to the 20th century. Remains from this period are not necessarily older than sixty years and therefore may not qualify as archaeological or historical remains. Some of these remains, however, may be close to sixty years of age and may, in the near future, qualify as heritage resources.

- Protected area: A geographically defined area designated and managed to achieve specific conservation objectives. Protected areas are dedicated primarily to the protection and enjoyment of natural or cultural heritage, to the maintenance of biodiversity, and to the maintenance of life-support systems. Various types of protected areas occur in South Africa.

- Reconstruction: Re-erecting a structure on its original site using original components.

- Replication: The act or process of reproducing by new construction the exact form and detail of a vanished building, structure, object, or a part thereof, as it appeared at a specific period.

- Restoration: Returning the existing fabric of a place to a known earlier state by removing additions or by reassembling existing components.

- Stone Age: Refers to the prehistoric past, although Late Stone Age people lived in South Africa well into the Historical Period. The Stone Age is divided into an Earlier Stone Age (3 million years to 150 000 thousand years ago) the Middle Stone Age (150 000 years to 40 000 years ago) and the Late Stone Age (40 000 years to 200 years ago).

- Sustainability: The ability of an activity to continue indefinitely, at current and projected levels, without depleting social, financial, physical and other resources required to produce the expected benefits.

- Translocation: Dismantling a structure and re-erecting it on a new site using original components.

- Project Area: refers to the area (footprint) where the developer wants to focus its development activities.

- Phase I studies refer to surveys using various sources of data in order to establish the presence of all possible types and ranges of heritage resources in any given Project Area (excluding paleontological remains as these studies are done by registered and accredited palaeontologists).

- Phase II studies include in-depth cultural heritage studies such as archaeological mapping, excavating and sometimes laboratory work. Phase II work may include the documenting of rock art, engraving or historical sites and dwellings; the sampling of archaeological sites or shipwrecks; extended excavations of archaeological sites; the exhumation of human remains and the relocation of graveyards, etc. Phase II work involves permitting processes, requires the input of different specialists and the co-operation and approval of the SAHRA.

CONTENTS

1 INTRODUCTION

1.1 Background and context

Jones & Wagener Engineering and Environmental Consultants (J&W) was appointed by South32 SA Coal Holdings Pty Ltd (South32) as an independent Environmental Assessment Practitioner (EAP) to undertake an Integrated Regulatory Process to obtain the required approvals/authorisations for the proposed infrastructure and mining development at the Vandyksdrift Central (VDDC) section of the Wolvekrans Colliery.

The environmental applications foreseen include:

- Application for an Environmental Authorisation (EA) through a Scoping and Environmental Impact Assessment Report (S&EIAR) process and the compilation of an Environmental Management Programme (EMPr) in terms of the National Environmental Management Act, 1998 (Act No 107 of 1998; NEMA) and its 2014 Regulations, as amended in 2017;
- Waste Management Licence Application in terms of the National Environmental Management: Waste Act, 2008 (Act No 59 of 2008; NEM:WA); and
- Integrated Water Use Licence Application in terms of the National Water Act, 1998 (Act No 36 of 1998; NWA), including an Integrated Water and Waste Management Plan.

This Phase I Heritage Impact Assessment (HIA) study undertaken in terms of Section 38 of the National Heritage Resources Act, 1999 (Act No 25 of 1999, NHRA) is part of this process.

1.2 Aims with this report

This study comprises a heritage survey and a HIA study for the VDDC Project. The aims with the heritage survey and impact assessment for the VDDC project area were the following:

- To establish whether any of the types and ranges of heritage resources as outlined in Section 38 of the NHRA do occur in the project area.
- To establish the significance of the heritage resources in the project area and the level of significance of any possible impact on any of these heritage resources.
- To propose mitigation measures for those types and ranges of heritage resources that may be affected by the proposed VDDC Project.

1.3 Assumptions and limitations

The findings, observations, conclusions and recommendations reached in this report are based on the author's best scientific and professional knowledge, available information and his ability to keep up with the physical and other comprehensive challenges that the project commanded. The author has a good understanding of the types and ranges of heritage resources that occur on the Eastern Highveld as he was involved in several heritage impact assessment studies in the area during the last fifteen years (See Part 12, 'Bibliography relating to earlier heritage studies').

The report's findings are based on accepted archaeological survey and assessment techniques and methodologies.

Areas that were not covered on foot comprise current and older abandoned mining areas as well as unaltered pieces of land which seem to have been utilized for agricultural activities in the past. The project area was also surveyed on at least two known occasions in the past when HIAs were done by heritage specialists.

The author reserves the right to modify aspects of the report including the recommendations if and when new information becomes available particularly if this information may have an influence on the reports final results and recommendations.

The heritage survey may have missed heritage resources as heritage sites may occur in tall grass or thick clumps of vegetation whilst others may be located below the surface of the earth and may only be exposed once development commences.

It is also possible that heritage resources may simply have been missed as a result of human failure either to observe or to recognise them as such.

2 DETAILS OF THE SPECIALIST

Profession: Archaeologist, Museologist (Museum Scientists), Lecturer, Heritage Guide Trainer and Heritage Consultant

Qualifications:

BA (Archaeology, Anthropology and Psychology) (UP, 1976)

BA (Hons) Archaeology (distinction) (UP, 1979)

MA Archaeology (distinction) (UP, 1985)

D Phil Archaeology (UP, 1989)

Post Graduate Diploma in Museology (Museum Sciences) (UP, 1981)

Work experience:

Museum curator and archaeologist for the Rustenburg and Phalaborwa Town Councils (1980-1984)

Head of the Department of Archaeology, National Cultural History Museum in Pretoria (1988-1989)

Lecturer and Senior lecturer Department of Anthropology and Archaeology, University of Pretoria (1990-2003)

Independent Archaeologist and Heritage Consultant (2003-)

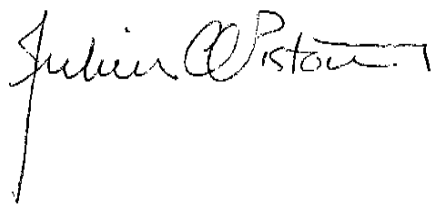
Accreditation: Member of the Association for Southern African Professional Archaeologists. (ASAPA)

Summary: Julius Pistorius is a qualified archaeologist and heritage specialist with extensive experience as a university lecturer, museum scientist, researcher and heritage consultant. His research focussed on the Late Iron Age Tswana and Lowveld-Sotho (particularly the Bamalatji of Phalaborwa). He has published a book on early Tswana settlement in the North-West Province and has completed an unpublished manuscript on the rise of Bamalatji metal workings spheres in Phalaborwa during the last 1 200 years. He has excavated more than twenty LIA settlements in North-West and twelve IA settlements in the Lowveld and has mapped hundreds of stone walled sites in the North-West. He has written a guide for Eskom's field personnel on heritage management. He has published twenty scientific papers in academic journals and several popular articles on archaeology and heritage matters. He collaborated with environmental companies in compiling State of the Environmental Reports for Ekhurhuleni, Hartebeespoort and heritage management plans for the Magaliesberg and Waterberg. Since acting as an independent consultant he has done approximately 800 large to small heritage impact assessment reports. He has a longstanding working relationship with Eskom, Rio Tinto (PMC), Rio Tinto (EXP), Impala Platinum, Angloplats (Rustenburg), Lonmin, Sasol, PMC, Foskor, Kudu and Kelgran Granite, Bafokeng Royal Resources, Pilanesberg Platinum Mine (PPM) etc. as well as with several environmental companies.

3 DECLARATION OF INDEPENDENCE

I, Dr Julius CC Pistorius declare the following:

- I act as an independent specialist in this application;
- I will perform the work relating to the application in an objective manner, even, if this result in views and findings that are not favourable for the applicant;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting the specialists report relevant to this application, including knowledge of the Act, Regulations and any guidelines that have relevance to the applications;
- I will comply with the Act, Regulations and other applicable legislation;
- I will consider, to the extent possible, the matters listed in Regulation 13;
- I understand to disclose to the applicant and the compentent authority all material information in my possession
- All the particulars furnished by me in this form are true and correct that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority; and
- I realise that a false declaration is offence in terms of regulation 48 and is punishable in terms of section 24F of the Act.



1 July 2019

4 LEGAL FRAMEWORK

South Africa's heritage resources ('national estate') are protected by international, national, provincial and local legislation which provides regulations, policies and guidelines for the protection, management, promotion and utilization of heritage resources. South Africa's 'national estate' includes a wide range of various types of heritage resources as outlined in Section 3 of the NHRA (see Box 1).

At a national level, heritage resources are dealt with by the National Heritage Council Act (Act No 11 of 1999) and the NHRA. According to the NHRA, heritage resources are categorized using a three-tier system, namely Grade I (national), Grade II (provincial) and Grade III (local) heritage resources.

At the provincial level, heritage legislation is implemented by Provincial Heritage Resources Agencies (PHRA's) which apply the NHRA together with provincial government guidelines and strategic frameworks. Metropolitan or Municipal (local) policy regarding the protection of cultural heritage resources is also linked to national and provincial acts and is implemented by the SAHRA and the PHRA's.

4.1 Legislation relevant to heritage resources

Legislation relevant to South Africa's national estate includes the following:

- National Environmental Management Act (NEMA), Act No 107 of 1998
- Mineral and Petroleum Resources Development Act (MPRDA), Act No 28 of 2002
- National Heritage Resources Act (NHRA), Act No 25 of 1999.

Box 1: Types and ranges of heritage resources (the national estate) as outlined in Section 3 of the National Heritage Resources Act, 1999 (No 25 of 1999).

The National Heritage Resources Act (Act No 25 of 1999, Art 3) outlines the following types and ranges of heritage resources that qualify as part of the National Estate, namely:

(a) places, buildings structures and equipment of cultural significance;
(b) places to 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 by in terms of the Human Tissues Act, 1983 (Act No 65 of 1983);
(h) sites of significance relating to the history of slavery 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 interest; and
  (vii) books, records, documents, photographs, positives and negatives, graphic, film or video material or sound recordings, excluding those that are public records as defined in section 1(xiv) of the National Archives of South Africa Act, 1996 (Act No 43 of 1996).

The National Heritage Resources Act (Act No 25 of 1999, Art 3) also distinguishes nine criteria for places and objects to qualify as 'part of the national estate if they have cultural significance or other special value …'. These criteria are the following:

(a) its importance in the community, or pattern of South Africa's history;
(a) its possession of uncommon, rare or endangered aspects of South Africa's natural or cultural heritage;
(b) its potential to yield information that will contribute to an understanding of South Africa's natural or cultural heritage;
(c) its importance in demonstrating the principal characteristics of a particular class of South Africa's natural or cultural places or 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)
(h) its strong or special association with the life or work of a person, group or organisation of importance in the history of South Africa;
(i) sites of significance relating to the history of slavery in South Africa

4.1.1 NEMA

The NEMA stipulates under Section 2(4)(a) that sustainable development requires the consideration of all relevant factors including (iii) the disturbance of landscapes and sites that constitute the nation's cultural heritage must be avoided, or where it cannot be altogether avoided, is minimised and remedied. Heritage assessments are implemented in terms of the NEMA Section 24 in order to give effect to the general objectives. Procedures considering heritage resource management in terms of the NEMA are summarised under Section 24(4) as amended. In addition to the NEMA, the National Environmental Management: Protected Areas Act, 2003 (Act No 57 of 2003) may also be applicable. This act applies to protected areas and world heritage sites, declared as such in terms of the World Heritage Convention Act, 1999 (Act No 49 of 1999).

4.1.2 MPRDA

The MPRDA stipulates under Section 5(4) no person may prospect for or remove, mine, conduct technical co-operation operations, reconnaissance operations, explore for and produce any mineral or petroleum or commence with any work incidental thereto on any area without (a) an approved environmental management programme or approved environmental management plan, as the case may be.

4.1.3 NHRA

According to Section 3 of the NHRA the 'national estate' comprises a wide range and various types of heritage resources (see Box 1).

4.1.3.1 Heritage Impact Assessment studies

According to Section 38 of the NHRA, a HIA process must be followed under the following circumstances:

- The construction of a linear development (road, wall, power line, canal etc.) exceeding 300m in length

- The construction of a bridge or similar structure exceeding 50m in length
- Any development or activity that will change the character of a site and which exceeds 5 000m^2 or which involve three or more existing erven or subdivisions thereof
- Re-zoning of a site exceeding 10 000 m^2
- Any other category provided for in the regulations of SAHRA, a provincial or local heritage authority or any other legislation such as NEMA, MPRDA, etc.

4.1.3.2 Section 34 (Buildings and structures)

Section 34 of the NHRA provides for general protection of structures older than 60 years. According to Section 34(1) no person may alter (demolish) any structure or part thereof which is older than 60 years without a permit issued by the relevant provincial heritage resources authority.

A structure means any building, works, device or any other facility made by people and which is fixed to land and which includes fixtures, fittings and equipment associated with such structures.

Alter means any action which affects the structure, appearance or physical properties of a place or object, whether by way of structural or any other works such as painting, plastering, decorating, etc..

Most importantly, Section 34(1) clearly states that no structure or part thereof may be altered or demolished without a permit issued by the relevant PHRA. These permits will not be granted without a HIA being completed. A destruction permit will thus be required before any removal and/or demolition may take place, unless exempted by the PHRA according to Section 34(2) of the NHRA.

4.1.3.3 Section 35 (Archaeological and palaeontological resources and meteorites)

Section 35 of the NHRA provides for the general protection of archaeological and palaeontological resources, and meteorites. In the event that archaeological resources are discovered during the course of development, Section 38(3) specifically requires that the discovery must immediately be reported to the PHRA, or local authority or museum who must notify the PHRA. Furthermore, no person without permits issued by the responsible heritage resources authority may:

- destroy, damage, excavate, alter, deface or otherwise disturb any archaeological or paleontological site or any meteorite
- destroy, damage, excavate, remove from its original position, collect or own any archaeological or paleontological material or object or any meteorite
- trade in, sell for private gain, export or attempt to export from the Republic any category of archaeological or paleontological material or object, or any meteorite; or bring onto or use at an archaeological or paleontological site any excavation equipment or any equipment that assists in the detection or recovery of metals or archaeological and paleontological material or objects, or use such equipment for the recovery of meteorites
- alter or demolish any structure or part of a structure which is older than 60 years.

Heritage resources may only be disturbed or moved by an archaeologist after being issued with a permit received from SAHRA. In order to demolish heritage resources the developer has to acquire a destruction permit by from SAHRA.

4.1.3.4 Section 36 (Burial grounds and graves)

Section 36 of the NHRA allows for the general protection of burial grounds and graves. Should burial grounds or graves be found during the course of development, Section 36(6) stipulates that such activities must immediately cease and the discovery reported to the responsible heritage resources authority and the South African Police

Service (SAPS). Section 36 also stipulates that no person without a permit issued by the relevant heritage resources authority may:

(a) destroy, damage, alter, exhume or remove from its original position or otherwise disturb the grave of a victim of conflict, or any burial ground or part thereof which contains such graves

(b) destroy, damage, alter, exhume or remove from its original position or otherwise disturb any grave or burial ground older than 60 years which is situated outside a formal cemetery administered by a local authority; or

9(c) bring onto or use at a burial ground or grave referred to in paragraph (a) or (b) any excavation, or any equipment which assists in the detection or recovery of metals.

Section 36 of the NHRA divides graves and burial grounds into the following categories:

a. ancestral graves
b. royal graves and graves of traditional leaders
c. graves of victims of conflict
d. graves designated by the Minister
e. historical graves and cemeteries
f. human remains

Human remains less than 60 years old are subject to provisions of the National Health Act, 2003 (Act No 61 of 2003), Ordinance 12 of 1980 (Exhumation Ordinance) and Ordinance No 7 of 1925 (Graves and dead bodies Ordinance, repealed by Mpumalanga). Municipal bylaws with regard to graves and graveyards may differ. Professionals involved with the exhumation and relocation of graves and graveyards must establish whether such bylaws exist and must adhere to these laws.

Unidentified graves are handled as if they are older than 60 years until proven otherwise.

Permission for the exhumation and relocation of graves older than sixty years must also be gained from descendants of the deceased (where known), the National Department of Health, Provincial Department of Health, Premier of the Province and

local police. Furthermore, permission must also be gained from the various landowners (i.e. where the graves are located and where they are to be relocated) before exhumation can take place.

Human remains can only be handled by a registered undertaker or an institution declared under the Human Tissues Act (Act No 65 of 1983 as amended).

4.1.3.5 Section 37 (Public monuments and memorials)

Section 37 makes provision for the protection of all public monuments and memorials in the same manner as places which are entered in a heritage register referred to in Section 30 of the NHRA.

4.1.3.6 Section 38 (Heritage Resource Management)

Section 38 (8): The provisions of this section do not apply to a development as described in Section 38 (1) if an evaluation of the impact of such development on heritage resources is required in terms of the Environment Conservation Act, 1989 (Act No 73 of 1989), or the integrated environmental management guidelines issued by the Department of Environment Affairs and Tourism, or the Minerals Act, 1991 (Act No 50 of 1991), or any other legislation. Section 38(8) ensures cooperative governance between all responsible authorities through ensuring that the evaluation fulfils the requirements of the relevant heritage resources authority in terms of Subsection (3), and any comments and recommendations of the relevant heritage resources authority with regard to such development have been taken into account prior to the granting of the consent.

The Listed Activities in terms of the Government Notice Regulations (GNRs) stipulated under NEMA for which EA will be applied for, will trigger a HIA as contemplated in Section 38(1) above as follows:

4.2. NEMA Appendix 6 requirements

NEMA Regulations, 2014 (as amended 2017) - Appendix 6	Relevant section in report
Details of the specialist who prepared the report and the expertise of that person to compile a specialist report including a curriculum vitae	Part 2. Details of the specialist
A declaration that the person is independent in a form as may be specified by the competent authority	Part 3. Declaration of independence
An indication of the scope of, and the purpose for which the report was prepared	Part 1. Introduction
An indication of the quality and age of base data used for the specialist report	Part 8. Approach and Methodology
The duration, date and season of the site investigation and the relevance of the season to the outcome of the assessment	Part 8. Approach and Methodology Part 8.1. Field survey
A description of the methodology adopted in preparing the report or carrying out the specialised process inclusive of equipment and modelling used	Part 8. Approach and Methodology
Details of an assessment of the specific identified sensitivity of the site related to the proposed activity or activities and its associated structures and infrastructure, inclusive of a site plan identifying site alternatives	Part 9. Heritage survey
An identification of any areas to be avoided, including buffers	Part 9.2 Possible impact on heritage resources
A map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers;	Figure 9
A description of any assumptions made and any uncertainties or gaps in knowledge;	Part 1.3. Assumptions and limitations
A description of the findings and potential implications of such findings on the impact of	Part 10 Conclusion and recommendations

NEMA Regulations, 2014 (as amended 2017) - Appendix 6	Relevant section in report
the proposed activity, including identified alternatives, on the environment	
Any mitigation measures for inclusion in the EMPr	Part 9.4 Mitigating the graveyard (GY02) that will be affected
Any conditions for inclusion in the environmental authorisation	Part 9.5 Chance-find procedures
Any monitoring requirements for inclusion in the EMPr or environmental authorisation	Part 9.4 Managing the graveyard (GY01) that remain unaffected
A reasoned opinion – • whether the proposed activity, activities or portions thereof should be authorised; • regarding the acceptability of the proposed activity or activities; and if the opinion is that the proposed activity, activities or portions thereof should be authorised, any avoidance, management and mitigation measures that should be included in the EMPr.	Part 10 Conclusion and recommendations Part 9.5 Chance-find procedures
A description of any consultation process that was undertaken during the course of preparing the specialist report	Part 7.4 Consultation process undertaken and comments received from stakeholders
A summary and copies if any comments that were received during any consultation process	Part 7.4 Consultation process undertaken and comments received from stakeholders
Any other information requested by the competent authority.	None

5 THE VANDYKSDRIFT CENTRAL (VDDC) PROJECT

5.1 Location

The VDDC infrastructure development project is a brownfields project within the greater Wolvekrans Colliery mining right area. Wolvekrans Colliery is located between the towns of eMalahleni and Kriel, within the jurisdictional area of the eMalahleni Local Municipality and the Nkangala District Municipality of the Mpumalanga Province. The mine is situated approximately 30 km south-east of the town of eMalahleni, in close proximity to the Duvha Power Station. VDDC is located on the western boundary of Wolvekrans Colliery. The Olifants River determines the southern boundary. The proposed infrastructure development will take place on the farms Kleinkopje 15 IS, VanDyksdrift 19 IS, Wolvekrans 17 IS and Steenkoolspruit 18 IS. (2629AB Van Dyksdrift [1:50 000]; 2628 East Rand [1: 250 000]) (Figure 1).

5.2 The nature of the VDDC project area

The VDDC Project is part of the undulating landscape of the southerly districts of the Mpumalanga Province and is wedged between the Olifants River that runs along the western perimeter of the mine complex and the R544 which demarcated its eastern boundary. It has been subjected to underground and open cast coal mining for many decades and as such represents a brown fields area with low cultural and historical significance.

The larger part of the project area today is covered with mining related activities whilst open veld in most instances comprise former agricultural fields. Few trees occur in the study area, the majority of which are blue gum trees and wattles. Groves with poplar trees have encroached on the banks of the Olifants River.

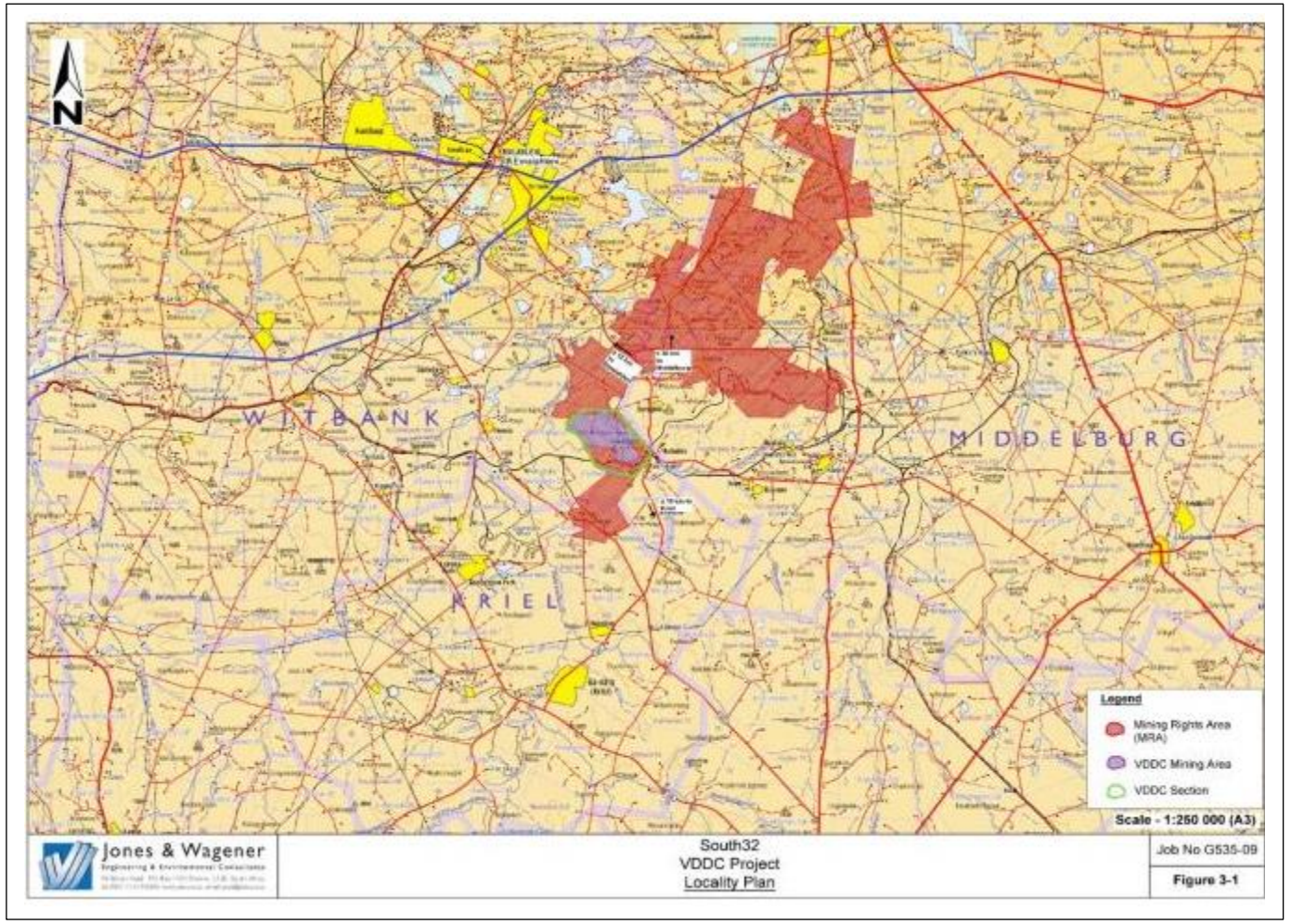


Figure 1- Regional location of the VDDC Project (purple demarcated) on the Eastern Highveld in the Mpumalanga Province

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5.3 The nature of the VDDC Project

South32 is the holder of an amended mining right for coal, granted by the Minister of Mineral Resources, in terms of the MPRDA and notarially executed on the 21st of May 2015 under reference MP30/5/1/2/2/379MR, in respect of its Wolvekrans – Ifalethu Colliery. This mining right comprises of the following areas:

- Ifalethu Colliery (previously referred to as Wolvekrans North Section[1]) consisting of the Hartbeestfontein, Bankfontein (mining now ceased), Goedehoop, Klipfontein sections and the North Processing Plant; and
- Wolvekrans Colliery (previously referred to as the Wolvekrans South Section) consisting of the Wolvekrans, Vlaklaagte (mining ceased), Driefontein, Boschmanskrans, Vandyksdrift, Albion and Steenkoolspruit sections, as well as the South Processing Plants (Eskom and Export). Some of these areas were previously known as Douglas Colliery.

The VDDC area falls within the footprint of historic underground mining operations at the old Douglas Colliery. In 2007, an amendment of the Environmental Management Programme Report (EMPR) for the Douglas Colliery operations was approved, to allow pillar mining (opencast) of the area previously mined by underground bord and pillar mining. Authorisation of the VDDC mining project included the following:

- Opencast operation on the farm Kleinkopje 15 IS;
- Opencast operation on the farm Steenkoolspruit 18 IS;
- Pillar extraction operation on the farm Vandyksdrift 19IS.
- Reclamation of existing slurry ponds; and
- Rewashing of existing discard dumps (PHD, 2006).

The water uses associated with the opencast mining have been authorised in terms of Water Use Licence (WUL) number 24084535 dated 10 October 2008, issued to Douglas Colliery Services Limited.

The No. 2 seam workings are flooded with water and must be dewatered to enable the open pit development to proceed. A dewatering strategy has therefore been developed and an application for EA of the dewatering activities was submitted to the Department of Mineral Resources ; a decision in this regard is pending. The water use activities

[1] This was previously referred to as Middelburg Colliery

associated with this upfront dewatering strategy have been authorised by WUL number 06/B11F/GCIJ/7943 dated 19 July 2018.

The 2007 approved EMPR Amendment included limited additional infrastructure in support of the opencast mining operations, as it was assumed at that stage that existing infrastructure will be used. In addition, the applications for authorisation of the activities associated with the dewatering strategy, were limited to the infrastructure to facilitate dewatering (i.e. dewatering boreholes, pumps, pipelines, storage tanks, mechanical evaporators, roads and power lines).

A pre-feasibility investigation has since been conducted, and the need to develop additional infrastructure to support the proposed opencast mining was identified. The additional infrastructure includes the following (**Figure 2a**):

- Storm water management structures (drains and berms);
- Water management measures for the management of mine impacted water;
- Overburden dumps;
- ROM coal stockpile areas;
- Mixed ROM coal and slurry stockpile areas;
- Topsoil stockpiles following clearance of vegetation;
- Pipelines for the conveyance of water;
- Hard park area and brake test ramp; and
- Haul roads and service roads.

The proposed VDDC opencast pit boundary as determined through the pre-feasibility investigation also differs from the mining area approved in the 2007 EMPR amendment. An area of approximately 196 hectares in the latest mine lay-out was not included in the previous mine lay-out and is therefore not approved to be mined according to an open-cast mine methodology (**Figure 2b**).

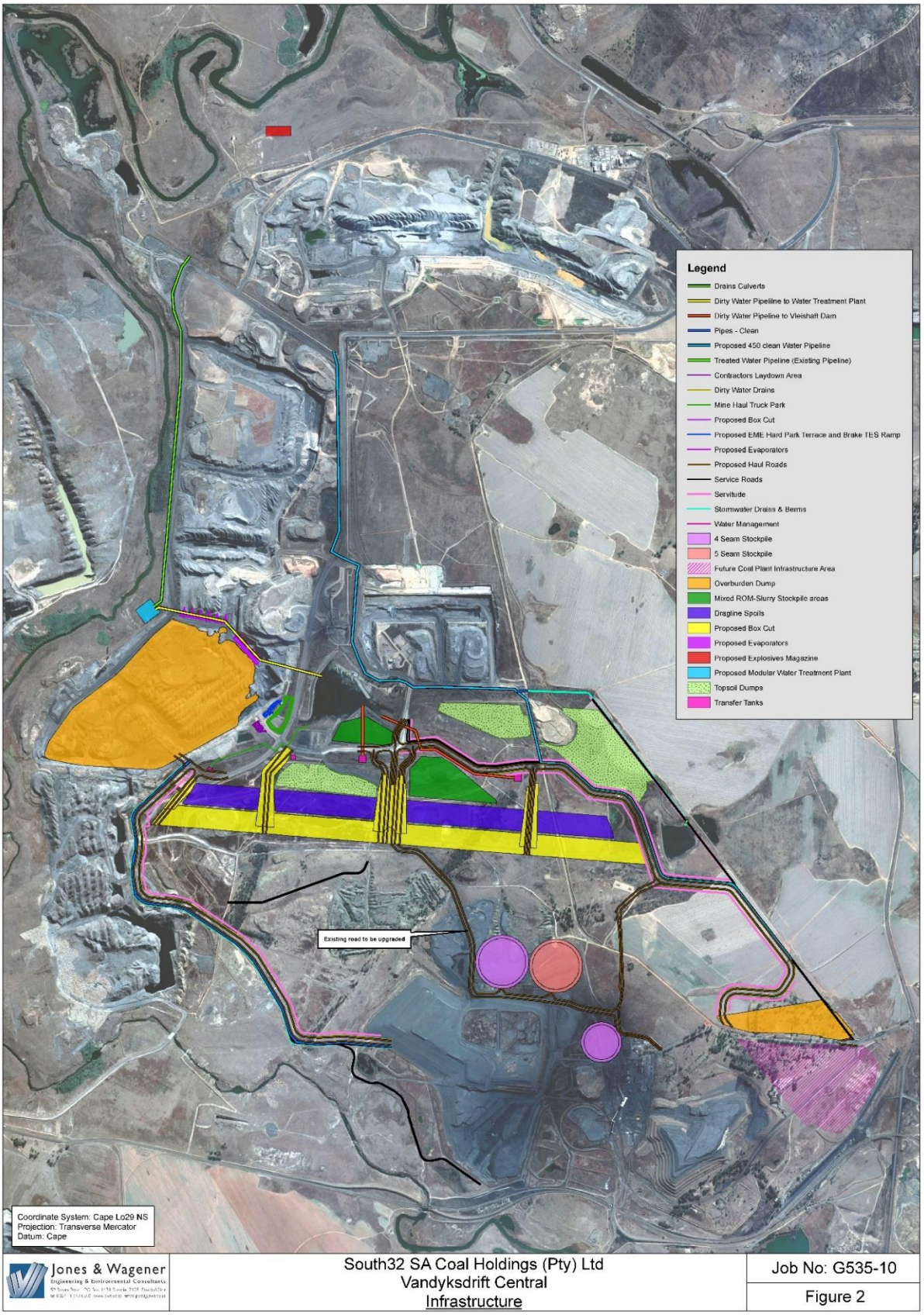

Figure 2a- The proposed footprint of the developmental components of the VDDC project.

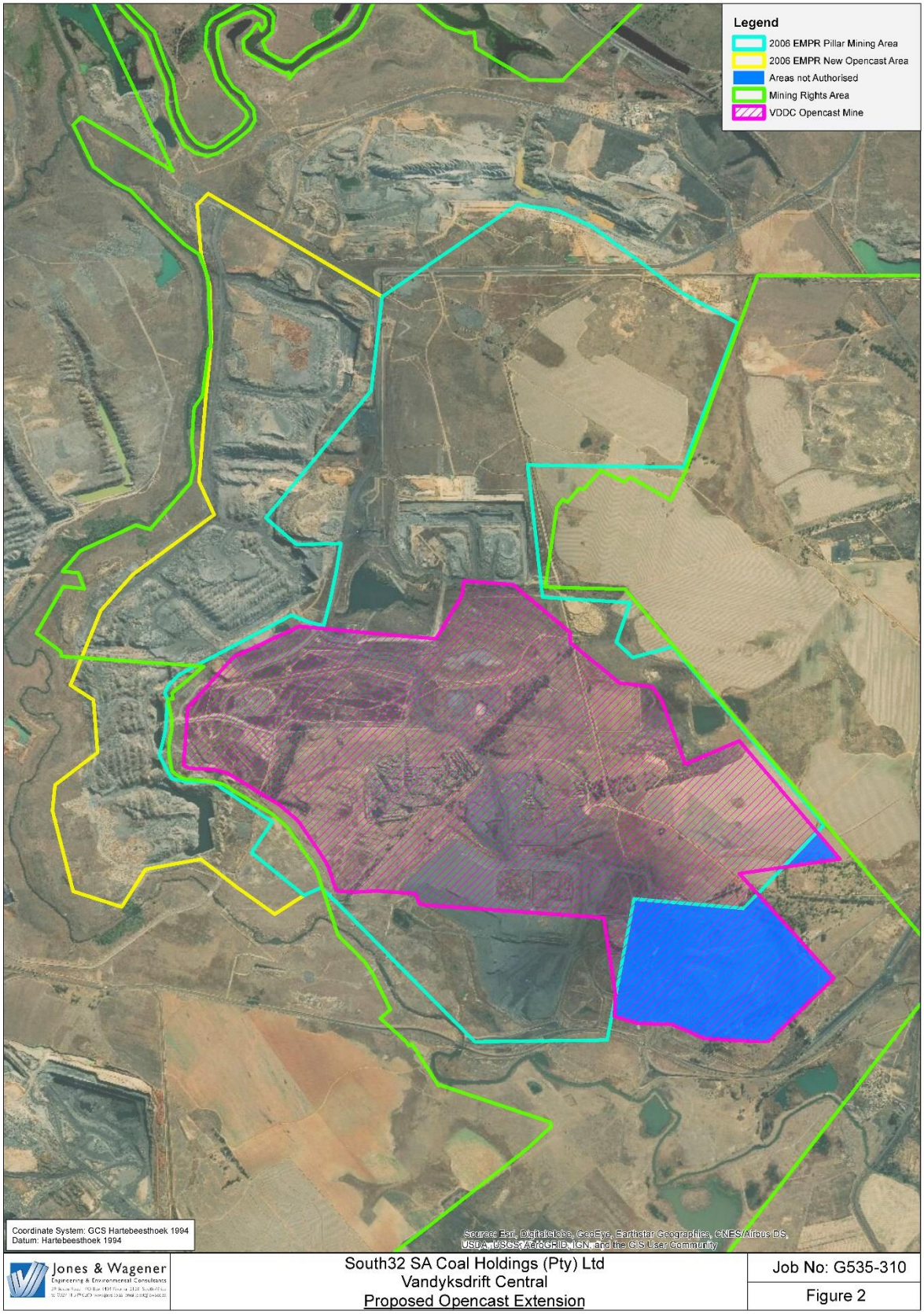

Figure 2b- The VDDC opencast pit compared to the mine lay-out plan in the approved EMPR Amendment of 2007.

5.4 The heritage character of the larger project area

A large number of heritage studies have been conducted in the larger project area covering a part of the Eastern Highveld of the Mpumalanga Province during the last one to two decades (see Part 11, 'Bibliography relating to earlier heritage studies'). These studies have revealed that the most common types and ranges of heritage resources near the project area to be found include the following:

- Limited numbers of historical farmstead complexes as these have largely disappeared as a result of various reasons.
- Graveyards associated with colonial farmers who occupied these historical farmstead complexes as well as graveyards belonging to farm workers who lived and worked on these farms.

However, the coal mining complex which developed during the last century on the Eastern Highveld as well as the expansion of dry land agriculture into mega farming enterprises have largely changed the heritage character of a large part of the Eastern Highveld. The archaeological and historical significance of the Eastern Highveld, albeit in a gradual decline and in places disappearing at an alarming rate is described and explained in more detail before the results of the Phase I HIA study is discussed (see Part 6, 'Contextualising the VDDC project area').

6 CONTEXTUALISING THE VDDC PROJECT AREA

The following overview of pre-historical, historical and cultural evidence indicates the wide range of heritage resources which do occur across the Eastern Highveld in which the project area is located, namely:

6.1 Stone Age and rock art sites

Stone Age sites are marked by stone artefacts that are found scattered on the surface of the earth or as parts of deposits in caves and rock shelters. The Stone Age is divided into the Early Stone Age (ESA) (covers the period from 2.5 million years ago to 250 000 years ago), the Middle Stone Age (MSA) (refers to the period from 250 000 years ago to 22 000 years ago) and the Late Stone Age (LSA) (the period from 22 000 years ago to 200 years ago).

Dongas and eroded areas at Maleoskop near Groblersdal is one of only a few places in Mpumalanga where ESA Olduwan and Acheulian artefacts have been recorded. Evidence for the MSA has been excavated at the Bushman Rock Shelter near Ohrigstad. This cave was repeatedly visited over a prolonged period. The oldest layers date back to 40 000 years BP (Before Present) and the youngest to 27 000BP (Esterhuysen & Smith 2007).

LSA occupation of the Mpumalanga Province also has been researched at Bushman Rock Shelter where it dates back 12 000BP to 9 000BP and at Höningnestkrans near Badfontein where a LSA site dates back to 4 870BP to 200BP (Esterhuysen & Smith 2007).

The LSA is also associated with rock paintings and engravings which were done by San hunter-gatherers, Khoi Khoi herders and EIA (Early Iron Age) farmers (Maggs 1983, 2008). Approximately 400 rock art sites are distributed throughout Mpumalanga, notably in the northern and eastern regions at places such as Emalahleni (Witbank)

(4), Lydenburg (2), White River and the southern Kruger National Park (76), Nelspruit and the Nsikazi District (250). The Ermelo area holds eight rock paintings (Smith & Zubieta 2007).

The rock art of the Mpumalanga Province can be divided into San rock art which is the most wide spread, herder or Khoe Khoe (Khoi Khoi) paintings (thin scattering from the Limpopo Valley) through the Lydenburg district into the Nelspruit area) and localised late white farmer paintings. Farmer paintings can be divided into Sotho-Tswana finger paintings and Nguni engravings (Only 20 engravings occur at Boomplaats, north-west of Lydenburg). Farmer paintings are more localised than San or herder paintings and were mainly used by the painters for instructional purposes (Smith & Zubieta 2007).

During the LSA and Historical Period, San people called the Batwa lived in sandstones caves and rock shelters near Lake Chrissie in the Ermelo area. The Batwa are descendants of the San, the majority of which intermarried with Bantu-Negroid people such as the Nhlapo from Swazi-descend and Sotho-Tswana clans such as the Pai and Pulana. Significant intermarriages and cultural exchanges occurred between these groups. The Batwa were hunter-gatherers who lived from food which they collected from the veldt as well as from the pans and swamps in the area. During times of unrest, such as the *difaqane* in the early nineteenth century, the San would converge on Lake Chrissie for food and sanctuary. The caves, lakes, water pans and swamps provided relative security and camouflage. Here, some of the San lived on the surfaces of the water bodies by establishing platforms with reeds. With the arrival of the first colonists in the nineteenth century many of the local Batwa family groups were employed as farm labourers. Descendants of the Batwa people still live in the larger Project Area (Schapera 1927; Potgieter 1955; Schoonraad & Schoonraad 1975).

No sites dating from the Stone Age or any lithic scatters with tools, flakes or waste material have been recorded close to where the proposed development is planned.

6.2 Iron Age remains

The Iron Age is associated with the first agro-pastoralists or farming communities who lived in semi-permanent villages and who practised metal working during the last two millennia. The Iron Age is usually divided into the Early Iron Age (EIA) (covers the 1st millennium AD) and the Later Iron Age (LIA) (covers the first 880 years of the 2nd millennium AD).

Evidence of the first farming communities in the Mpumalanga Province is derived from a few EIA potsherds which occur in association with the LSA occupation of the Höningnest Shelter near Badfontein. The co-existence of EIA potsherds and LSA stone tools suggest some form of 'symbiotic relationship' between the Stone Age hunter-gatherers who lived in the cave and EIA farmers in the area (also note Batwa and Swazi/Sotho Tswana relationship) (Esterhuysen & Smith 2007).

The Welgelegen Shelter on the banks of the Vaal River near Ermelo also reflects some relationship between EIA farmers who lived in this shelter and hunter-gatherers who manufactured stone tools and who occupied a less favourable overhang nearby during AD1200 (Schoonraad & Beaumont 1971).

EIA sites were also investigated at Sterkspruit near Lydenburg (AD720) and in Nelspruit where the provincial governmental offices were constructed. The most infamous EIA site in South Africa is the Lydenburg head site which provided two occupation dates, namely during AD600 and from AD900 to AD1100. At this site the Lydenburg terracotta heads were brought to light. Doornkop, located south of Lydenburg, dates from AD740 and AD810 (Evers 1981; Whitelaw 1996).

The LIA is well represented in Mpumalanga and stretches from AD1500 well into the nineteenth century and the Historical Period. Several spheres of influence, mostly associated with stone walled sites, can be distinguished in the region. Some of the historically well-known spheres of influence include the following:

- Early arrivals in the Mpumalanga Province such as Bakone clans who lived between Lydenburg, Badfontein and Machadodorp and Eastern Sotho clans

such as the Pai, Pulana and Kutswe who established themselves in the eastern parts of the province (Collett 1979, 1983; Delius 2007; Makhura 2007; Delius & Schoeman 2008).

- Swazi expansion into the Highveld and Lowveld of the Mpumalanga Province occurred during the reign of Sobhuza (AD1815 to 1836/39) and Mswati (AD1845 to 1868) while Shangaan clans entered the province across the Lembombo Mountains in the east during the second half of the nineteenth century (Delius 2007; Makhura 2007.).
- The Bakgatla (Pedi) chiefdom in the Steelpoort Valley rose to prominence under Thulare during the early 1800's and was later ruled by Sekwati and Sekhukune from the village of Tsjate in the Leolo Mountains. The Pedi maintained an extended sphere of influence across the Limpopo and Mpumalanga Provinces during the nineteenth century (Mönnig 1978; Delius 1984).
- The Ndzundza-Ndebele established settlements at Kwasimkulu (between Middelburg and Belfast) and at the foot of the Bothasberge (Kwa Maza and Esikhunjini) in the 1700's and lived at Erholweni from AD1839 to AD1883 where the Ndzundza-Ndebele's sphere of influence known as KoNomthjarhelo stretched across the Steenkampsberge.
- The Bakopa lived at Maleoskop (1840 to 1864) where they were massacred by the Swazi while the Bantwane live in the greater Groblersdal and Marble Hall areas.
- Corbelled stone huts which are associated with ancestors of the Sotho on Tafelkop near Davel which date from the AD1700's into the nineteenth century (Hoernle 1930).
- Stone walled settlements spread out along the eastern edge of the Groot Dwarsriver Valley served as the early abode for smaller clans such as the Choma and Phetla communities which date from the nineteenth century.

Stone walled sites which occur closest to the project area are those approximately twenty kilometers to the north-west of the project area. Here the Ndzundza-Ndebele

established a capital Kwasimkulu and other villages in a hilly area from AD1600 onwards.

6.3 The Historical Period

Historical towns closest to the project area include Witbank, Middelburg, Belfast and Carolina. Witbank came into being as the railway line between Pretoria and Lourenzo Marques which was built in 1894 passed close to where Witbank is located today. The first Europeans who came to the area observed the abundance of coal, which is evident on the surface or in the beds of streams. A stage post for wagons close to a large outcrop of whitish stones (a 'white ridge') gave the town its name. Witbank was established in 1903 on a farm known as Swartbos which belonged to Jacob Taljaard.

Middelburg is one of the oldest towns that were established by the Voortrekkers in the previous Transvaal. The town was established on the farms of Klipfontein and Keerom on the banks of the Klein Olifants River in 1859. It is generally accepted that Middelburg's name is derived from the fact that the Transvaal Republic established the town midway between Pretoria and Lydenburg.

The choice for Middelburg's location was not well accepted by the inhabitants and it was moved to the farm Sterkfontein. Here, a town was established and named Nasaret (Nazareth). However, the name did not appeal to the local community and its original name was reinstated. Middelburg temporary served as the seat of the Transvaal Republic after the siege of Pretoria during the Second Anglo Boer War.

Today Middelburg and Witbank are important centres where coal is mined and transported to Richards Bay from where it is exported all over the world. The 20th century also saw the introduction of large-scale irrigation and dry land farming on the Eastern Highveld. Today the economic activities of the area include diamond and coal mining, light and heavy industries as well as steel and vanadium operations.

Belfast was founded on 30 June 1890. Farmer Richard O' Neil bought the farm Tweefontein near where the expected railway line between Pretoria and Lourenço

Marques in Mozambique would run. He set up a store and applied for permission to lay out a village. He named it Belfast in honour of the city in Ireland from where his father had immigrated. The railway reached the village in 1894 and the first village council took office in 1902.

The area where the town of Carolina was proclaimed on 16 June 1886 served as a popular stop-over for transport riders for several years – especially after a gold reef was discovered in what was to become Barberton in 1884. Traffic increased to such an extent that a trading and staging post was soon established. However, there is uncertainty about the origins of Carolina. A notice in the Transvaal government gazette stated that it was laid out on the farms Groenvlei and Goede Hoop. According to another sources Cornelis Coetzee made available part of his farm Steynsdraai for a village provided it was given the name of his wife, Carolina.

6.4 A coal mining heritage

Coal mining on the eastern Highveld is now older than one century and has become the most important coal mining region in South Africa**.** Whilst millions of tons of high-grade coal are annually exported overseas more than 80% of the country's electricity is generated on low-grade coal in Eskom's power stations such as Duvha, Matla and Arnot situated near coal mines on the eastern Highveld.

The earliest use of coal (charcoal) in South Africa was during the Iron Age (300-1880AD) when metal workers used charcoal, iron and copper ores and fluxes (quartzite stone and bone) to smelt iron and copper in clay furnaces.

Colonists are said to have discovered coal in the French Hoek Valley near Stellenbosch in the Cape Province in 1699. The first reported discovery of coal in the interior of South Africa was in the mid-1830s when coal was mined in Kwa-Zulu/Natal. The first exploitation for coal was probably in Kwa-Zulu/Natal as documentary evidence refers to a wagon load of coal brought to Pietermaritzburg to be sold in 1842. In 1860 the coal trade started in Dundee when a certain Pieter Smith charged ten shillings for a load of coal dug by the buyer from a coal outcrop in a stream. In 1864 a

coal mine was opened in Molteno. The explorer, Thomas Baines mentioned that farmers worked coal deposits in the neighbourhood of Bethal (Transvaal) in 1868. Until the discovery of diamonds in 1867 and gold on the Witwatersrand in 1886, coal mining only satisfied a very small domestic demand.

With the discovery of gold in the Southern Transvaal and the development of the gold mining industry around Johannesburg came the exploitation of the Boksburg-Spring coal fields, which is now largely worked out. By 1899, at least four collieries were operating in the Middelburg-Witbank district, also supplying the gold mining industry. At this time coal mining also had started in Vereeniging. The Natal Collieries importance was boosted by the need to find an alternative for imported Welsh anthracite used by the Natal Government Railways.

By 1920 the output of all operating collieries in South Africa attained an annual figure of 9,5million tonnes. Total in-situ reserves were estimated to be 23 billion tonnes in Witbank-Springs, Natal and Vereeniging. The total in situ reserves today are calculated to be 121 billion tonnes. The largest consumers of coal are Sasol, Mittal and Eskom.

No evidence for early coal mining activities was observed in or near the project area.

6.5 A vernacular stone architectural heritage

A unique stone architectural heritage was established in the eastern Highveld from the second half of the 19th century well into the early 20th century. During this time period stone was used to build farmsteads and dwellings, both in urban and in rural areas. Although a contemporary stone architecture also existed in the Karoo and in the Eastern Free State Province of South Africa a wider variety of stone types were used in the eastern Highveld. These included sandstone, ferricrete (‘ouklip’), dolerite (‘blouklip’), granite, shale and slate (Naude 1993).

The origins of a vernacular stone architecture in the eastern Highveld may be ascribed to various reasons of which the ecological characteristics of the region may be the most important. Whilst this region is generally devoid of any natural trees which could be used as timber in the construction of farmsteads, outbuildings, cattle enclosures and other

structures, the scarcity of fire wood also prevented the manufacture of baked clay bricks. Consequently stone served as the most important building material in the eastern Highveld (Naude 1993, 2000). One of these historical structures was excavated and described after a heritage mitigation project was conducted for a coal mine (Pistorius 2005).

LIA Sotho, Pedi, Ndebele and Swazi communities contributed to the Eastern Highveld's stone walled architecture. The tradition set by these groups influenced settlers from Natal and the Cape Colony to utilise the same resources to construct dwellings and shelters. Farmers from Scottish, Irish, Dutch, German and Scandinavian descend settled and farmed in the eastern Highveld. They brought the knowledge of stone masonry from Europe. This compensated for the lack of fire wood on the Eastern Highveld which was necessary to bake clay bricks.

No sandstone structures were recorded in the project area although farmsteads with wagon sheds and outbuildings that were constructed with this building material occur in the wider Eastern Highveld area .

6.6 Most common types and ranges of heritage resources

Heritage resources which are common on the Eastern Highveld near the project area are the following (see Part 11, 'Bibliography relating to earlier heritage studies'):

- Historical remains associated with farmstead complexes consisting of houses, associated outbuildings, cattle enclosures and graveyards.
- Abandoned graveyards left by farm workers who moved from farms to urban areas.
- Stone walled settlements dating from the Late Iron Age. However, these remains are confined to low dolerite outcrops or sandstone ridges and kopjes.

6.7 Earlier heritage surveys

Several heritage surveys have been conducted by different heritage practitioners in the Vandyksdrift Central mine complex. These heritage investigations comprised Phase I surveys of the farms Wolvekrans 17 IS, Kleinkopje 15 IS, Steenkoolspruit 18 IS, Van

Dyksdrift 19 IS, Middeldrift 42 IS and Rietfontein 43 IS. These surveys revealed a historical sandstone farm building; farmhouses which were mostly destroyed some of which were associated with farm worker accommodation; a number of graves and graveyards and a number of sites with remains which date from the recent past (RRP) (Pistorius 2004).

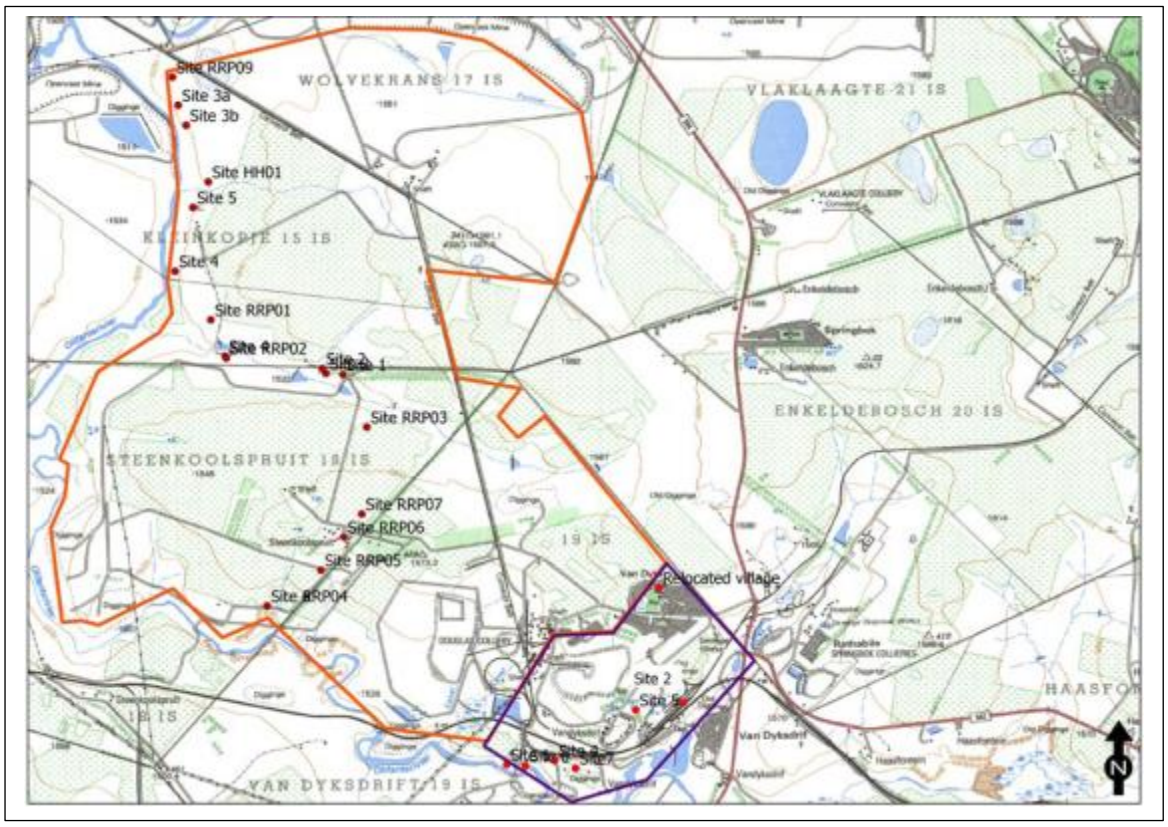

Figure 3 – Heritage sites that were recorded during earlier heritage surveys in the VDDC project area which at the time was more pristine than today (Coetzee 2014)

During a Phase 2 project the historical sandstone house was excavated and recorded (Pistorius 2005) whilst all the graves and graveyards were relocated (Pelser 2005, 2006 & 2007; Pelser & Van Vollenhoven 2008). Most of the remains from the recent past which had low significance have been destroyed during the last one and a half decade or have totally deteriorated and can no longer be recognised. During more recent surveys for the Vandyksdrift Central (VDDC) Project, the farm Van Dyksdrift 19 IS was subjected to at least two heritage surveys (Coetzee 2014; Pistorius 2019).

7 APPROACH AND METHODOLOGY

This heritage survey and impact assessment study was conducted by means of the following:

7.1 Field survey

A field survey was conducted on 31 July 2018 during which the author was accompanied by a representative of South32 who is well acquainted with the mine property where he has been working for longer than the last two decades. At least two previous heritage surveys for portions of the project area was undertaken by the author himself (Pistorius 2004, 2005) and during the more recent past (Coetzee 2017). A survey for the realignment of a new 132kV power line was also conducted in the more recent past (Pistorius 2019) (see Part 12, 'Bibliography relating to earlier heritage studies').

Figure 4- GPS track log registered with a mounted GPS instrument on the infrastructure footprint of the project area. Pedestrian surveys were conducted from the main pathway. Not all tracks were recorded as a result of signal loss.

Some of these surveys were conducted *prior* to SAHRA requesting GPS track logs to be registered for heritage studies. Consequently, only the GPS track log which was registered during the latest heritage survey is included in this report. The footprint of the project area changed several times. The track log registered in Figure 4 is on one of the earlier footprints of the mine. However, due to the intense disturbance which have occurred this has not had any influence on the results of the survey.

The field survey was conducted by means of following national, dirt and farm roads across the project area. Other accessible pathways such as ‘two spoor’ field tracks were also utilized to gain access to parts of the project area. The track log only outlines main routes that were travelled. Pedestrian surveys were undertaken from some of these primary routes and therefore were not recorded.

Ecological indicators such as alternations in vegetation patterns; open or bald spots in the veld; protrusions of boulders, low hills or patches with grass or extreme dense vegetation were searched as these could have harboured former dwellings of farm workers.

Google Earth imagery served as a supplementary source (*prior* and after fieldwork) to establish the possible presence of heritage resources such as farm homesteads or extended stone walled villages.

All coordinates for heritage resources recorded by the author were done with a Garmin Etrex hand set Global Positioning System (instrument) with an accuracy of < 15m.

The nature and character of the project area is further illuminated with descriptions and photographs (see Part 8.1 ‘The field survey’).

7.2 Databases, literature survey and maps

Databases kept and maintained at institutions such as the PHRA, the Archaeological Data Recording Centre at the National Flagship Institute (Museum Africa) in Pretoria and SAHRA's national archive (referred to as the South African Heritage Resources Information System, SAHRIS) were consulted by the author and other heritage practitioners to determine whether any heritage resources of significance had been identified during earlier heritage surveys in or near the project area. Nevertheless heritage resources may have been missed as a result of various factors (Part 1.3, 'Assumptions and limitations).

7.3 Spokespersons consulted

Employers well acquainted with the project area were consulted regarding the possible presence of graveyards in the project area (see Part 13, 'Spokespersons consulted').

7.4 Consultation process undertaken and comments received from stakeholders

No specific consultation process was undertaken for the purposes of the heritage study as the stakeholder consultation for the project is being done by J&W.

7.5 Significance ratings

The significance of possible impacts on the heritage resources was determined using a ranking scale based on the following:

- Occurrence
  - Probability of occurrence (how likely is it that the impact may/will occur?), and
  - Duration of occurrence (how long may/will it last?)
- Severity
  - Magnitude (severity) of impact (will the impact be of high, moderate or low severity?), and
  - Scale/extent of impact (will the impact affect the national, regional or local environment, or only that of the site?).

Each of these factors has been assessed for each potential impact using the following ranking scales:

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

The heritage significance of each potential impact was assessed using the following formula:

Significance Points (SP) = (Magnitude + Duration + Scale) x Probability

The maximum value is 100 Significance Points (SP). Potential environmental impacts are rated as very high, high, moderate, low or very low significance on the following basis:

- More than 80 significance points indicates VERY HIGH heritage significance.
- Between 60 and 80 significance points indicates HIGH heritage significance.
- Between 40 and 60 significance points indicates MODERATE heritage significance.
- Between 20 and 40 significance points indicates LOW heritage significance.
- Less than 20 significance points indicates VERY LOW heritage significance.

8 HERITAGE SURVEY FOR VANDYKSDRIFT CENTRAL (VDDC)

8.1 The field survey

The field survey was done by means of following two track roads across the project area in order to gain access to the footprint of developmental components of the VDDC Project. However, the largest part of the project area comprises former and current mining areas which have been severely disturbed. The footprints of developmental components which overlap with active mining areas were not surveyed due to the total absence of any possible heritage resources or remains in these areas.

As stated earlier the author was accompanied by a representative of South32 who has a work record close to two decades with current and former coal mining companies who mined and worked the project area whilst employees of South32's Environmental Department also accompanied the author during a more recent survey for the realignment of a 132kV power line (see Part 12, 'Spokespersons consulted').

Figure 5- The largest part of the project area has been turned into a coal mining complex (background) with relatively little undisturbed land left mostly occurring along the Olifants River.

Figure 6 - The south- western part of the project area bordering on the Olifants River is still relatively pristine and will not be affected by the proposed VDDC Project.

Figure 7 – A few Blue Gum lots occur towards the central and northern part of the project area. A historical sandstone house in one of these plantations was subjected to a Phase 2 heritage study in the past (Pistorius 2005).

Figure 8 – The northern part of the project area has been scorched by veld fires thus revealing the sandstone and ferricrete outcrops across this part of the proposed new mining areas.

8.2 Types and ranges of heritage resources

The heritage survey revealed that the following heritage resources as outlines in Section 38 of the NHRA still occur in the project area, namely:

- Historical structures consisting of rail infrastructure and pump stations.
- Two graveyards.

The heritage resources were geo-referenced (Tables 1 & 2); their significance is indicated (Tables 3 & 4) whilst the significance of the impact of the development on these remains is also outlined (Tables 5 & 6).

The Phase I HIA study is now briefly discussed and illustrated with photographs.

Figure 9- Footprint of the proposed open cast pit approaching heritage resources comprising two graveyards, historical structures (two pump stations and the Vandyksdrift Railway Station) that were recorded in the project area.

8.2.1 Historical structures

Several building structures which may qualify as historical structures still occur in the project area. These include the following, namely (Figure 9):

- A pump station on the banks of the Olifants River which was used by the former Douglas Colliery.
- A second pump station on the banks of the Olifants River which the South African Railways (SAR) used for operations along the railway line which is situated in close proximity of the Olifants River.
- A small railway station located along the railway line.

8.2.1.1 The Douglas Colliery pump station

This pump station on the banks of the Olifants River comprises a double-story building which was constructed of reinforced concrete. It was fitted with a corrugated iron roof and steel fittings. It covers a footprint of approximately 10mx12m. It is shows signs of deterioration as it is probably not in operation any longer.

Figure 10- The former Douglas Colliers' pump station along the Olifants River.

8.2.1.2 The South African Railway station pump station

The SAR pump station is not as impressive as that of the former Douglas Colliery. It also comprises a double-story building constructed with concrete and steel. It is smaller than the Douglas Colliery pump station and covers a footprint of roughly 5mx6m. It is also located on the eastern banks of the Olifants River.

F.P. Coetzee made the interesting observation that old railway bars were used in the construction of the pump station whilst he also observed the inscription 'KRUPP 1910' on one of the bars (Coetzee 2014). This date may give a relative indication of the age of the pump station. However, the pump station's general 'modern' appearance suggests that it may have been constructed some decades after the railway line was built.

Figure 11- The pump station along the Olifants River which was used by the South African Railways.

8.2.1.3 The Vandyksdrift Railway Station (siding)

The Vandyksdrift Railway Station (siding) comprises several buildings and structures. It was part of the wider railway network that was connected to the Richards Bay harbour for the export of coal and other commodities.

Figure 12- The rail way station along the railway line in close proximity of the Olifants River (Coetzee 2014).

8.2.2 Graveyards

Two graveyards were recorded in the project area, namely:

8.2.2.2 Graveyard 01

This graveyard (GY01) comprises at least 31 graves with an east to west orientation. Most of the graves are marked by cement bases on which cement headstones were erected.

It is highly likely that most of the graves are older than sixty years.

Figure 13- Graveyard 01 holds approximately 31 graves with no or indecipherable inscriptions on the cement head stones (Coetzee 2014).

8.2.2.3 Graveyard 02

This graveyard (GY02) holds at least 13 graves with an east to west orientation. The graves are marked by cement bases on which headstones were fitted.

One of the headstones bears an inscription date of ‘1957’. It can therefore be expected that the majority of the graves are sixty years or older.

Figure 14- Graveyard 02 holds approximately 13 graves. A single headstone holds and inscription date of 1957 (Coetzee 2014).

Figure 15- Graveyard 02 was covered with grass during a second survey. A single headstone holds an inscription date of 1957.

8.3 Tables with details of historical structures and graveyards

Table 1- Coordinates for historical structures in the project area .

Historical structures	Coordinates	Significance
Douglas Colliery pump house	26.100306'S 29.302130'E	**Medium**
South African Railways pump house	26.100458'S 29.304178'E	**Medium**
Vandyksdrift Rail way station	26.073630"S 29.321430E	**Medium**

Table 2- Coordinates for graveyards and graves in and near the Project Area.

Graveyards	Coordinates	Significance
GY01. Approximately 31 graves	26.099837'S 29.307367'E	**HIGH**
GY02. Approximately 13 graves	26.094363'S 29.316150' E	**HIGH**

9 THE HERITAGE ASSESSMENT FOR THE VDDC PROJECT

9.1 The significance of the heritage resources

The significance of the heritage resources is indicated in order to establish the significance of the impact on any of these remains. This will determine whether any mitigation measures may be required for heritage resources which may be negatively affected by the VDDC Project.

9.1.1 The significance of the historical remains

The historical structures comprise remains which are older than sixty years or which are approaching this age and which therefore are protected by the NHRA.

The historical remains are rated as of medium significance. This rating is based on the use of two rating (grading) schemes, namely:

- A scheme of criteria which outlines places and objects as part of the national estate as they have cultural-historical significance or other special value (outlined in Section 3 of the NHRA (see Box 1) (Table 3).
- A field rating scheme according to which heritage resources are graded in three tiers (levels) of significance based on the regional occurrence of heritage resources (Table 4) (Section 7 of the NHRA).

9.1.1.1 Criteria to be part of the national estate

The NHRA distinguishes nine criteria for places and objects to be 'part of the national estate' if they have cultural significance or other special value, namely (also see Box 1):

- **Its importance in/to the community, or pattern of South Africa's history**;
- **Its possession of uncommon, rare or endangered aspects of South Africa's natural or cultural herit**age;
- **Its potential to yield information that will contribute to an understanding of South Africa's natural or cultural heritage;**
- Its importance in demonstrating the principal characteristics of a particular class of South Africa's natural or cultural places or objects;

- Its importance in exhibiting particular aesthetic characteristics valued by a community or cultural group;
- **Its importance in demonstrating a high degree of creative or technical achievement at a particular period**;
- Its strong or special association with a particular community or cultural group for social, cultural or spiritual reasons;
- **Its strong or special association with the life or work of a person, group or organisation of importance in the history of South Africa**; and
- Sites of significance relating to the history of slavery in South Africa.

Table 3- Rating the historical remains' significance according to criteria outlined in the NHRA.

Criteria	Low	Medium	High
Historical significance	X	X	
Social significance	X	X	
Technical significance	X	X	
Scientific significance (research, use, application, e.g. in tourism industry)	X	X	

The highlighted criteria reflect aspects of the historical, social, technical or scientific significance (research, use and application, e.g. in tourism industry) of the historical remains. According to these criteria the significance of the historical remains is graded as of low to medium significance (Table 3).

9.1.1.2 Field rating scheme for heritage resources

Grading of heritage resources remains the responsibility of heritage resources authorities. However, in terms of minimum standards SAHRA requires that heritage reports include field ratings in order to comply with Section 38 of the NHRA. Section 7 of the NHRA) provides for a three-tier grading system for heritage resources. The field rating process is designed to provide a qualitative and quantitative rating of heritage resources. The rating system distinguishes three categories of heritage resources:

- Grade I Heritage resources hold qualities so exceptional that they are of special national significance.
- Grade II Heritage resources hold qualities which make them significant within the context of a province or a region.
- Grade III heritage resources are worthy of conservation, i.e. are generally protected in terms of Sections 33 to 37 of the NHRA.

Table 4- Field rating (grading) for archaeological remains in the project area

Field rating	**Grade**	**Significance**	**Recommended mitigation**
National significance	Grade 1	High significance	Nominate national site. Conservation
Provincial significance	Grade 2	High significance	Nominate provincial site. Conservation
Local significance	Grade 3A	High significance	Conservation. Mitigation not advised.
Local significance	Grade 3B	High significance	Mitigation (part of site should be retained)
Generally Protected (GP.A)	-	Medium to High significance	Mitigation before destruction
Generally Protected (GP.B)	**-**	**Medium significance**	**Recording before destruction**
Generally Protected (GP.C)	-	Low significance	Destruction

According to the highlighted field rating scheme, the historical remains can be rated as of medium significance and can be destroyed after the remains have been recorded and a permit allowing for the destruction of the remains have been obtained from SAHRA (Table 4).

9.1.2 The significance of the graveyards

All graveyards and graves can be considered to be of high significance and are protected by various laws (Table 1). Legislation with regard to graves includes Section 36 of the NHRA in instances where graves are older than sixty years. Other legislation with regard to graves includes those which apply when graves are exhumed and relocated, namely the Ordinance on Exhumations (No 12 of 1980) and the Human Tissues Act (No 65 of 1983 as amended). Municipal laws with regard to graves and graveyards may differ and professionals involved with the exhumation and relocation of graves and graveyards must adhere to these laws.

9.2 Possible impact on the heritage resources

According to the layout plan for the VDDC Project the following can be noted (Figure 9):

- The historical structures consisting of pump stations and a railway siding will not be affected by the proposed VDDC Project.
- GY02 will be affected when the open cast pit is expanded beyond the current approved area.

9.3 The significance of the impact on the heritage resources

9.3.1 The significance of the impact on the historical remains

None of the historical remains will be affected by the proposed VDDC Project. The significance of the impact on these remains therefore is very low (Table 5).

Table 5- The significance of the impact on the historical structures is very low.

Historical Structures	Probability of impact	Magnitude of impact	Duration of impact	Scale	Significance points	Significance rating	Significance after management
Douglas Pump Station	**1**	**2**	**1**	**1**	**4**	**Very low**	**Very low**
SAR Pump Station	**1**	**2**	**1**	**1**	**4**	**Very low**	**Very low**
Vandyksdrift Railway	**1**	**2**	**1**	**1**	**4**	**Very low**	**Very low**

9.3.2 The significance of the impact on the graveyards

GY01 will not be affected by the VDDC Project. The significance of the impact on GY01 therefore is very low and will remain very low if management measures as outlined in the report are implemented.

GY02 will be affected by open cast mining activities. The significance of the impact on GY02 therefore is high but will be low if mitigation measures as outlined in the report be implemented (Table 6).

Table 6- The significance of the impact on the graveyards.

	Probability of impact	Magnitude of impact	Duration of impact	Scale	Significance points	Significance rating	Significance after management
GY01	**1**	**2**	**1**	**1**	**4**	**Very low**	**Very low**
GY02	**5**	**10**	**5**	**1**	**90**	**High**	**Low**

9.4 Mitigating the graveyard (GY02) that will be affected

GY02 must be exhumed and relocated. The exhumation of human remains and the relocation of graveyards are regulated by various laws, regulations and administrative procedures. This task is undertaken by forensic archaeologists or by reputed

undertakers who are acquainted with all the administrative procedures and relevant legislation that have to be adhered to whenever human remains are exhumed and relocated. This process also includes social consultation with a 60 days statutory notice period for graves older than sixty years. Permission for the exhumation and relocation of human remains have to be obtained from the descendants of the deceased (if known), the National Department of Health, the Provincial Department of Health, the Premier of the Province and the local police. Municipal laws with regard to graves and graveyards may differ and professionals involved with the exhumation and relocation of graves and graveyards must adhere to these laws.

9.5 Managing the graveyard (GY01) that remains unaffected

GY01 in the VDDC project area must be managed in order to ensure its future unaffected existence in the project area, namely:

- The graveyard must be demarcated with a fence or with walls and should be fitted with an access gate. Relatives of the deceased must be located by means of social consultation and to obtain permission for fencing or walling the cemetery.
- Regulated visitor hours must be implemented that is compatible with safety rules. This will not be necessary if the graveyard is located next to a public or national road which can provide direct access to the graveyard.
- Corridors of at least 100m should be maintained between the graveyard's border fences and any developmental components such as roads or other infrastructure that may be developed in the future. This buffer zone must be maintained at all times.
- The graveyard should be inspected every three months. Inspections should be noted in an inspection register. The register should outline the state of the graveyard during each inspection. Reports on damages to any of the graves or to the graveyards (fences, walls, gates) should be followed with the necessary maintenance work. Maintenance work should be recorded in the inspection register.
- The graveyards should be kept tidy from any invader weeds and any other refuse.

9.6 Chance-find procedures

Chance Find Procedures are applicable during the construction, operation or closure phases of the VDDC Project and apply to all contractors, subcontractors, subsidiaries or service providers. If any of these institutions' employees find any heritage resources during any developmental activity all work at the site must be stopped and kept on hold. Chance finds must be reported to supervisors and through supervisors to the senior manager on site. Chance find procedures are summarized for heritage resources and graveyards.

9.6.1 Chance-find procedures for heritage resources

The initial procedure to follow whenever heritage resources are uncovered during development is aimed at avoiding any further possible damage to the heritage resources, namely:

- The person or group (identifier) who identified or exposed the heritage resource or burial ground must cease all activity in the immediate vicinity of the site.
- The identifier must immediately inform the senior on-site manager of the discovery.
- The senior on-site manager must make an initial assessment of the extent of the find and confirm that further work has stopped and ensure that the site is secured and that controlled access is implemented.
- The senior on-site manager will inform the Environmental Officer (EO) and Health and Safety (HS) officers of the chance find and its immediate impact on the VDDC Project. The EO will then contact the project archaeologist.
- The project archaeologist will do a site inspection and confirm the significance of the discovery, recommend appropriate mitigation measures to the mine and notify the relevant authorities.
- Based on the comments received from the authorities the project archaeologist will provide the mine with a Terms of Reference and associated costs if mitigation measures have to be implemented.

9.6.2 Chance-find Procedures for burials and graves

In the event that unidentified burial grounds or graves are identified and/or exposed during any of the developmental phases of the VDDC Project the following steps must be implemented subsequent to those outlined above:

- The project archaeologist must confirm the presence of graveyards and graves and follow the following procedures.
- Inform the local South African Police Service (SAPS) and traditional authority.
- The project archaeologist in conjunction with the SAPS and traditional authority will inspect the possible graves and make an informed decision whether the remains are of forensic, recent, cultural-historical or archaeological significance.
- Should it be concluded that the find is of heritage significance and therefore protected in terms of heritage legislation the project archaeologist will notify the relevant authorities.
- The project archaeologist will provide advice with regard to mitigation measures for the burial grounds and graves.

10 CONCLUSION AND RECOMMENDATIONS

The heritage survey revealed that the following heritage resources as outlined in Section 38 of the NHRA still occur in the project area, namely (Figure 9):

- Historical structures consisting of rail infrastructure and pump stations.
- Two graveyards.

The historical remains are rated as of medium significance. None of the historical remains will be affected by the proposed VDDC Project and the significance of the impact on these remains therefore is very low. All graveyards and graves can be considered to be of high significance and are protected by various laws (Table 1).

GY01 will not be affected by the VDDC Project. The significance of the impact on GY01 therefore is very low and will remain very low if management measures as outlined in the report are implemented.

GY02 will be affected by open cast mining activities. The significance of the impact on GY02 therefore is very high but will be low if mitigation measures as outlined in the report be implemented, i.e. GY02 must be exhumed and relocated.

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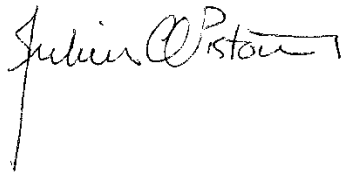
Chance-find Procedures are applicable during the construction, operation or closure phases of the VDDC Project and apply to all contractors, subcontractors, subsidiaries or service providers. If any of these institutions' employees find any heritage resources during any developmental activity all work at the site must be stopped and kept on hold. Chance finds must be reported to supervisors and through supervisors to the senior manager on site. Chance find procedures for heritage resources and graveyards are outlined in the report.



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8.7 Biodiversity and Wetland Assessment

BASELINE ENVIRONMENTAL & IMPACT ASSESSMENT FOR THE VANDYKSDRIFT CENTRAL (VDDC) MINING AND INFRASTRUCTURE DEVELOPMENT

Emalahleni, Mpumalanga

November 2018 (Revised September 2019)

CLIENT

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Report Name	**BIODIVERSITY BASELINE & IMPACT ASSESSMENT FOR THE VANDYKSDRIFT CENTRAL (VDDC) MINING: INFRASTRUCTURE DEVELOPMENT**	
Reference	**VDDC South32**	
Submitted to	**Jones & Wagener Engineering and Environmental Consultants**	
Report Writer / Reviewer	**Andrew Husted**	
	Andrew Husted is Pr Sci Nat registered (400213/11) in the following fields of practice: Ecological Science, Environmental Science and Aquatic Science. Andrew is an Aquatic, Wetland and Biodiversity Specialist with more than 12 years' experience in the environmental consulting field. Andrew has completed numerous wetland training courses, and is an accredited wetland practitioner, recognised by the DWS, and also the Mondi Wetlands programme as a competent wetland consultant.	
Report Writer (Herpetofauna)	**Michael Adams**	
	Michael Adams is Cert Sci Nat registered (118544) and is an experienced natural scientist with a specialisation in herpetofauna. He has over 10 years of experience working with reptiles and amphibians as a consultant and through various conservation initiatives.	
Report Writer (Aquatic Ecology)	**Russell Tate**	
	Russell Tate is a published, registered Professional Scientist (Pr. Sci. Nat Aquatic Health: 400089/15) with an MSc in aquatic eco-toxicology.Russell has worked on numerous coal mining related assessments which include the monitoring of the impacts of existing surface and underground coal mines. Russell therefore has a knowledge of the potential impacts arising from the proposed project.	
Report Contributor (Botany & Fauna)	**Martinus Erasmus**	
	Martinus Erasmus obtained his B-Tech degree in Nature Conservation in 2016 at the Tshwane University of Technology. Martinus has been conducting basic assessments and assisting specialists in field during his studies since 2015.	
Declaration	The Biodiversity Company and its associates operate as independent consultants under the auspice of the South African Council for Natural Scientific Professions. We declare that we have no affiliation with or vested financial interests in the proponent, other than for work performed under the Ecological Assessment Regulations, 2017. We have no conflicting interests in the undertaking of this activity and have no interests in secondary developments resulting from the authorisation of this project. We have no vested interest in the project, other than to provide a professional service within the constraints of the project (timing, time and budget) based on the principals of science.	

DOCUMENT GUIDE

The table below provides the NEMA (2014) Requirements for Ecological Assessments, and also the relevant sections in the reports where these requirements are addressed:

GN R982	Description	Section in the Report
Specialist Report		
Appendix 6 (a)	A specialist report prepared in terms of these Regulations must contain— details of— i. the specialist who prepared the report; and ii. the expertise of that specialist to compile a specialist report including a curriculum vitae;	Page i
Appendix 6 (b)	A declaration that the specialist is independent in a form as may be specified by the competent authority;	Page iii - v
Appendix 6 (c)	An indication of the scope of, and the purpose for which, the report was prepared;	Section 1
Appendix 6 (cA)	An indication of the quality and age of base data used for the specialist report;	Section 6 & 7
Appendix 6 (cB)	A description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change;	Section 9
Appendix 6 (d)	The duration, date and season of the site investigation and the relevance of the season to the outcome of the assessment;	Section 1
Appendix 6 (e)	A description of the methodology adopted in preparing the report or carrying out the specialised process inclusive of equipment and modelling used;	Section 2
Appendix 6 (f)	Details of an assessment of the specific identified sensitivity of the site related to the proposed activity or activities and its associated structures and infrastructure, inclusive of a, site plan identifying site alternatives;	Section 7 & 8
Appendix 6 (g)	An identification of any areas to be avoided, including buffers;	Section 8
Appendix 6 (h)	A map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers;	Section 8
Appendix 6 (i)	A description of any assumptions made and any uncertainties or gaps in knowledge;	Section 3
Appendix 6 (j)	A description of the findings and potential implications of such findings on the impact of the proposed activity **[including identified alternatives on the environment]** or activities;	Section 7- 9
Appendix 6 (k)	Any mitigation measures for inclusion in the EMPr;	Section 9
Appendix 6 (l)	Any conditions for inclusion in the environmental authorisation;	Section 9
Appendix 6 (m)	Any monitoring requirements for inclusion in the EMPr or environmental authorisation;	Section 9
Appendix 6 (n)	A reasoned opinion— i. **[as to]** whether the proposed activity, activities or portions thereof should be authorised; (iA) regarding the acceptability of the proposed activity or activities; and ii. if the opinion is that the proposed activity, activities or portions thereof should be authorised, any avoidance, management and mitigation measures that should be included in the EMPr, and where applicable, the closure plan;	Section 10
Appendix 6 (o)	A description of any consultation process that was undertaken during the course of preparing the specialist report;	N/A
Appendix 6 (p)	A summary and copies of any comments received during any consultation process and where applicable all responses thereto; and	N/A
Appendix 6 (q)	Any other information requested by the competent authority.	None

DECLARATION

I, Michael Adams, declare that:

- I act as the independent specialist in this application;
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the Act, regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, regulations and all other applicable legislation;
- I have no, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing any decision to be taken with respect to the application by the competent authority; and the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- All the particulars furnished by me in this form are true and correct; and
- I realise that a false declaration is an offence in terms of Regulation 71 and is punishable in terms of Section 24F of the Act.

Michael Adams

Terrestrial Ecologist

The Biodiversity Company

15th August 2018

DECLARATION

I, Andrew Husted declare that:

- I act as the independent specialist in this application;
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the Act, regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, regulations and all other applicable legislation;
- I have no, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing any decision to be taken with respect to the application by the competent authority; and the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
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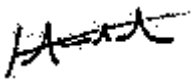

Andrew Husted

Wetland Ecologist

The Biodiversity Company

15th August 2018

DECLARATION

I, Russell Tate declare that:

- I act as the independent specialist in this application;
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the Act, regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, regulations and all other applicable legislation;
- I have no, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing any decision to be taken with respect to the application by the competent authority; and the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- All the particulars furnished by me in this form are true and correct; and
- I realise that a false declaration is an offence in terms of Regulation 71 and is punishable in terms of Section 24F of the Act.

Russell Tate

Aquatic Specialist

The Biodiversity Company

15th August 2018

Table of Contents

Tables

Figures

1 Introduction and Background

South32 SA Coal Holdings (Pty) Ltd (South32), is the holder of an amended mining right for coal, granted by the Minister of Mineral Resources, in terms of the Mineral and Petroleum Resources Development Act, 2002 (Act 28 of 2002) (MPRDA) and notarially executed on the 21st of May 2015 under DMR reference MP30/5/1/2/2/379MR, in respect of its Wolvekrans – Ifalethu Colliery. This mining right comprises of the following areas:

- Ifalethu Colliery (previously referred to as Wolvekrans North Section[1]) consisting of the Hartbeestfontein, Bankfontein (mining now ceased), Goedehoop, Klipfontein sections and the North Processing Plant; and
- Wolvekrans Colliery (previously referred to as the Wolvekrans South Section) consisting of the Wolvekrans, Vlaklaagte (mining ceased), Driefontein, Boschmanskrans, Vandyksdrift, Albion and Steenkoolspruit sections, as well as the South Processing Plants (Eskom and Export). Some of these areas were previously known as Douglas Colliery.

The Vandyksdrift Central (VDDC) area falls within the footprint of historic underground mining operations at the old Douglas Colliery. In 2007, an amendment of the Environmental Management Programme Report (EMPR) for the Douglas Colliery operations was approved, to allow pillar mining (opencast) of the area previously mined by underground bord and pillar mining. Authorisation of the VDDC mining project included the following:

- Opencast operation on the farm Kleinkopje 15 IS;
- Opencast operation on the farm Steenkoolspruit 18 IS;
- Pillar extraction operation on the farm Vandyksdrift 19 IS;
- Reclamation of existing slurry ponds; and
- Rewashing of existing discard dumps (PHD, 2006).

The water uses associated with the opencast mining have been authorised in terms of Water Use Licence (WUL) number 24084535 dated 10 October 2008, issued to Douglas Colliery Services Limited.

The No. 2 seam workings are flooded with water and must be dewatered to enable the open pit development to proceed. A dewatering strategy has therefore been developed and an application for Environmental Authorisation (EA) of the dewatering activities was submitted to the Department of Mineral Resources (DMR) (Jaco-K Consulting, 2016(a)); a decision in this regard is pending. The water use activities associated with this upfront dewatering strategy have been authorised by WUL number 06/B11F/GCIJ/7943 dated 19 July 2018.

The 2007 approved EMPR Amendment included limited additional infrastructure in support of the opencast mining operations, as it was assumed at that stage that existing infrastructure will be used. In addition, the applications for authorisation of the activities associated with the

[1] This was previously referred to as Middelburg Colliery

dewatering strategy, were limited to the infrastructure to facilitate dewatering (i.e. dewatering boreholes, pumps, pipelines, storage tanks, mechanical evaporators, roads and power lines).

A pre-feasibility investigation has since been conducted, and the need to develop additional infrastructure to support the proposed opencast mining was identified. The additional infrastructure includes the following:

- Storm water management structures (drains and berms);
- Water management measures for the management of mine impacted water;
- Overburden dumps;
- ROM coal stockpile areas;
- Mixed ROM coal and slurry stockpile areas;
- Topsoil stockpiles following clearance of vegetation;
- Pipelines for the conveyance of water;
- Hard park area and brake test ramp; and
- Haul roads and service roads.

The proposed VDDC opencast pit boundary as determined through the pre-feasibility investigation also differs from the mining area approved in the 2007 EMPR amendment. An area of approximately 196 hectares in the latest mine lay-out was not included in the previous mine lay-out and is therefore not approved to be opencast mined.

The Biodiversity Company (TBC) was appointed by Jones and Wagener (J&W) to conduct a baseline assessment of the fauna, flora, wetlands and riverine ecology and to assess the impacts that the proposed project will have on the remaining natural ecosystems and associated biodiversity.

1.1 Terms of Reference

The requirements stipulated by the minimum standards required by the Mpumalanga Tourism and Parks Agency[2] (MTPA) for environmental assessments and the Department of Water and Sanitation[3] (DWS) were considered for determining the Terms of Reference (ToR) for the assessment.

Dry season surveys were conducted in the first week of August 2018 and a wet season survey was conducted from the 26th to 28th of November 2018. A third survey was conducted on 13th June 2019 to accommodate some infrastructure amendments. The surveys were conducted by three terrestrial ecologists, two (separate) wetland specialists and one aquatic ecology specialist. The surveys focused primarily on those areas which were likely to be impacted upon

2 Minimum requirements for environmental study reports when applying for authorisation for an activity that may have a detrimental effect on the environment

3 Regulations regarding the procedural requirements for Water Use Licence Applications and appeals, Government Gazette, 24 March 2017

by the proposed development at VDDC and specifically where surface infrastructure was due to be altered or constructed.

Furthermore, identification and description of any sensitive receptors were recorded across the Project area, and the manner in which these sensitive receptors may be affected by the activity was also investigated. The purpose of the specialist study is to provide relevant input into the Environmental Impact Assessment (EIA) process and to provide a report for the proposed activities associated with mining and ancillary activities proposed to take place on site.

This report, after taking into consideration the findings and recommendation provided by the specialist herein, should inform and guide the Environmental Assessment Practitioner (EAP) and regulatory authorities, enabling informed decision making with regards to the proposed activity.

1.2 Project Location

The VDDC infrastructure and mining project is a brownfields project within the greater Wolvekrans Colliery mining rights area. Wolvekrans Colliery is located between the towns of eMalahleni and Kriel, within the jurisdictional area of the eMalahleni Local Municipality (ELM) and the Nkangala District Municipality (NDM) of the Mpumalanga Province. The mine is situated approximately 30 km south-east of the town of eMalahleni, in close proximity to the Duvha Power Station (Figure 1).

The VDDC section is located on the western boundary of Wolvekrans Colliery. The Olifants River forms the southern boundary of this mining section.

The proposed infrastructure and mining development will take place on the farms Kleinkopje 15 IS, Vandyksdrift 19 IS, Wolvekrans 17 IS and Steenkoolspruit 18 IS.

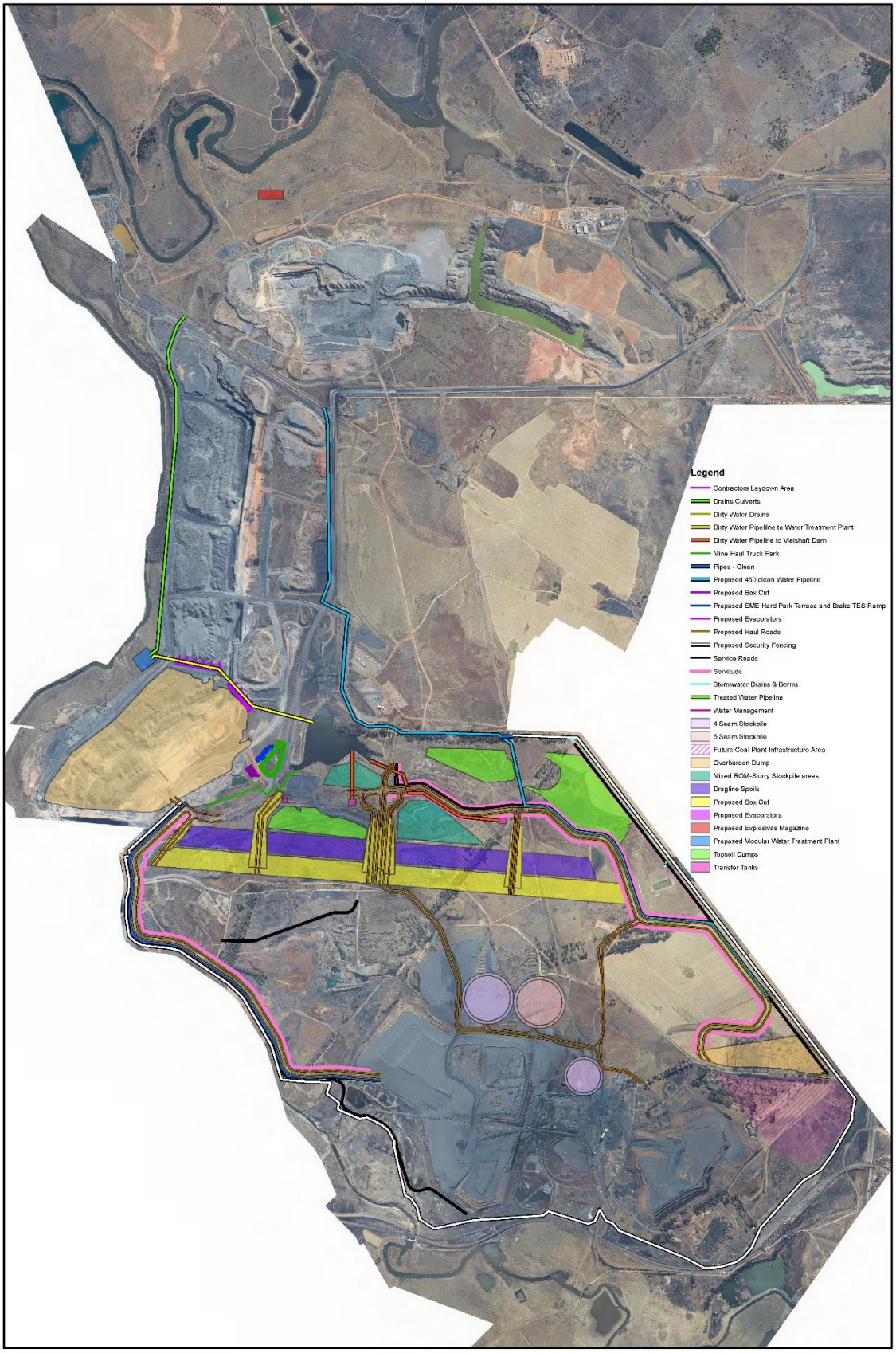

Figure 1: The proposed VDDC project area

2 Methodologies

Field surveys were conducted within the first week of August 2018 and the last week of November 2018, as well as in June 2019 to confirm the presence of species identified in the desktop assessment. The specialist disciplines were completed for this study:

- Botanical;
- Fauna (mammals and avifauna);
- Herpetology (reptiles and amphibians);
- Wetland ecology; and
- Aquatic ecology.

Brief descriptions of the standardised methodologies applied in each of the specialist disciplines are provided below. More detailed descriptions of survey methodologies are available upon request.

2.1 Geographic Information Systems (GIS) Mapping

A National Aeronautics and Space Administration (NASA) Shuttle Radar Topography Mission (SRTM) (V3.0, 1 arcsec resolution) Digital Elevation Model (DEM) was obtained from the United States Geological Survey (USGS) Earth Explorer website. Basic terrain analysis was performed on this DEM using the SAGA GIS software that encompassed a slope, landforms and channel network analyses in order to detect ridges, potential landscape depressions and drainage lines respectively.

Additional existing data layers were incorporated into a GIS to establish how the proposed mining operation interacts with these important entities. Emphasis was placed around the following spatial datasets:

- Vegetation Map of South Africa, Lesotho and Swaziland (Mucina *et al*., 2007);
- Mpumalanga Biodiversity Sector Plan (MBSP) Terrestrial Assessment 2014 (MTPA, 2014);
- MBSP Landcover 2010 (MTPA, 2010); and
- Mining and Biodiversity Guideline (SANBI & SAMBF 2012).

2.2 Botanical Assessment

The botanical study encompassed an assessment of all the vegetation units and habitat types within the Project area. The focus was on a full assessment of habitat types as well as identification for any red-data species within the known distribution of the Project area. The methodology included the following survey techniques:

- Timed Meander;
- Sensitivity analysis based on structural and species diversity;
- Identification of floral red-data species; and

- Delineation of wetlands based on vegetation.

2.3 Literature Study

A literature review was conducted as part of the desktop study to identify the potential habitats present within the Project area. The South African National Biodiversity Institute (SANBI) provides an electronic database system, namely the Botanical Database of Southern Africa (BODATSA), to access distribution records on southern African plants4. This is a new database which replaces the old Plants of Southern Africa (POSA) database. The POSA database provided distribution data of flora at the quarter degree square (QDS) resolution. However, the BODATSA database provides distribution data as point coordinates. The literature study, therefore, focussed on querying the database to generate species lists for the extent in order to increase the likelihood of obtaining a representative species list for the Project Area. The Red List of South African Plants website (SANBI, 2016) was utilized to provide the most current account of the national status of flora. Relevant field guides and texts consulted for identification purposes in the field during the surveys included the following:

- Field Guide to the Wild Flowers of the Highveld (Van Wyk & Malan, 1997);
- A Field Guide to Wild Flowers (Pooley, 1998);
- Guide to grasses of Southern Africa (Van Oudtshoorn, 1999);
- Orchids of South Africa (Johnson & Bytebier, 2015);
- Guide to the Aloes of South Africa (Van Wyk & Smith, Guide to the Aloes of South Africa, 2014);
- Mesembs of the World (Smith, et al., 1998);
- Medicinal Plants of South Africa (Van Wyk, Van Oudtshoorn, & Gericke, Medicinal Plants of South Africa, 2013);
- Freshwater Life: A field guide to the plants and animals of Southern Africa (Griffiths & Day, 2016); and
- Identification guide to southern African grasses. An identification manual with keys, descriptions and distributions (Fish, Mashau, Moeaha, & Nembudani, 2015).

Additional information regarding ecosystems, vegetation types, and species of conservation concern (SCC) included the following sources:

- The Vegetation of South Africa, Lesotho and Swaziland (Mucina & Rutherford, 2006);
- Grassland Ecosystem Guidelines: landscape interpretation for planners and managers (SANBI, 2013); and
- Red List of South African Plants (Raimonde, et al., 2009; SANBI, 2016).

4 Data is obtained from the National Herbarium in Pretoria (PRE), the Compton Herbarium in Cape Town (NBG & SAM) and the KwaZulu-Natal Herbarium in Durban (NH)

2.4 Dry and Wet Season Fieldwork

The dry and wet season fieldwork and sample sites were placed within targeted areas (i.e. target sites) perceived as ecologically sensitive based on the preliminary interpretation of satellite imagery and GIS analysis (which included the latest applicable biodiversity datasets) available prior to the fieldwork.

The focus of the fieldwork was therefore to maximise coverage and navigate to each target site in the field in order to perform a basic vegetation and ecological habitat assessment at each sample site. Emphasis was placed on sensitive habitats, especially those overlapping with proposed development areas.

At each sample site notes were made regarding current impacts (e.g. mining, erosion etc.), subjective recording of dominant vegetation species and any sensitive features (e.g. wetlands, outcrops etc.). In addition, opportunistic observations were made while navigating through the Project area. Effort was made to cover all the different habitat types within the limits of time and access.

2.5 Faunal Assessment (Mammals and Avifauna)

The faunal desktop assessment included the following:

- Compilation of expected species lists;
- Compilation of identified species lists;
- Identification of any Red Data or species of conservation concern (SCC) present or potentially occurring in the area (especially relating to avifauna); and
- Emphasis was placed on the probability of occurrence of species of provincial, national and international conservation importance.

The field survey component of the study utilised a variety of sampling techniques including, but not limited to, the following:

- Camera trapping (Figure 2);
- Visual observations;
- Small mammal trapping (Figure 2);
- Identification of tracks and signs; and
- Utilization of local knowledge.

Site selection for trapping focussed on the representative habitats within the project area. Sites were selected on the basis of GIS mapping and Google Earth imagery and then final selection was confirmed through ground truthing during the surveys. Habitat types sampled included pristine, disturbed and semi-disturbed zones, drainage lines, wetlands and rocky ridges.

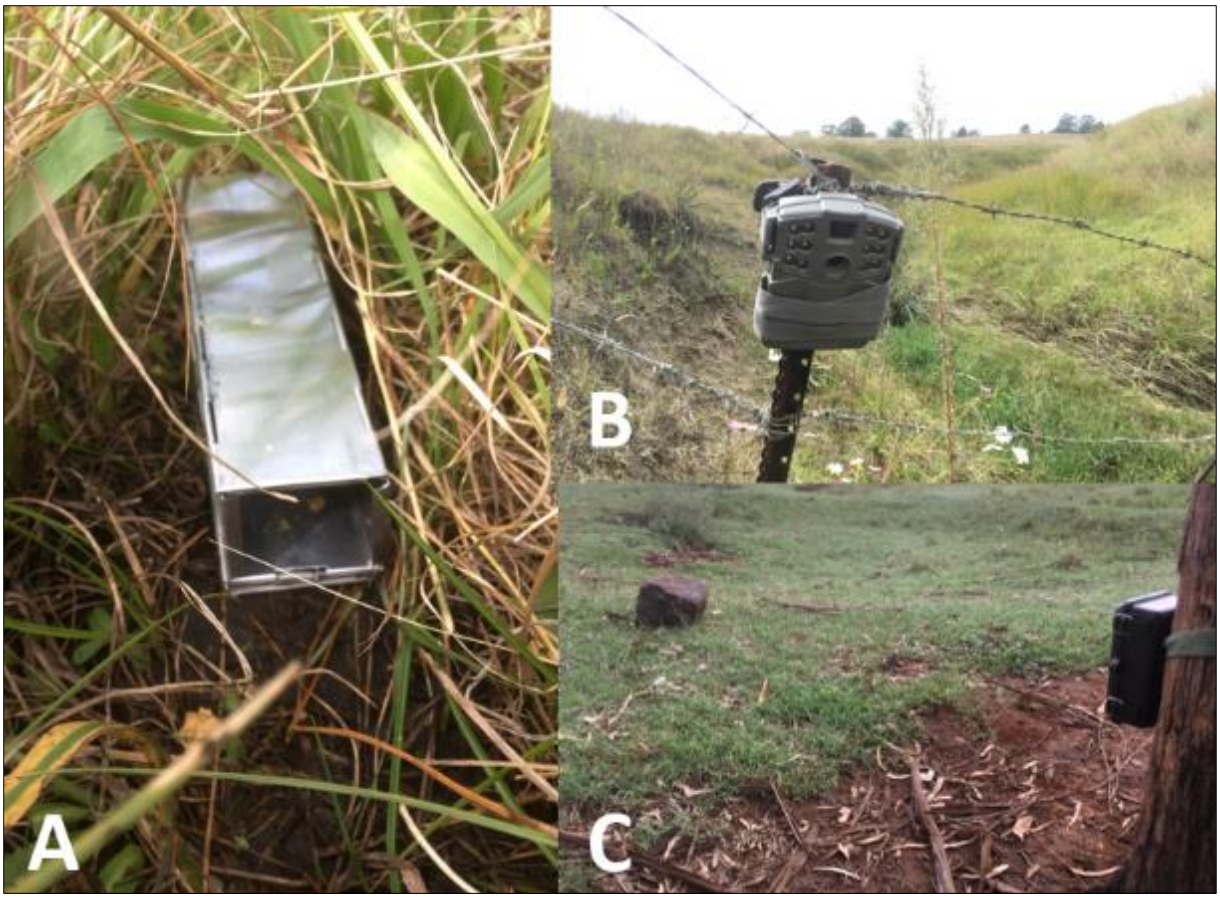

Figure 2: A) A baited Sherman trap deployed in the Project area; B) & C) An example of the motion-activated camera traps deployed in the Project area

2.6 Herpetology (Reptiles and Amphibians)

A herpetofauna assessment of the Project area was conducted, including in-depth, site-specific research and focused searching. Ideally, surveys for herpetofauna should be conducted at those times when the target species or communities are known to be active because these periods of activity are more likely to lead to capture success (for most species). In South Africa this is during the summer months and ideally after or during periods when rainfall is most likely or has recently occurred.

Surveys were conducted in each habitat or vegetation type within the Project area, as identified from the desktop study, with a focus on those areas which will be most impacted by the proposed development (i.e. the infrastructure development and waste stockpiling areas).

The herpetological field survey comprised the following techniques:

- Diurnal hand searches - are used for reptile species that shelter in or under particular microhabitats (typically rocks, exfoliating rock outcrops, fallen timber, leaf litter, bark etc.);
- Visual searches - typically undertaken for species whose behaviour involves surface activity or for species that are difficult to detect by hand-searches or pitfall trapping. May include walking transects or using binoculars to view species from a distance without them being disturbed;

- Amphibians – many of the survey techniques listed above will be able to detect species of amphibians. Over and above these techniques, vocalisation sampling techniques are often the best to detect the presence of amphibians as each species has a distinct call; and
- Opportunistic sampling - Reptiles, especially snakes, are incredibly illusive and difficult to observe. Consequently, all possible opportunities to observe reptiles are taken, in order to augment the standard sampling procedures described above. This will include talking to local people and staff at the site and reviewing photographs of reptiles and amphibians that the other biodiversity specialists may come across while on site.

2.7 Wetland Assessment

The National Wetland Classification Systems (NWCS) developed by the South African National Biodiversity Institute (SANBI) was considered for this study. This system comprises a hierarchical classification process of defining a wetland based on the principles of the hydrogeomorphic (HGM) approach at higher levels. In addition, the method also includes the assessment of structural features at the lower levels of classification (Ollis *et al*. 2013).

2.7.1 Wetland Identification and Mapping

The wetland areas are delineated in accordance with the DWAF (2005) guidelines, a cross section is presented in Figure 3. The outer edges of the wetland areas were identified by considering the following four specific indicators:

- The Terrain Unit Indicator helps to identify those parts of the landscape where wetlands are more likely to occur;
- The Soil Form Indicator identifies the soil forms, as defined by the Soil Classification Working Group (1991), which are associated with prolonged and frequent saturation.
    - The soil forms (types of soil) found in the landscape were identified using the South African soil classification system namely; Soil Classification: A Taxonomic System for South Africa (Soil Classification Working Group, 1991);
- The Soil Wetness Indicator identifies the morphological "signatures" developed in the soil profile as a result of prolonged and frequent saturation; and
- The Vegetation Indicator identifies hydrophilic vegetation associated with frequently saturated soils.

Vegetation is used as the primary wetland indicator. However, in practise the soil wetness indicator tends to be the most important, and the other three indicators are used in a confirmatory role.

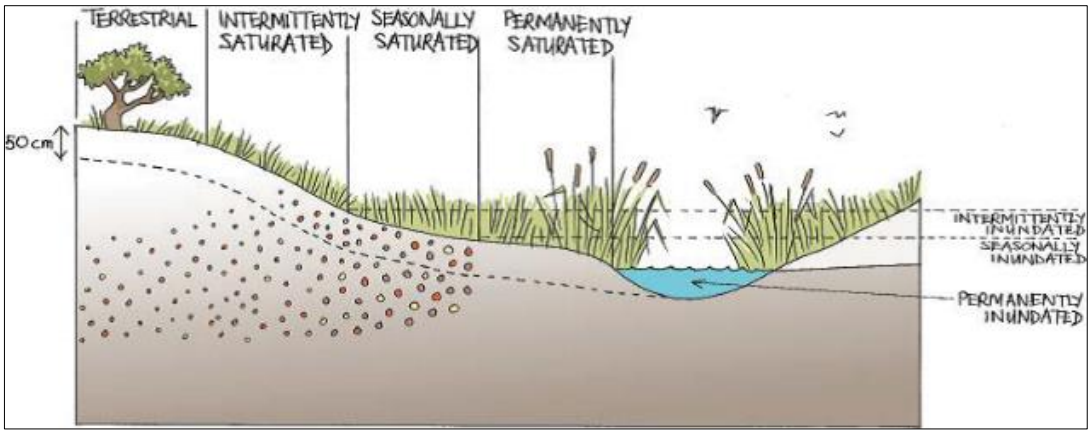

Figure 3: Cross section through a wetland, indicating how the soil wetness and vegetation indicators change (Ollis *et al*. 2013)

2.7.2 Wetland Delineation

The wetland indicators described above are used to determine the boundaries of the wetlands within the Project area. These delineations are then illustrated by means of maps accompanied by descriptions.

2.7.3 Wetland Functional Assessment

Wetland Functionality refers to the ability of wetlands to provide healthy conditions for the wide variety of organisms found in wetlands as well as humans. Eco Services serve as the main factor contributing to wetland functionality.

The assessment of the ecosystem services supplied by the identified wetlands was conducted per the guidelines as described in WET-EcoServices (Kotze *et al*. 2009). An assessment was undertaken that examines and rates the following services according to their degree of importance and the degree to which the services are provided (Table 1).

Table 1: Classes for determining the likely extent to which a benefit is being supplied

Score	Rating of likely extent to which a benefit is being supplied
< 0.5	Low
0.6 - 1.2	Moderately Low
1.3 - 2.0	Intermediate
2.1 - 3.0	Moderately High
> 3.0	High

2.7.4 Determining the Present Ecological Status (PES)

The overall approach is to quantify the impacts of human activity or clearly visible impacts on wetland health, and then to convert the impact scores to a Present Ecological Status (PES) score. This takes the form of assessing the spatial extent of impact of individual activities/occurrences and then separately assessing the intensity of impact of each activity in

the affected area. The extent and intensity are then combined to determine an overall magnitude of impact. The Present State categories are provided in Table 2.

Table 2: The Present Ecological Status categories (Macfarlane, et al., 2009)

Impact Category	Description	Impact Score Range	PES
None	**Unmodified, natural**	**0 to 0.9**	**A**
Small	**Largely Natural** with few modifications. A slight change in ecosystem processes is discernible and a small loss of natural habitats and biota may have taken place.	**1.0 to 1.9**	**B**
Moderate	**Moderately Modified.** A moderate change in ecosystem processes and loss of natural habitats has taken place, but the natural habitat remains predominantly intact.	**2.0 to 3.9**	**C**
Large	**Largely Modified.** A large change in ecosystem processes and loss of natural habitat and biota has occurred.	**4.0 to 5.9**	**D**
Serious	**Seriously Modified.** The change in ecosystem processes and loss of natural habitat and biota is great, but some remaining natural habitat features are still recognizable.	**6.0 to 7.9**	**E**
Critical	**Critical Modification.** The modifications have reached a critical level and the ecosystem processes have been modified completely with an almost complete loss of natural habitat and biota.	**8.0 to 10**	**F**

2.7.5 Determining the Ecological Importance and Sensitivity (EIS)

The method used for the EIS determination was adapted from the method as provided by DWS (1999) for floodplains. The method takes into consideration PES scores obtained for WET-Health as well as function and service provision to enable the assessor to determine the most representative EIS category for the wetland feature or group being assessed. A series of determinants for EIS are assessed on a scale of 0 to 4, where 0 indicates no importance and 4 indicates very high importance. The mean of the determinants is used to assign the EIS category as listed in Table 3 (Rountree *et al*. 2012).

Table 3: Description of Ecological Importance and Sensitivity categories

EIS Category	Range of Mean	Recommended Ecological Management Class
Very High	3.1 to 4.0	**A**
High	2.1 to 3.0	**B**
Moderate	1.1 to 2.0	**C**
Low Marginal	< 1.0	**D**

2.7.6 Ecological Classification and Description

The National Wetland Classification Systems (NWCS) developed by the South African National Biodiversity Institute (SANBI) was considered for this study. This system comprises a hierarchical classification process of defining a wetland based on the principles of the

hydrogeomorphic (HGM) approach at higher levels, and also then includes structural features at the lower levels of classification (Ollis *et al*. 2013).

2.7.7 Determining Buffer Requirements

The “Preliminary Guideline for the Determination of Buffer Zones for Rivers, Wetlands and Estuaries” (Macfarlane *et al*. 2014) was used to determine the appropriate buffer zone for the proposed activity.

2.8 Aquatic assessment

A single aquatic sampling survey was conducted in the first week of August 2018. The sampling during this period would constitute a low flow assessment.

2.8.1 Water Quality

Water quality was measured *in situ* using a handheld pre calibrated Extech ExStik II meter (probe). The constituents considered that were measured included: pH, conductivity (µS/cm), temperature (°C) and Dissolved Oxygen (DO) in mg/l.

2.8.2 Aquatic Habitat Integrity

The Intermediate Habitat Integrity Assessment (IHIA) index as described in the Procedure for Rapid Determination of Resource Directed Measures for River Ecosystems (Section D), was used to define the ecological status of the river reach. The method is based on Kleynhans (1996).

The IHIA model was used to assess the integrity of the habitats from a riparian and instream perspective. The habitat integrity of a river refers to the maintenance of a balanced composition of physico-chemical and habitat characteristics on a temporal and spatial scale that are comparable to the characteristics of natural habitats of the region (Kleynhans, 1996). The criteria and ratings utilised in the assessment of habitat integrity in the current study are presented in Table 4 and Table 5.

Table 4: Criteria used in the assessment of habitat integrity (Kleynhans, 1996)

Criterion	Relevance
Water abstraction	Direct impact on habitat type, abundance and size. Also implicated in flow, bed, channel and water quality characteristics. Riparian vegetation may be influenced by a decrease in the supply of water.
Flow modification	Consequence of abstraction or regulation by impoundments. Changes in temporal and spatial characteristics of flow can have an impact on habitat attributes such as an increase in duration of low flow season, resulting in low availability of certain habitat types or water at the start of the breeding, flowering or growing season.
Bed modification	Regarded as the result of increased input of sediment from the catchment or a decrease in the ability of the river to transport sediment. Indirect indications of sedimentation are stream bank and catchment erosion. Purposeful alteration of the stream bed, e.g. the removal of rapids for navigation is also included.
Channel modification	May be the result of a change in flow, which may alter channel characteristics causing a change in marginal instream and riparian habitat. Purposeful channel modification to improve drainage is also included.
Water quality modification	Originates from point and diffuse point sources. Measured directly or alternatively agricultural activities, human settlements and industrial activities may indicate the likelihood of modification. Aggravated by a decrease in the volume of water during low or no flow conditions.
Inundation	Destruction of riffle, rapid and riparian zone habitat. Obstruction to the movement of aquatic fauna and influences water quality and the movement of sediments.
Exotic macrophytes	Alteration of habitat by obstruction of flow and may influence water quality. Dependent upon the species involved and scale of infestation.
Exotic aquatic fauna	The disturbance of the stream bottom during feeding may influence the water quality and increase turbidity. Dependent upon the species involved and their abundance.
Solid waste disposal	A direct anthropogenic impact which may alter habitat structurally. Also, a general indication of the misuse and mismanagement of the river.
Indigenous vegetation removal	Impairment of the buffer the vegetation forms to the movement of sediment and other catchment runoff products into the river. Refers to physical removal for farming, firewood and overgrazing.
Exotic vegetation encroachment	Excludes natural vegetation due to vigorous growth, causing bank instability and decreasing the buffering function of the riparian zone. Allochtonous organic matter input will also be changed. Riparian zone habitat diversity is also reduced.
Bank erosion	Decrease in bank stability will cause sedimentation and possible collapse of the river bank resulting in a loss or modification of both instream and riparian habitats. Increased erosion can be the result of natural vegetation removal, overgrazing or exotic vegetation encroachment.

Table 5: Descriptions used for the ratings of the various habitat criteria

Impact Category	Description	Score
None	No discernible impact or the modification is located in such a way that it has no impact on habitat quality, diversity, size and variability.	0
Small	The modification is limited to very few localities and the impact on habitat quality, diversity, size and variability are also very small.	1-5
Moderate	The modifications are present at a small number of localities and the impact on habitat quality, diversity, size and variability are also limited.	6-10
Large	The modification is generally present with a clearly detrimental impact on habitat quality, diversity, size and variability. Large areas are, however, not influenced.	11-15
Serious	The modification is frequently present and the habitat quality, diversity, size and variability in almost the whole of the defined area are affected. Only small areas are not influenced.	16-20
Critical	The modification is present overall with a high intensity. The habitat quality, diversity, size and variability in almost the whole of the defined section are influenced detrimentally.	21-25

2.8.3 Aquatic Macroinvertebrate Assessment

Macroinvertebrate assemblages are good indicators of localised conditions because many benthic macroinvertebrates have limited migration patterns or a sessile mode of life. They are particularly well-suited for assessing site-specific impacts (upstream and downstream studies) (Barbour *et al*., 1999). Benthic macroinvertebrate assemblages are made up of species that constitute a broad range of trophic levels and pollution tolerances, thus providing strong information for interpreting cumulative effects (Barbour *et al*., 1999). The assessment and monitoring of benthic macroinvertebrate communities forms an integral part of the monitoring of the health of an aquatic ecosystem.

2.8.3.1 South African Scoring System

The South African Scoring System version 5 (SASS5) is the current index being used to assess the status of riverine macroinvertebrates in South Africa. According to Dickens and Graham (2002), the index is based on the presence of aquatic invertebrate families and the perceived sensitivity to water quality changes of these families. Different families exhibit different sensitivities to pollution, these sensitivities range from highly tolerant families (e.g. Chironomidae) to highly sensitive families (e.g. Perlidae). SASS results are expressed both as an index score (SASS score) and the Average Score Per recorded Taxon (ASPT value).

Sampled invertebrates were identified using the “Aquatic Invertebrates of South African Rivers” Illustrations book, by Gerber and Gabriel (2002). Identification of organisms was made to family level (Thirion *et al*., 2007; Dickens and Graham, 2002; Gerber and Gabriel, 2002).

All SASS5 and ASPT scores are compared with the SASS5 Data Interpretation Guidelines (Dallas, 2007) for the Highveld Lower macroinvertebrate ecoregion. This method seeks to develop biological bands depicting the various ecological states and is derived from data contained within the Rivers Database and supplemented with other data not yet in the database.

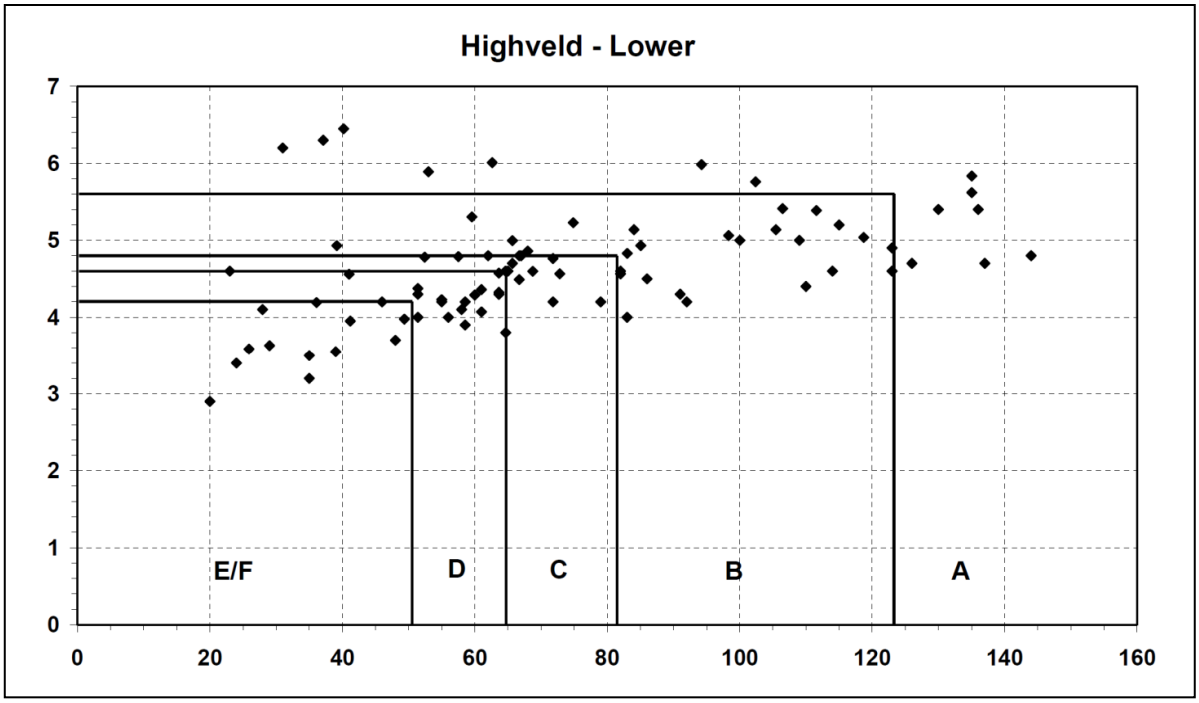

Figure 4: Guidelines used for the interpretation and classification of the SASS5 scores (Dallas, 2007)

2.8.3.2 Macroinvertebrate Response Assessment Index

The Macroinvertebrate Response Assessment Index (MIRAI) was used to provide a habitat-based cause-and-effect foundation to interpret the deviation of the aquatic invertebrate community from the calculated reference conditions for the sub-quaternary reach (SQR). This does not preclude the calculation of SASS5 scores if required (Thirion, 2007). The four major components of a stream system that determine productivity for aquatic macroinvertebrates are as follows:

- Flow regime;
- Physical habitat structure;
- Water quality; and
- Energy inputs from the watershed.

The results of the MIRAI will provide an indication of the current ecological category and therefore assist in the determination of the PES.

2.8.4 Present Ecological Status

Ecological classification refers to the determination and categorisation of the integrity of the various selected biophysical attributes of ecosystems compared to the natural or close to natural reference conditions (Kleynhans and Louw, 2007). For the purpose of this study, ecological classifications have been determined for biophysical attributes for the associated water course. This was completed using the river ecoclassification manual by Kleynhans and Louw (2007). The areas considered in the PES assessment are outline in the IHIA section above.

3 Limitations

The following limitations should be noted for the study:

- In the event of shapefiles being unavailable, previous study findings have been georeferenced for this project. This is likely to result in a degree of inaccuracy, and should be taken into account;
- Delineations have only been assigned to wetlands within the vicinity of the proposed VDDC mining infrastructure. These delineations end abruptly once the infrastructure area is outside of the wetland's reach;
- Limitations did exist regarding access to some of the areas. Therefore, some of the delineations have been completed at a desktop level only, with extrapolations from field surveys;
- The selection of aquatic sampling points was completed in accordance to accessibility. Areas where accessibility were limited included areas associated with the iMpunzi opencast mining operations;
- The chemical quality of the proposed treated water discharge is unknown. For the purposes of this study, it is assumed that the treated water discharge will have low salinity, no dissolved nutrients or metals and a neutral pH;
- The GPS used for water resource delineations is accurate to within five meters. Therefore, the wetland delineation plotted digitally may be offset by at least five meters to either side;
- The planned activities will have known impacts and these have been considered, but no unplanned activities or events have been considered for the risk assessment;
- Despite these limitations, a comprehensive desktop study was conducted, in conjunction with the detailed results from the surveys, and as such there is a high confidence in the information provided.

4 Key Legislative Requirements

4.1 Biodiversity

The legislation, policies and guidelines listed below are applicable to the current project in terms of biodiversity and ecological support systems. The list below, although extensive, may not be complete and other legislation, policies and guidelines may apply in addition to those listed below.

Explanation of certain documents or organisations is provided where these have a high degree of relevance to the project and/or are referred to in this assessment.

4.1.1 International Legislation and Policy

- Convention on Biological Diversity (Rio de Janeiro, 1992);
- The Ramsar Convention (on wetlands of international importance);

- The Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES). CITES is an international agreement between governments. Its aim is to ensure that international trade in specimens of wild animals and plants does not threaten their survival; and
- The IUCN (World Conservation Union). The IUCN's mission is to influence, encourage and assist societies throughout the world to conserve the integrity and diversity of nature and to ensure that any use of natural resources is equitable and ecologically sustainable.

4.1.2 National Level

- Constitution of the Republic of South Africa (Act 108 of 1996). The Bill of Rights, in the Constitution of South Africa states that everyone has a right to a nonthreatening environment and requires that reasonable measures be applied to protect the environment. This protection encompasses preventing pollution and promoting conservation and environmentally sustainable development;
- The National Environmental Management Act (NEMA) (Act 107 of 1998): Ecological Assessment Regulations, 2014. Specifically, the requirements of the specialist report as per the requirements of Appendix 6;
- The National Environmental Management: Biodiversity Act (NEM:BA) (Act 10 of 2004: specifically, the management and conservation of biological diversity within the RSA and of the components of such biological diversity;
- National Environmental Management: Biodiversity Act, 2004: Threatened and Protected Species Regulations;
- National Environmental Management: Protected Areas Act, 2003 (Act 57 of 2003);
- National Environmental Management: Waste Act, 2008 (Act 59 of 2008);
- National Water Act, 1998 (Act 36 of 1998);
- National Veld and Forest Fire Act, 1998 (Act 101 of 1998);
- Environmental Conservation Act, 1989 (ECA), (Act 73 of 1989);
- National Forests Act, 1998 (Act 84 of 1998), specifically with reference to Protected Tree species;
- National Heritage Resources Act, 1999 (Act 25 of 1999);
- Conservation of Agricultural Resources Act, 1983 (Act 43 of 1983); and
- Sustainable Utilisation of Agricultural Resources (Draft Legislation).

4.1.3 National Policy and Guidelines

- South Africa's National Biodiversity Strategy and Action Plan (NBSAP);
- National Spatial Biodiversity Assessment (NSBA); and
- National Freshwater Ecosystem Priority Areas (NFEPA's).

4.1.3.1 National Biodiversity Assessment

The National Biodiversity Assessment (NBA) was completed as a collaboration between the South African National Biodiversity Institute (SANBI), the Department of Environmental Affairs (DEA) and other stakeholders, including scientists and biodiversity management experts throughout the country over a three-year period (Driver *et al*., 2011).

The purpose of the NBA is to assess the state of South Africa's biodiversity with a view to understanding trends over time and informing policy and decision-making across a range of sectors (Driver *et al*., 2011).

4.1.4 Provincial and Municipal Level

In addition to national legislation, South Africa's nine provinces have their own provincial biodiversity legislation, as nature conservation is a concurrent function of national and provincial government in terms of the Constitution (Act 108 of 1996).

The Provincial Department responsible for environmental matters in Mpumalanga is the Mpumalanga Department of Agriculture, Rural Development, Land and Environmental Affairs (MDARDLEA). Relevant provincial legislation includes, but is not limited to:

4.1.4.1 Mpumalanga Parks Board Act, 1995 (Act 6 of 1995)

The Mpumalanga Parks Board was established in terms of the Mpumalanga Parks Board Act, 1998 (Act 6 of 1995, as amended). The objectives of this Act are inter alia as follows:

- To provide effective conservation management of natural resources of the Mpumalanga Province;
- To promote the creation of economic and employment opportunities in pursuit of nature conservation and biodiversity;
- To ensure that natural systems, biodiversity and ecological functions and processes in the Mpumalanga Province are maintained;
- To determine and enforce limits to sustainable utilization of natural resources;
- To contribute to the advancement of scientific knowledge, and facilitate technology transfer in respect of conservation; and
- Provide information and extension services to the public on conservation management, problem species, legal aspects of conservation and other conservation matters.

4.1.4.2 Mpumalanga Conservation Act, 1998 (Act 10 of 1998)

The aim of this Act is to consolidate and amend the laws relating to nature conservation within the Province and to provide for matters connected therewith.

4.1.4.3 Mpumalanga Tourism and Parks Agency Act, 2005 (Act 5 of 2005)

This act provides for the establishment of the Mpumalanga Tourism and Parks Agency (MTPA) and for the management thereof by a Board; to provide for the sustainable development and improvement of the tourism industry in Mpumalanga; to provide for

conservation management of the natural resources of Mpumalanga; to confer powers and functions upon the Agency; to provide for the registration of certain persons and entities directly involved in tourism; to provide for transitional arrangements; and to provide for matters incidental thereto.

4.1.4.4 Mpumalanga Conservation Plan

Mpumalanga's Conservation Plan Version 2 (C-Plan 2) database (MBSP, 2006), is intended to guide conservation and land-use decisions in support of sustainable development at a strategic level, have been identified. The C-Plan 2 maps the distribution of the Province's known biodiversity into categories according to ecological and biodiversity importance and their contribution to meeting the quantitative targets set for each biodiversity feature.

4.1.4.5 Mpumalanga Biodiversity Sector Plan (MBSP)

In 2006 the MTPA and the (then) Department of Agriculture and Land Administration (DALA) initiated the development of the Mpumalanga Biodiversity Conservation Plan (MBCP). As the first such plan produced for the Province, it was intended to guide conservation and land-use decisions in support of sustainable development. The MBCP provided a spatial framework that supported land-use planning and helped to streamline and monitor environmental decision-making (Ferrar & Lotter, 2007).

Since 2007 several technical advances and land use changes necessitated the need for an update of the MBCP. The updated product is called the Mpumalanga Biodiversity Sector Plan (MBSP) and builds on the successes of the MBCP but incorporates improvements in science, technology and data, to provide a more comprehensive assessment of the biodiversity of the terrestrial and freshwater environment in Mpumalanga (MTPA, 2014).

4.1.4.6 MTPA Guidelines for Ecological Assessment

To promote national uniform standards in Environmental Management Plans (EMP's) the Mpumalanga Tourism and Parks Agency (MTPA) have set minimum standards that need to be conformed to in terms of Ecological Assessments for development applications. These guidelines cover flora, fauna, aquatic and wetland systems.

5 Study Approach

All specialist studies were initiated on the basis of the conceptual layout plan indicating the proposed mining areas and mine infrastructure associated with the Project area as provided by the client. Desktop information was reviewed to supplement this assessment, the following (recent) reports were considered:

- Floral, faunal, wetland and aquatic assessment as part of the environmental assessment and authorisation process for the proposed Vandyksdrift Central (VDDC) project, development at the Wolvekrans Colliery, Mpumalanga province (SAS, 2013);
- Establishing measures for off-site mitigation of wetland impacts, Douglas Coal Mine (WetCS, 2006);
- Hydropedological study for the Vandyksdrift Central (VDDC) project (Geo Pollution Technologies, 2017); and

- Aquatic biomonitoring assessment: Spring 2017, Wolvekrans Colliery (South Section) (Ecology International (Pty) Ltd, 2017).

6 Study Area

6.1 Description of the Project Area

The VDDC Project area falls within the footprint of historic underground mining operations at the old Douglas Colliery. The mining area is approximately 30 km south of the town eMalahleni and 25 km east of the town Ogies in Mpumalanga Province, South Africa.

The Project area are separated into blocks consisting of a number of properties and farm portions. The dominant land use of the surrounding area is existing coal mining operations, both opencast and underground, and associated mining-related infrastructure. Some subsistence farming also occurs in the vicinity of the Project area. The following infrastructure and habitat features exists in the Project area and surrounds:

- Existing coal mining activities and associated infrastructure;
- Agricultural properties and cultivated fields;
- Various secondary farm roads and minor tar roads;
- The Witbank Dam to the north of the Wolvekrans Mining Right Area;
- Olifants River which bisects the Project area;
- Wetland areas;
- Powerlines – especially Eskom powerlines transecting multiple farm portions;
- Telephone lines;
- Agricultural homesteads; and
- Urban dwellings.

A study area was defined for this assessment which includes the VDDC mining and infrastructure development areas, as well as adjacent areas. It is therefore larger than the VDDC project area and is shown as a light blue polygon in the figures to follow.

6.2 The Mpumalanga Biodiversity Sector Plan

The key output of a systematic biodiversity plan is a map of biodiversity priority areas (MTPA, 2014). The MBSP uses the following terms to categorise the various land used types according to their biodiversity and environmental importance:

- Critical Biodiversity Area – Irreplaceable (CBA: Irreplaceable);
- Critical Biodiversity Area – Optimal (CBA: Optimal);
- Ecological Support Area (ESA);
- Other Natural Area (ONA);
- Protected Area (PA); and

- Moderately or Heavily Modified Areas (MMA's or HMA's).

CBAs are terrestrial and aquatic areas of the landscape that need to be maintained in a natural or near-natural state to ensure the continued existence and functioning of species and ecosystems and the delivery of ecosystem services. CBAs are areas of high biodiversity value and need to be kept in a natural state, with no further loss of habitat or species (MTPA, 2014). Thus, if these areas are not maintained in a natural or near natural state then biodiversity targets cannot be met. Maintaining an area in a natural state can include a variety of biodiversity compatible land uses and resource uses (BGIS, 2017).

CBAs are areas of high biodiversity value and need to be kept in a natural state, with no further loss of habitat or species (MTPA, 2014). These areas are therefore incompatible with mining developments.

The MBSP specifies two different CBA areas, Irreplaceable CBA's and Optimal CBA's. Irreplaceable CBA's include: (1) areas required to meet targets and with irreplaceability biodiversity values of more than 80%; (2) critical linkages or pinch-points in the landscape that must remain natural; or (3) critically Endangered ecosystems (MTPA, 2014).

ESAs are not essential for meeting biodiversity targets but play an important role in supporting the ecological functioning of CBAs and/or in delivering ecosystem services. Critical Biodiversity Areas and Ecological Support Areas may be terrestrial or aquatic (SANBI-BGIS, 2017).

ONAs consist of all those areas in good or fair ecological condition that fall outside the protected area network and have not been identified as CBAs or ESAs. A biodiversity sector plan or bioregional plan must not specify the desired state/management objectives for ONAs or provide land-use guidelines for ONAs (SANBI-BGIS, 2017).

Moderately or Heavily Modified Areas (sometimes called 'transformed' areas) are areas that have been heavily modified by human activity so that they are by-and-large no longer natural, and do not contribute to biodiversity targets (MTPA, 2014). Some of these areas may still provide limited biodiversity and ecological infrastructural functions but, their biodiversity value has been significantly, and in many cases irreversibly, compromised.

6.2.1 The Study Area in Relation to the Mpumalanga Biodiversity Sector Plan

Figure 5 shows the VDDC South32 study area superimposed on the MBSP Terrestrial CBA map. Based on this, the proposed mining area (VDDC South32) will overlap with:

- Critical Biodiversity Areas (CBAs) (North western corner of the study area);
- Heavily or Moderately Modified Areas (HMAs); and
- Other Natural Areas (ONAs).

Based on this desktop information, much of the study area, as well as the Project area is identified as either HMAs or ONAs (Figure 5). However, some CBAs exist across the north-western corner of the mining right area (Naauwpoort section of the Wolvekrans Colliery). A Protected Area (PA) occurs across the central portion of the mining right area (in the Hartbeesfontein section of Ifalethu Colliery). The 5 km ESA buffer as mandated by the MBSP is shown around this PA (Figure 5).

In terms of section 48 of NEM:PAA, certain restrictions are placed on mining within nature reserves. However, the mining activities in these areas are historical activities (i.e. activities that were conducted lawfully before the commencement of section 48 of NEM:PAA) and such activities can continue.

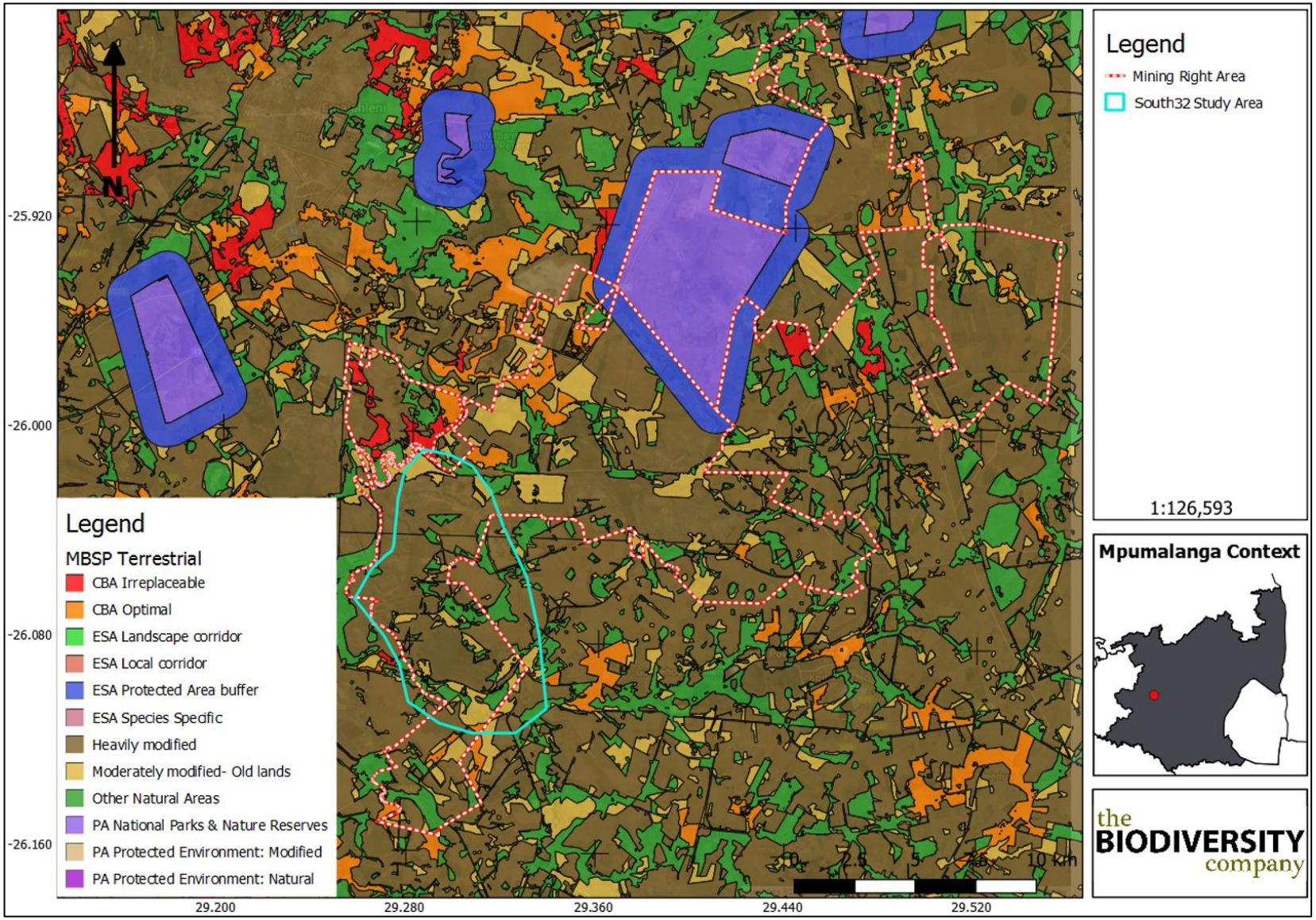

Figure 5: The study area superimposed on the MBSP Terrestrial Critical Biodiversity Areas (CBA) map (MBSP, 2014)

6.3 Study Area in Relation to the National Biodiversity Assessment

The recently completed National Biodiversity Assessment (NBA) 2011 provides an assessment of South Africa's biodiversity and ecosystems, including headline indicators and national maps for the terrestrial, freshwater, estuarine and marine environments. The NBA 2011 was led by the South African National Biodiversity Institute (SANBI) in partnership with a range of organisations, including the Department of Environmental Affairs (DEA), CSIR and SANParks. It follows on from the National Spatial Biodiversity Assessment 2004, broadening the scope of the assessment to include key thematic issues as well as a spatial assessment. The NBA 2011 includes a summary of spatial biodiversity priority areas that have been identified through systematic biodiversity plans at national, provincial and local level.

Information from the NBA can be used to:

- Streamline environmental decision-making, including environmental impact assessments (EIAs), by providing upfront information about threatened ecosystems and biodiversity priority areas that can be integrated early on in the process to improve the quality and efficiency of decision making at the site scale.
- Strengthen land-use planning, including through provincial and municipal Spatial Development Frameworks which set out desired future patterns of land-use, taking into account the priorities and requirements of a range of sectors.
- Strengthen national development planning and other strategic planning processes, through provision of clear spatial inputs to enable optimal development decisions for South Africa's future. This should happen at the national and landscape scale through scenario planning, enabling strategic trade-offs where necessary, for example between minerals development, energy security and water security.
- Identify priorities for management and restoration of ecosystems, which provides opportunities for ecosystem-based job creation and supports the provision of ecosystem services.
- Provide initial identification of threatened ecosystems, for listing in terms of the Biodiversity Act.
- Highlight areas where more detailed assessment and planning is required, for example the need for a national coastal biodiversity plan to identify coastal ecosystem priority areas.

The NBA also provides standard national spatial data layers that can be used in other national, provincial and local planning projects, and an agreed set of national biodiversity targets. In the NBA 2011 these include the first national map of coastal and marine habitat types, and the first national spatial demarcation of the estuarine functional zone.

The two headline indicators assessed in the NBA are ecosystem threat status and ecosystem protection level (Driver *et al*., 2011).

6.3.1 Ecosystem Threat Status

Ecosystem threat status outlines the degree to which ecosystems are still intact or alternatively losing vital aspects of their structure, function and composition, on which their ability to provide ecosystem services ultimately depends (Driver *et al*., 2011).

Ecosystem types are categorised as Critically Endangered (CR), Endangered (EN), Vulnerable (VU) or Least Threatened (LT), based on the proportion of each ecosystem type that remains in good ecological condition (Driver *et al*., 2011).

The study area was superimposed on the terrestrial ecosystem threat status (Figure 6). As seen in Figure 6 the infrastructure development portions, as well as the overall mining right area, overlap entirely with ecosystems that are listed as Vulnerable (VU) (Figure 6). The threat status is partly due to the sensitive nature of the vegetation type (grassland) and partly due to the activities in the area, which is resulting in a low protection level and large portions being transformed.

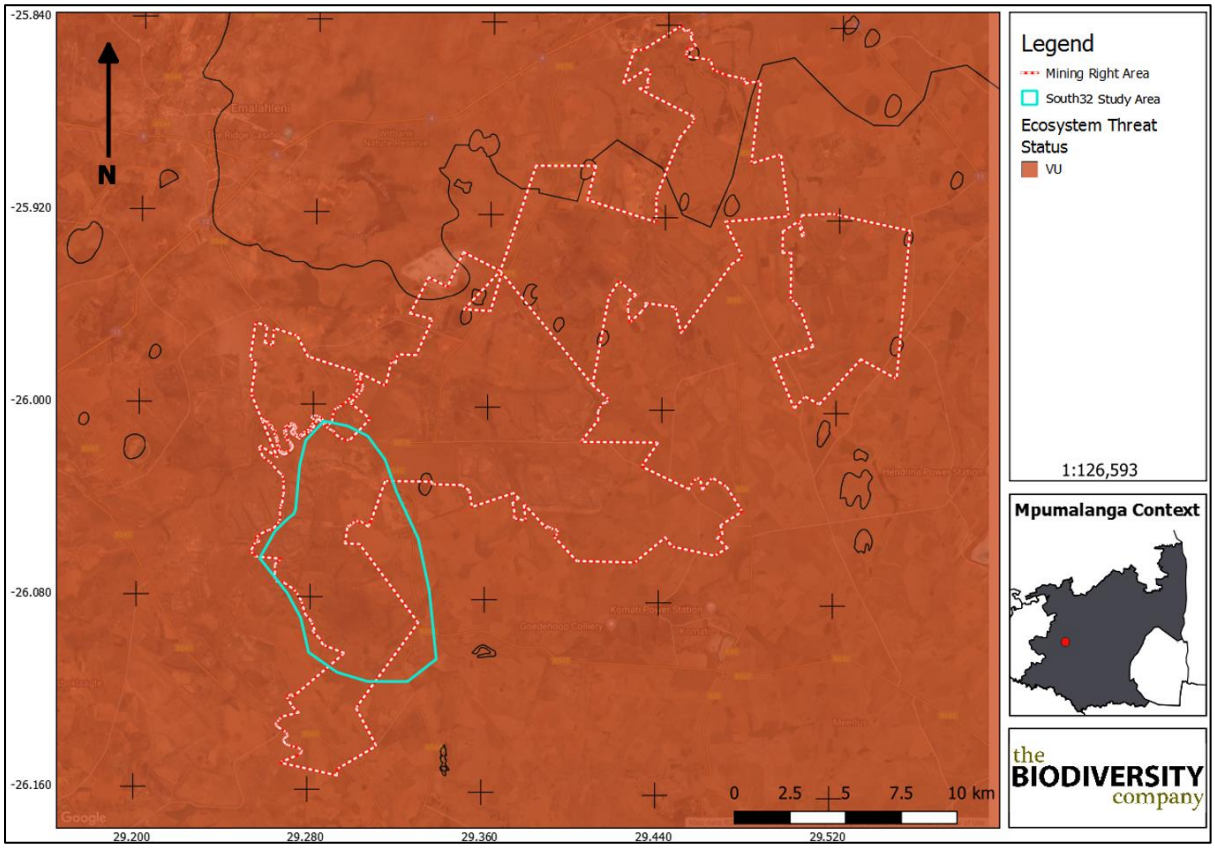

Figure 6: The study area showing the ecosystem threat status of the associated terrestrial ecosystems (NBA, 2012)

6.3.2 Ecosystem Protection Level

Ecosystem protection level tells us whether ecosystems are adequately protected or under-protected. Ecosystem types are categorised as not protected, poorly protected, moderately protected or well protected, based on the proportion of each ecosystem type that occurs within a protected area recognised in the Protected Areas Act (Driver *et al*., 2011).

The VDDC study area was superimposed on the ecosystem protection level map to assess the protection status of terrestrial ecosystems associated with the development (Figure 7). Based on Figure 7 the majority of the terrestrial ecosystems associated with the development are rated as *not protected*. This means that these ecosystems are not adequately protected or preserved in legislated protected areas (such as in provincial or national parks). A number of smaller ecosystems within the overall mining right area are classified as poorly protected.

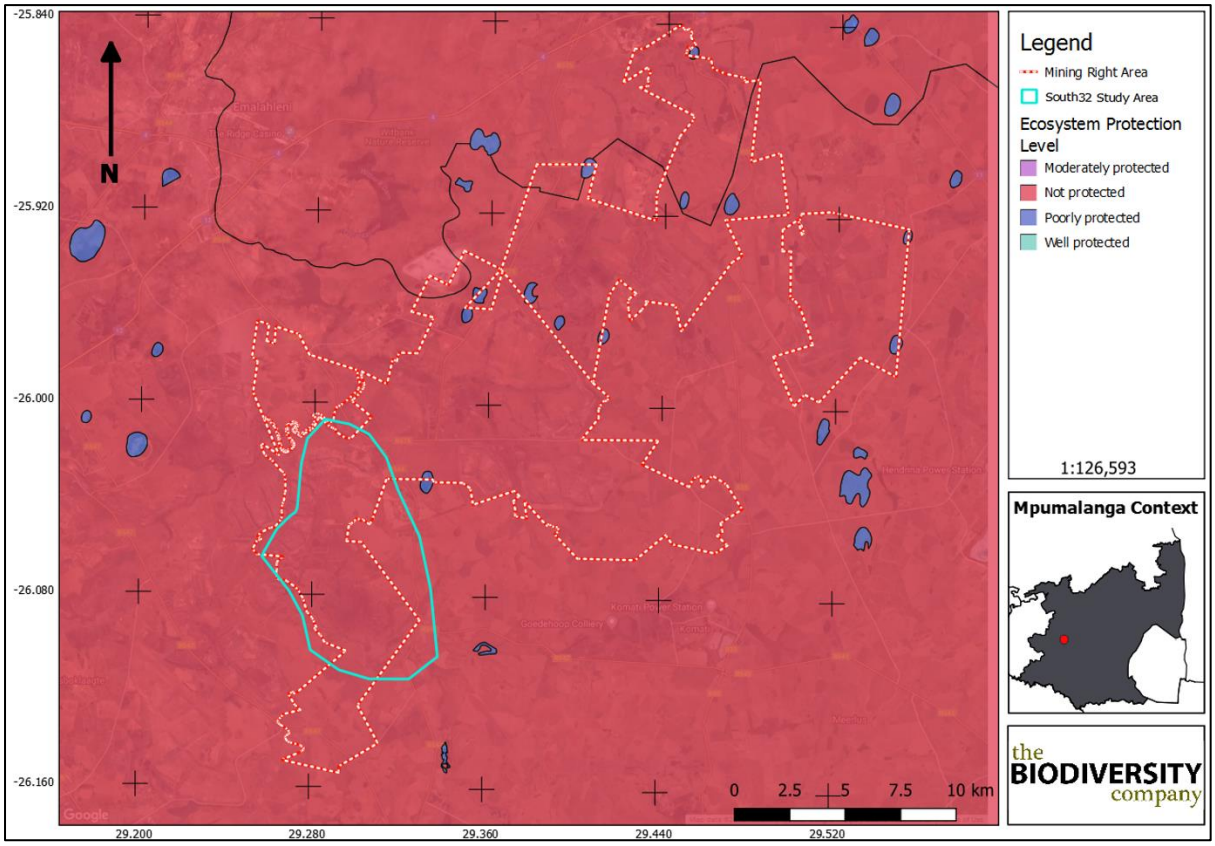

Figure 7: The Project area showing the level of protection of terrestrial ecosystems (NBA, 2012)

6.3.3 Study Area in Relation to Protected Areas

Figure 8 shows the location of formally protected areas in relation to the VDDC study area. Formally protected areas refer to areas protected either by national or provincial legislation.

Based on the SANBI (2010) Protected Areas Map and the National Protected Areas Development Strategy (NPAES) the Project area does not overlap with any formally or informally protected area (Figure 8). The closest protected area is the Witbank Nature Reserve which is situated approximately 8.2 km North-Northeast of the Project area (Figure 8).

Based on the NPAES and the location of the proposed development, the VDDC mine activities are not expected to have an impact on any formally or informally protected areas.

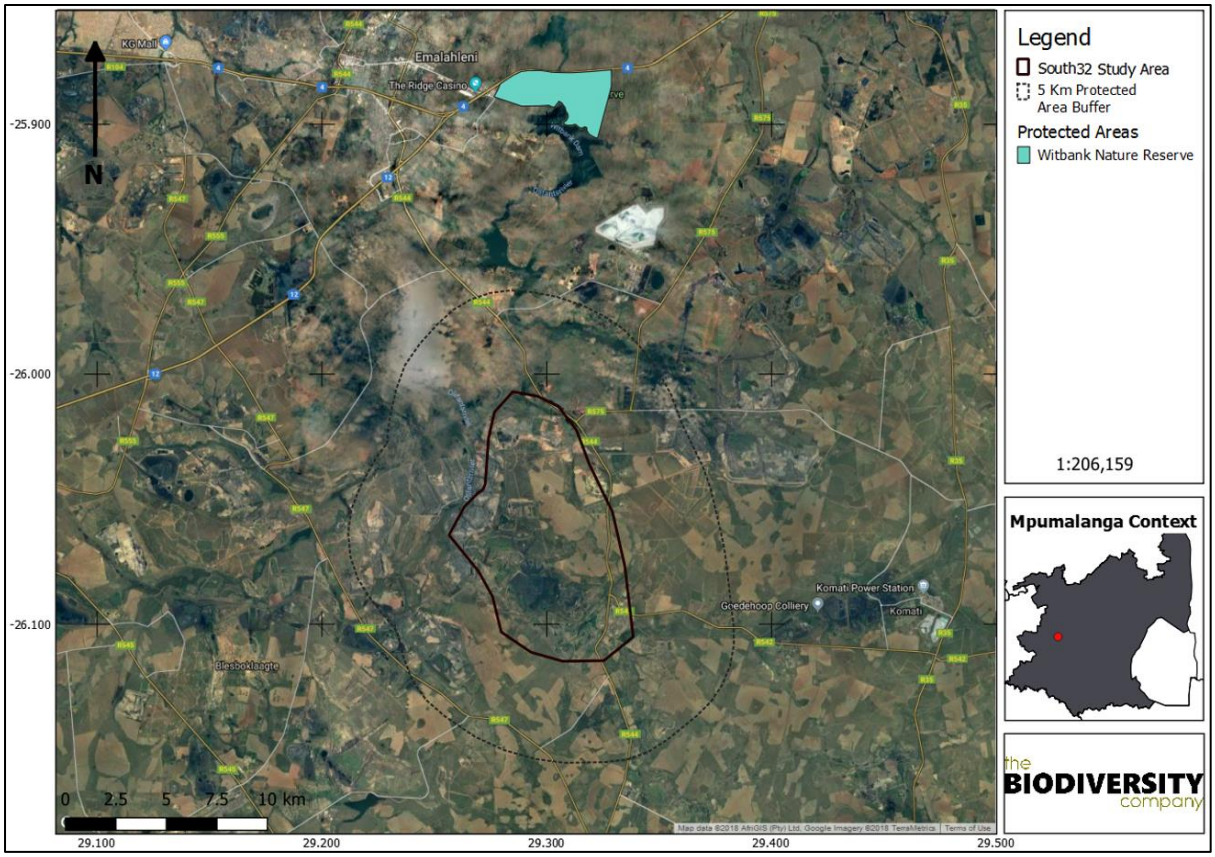

Figure 8: Formally protected areas in relation to the study area (BGIS, 2017)

6.3.4 National Freshwater Ecosystem Priority Area (NFEPA) Status

In an attempt to better conserve aquatic ecosystems, South Africa has recently categorised its river systems according to set ecological criteria (i.e. ecosystem representation, water yield, connectivity, unique features, and threatened taxa) to identify Freshwater Ecosystem Priority Areas (FEPAs) (Driver *et al*. 2011). The FEPAs are intended to be conservation support tools and envisioned to guide the effective implementation of measures to achieve the National Environment Management Biodiversity Act (NEM:BA) biodiversity goals (Nel *et al*. 2011).

Figure 9 shows the location of the study area in relation to wetland and river FEPAs. Based on this information, the study area and project area do overlap with extensive wetland areas in the northern, central and southern portions. The southern portion of the VDDC Project area, and specifically the infrastructure footprint area, are situated adjacent to two perennial rivers – the Olifants and the Koringspruit. However, these rivers are classified as non-NFEPA rivers. A non-FEPA wetland occurs across the central area designated for the proposed infrastructure construction (this wetland, the Vleishaft tributary has previously been approved for mining). Some FEPA rivers do occur to the east and north-east of the overall mining right area.

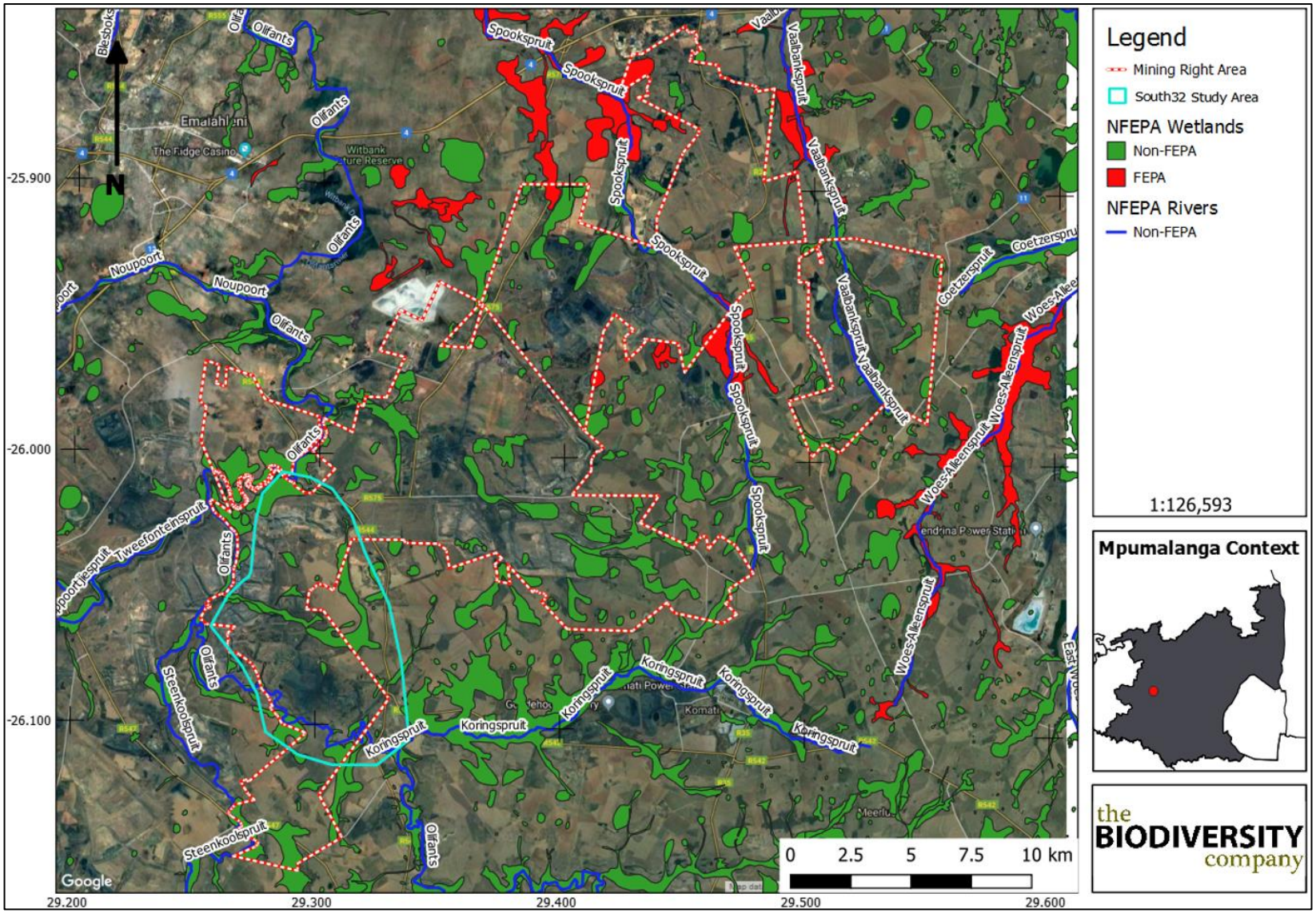

Figure 9: The study area in relation to the National Freshwater Ecosystem Priority Areas (2011)

6.3.5 The MBSP Freshwater Assessment

The MBSP Freshwater Assessment outlines priority areas for freshwater biodiversity in Mpumalanga. The resulting features are predominantly derived from the NFEPA products, layers include CBA Rivers (based on FEPA and free-flowing rivers), CBA Wetlands (based on FEPA wetlands), CBA Aquatic species (Odonata & crab taxa of conservation concern only), ESA Wetland Clusters (FEPA wetland clusters), and ESA Wetlands (all other non-FEPA wetlands). The MTPA created an updated land-cover using SPOT 2010 imagery. This data, together with high-resolution aerial imagery, was used to update and clean some of the features (MTPA, 2014; Freshwater Assessment, 2011).

The VDDC study area in relation to the MBSP Freshwater Assessment overlaps with the following areas: Ecological Support Areas: Wetlands (ESAs), Heavily Modified Areas (HMAs) and Other Natural Areas (ONAs) (Figure 10).

It is important to note that the ESA Wetlands in the MBSP are based on non-FEPA wetlands. The central wetland area (Vleishaft tributary) is therefore indicated as an ESA Wetlands. This system has, however been partially mined based on previous authorisations.

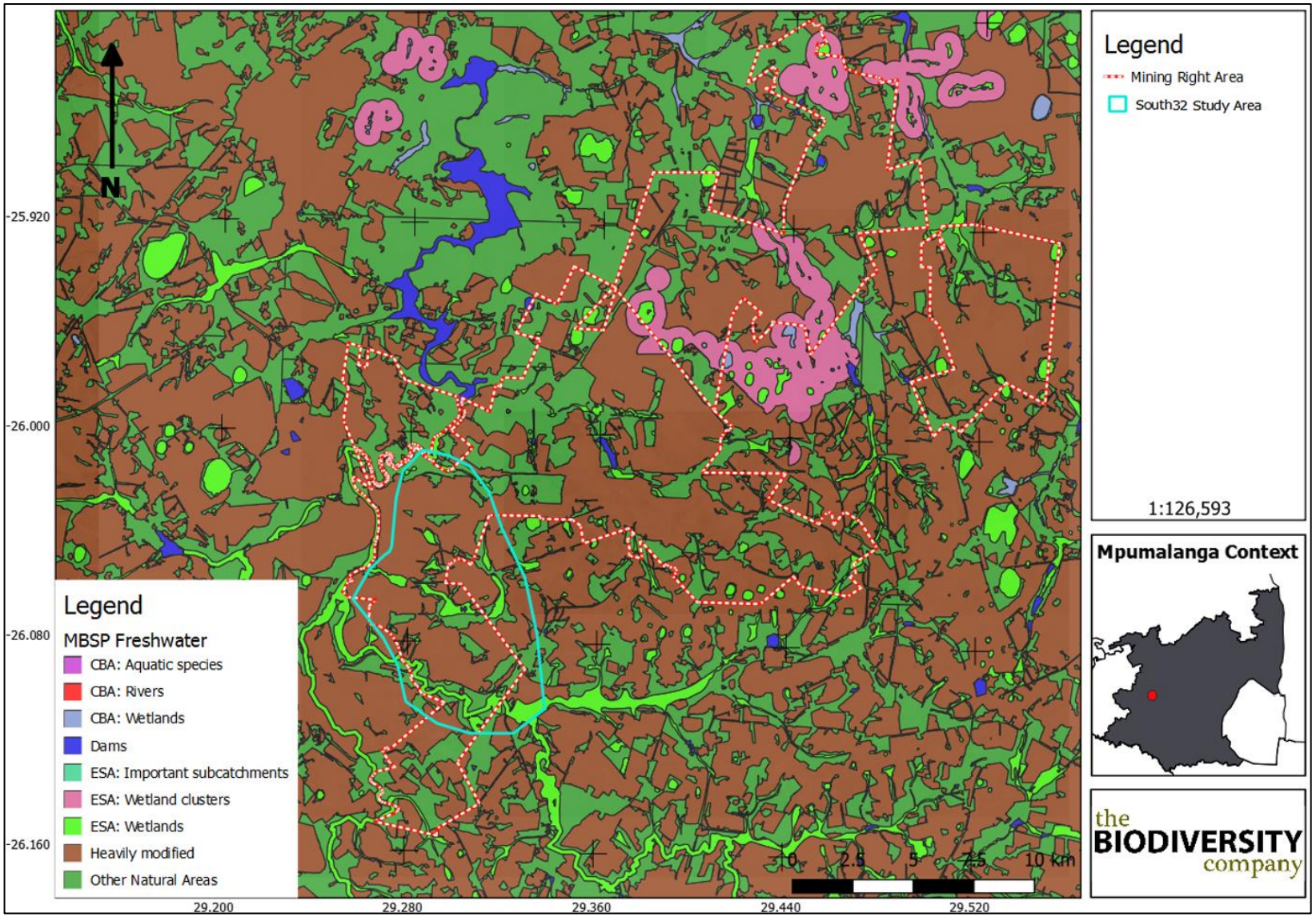

Figure 10: The study area in relation to the MBSP Freshwater Assessment

6.3.6 Mpumalanga Highveld Wetlands

The purpose of the Mpumalanga Highveld (MH) Wetlands project was to:

- Ground-truth and refine the current data layers of the extent, distribution, condition and type of freshwater ecosystems in the Mpumalanga Highveld coal belt, to support informed and consistent decision-making by regulators in relation to the water-biodiversity-energy nexus;
- To incorporate these revised data layers into the atlas of high-risk freshwater ecosystems and guidelines for wetland offsets, currently being developed by SANBI, to improve the scientific robustness of these tools; and
- To support the uptake, and development of the necessary capacity to apply the data, atlas and guidelines by regulators and the coal mining industry in their planning and decision-making processes'' (SANBI, 2012).

The Mpumalanga Highveld Wetlands data also classifies NFEPA land cover based on the defined condition of each area. These are known as the NFEPA wetland conditions categories. The categories are listed in Figure 11 and are represented in relation to the Project area in Figure 12.

Description of NFEPA wetland conditions categories.
PES equivalent provides a description of the condition category that is broadly equivalent to that used by the Department of Water Affairs to describe Present Ecological State. Percentage of total area in each condition category is also provided.

PES equivalent	NFEPA condition	Description	% of total wetland area*
Natural or Good	AB	Percentage natural land cover ≥ 75%	47
Moderately modified	C	Percentage natural land cover 25-75%	18
Heavily to critically modified	DEF	Riverine wetland associated with a D, E, F or Z ecological category river	2
	Z1	Wetland overlaps with a 1:50,000 "artificial" inland water body from the Department of Land Affairs: Chief Directorate of Surveys and Mapping (2005-2007)	7
	Z2	Majority of the wetland unit is classified as "artificial" in the wetland delineation GIS layer	4
	Z3	Percentage natural land cover < 25%	20

** This percentage excludes the unmapped wetlands that have been irreversibly lost due to draining, ploughing and concreting*

Figure 11: A breakdown of the NFEPA wetland condition categories as defined by the MH dataset

Figure 12 shows the study area in relation to the Mpumalanga Highveld Wetlands data as provided by SANBI. The defined VDDC project area (proposed infrastructure area) intersects with wetland areas classified as C and D, which means that these areas have been classified as moderately to heavily modified. Some dams and wetlands classified as AB (natural) occur on the boundary of the survey area. Various AB, C and D wetlands occur across the rest of the overall mining right area.

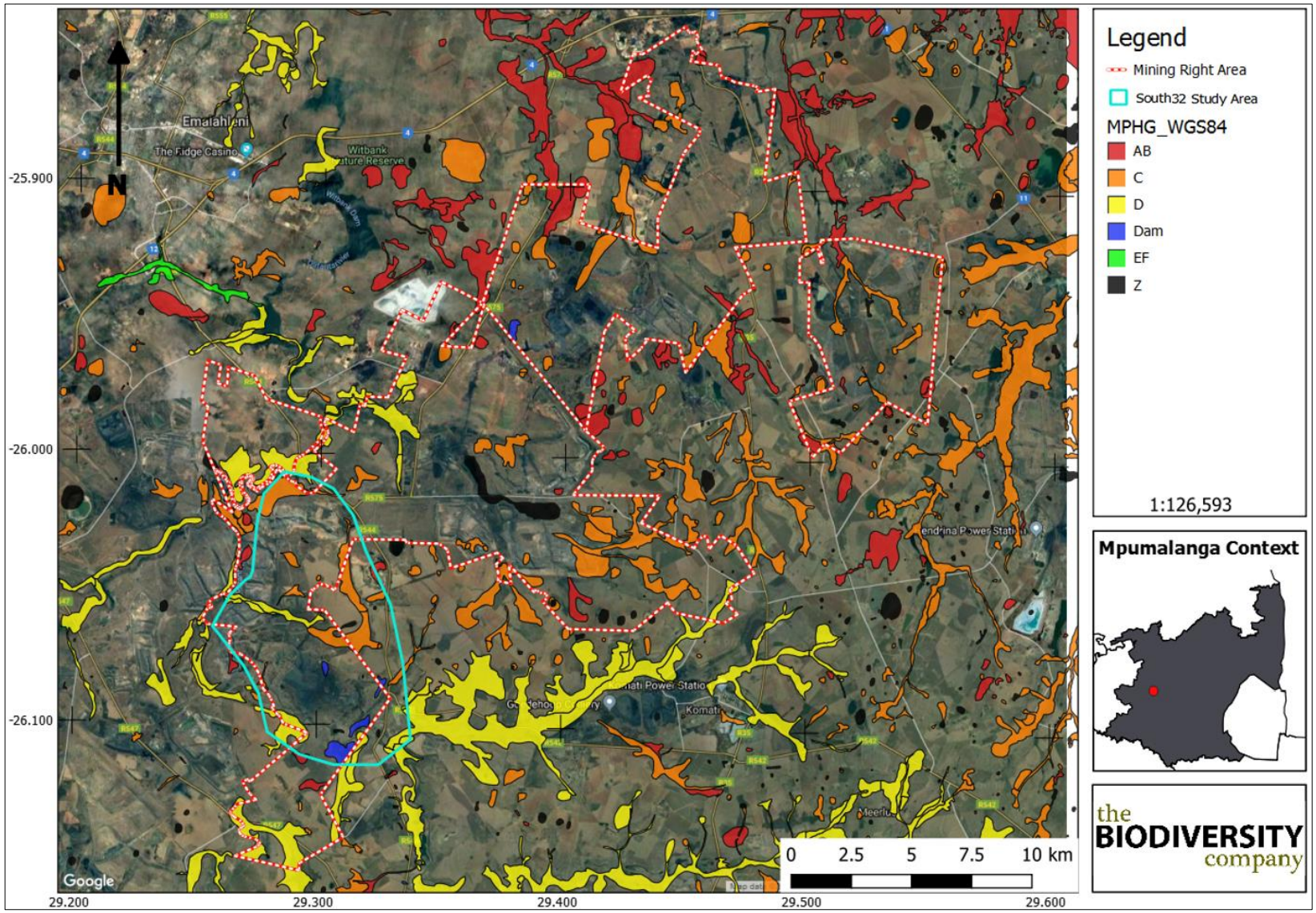

Figure 12: The study area in relation to the Mpumalanga Highveld Wetlands (SANBI, 2012)

6.4 Important Bird & Biodiversity Areas

Important Bird & Biodiversity Areas (IBAs) are the sites of international significance for the conservation of the world's birds and other nature as identified by BirdLife International. These sites are also all Key Biodiversity Areas; sites that contribute significantly to the global persistence of biodiversity (Birdlife, 2017).

According to Birdlife (2017), the selection of IBAs is achieved through the application of quantitative ornithological criteria, grounded in up-to-date knowledge of the sizes and trends of bird populations. The criteria ensure that the sites selected as IBAs have true significance for the international conservation of bird populations and provide a common currency that all IBAs adhere to, thus creating consistency among, and enabling comparability between, sites at national, continental and global levels.

Based on the Birdlife IBA dataset, the VDDC study area is not situated in close proximity to any IBAs (Figure 13). Therefore, based on this initial desktop analysis the proposed project is not expected to impact on any IBAs.

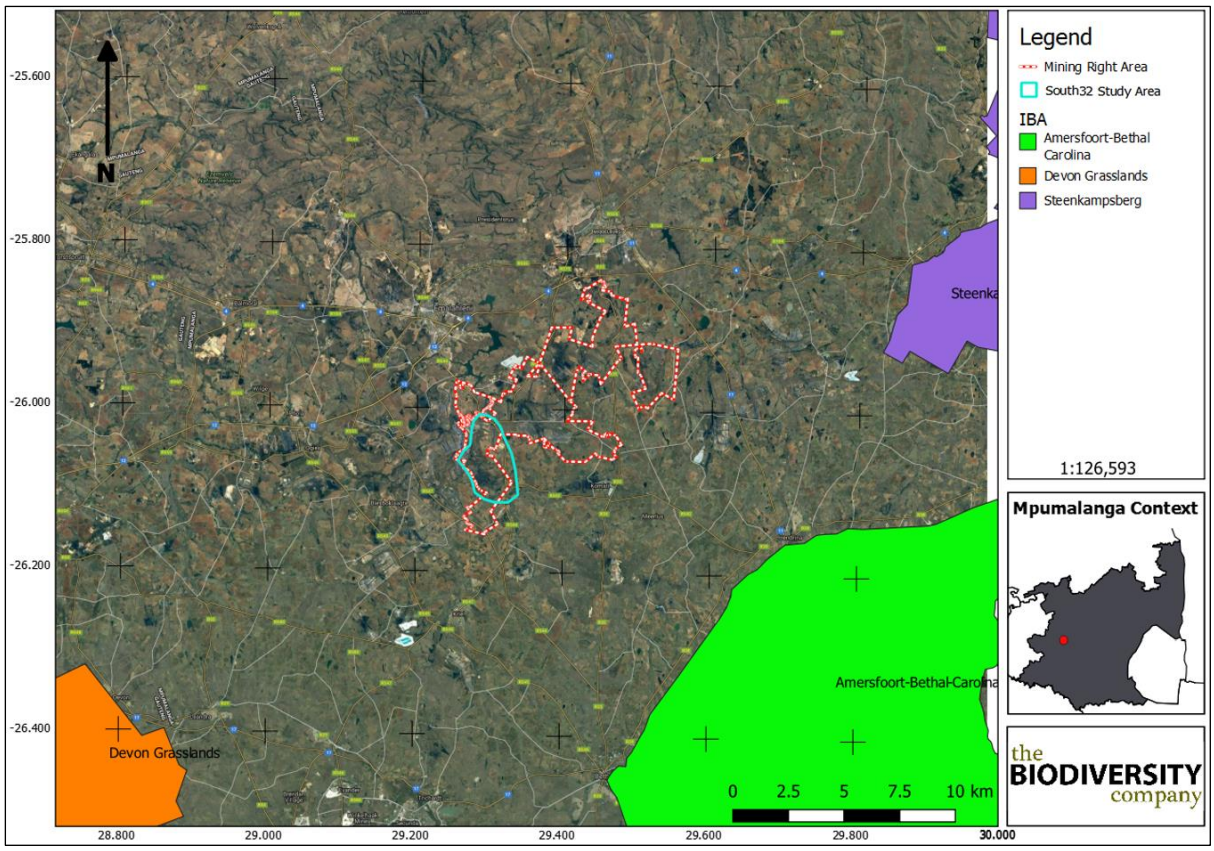

Figure 13: Proximity of the study area to Important Bird and Biodiversity Areas

6.5 Mining and Biodiversity Guidelines

The Mining and Biodiversity Guidelines (2013) was developed by the Department of Mineral Resources, the Chamber of Mines, the South African National Biodiversity Institute and the South African Mining and Biodiversity Forum, with the intention to find a balance between economic growth and environmental sustainability. The Guideline is envisioned as a tool to "foster a strong relationship between biodiversity and mining which will eventually translate

into best practice within the mining sector. In identifying biodiversity priority areas which have different levels of risk against mining, the Guideline categorises biodiversity priority areas into four categories of biodiversity priority areas in relation to their importance from a biodiversity and ecosystem service point of view as well as the implications for mining in these areas:

A) Legally protected areas, where mining is prohibited;

B) Areas of highest biodiversity importance, which are at the highest risk for mining;

C) Areas of high biodiversity importance, which are at a high risk for mining; and

D) Areas of moderate biodiversity importance, which are at a moderate risk for mining.

Table 6 shows the four different categories and the implications for mining within each of these categories.

The Guideline provides a tool to facilitate the sustainable development of South Africa's mineral resources in a way that enables regulators, industry and practitioners to minimise the impact of mining on the country's biodiversity and ecosystem services. It provides the mining sector with a practical, user- friendly manual for integrating biodiversity considerations into the planning processes and managing biodiversity during the operational phases of a mine, from exploration through to closure. The Guideline provides explicit direction in terms of where mining-related impacts are legally prohibited, where biodiversity priority areas may present high risks for mining projects, and where biodiversity may limit the potential for mining.

Overall, proponents of a mining activity in biodiversity priority areas should demonstrate that:

- There is significant cause to undertake mining – by commenting on whether the biodiversity priority area coincides with mineral or petroleum reserves that are strategically in the national interest to exploit. Reference should also be made to whether alternative deposits or reserves exist that could be exploited in areas that are not biodiversity priority areas or are less environmentally sensitive areas.
- Through the process of a rigorous EIA and associated specialist biodiversity studies the impacts of the proposed mining are properly assessed following good practice. It is critical that sufficient time and resources are budgeted to do so early in the planning and impact assessment process, including appointing appropriate team of people with the relevant skills and knowledge as required by legislation.
- Cumulative impacts have been taken into account.
- The mitigation hierarchy has been systematically applied and alternatives have been rigorously considered.
- The issues related to biodiversity priority areas have been incorporated into a robust EMP as the main tool for describing how the mining or prospecting operation's environmental impacts are to be mitigated and managed.

Good practice environmental management is followed, and monitoring and compliance enforcement is ensured.

Table 6: The mining and biodiversity guidelines categories

Category	Biodiversity priority areas	Risk for mining	Implications for mining
A. Legally protected	• Protected areas (including National Parks, Nature Reserves, World Heritage Sites, Protected Environments, Nature Reserves) • Areas declared under Section 49 of the Mineral and Petroleum Resources Development Act (No. 28 of 2002)	**Mining prohibited**	Mining projects cannot commence as mining is legally prohibited. Although mining is prohibited in Protected Areas, it may be allowed in Protected Environments if both the Minister of Mineral Resources and Minister of Environmental Affairs approve it. In cases where mining activities were conducted lawfully in protected areas before Section 48 of the Protected Areas Act (No. 57 of 2003) came into effect, the Minister of Environmental Affairs may, after consulting with the Minister of Mineral Resources, allow such mining activities to continue, subject to prescribed conditions that reduce environmental impacts.
B. Highest biodiversity importance	• Critically endangered and endangered ecosystems • Critical Biodiversity Areas (or equivalent areas) from provincial spatial biodiversity plans • River and wetland Freshwater Ecosystem Priority Areas (FEPAs) and a 1km buffer around these FEPAs • Ramsar Sites	**Highest risk for mining**	Environmental screening, environmental impact assessment (EIA) and their associated specialist studies should focus on confirming the presence and significance of these biodiversity features, and to provide site-specific basis on which to apply the mitigation hierarchy to inform regulatory decision-making for mining, water use licenses, and environmental authorisations. If they are confirmed, the likelihood of a fatal flaw for new mining projects is very high because of the significance of the biodiversity features in these areas and the associated ecosystem services. These areas are viewed as necessary to ensure protection of biodiversity, environmental sustainability, and human well-being. An EIA should include the strategic assessment of optimum, sustainable land use for a particular area and will determine the significance of the impact on biodiversity. This assessment should fully take into account the environmental sensitivity of the area, the overall environmental and socio-economic costs and benefits of mining, as well as the potential strategic importance of the minerals to the country. Authorisations may well not be granted. If granted, the authorisation may set limits on allowed activities and impacts and may specify biodiversity offsets that would be written into license agreements and/or authorisations.

C. High biodiversity importance	• Protected area buffers (including buffers around National Parks, World Heritage Sites* and Nature Reserves) • Transfrontier Conservation Areas (remaining areas outside of formally proclaimed protected areas) • Other identified priorities from provincial spatial biodiversity plans • High water yield areas • Coastal Protection Zone • Estuarine functional zone	**High risk for mining**	These areas are important for conserving biodiversity, for supporting or buffering other biodiversity priority areas, and for maintaining important ecosystem services for particular communities or the country as a whole. An EIA should include an assessment of optimum, sustainable land use for a particular area and will determine the significance of the impact on biodiversity. Mining options may be limited in these areas, and limitations for mining projects are possible. Authorisations may set limits and specify biodiversity offsets that would be written into license agreements and/or authorisations.
D. Moderate biodiversity importance	• Ecological support areas • Vulnerable ecosystems • Focus areas for protected area expansion (land-based and offshore protection)	**Moderate risk for mining**	These areas are of moderate biodiversity value. EIA's and their associated specialist studies should focus on confirming the presence and significance of these biodiversity features, identifying features (e.g. threatened species) not included in the existing datasets, and on providing site-specific information to guide the application of the mitigation hierarchy. Authorisations may set limits and specify biodiversity offsets that would be written into license agreements and/or authorisations.

According to the Mining and Biodiversity Guidelines spatial dataset (2013), the majority of the VDDC study area is considered to be of low biodiversity importance and there is therefore a correlating low risk for mining. However, various portions of the mining right area (including portions of the study area) are classified as 'Highest biodiversity importance – Highest risk to mining' (Figure 14 and Figure 15). The specific infrastructure development area is situated predominantly within an area classified as 'Moderate biodiversity risk – Moderate risk to mining' (Figure 15). As some of the areas (classed as highest biodiversity importance) based on ground truthing was found to be impacted upon it is possible that the dataset might not be completely accurate. The dataset is based on a combination of other ecological datasets and it is likely that the source datasets might be outdated. It is also possible that a section of the area functions as a corridor and it was given a buffer to protect this pathway or that a section of that area has been rehabilitated and appears to be in a semi natural state where SCC's could have been found.

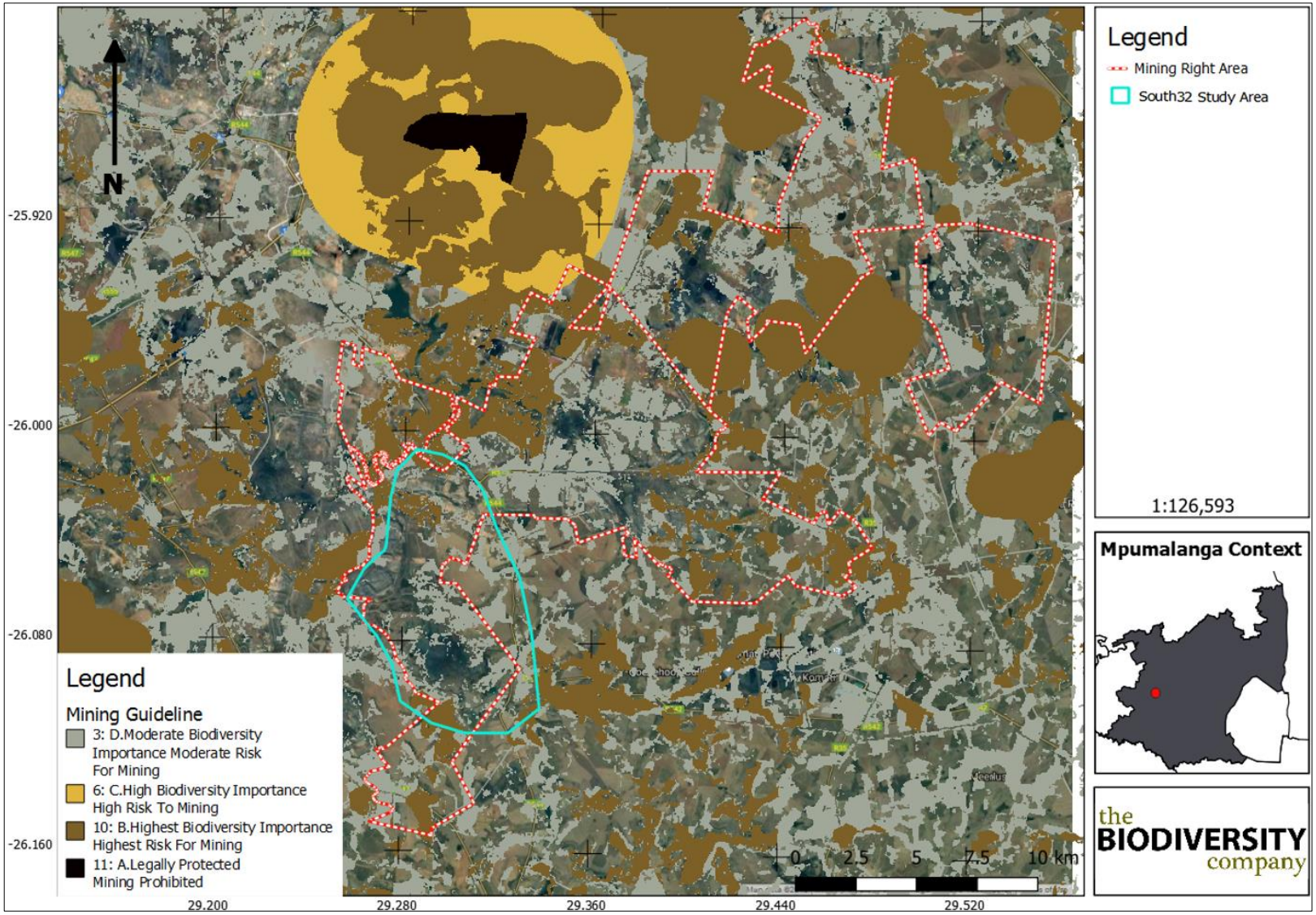

Figure 14: The study area in relation to the Mining and Biodiversity Guidelines (2013)

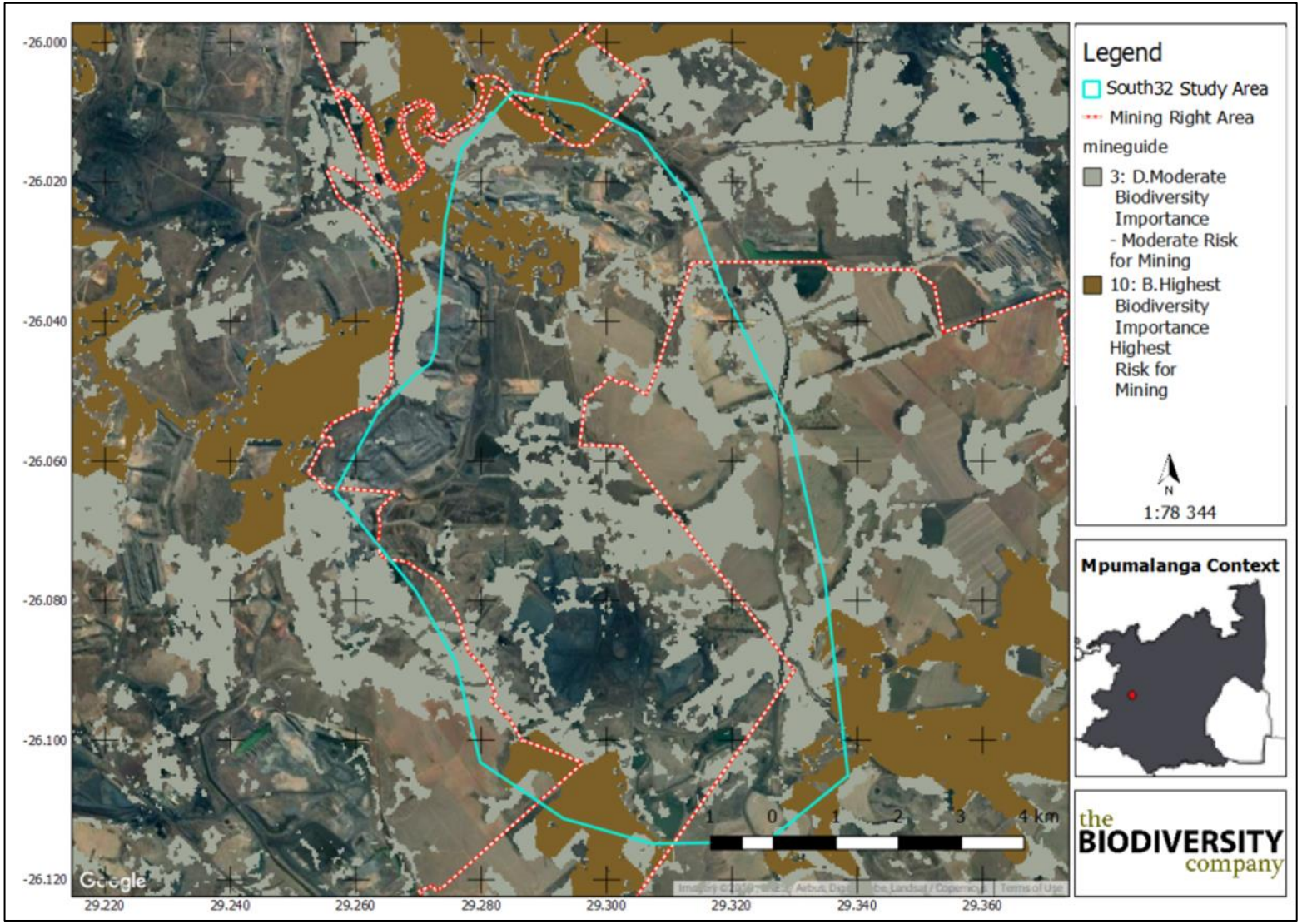

Figure 15: A close-up of the study area in relation to the Mining and Biodiversity Guidelines (2013)

6.6 Land type

According to the land type database (Land Type Survey Staff, 1972 - 2006) the Project area falls within the Bb4 and Bb5 land types (Figure 16). The Bb land type is described as follows; Plinthic catena: Upland duplex and margalatic soils rare. Dystrohic and/or mesotrophic with red soils not wide spread.

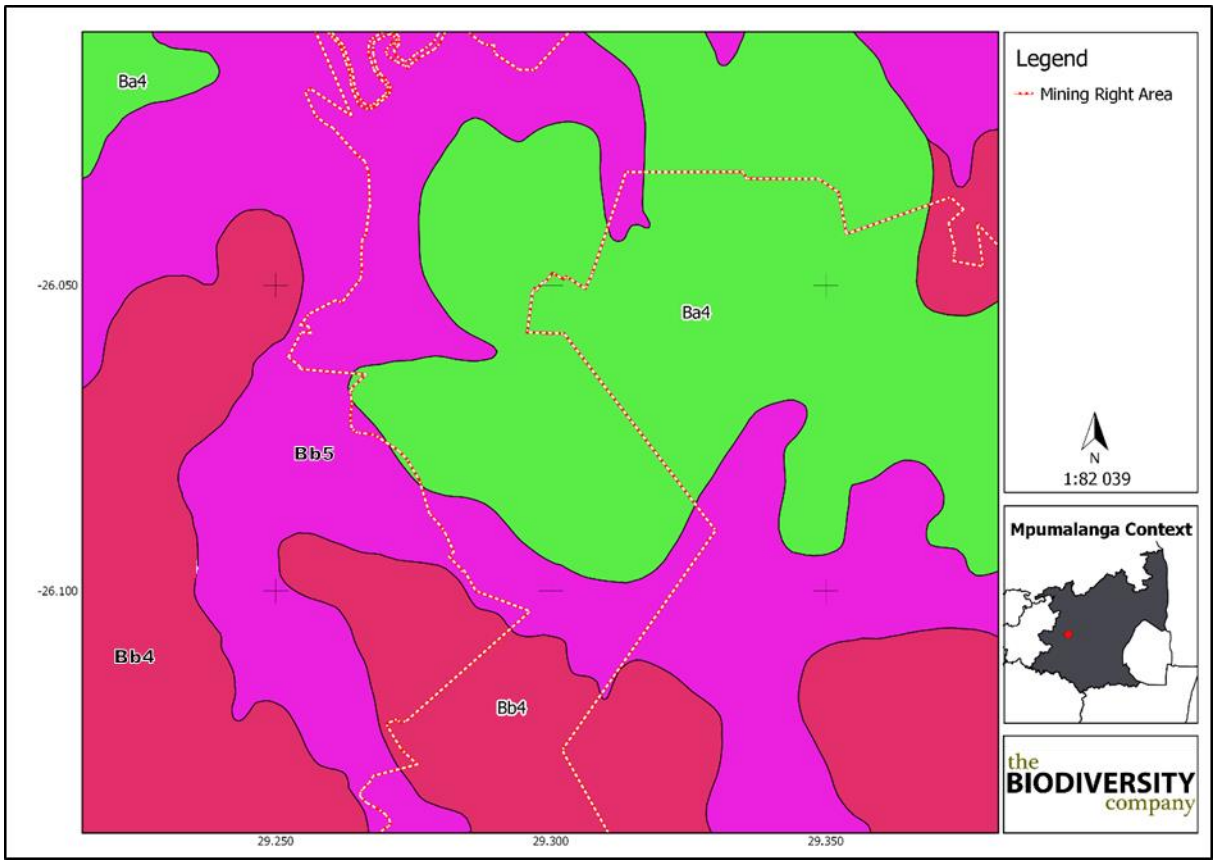

Figure 16: The land types associated with the Project area

7 Results and Discussion

The results and discussion are divided into three sections, Biodiversity, Wetlands and Riverine Ecology. This division allows for the results to be represented in a logical way that also adheres to the legal requirements for each discipline.

7.1 Biodiversity Desktop Assessment

7.1.1 Vegetation Assessment

The VDDC study area is situated within the grassland biome. This biome is centrally located in southern Africa, and adjoins all except the desert, fynbos and succulent Karoo biomes (Mucina & Rutherford, 2006). Major macroclimatic traits that characterise the grassland biome include:

a) Seasonal precipitation; and

b) The minimum temperatures in winter (Mucina & Rutherford, 2006).

7.1.1.1 Vegetation Types

The grassland biome comprises many different vegetation types. The study area is situated predominantly within one vegetation type; namely the Eastern Highveld Grassland (GM12) vegetation type according to Mucina & Rutherford (2006) (Figure 17).

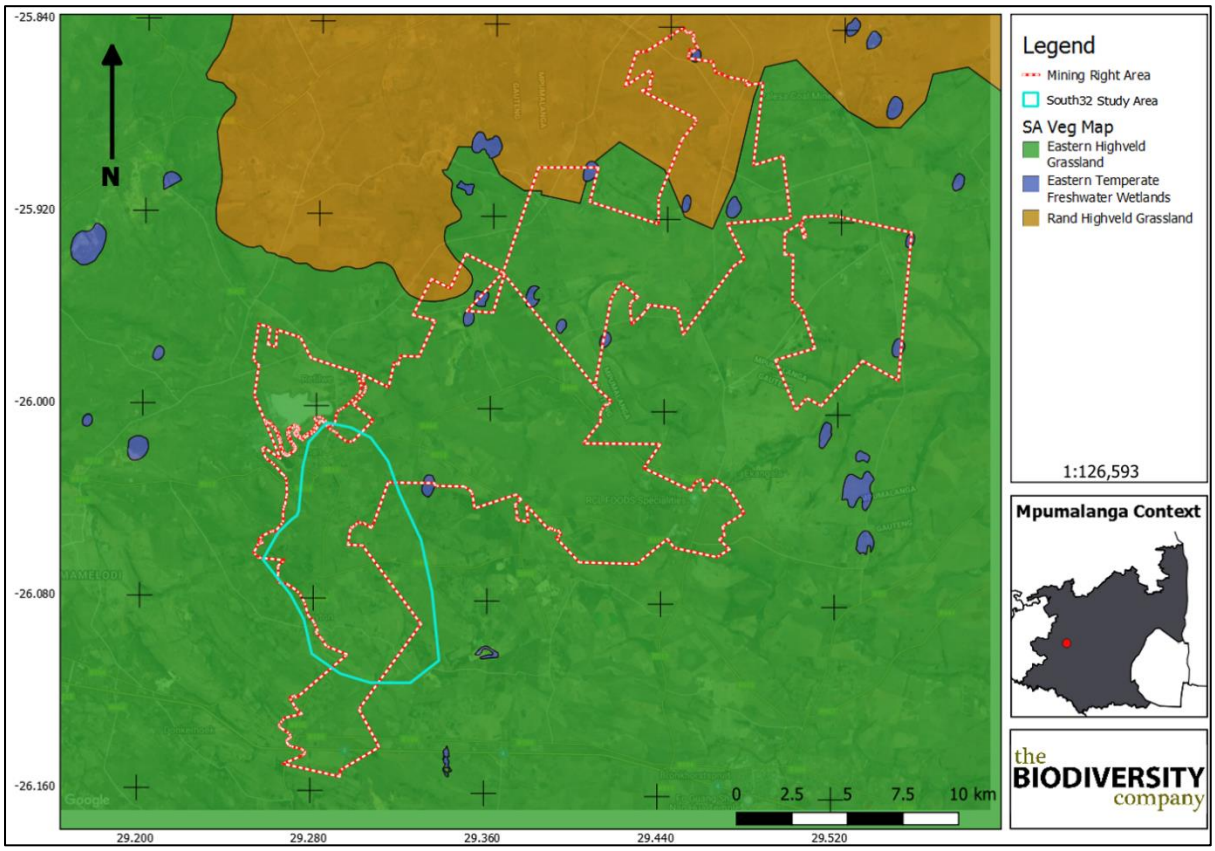

Figure 17: Project area showing the vegetation types based on the Vegetation Map of South Africa, Lesotho & Swaziland (BGIS, 2017)

7.1.1.2 Eastern Highveld Grassland

This vegetation type occurs on slightly to moderately undulating planes, including some low hills and pan depressions. The vegetation is a short dense grass land dominated by the usual highveld grass composition (*Aristida, Digitaria, Eragrostis, Themeda, Tristachya* etc.) with small scattered rocky outcrops with wiry sour grasses and some woody species. Some 44% transformed primarily by cultivation, plantations, mines, urbanisation and by building of dams (Mucina & Rutherford, 2006).

7.1.1.3 Important Plant Taxa

Important plant taxa are those species that have a high abundance, a frequent occurrence or are prominent in the landscape within a particular vegetation type (Mucina & Rutherford, 2006).

The following species are important in the **Eastern Highveld Grassland** vegetation type:

Graminoids: *Aristida aequiglumis, A. congesta, A. junciformis subsp. Galpinii, Brachiaria serrata, Cynodon dactylon, Digitaria monodactyla, D. tricholaenoides, Elionurus muticus,*

Eragrostis chloromelas, E. curvula, E plana, E racemosa E sclerantha Heteropogon contortus, Loudetia simplex, Microchloa caffra, Monocymbium ceresiiforme, Setaria sphacelata, Sporobolus africanus, S. pectinatus, Themeda triandra, Trachypogon spicatus, Tristachya leucothrix, T. rehmanni, Alloteropsis semialata subsp. eckloniana, Andropogon appendiculatus, A schirensis, Bewsia biflora, Ctenium concinnum, Diheteropogon amplectens, Eragrostis capensis, E. gummiflua, E. patentissima, Harpochloa falx, Panicum natalense, Rendlia altera, Schizachyrium sanguineum, Setaria nigrirostris, Urelytrum agropyroides.

Herbs: *Berkheya setifera, Haplocarpha scaposa, Justicia anagalloides, Acalypha angusta, Chamaecrista mimosoides, Dicoma anomala, Euryops gilfillanii, E. transvalensis subsp. setilobus, Helichrysum aureonitens, H. caespititium, H. callicomum, H. oreophilum, H. caespititium, H. oreophilum, H rugulosum, ipomoea crassipes, Pentanisia prunelloides subsp. latifolia, Selago densiflora, Senecio coronatus, Vernonia oligocephala, Wahlenbergia undulata;*

Geophytic herbs: *Gladiolus crassifolius, Haemanthus humilis subsp. hirsutus, Hypoxis rigidula var. pilosissima, Ledebouria ovatifolia;*

Succulent herb: *Aloe ecklonis*; and

Low shrubs: *Anthospermum rigidum subsp. pumilum, Stoebe plumosa.*

7.1.1.4 Conservation Status

According to Mucina & Rutherford (2006), this vegetation type is classified as Endangered. The national target for conservation protection for both these vegetation types is 24%, but only a few patches are statutorily conserved in Nooitgedacht Dam and Jericho Dam Nature Reserves and in private reserves (Holkranse, Kransbank, Morgenstond).

Some 44% of this vegetation type has already been transformed primarily by cultivation, plantations, mines, urbanisation and by building of dams. Cultivation may have had a more extensive impact, indicated by land-cover data. *Acacia mearnsii* (Black wattle) can become dominant in disturbed sites.

7.1.1.5 Plant Species of Conservation Concern

Based on the Plants of Southern Africa (BODATSA-POSA, 2016) database (Figure 18), 233 plant species are expected to occur in the area.

Of the 233-plant species, three (3) species are listed as being Species of Conservation Concern (SCC) (Table 7).

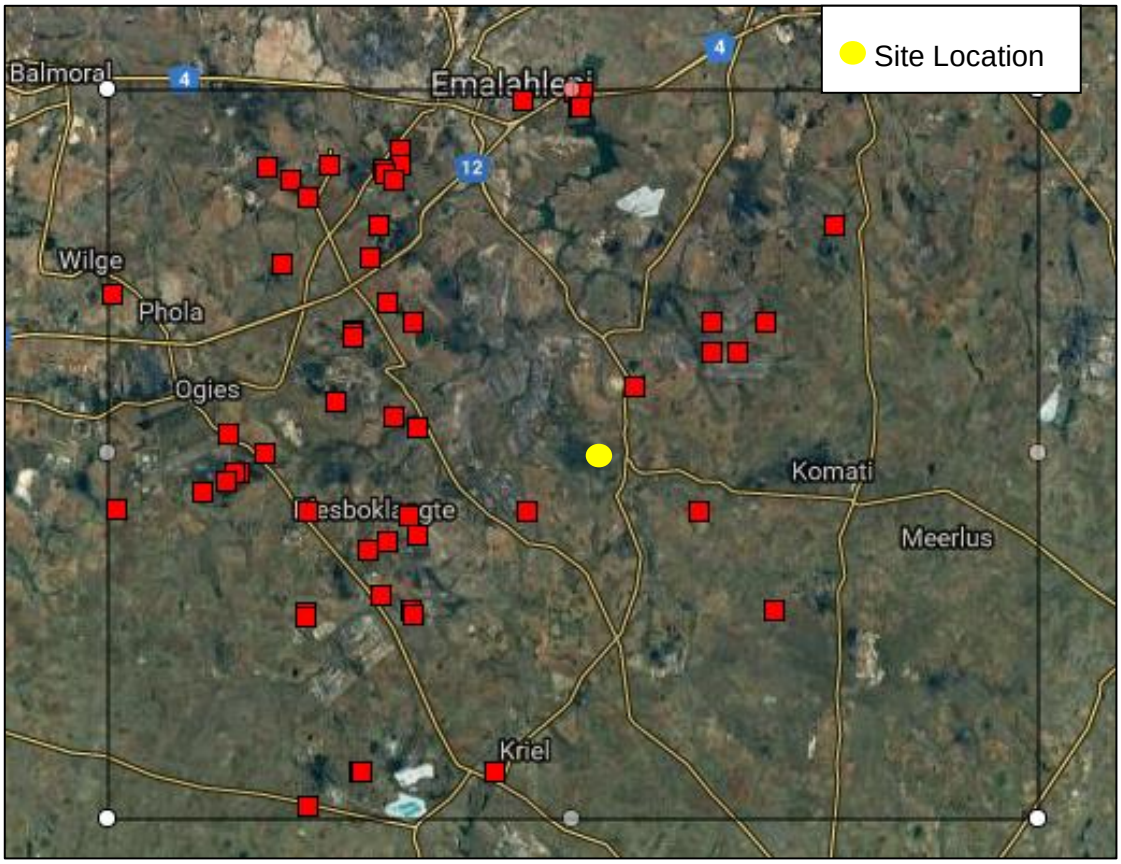

Figure 18: Map showing the grid drawn in order to compile an expected species list, the yellow dot indicates the location of the study area while the red blocks illustrates botanical records according to BODATSA-POSA, 2016.

Table 7: Plant Species of Conservation Concern (SCC) expected to occur in the study area (BODATSA-POSA, 2016)

Family	Taxon	Author	IUCN status	Habitat preference	Likelihood of occurrence
Fabaceae	*Argyrolobium longifolium*	(Meisn.) Walp.	VU	Ngongoni and sandstone grassland. Small populations only exist.	Moderate
Iridaceae	*Gladiolus paludosus*	Baker	VU	Moist highveld grasslands, found in wet, rocky sites, mostly dolerite outcrops, wedged in rock crevices.	Moderate
Aizoaceae	*Khadia carolinensis*	(L.Bolus) L.Bolus	VU	Well-drained, sandy loam soils among rocky outcrops, or at the edges of sandstone sheets, Highveld Grassland, 1700 m.	Moderate

Although care was taken to traverse as much of the suitable habitat during the fieldwork in search for these SCC, the effort failed to record any of these species. The fieldwork did however, reveal the disturbed nature of most of the habitats on the study area, largely due to existing mining activities in the area.

Based on the field observations, the likelihood of occurrence of any of the plant species outlined in Table 7 is low to medium and repeated field surveys throughout the phenological cycles of these plant SCC may yield observations of this species within the study area.

According to Scientific Aquatic Services (2013) four habitat units were observed during their wet season survey, the habitats were identified as transformed habitat, wetland and riparian habitat, rocky ridges and less disturbed habitat. The majority of the study area was covered by transformed habitat, while the wetland and riparian habitat comprised of two wetlands, a partially artificial wetland and the Olifants river. The grassland habitat as well as the rocky ridge is found adjacent to the river. Dominant plant species found in the project area by Scientific Aquatic services (2013) include *Pinus* spp., *Populus alba, P. canescens*, *Quercus robur, Eucalyptus camaldulensis, Celtis africana, Searsia lancea. Typha capensis, Phragmites australis, Cyperus marginatus, C. esculentus and C. rupestris, Imperata cylindrica, Eragrostis gummiflua, Juncus effusus and Leersia hexandra.*

7.1.2 Faunal Assessment

7.1.2.1 Avifauna

Based on the South African Bird Atlas Project, Version 2 (SABAP2) database and records from the Animal Demography Unit (2018), 326 bird species are expected to occur in the vicinity of the Project area (pentads 2555_2910, 2555_2915, 2555_2920, 2600_2910, 2600_2915, 2600_2920, 2605_2910, 2605_2915, 2605_2920, 2610_2910, 2610_2915, 2610_2920). The full list of potential bird species is provided in Appendix B.

Of the expected bird species, twenty-five (25) species (7.7%) are listed as SCC either on a regional (23) or global scale (12) (Table 8).

The SCC include the following:

- One (1) species that is listed as Critically Endangered (CR) on a regional basis;
- Four (4) species that are listed as Endangered (EN) on a regional basis;
- Ten (10) species that are listed as Vulnerable (VU) on a regional basis; and
- Eight (8) species that are listed as Near Threatened (NT) on a regional basis;

On a global scale, two (2) species are listed as EN, four (4) species are listed as VU and six (6) species as NT (Table 8). The likelihood of occurrence is discussed in the text below Table 8, overall the likelihood increases based on habitat preference, food availability and decreases because of threats. This rating is also based on literature and known occurrence of the species in the area.

Table 8: List of bird species of regional or global conservation importance that are expected to occur in pentads 2555_2910, 2555_2915, 2555_2920, 2600_2910, 2600_2915, 2600_2920, 2605_2910, 2605_2915, 2605_2920, 2610_2910, 2610_2915, 2610_2920 (ESKOM, 2015; IUCN, 2018; SABAP2, 2018)

Species	Common Name	Conservation Status		Likelihood of occurrence
		Regional (SANBI, 2016)	IUCN (2017)	
Alcedo semitorquata	Kingfisher, Half-collared	NT	LC	Moderate
Anthropoides paradiseus	Crane, Blue	NT	VU	Moderate
Aquila verreauxii	Eagle, Verreaux's	VU	LC	Low

Balearica regulorum	Crane, Grey Crowned	EN	EN	Low
Bugeranus carunculatus	Crane, Wattled	CR	VU	Low
Calidris ferruginea	Sandpiper, Curlew	LC	NT	High
Ciconia abdimii	Stork, Abdim's	NT	LC	High
Ciconia nigra	Stork, Black	VU	LC	Moderate
Circus ranivorus	Marsh-harrier, African	EN	LC	Moderate
Coracias garrulus	Roller, European	NT	LC	Moderate
Eupodotis caerulescens	Korhaan, Blue	LC	NT	Moderate
Eupodotis senegalensis	Korhaan, White-bellied	VU	LC	Moderate
Falco biarmicus	Falcon, Lanner	VU	LC	High
Geronticus calvus	Ibis, Southern Bald	VU	VU	High
Glareola nordmanni	Pratincole, Black-winged	NT	NT	Moderate
Mycteria ibis	Stork, Yellow-billed	EN	LC	Low
Neotis denhami	Bustard, Denham's	VU	NT	Moderate
Oxyura maccoa	Duck, Maccoa	NT	NT	High
Phoeniconaias minor	Flamingo, Lesser	NT	NT	Moderate
Phoenicopterus ruber	Flamingo, Greater	NT	LC	Moderate
Podica senegalensis	Finfoot, African	VU	LC	Low
Sagittarius serpentarius	Secretarybird	VU	VU	Moderate
Spizocorys fringillaris	Lark, Botha's	EN	EN	Moderate
Sterna caspia	Tern, Caspian	VU	LC	Low
Tyto capensis	Grass-owl, African	VU	LC	High

Alcedo semitorquata (Half-collared Kingfisher) is listed as Near Threatened (NT) on a regional scale and occurs across a large range. This species generally prefers narrow rivers, streams, and estuaries with dense vegetation onshore, but it may also move into coastal lagoons and lakes. It mainly feeds on fish (IUCN, 2017). The possibility of occurrence is rated as moderate due to the fact that there are some large farm and mine dams, and natural wetlands in the Project area, and there are various river systems throughout, both of which could provide suitable habitat for this species.

Anthropoides paradiseus (Blue Crane) is listed as NT on a regional scale and as VU on a global scale. This species has declined, largely owing to direct poisoning, power-line collisions and loss of its grassland breeding habitat owing to afforestation, mining, agriculture and development (IUCN, 2017). This species breeds in natural grass- and sedge-dominated habitats, preferring secluded grasslands at high elevations where the vegetation is thick and short. Due to the presence of some open grassland areas but the lack of extensive crane records from this area, the likelihood of occurrence is rated as moderate.

Aquila verreauxii (Verreaux's Eagle) is listed as VU on a regional scale and LC on a global scale. This species is locally persecuted in southern Africa where it coincides with livestock farms, but because the species does not take carrion, is little threatened by poisoned carcasses. Where hyraxes are hunted for food and skins, eagle populations have declined

(IUCN, 2017). Based on the expected habitat and the availability of prey items, the likelihood of occurrence of this species at the project site is rated as low.

Balearica regulorum (Grey Crowned Crane) is listed as Endangered (EN) on a regional scale as well as global scale. The species inhabits wetlands such as marshes, pans and dams with tall emergent vegetation, open riverine woodland, shallowly flooded plains and temporary pools with adjacent grasslands, open savannas, croplands and breeds within or at the edges of wetlands. Due to the lack of extensive open grassland areas and the lack of crane records from this area, the likelihood of occurrence is rated as low.

Bugeranus carunculatus (Wattled Crane) is listed as Critically Endangered (CR) on a regional scale (SANBI, 2016) and Vulnerable (VU) on a global scale (IUCN, 2017). This species is generally not migratory but those that inhabit seasonal wetlands are irregularly nomadic in response to water availability (del Hoyo *et al*., 1996). In South Africa this species was found to occupy large home ranges of approximately 16 km2, which consist largely (75%) of grassland with a small core of essential wetland breeding habitat (McCann & Benn, 2006). The primary threat is loss and degradation of wetlands as a result of upstream river regulation, intensified agriculture, mining, drainage, invasive species such as Mimosa pigra. Other threats include nest disturbance, grass-burning regimes, poisoning, collision with utility lines, direct consumption of chicks and traditional medicine. Due to the lack of extensive open grassland areas, undisturbed wetlands and the lack of crane records from this area, the likelihood of occurrence is rated as low.

Calidris ferruginea (Curlew Sandpiper) is migratory species which breeds on slightly elevated areas in the lowlands of the high Arctic and may be seen in parts of South Africa during winter. During winter, the species occurs at the coast, but also inland on the muddy edges of marshes, large rivers and lakes (both saline and freshwater), irrigated land, flooded areas, dams and saltpans (IUCN, 2017). Due to the presence of many of these habitat types within the Project area the likelihood of occurrence of this species was rated as high.

Ciconia abdimii (Abdim's Stork) is listed as NT on a local scale and the species is known to be found in open grassland and savanna woodland often near water but also in semi-arid areas, gathering beside pools and water-holes. They tend to roost in trees or cliffs (IUCN, 2017). The existence of multiple wet areas and grasslands creates the potential for this species to occur in the area and the likelihood of occurrence was rated as high.

Ciconia nigra (Black Stork) is native to South Africa, and inhabits old, undisturbed, open forests. They are known to forage in shallow streams, pools, marshes swampy patches, damp meadows, flood-plains, pools in dry riverbeds and occasionally grasslands, especially where there are stands of reeds or long grass (IUCN, 2017). It is unlikely that this species would breed in the Project area due to the lack of forested areas, however some suitable foraging habitat remains in the form of the open grasslands and wetland areas, and as such the likelihood of occurrence is rated as moderate.

Circus ranivorus (African Marsh Harrier) is listed as EN in South Africa (ESKOM, 2015). This species has an extremely large distributional range in sub-equatorial Africa. South African populations of this species are declining due to the degradation of wetland habitats, loss of habitat through over-grazing and human disturbance and possibly, poisoning owing to over-use of pesticides (IUCN, 2017). This species breeds in wetlands and forages primarily over reeds and lake margins. Due to the presence of some suitable habitat, especially along the

Olifants river and Witbank Dam adjacent to the Project area the likelihood of occurrence is considered as moderate.

Coracias garrulous (European Roller) is a winter migrant from most of South-central Europe and Asia occurring throughout sub-Saharan Africa (IUCN, 2017). The European Roller has a preference for bushy plains and dry savannah areas (IUCN, 2017). There is a moderate chance of this species occurring in the Project area as they prefer to forage in bushy savanna areas.

Eupodotis caerulescens (Blue Korhaan) is listed as near threatened according to the IUCN (2017). Their moderately rapid decline is accredited to habitat loss that is a result of intensive agriculture. They are found in high grassveld in close proximity to water, usually above an altitude of 1 500m (del Hoyo *et al*., 1996). The specie nests in bare open ground, situated in thick grass or cropland. Based on the required habitat the likelihood of occurrence of this species is rated as moderate.

Eupodotis senegalensis (White-bellied Korhaan) is Near-endemic to South Africa, occurring from the Limpopo Province and adjacent provinces, south through Swaziland to KwaZulu-Natal and the Eastern Cape (Hockey *et al*, 2005). It generally prefers tall, dense sour or mixed grassland, either open or lightly wooded, occasionally moving into cultivated or burnt land. This species may forage in the Project area but is unlikely to be resident and as such the likelihood of occurrence was rated as low.

Falco biarmicus (Lanner Falcon) is native to South Africa and inhabits a wide variety of habitats, from lowland deserts to forested mountains (IUCN, 2017). They may occur in groups up to 20 individuals but have also been observed solitary. Their diet is mainly composed of small birds such as pigeons and francolins. The likelihood of occurrence for this species in the Project area is rated as high due to the presence of good habitat for this species and the presence of many bird species on which Lanner Falcons may predate.

Geronticus calvus (Southern Bald Ibis) is listed as Vulnerable (VU) on a regional basis and prefers high rainfall (>700 mm p.a.), sour and alpine grasslands, with an absence of trees and a short, dense grass sward and also occurs in lightly wooded and relatively arid country. It forages on recently burned ground, also using unburnt natural grassland, cultivated pastures, reaped maize fields and ploughed areas. It has a varied diet, mainly consisting of insects and other terrestrial invertebrates (IUCN, 2017). It has high nesting success on safe, undisturbed cliffs. The likelihood of the species foraging within the Project area is high due to plentiful suitable habitat, although it is unlikely to roost in this area.

Glareola nordmanni (Black-winged Pratincole) is a migratory species which is listed as NT both globally and regionally. This species has a very large range, breeding mostly in Europe and Russia, before migrating to southern Africa. Overall population declines of approximately 20% for this species are suspected (IUCN, 2017). This species generally occurs near water and damp meadows, or marshes overgrown with dense grass. Due to its migratory nature, this species will only be present in South Africa for a few months during the year and will not breed locally. There is a small amount of suitable habitat within the Project area and adjacent to it and as such the likelihood of occurrence is rated as moderate.

Mycteria ibis (Yellow-billed Stork) is listed as EN on a regional scale and Least Concern (LC) on a global scale. This species is migratory and has a large distributional range which includes

much of sub-Saharan Africa. It is typically associated with freshwater ecosystems, especially wetlands and the margins of lakes and dams (IUCN, 2017). The presence of large water bodies within and adjacent to the Project area creates a moderate possibility that this species may occur.

Neotis denhami (Denhams Bustard) is listed as VU on a regional scale and NT on a global scale. It occurs in flat, arid, mostly open country such as grassland, Karoo, bushveld, thornveld, scrubland and savanna but also including modified habitats such as wheat fields and firebreaks Collisions with power lines may be a significant threat in parts of the range, particularly South Africa (IUCN, 2007). The habitat at the Project area does provide suitable habitat for this species and therefore it's likelihood of occurrence is rated as moderate.

Oxyura maccoa (Maccoa Duck) has a large northern and southern range, South Africa is part of its southern distribution. During the species' breeding season, it inhabits small temporary and permanent inland freshwater lakes, preferring those that are shallow and nutrient-rich with extensive emergent vegetation such as reeds (Phragmites spp.) and cattails (Typha spp.) on which it relies for nesting (IUCN, 2017). The likelihood of occurrence of this species in the Project area was rated as high due to the presence of dams and rivers within and adjacent to the Project area.

Phoeniconaias minor (Lesser Flamingo) is listed as NT on a global and regional scale whereas Phoenicopterus roseus (Greater Flamingo) is listed as NT on a regional scale only. Both species have similar habitat requirements and the species breed on large undisturbed alkaline and saline lakes, salt pans or coastal lagoons, usually far out from the shore after seasonal rains have provided the flooding necessary to isolate remote breeding sites from terrestrial predators and the soft muddy material for nest building (IUCN, 2017). Due to the presence of some preferred habitat within the Project area, the likelihood of occurrence is moderate for both species.

Podica senegalensis (African Finfoot) occurs in forest and wooded savanna along permanent streams with thick growths of Syzygium guineense, along secluded reaches of thickly wooded rivers and on the edges of pools, lakes and dams with well-vegetated banks on the edges of dense papyrus beds far from the shore. It is rarely found away from shoreline vegetation and generally avoids stagnant or fast-flowing water (IUCN, 2017). There is some habitat for this species in the Project area in the forms of dams and rivers and as such the likelihood of occurrence is rated as moderate.

Sagittarius serpentarius (Secretarybird) occurs in sub-Saharan Africa and inhabits grasslands, open plains, and lightly wooded savanna. It is also found in agricultural areas and sub-desert (IUCN, 2017). The likelihood of occurrence is rated as moderate due to the presence of some open grasslands present in the Project area.

Spizocorys fringillaris (Botha's Lark) is listed as endangered both globally and nationally (IUCN, 2017; SANBI, 2016). This species is endemic to South Africa, with a restricted distribution to southern Mpumalanga and eastern Free State. Their habitat is limited to well-grazed grasslands, mostly coinciding with black clay soils known as Moist Clay Highveld Grassland. The likelihood of occurrence is rated as moderate to low.

Sterna caspia (Caspian Tern) is native to South Africa and are known to occur in inland freshwater systems such as large rivers, creeks, floodlands, reservoirs and sewage ponds. Habitat suitability was found to be moderate and thus the likelihood of occurrence is moderate.

Tyto capensis (African Grass-owl) is rated as Vulnerable (VU) on a regional basis. The distribution of the species includes the eastern parts of South Africa. The species is generally solitary, but it does also occur in pairs, in moist grasslands where it roosts (IUCN, 2017). The species prefers thick grasses around wetlands and rivers which are present in the Project area. Furthermore, this species specifically has a preference for nesting in dense stands of the grass species *Imperata cylindrica*. Extensive areas of this grass species are evident within the Project area and as such the likelihood of occurrence is rated as high.

In a study performed by the Scientific Aquatic Services in 2013 on the VDDC property, thirty-seven bird species were recorded of which non were species of conservation concern. Species that were found were Long-tailed Whydah (*Vidua paradisaea*), Eastern Clapper Lark (*Mirafra fasciolata*), Squacco Heron (*Ardeola ralloides*), Black Heron (*Egretta ardesiaca*) and Black-chested Prinia (*Prinia flavicans*).

7.1.2.2 Mammals

The IUCN Red List Spatial Data (IUCN, 2017) lists 84 mammal species that could be expected to occur within the study area (Appendix C). Of these species, 12 are medium to large conservation dependant species, such as *Ceratotherium simum* (Southern White Rhinoceros) and *Tragelaphus oryx* (Common Eland) that, in South Africa today, are generally restricted to protected areas such as game reserves. These species are not expected to occur in the Project area and are removed from the expected SCC list. They are however still included in Appendix C.

Of the remaining 72 small to medium sized mammal species, sixteen (16) (22.2%) are listed as being of conservation concern on a regional or global basis (Table 9).

The list of potential species includes:

- Two (2) that are listed as Endangered (EN) on a regional basis;
- Four (4) that are listed as Vulnerable (VU) on a regional basis; and
- Five (5) that are listed as Near Threatened (NT) on a regional scale (Table 9).

On a global scale, one (1) species is listed as EN, two (2) are listed as VU and three (3) as NT (Table 9).

Table 9: List of mammal species of conservation concern that may occur in the Project area as well as their global and regional conservation statuses (IUCN, 2017; SANBI, 2016)

Species	Common name	Conservation Status		Likelihood of occurrence
		Regional (SANBI, 2016)	IUCN (2017)	
Aonyx capensis	Cape Clawless Otter	NT	NT	High
Atelerix frontalis	Southern African Hedgehog	NT	LC	Moderate
Cloeotis percivali	Short-eared Trident Bat	EN	LC	Moderate

Crocidura maquassiensis	Swamp Musk Shrew	NT	LC	Moderate
Dasymys incomtus	African Marsh Rat	NT	LC	Low
Eidolon helvum	African Straw-colored Fruit Bat	LC	NT	Moderate
Felis nigripes	Black-footed Cat	VU	VU	Moderate
Hydrictis maculicollis	Spotted-necked Otter	VU	NT	High
Leptailurus serval	Serval	NT	LC	High
Mystromys albicaudatus	White-tailed Rat	VU	EN	Moderate
Ourebia ourebi	Oribi	EN	LC	Low
Panthera pardus	Leopard	VU	VU	Low

Aonyx capensis (Cape Clawless Otter) is the most widely distributed otter species in Africa (IUCN, 2017). This species is predominantly aquatic, and it is seldom found far from water. Based on the presence of various rivers and dams within, or adjacent to, the Project area and therefore the likelihood of occurrence of this species occurring in the Project area is considered to be high.

Atelerix frontalis (South African Hedgehog) has a tolerance of a degree of habitat modification and occurs in a wide variety of semi-arid and sub-temperate habitats (IUCN, 2017). Based on the Red List of Mammals of South Africa, Lesotho and Swaziland (2016), *A. frontalis* populations are decreasing due to the threats of electrocution, veld fires, road collisions, predation from domestic pets and illegal harvesting. Although the species is cryptic and therefore not often seen, there is suitable habitat in the Project area the likelihood of occurrence is rated as moderate.

Cloeotis percivali (Short-eared Trident Bat) occurs in savanna areas where there is sufficient cover in the form of caves and mine tunnels for day roosting (IUCN, 2017). It feeds exclusively on moths and appears to be very sensitive to disturbance. Suitable habitat can be found around the Project area and therefore the likelihood of finding this species is rated as moderate.

Crocidura maquassiensis (Maquassie Musk Shrew) is listed as Vulnerable (VU) on a regional basis and is known to be found in rocky, mountain habitats. It may tolerate a wider range of habitats and individuals have been collected in Kwa-Zulu Natal from a garden, and in mixed bracken and grassland alongside a river at 1,500 m (IUCN, 2017). There is a lack of suitable habitat for this species in the Project area and therefore the likelihood of occurrence is rated as moderate.

Dasymys incomtus (African Marsh Rat) is listed as NT on a regional scale and LC on a global scale. This species has a wide distributional range that includes Central Africa, East Africa and parts of Southern Africa. This species has been recorded from a wide variety of habitats, including forest and savanna habitats, wetlands and grasslands (IUCN, 2017). Based on the presence of a river in the Project area the likelihood of occurrence of this species may be present in the Project area, the proximity of the mining area and degree of disturbance may cause the species to be absent, thus rated as low.

Eidolon helvum (African Straw-coloured Fruit Bat) is listed as LC on a regional scale and NT on a global scale. This species has been recorded from a very wide range of habitats across the lowland rainforest and savanna zones of Africa (IUCN, 2017). Although considered to be

widespread and abundant across its range, certain populations are decreasing due to severe deforestation, hunting for food and medicinal use (IUCN, 2017). This species is known to form large roosts and colonies numbering in the thousands to even millions of individuals (IUCN, 2017). No colonies of this species are known to occur in the Project area or in the immediate vicinity and, although individuals may occasionally be recorded, it is not expected to be resident within the Project area and therefore it's likelihood of occurrence is rated as moderate.

Felis nigripes (Black-footed cat) is endemic to the arid regions of southern Africa. This species is naturally rare, has cryptic colouring is small in size and is nocturnal. These factors have contributed to a lack of information on this species. Given that the highest densities of this species have been recorded in the more arid Karoo region of South Africa, the habitat in the Project area can be considered to be sub-optimal for the species and the likelihood of occurrence is rated as moderate.

Hydrictis maculicollis (Spotted-necked Otter) inhabits freshwater habitats where water is un-silted, unpolluted, and rich in small to medium sized fishes (IUCN, 2017). Suitable habitat may be available in the Olifants River adjacent to the Project area and therefore the likelihood of occurrence is moderate.

Leptailurus serval (Serval) occurs widely through sub-Saharan Africa and is commonly recorded from most major national parks and reserves (IUCN, 2017). The Serval's status outside reserves is not certain, but they are inconspicuous and may be common in suitable habitat as they are tolerant of farming practices provided there is cover and food available. In sub-Saharan Africa, they are found in habitat with well-watered savanna long-grass environments and are particularly associated with reedbeds and other riparian vegetation types. Due to the presence of grassland areas in the Project area the likelihood of oc *Mystromys albicaudatus* (White-tailed Rat) is listed as Vulnerable (VU) on a regional basis and Endangered (EN) on a global scale. It is relatively widespread across South Africa and Lesotho; the species is known to occur in shrubland and grassland areas. A major requirement of the species is black loam soils with good vegetation cover. Although the vegetation type is suitable, no black loam seems to be present on site, therefore the likelihood of occurrence of this species is rated as moderate.

Ourebia ourebi (Oribi) has a patchy distribution throughout Africa and is known to occur in South Africa. Populations are becoming more fragmented as it is gradually eliminated from moderately to densely settled areas (IUCN, 2017). Although suitable habitat exists within the Project area, the likelihood of occurrence is rated as moderate due to the relatively small size of the patches of natural vegetation that remain within the Project area, occurrence for this species is rated as low.

Panthera pardus (Leopard) has a wide distributional range across Africa and Asia, but populations have become reduced and isolated, and they are now extirpated from large portions of their historic range (IUCN, 2017). Impacts that have contributed to the decline in populations of this species include continued persecution by farmers, habitat fragmentation, increased illegal wildlife trade, excessive harvesting for ceremonial use of skins, prey base declines and poorly managed trophy hunting (IUCN, 2017). Although known to occur and persist outside of formally protected areas, the densities in these areas are considered to be low and the likelihood of occurrence in an area in close proximity to various mining activities in the area, and where they are likely to be persecuted, is regarded as low.

A study performed by Scientific Aquatic Services (2013) in the VDDC project area found no mammal species of conservation concern during their survey, they did however find *Atilax paludinosus* (Water mongoose), *Cynictis penicillata* (Yellow mongoose), *Lutra maculicollis* (Spotted-necked Otter), *Lepus saxatilis* (Scrub hare), *Suricata suricatta* (Meerkat), Common Mole Rat (*Cryptomys hottentotus*), Serval (*Leptailurus serval*), Common Duiker (*Sylvicapra gimmia*), *Hystrix africaeaustralis* (South African Porcupine) and *Crocidura mariquensis* (Swamp musk shrew).

7.1.2.3 Herpetofauna (Reptiles)

Based on the IUCN Red List Spatial Data (IUCN, 2017) and the ReptileMap database provided by the Animal Demography Unit (ADU, 2018), 22 reptile species are expected to occur in the study area (Appendix D). Of the expected reptile species, only one (1) is regarded as a SCC, namely *Crocodylus niloticus* (Nile Crocodile) which is listed as Near Threatened (NT) regionally (Table 10). Although this species is listed as expected to occur in the Project area, the extensive human presence, as well as the lack of recent records for the surrounding area, suggest that the likelihood of occurrence is low.

Table 10: List of reptile species of conservation concern that may occur in the Project area as well as their global and regional conservation statuses (SANBI, 2016; IUCN, 2017)

Species	Common Name	Conservation Status		Likelihood of occurrence
		Regional (SANBI, 2016)	IUCN (2017)	
Crocodylus niloticus	Nile Crocodile	VU	LC	Low

A study performed by the Scientific Aquatic Services in 2013 on the VDDC property found only one reptile species namely Striped Skink (*Mabuya striata*), they reported no species of conservation concern.

7.1.2.4 Amphibians

Based on the IUCN Red List Spatial Data (IUCN, 2017) and the AmphibianMap database provided by the Animal Demography Unit (ADU, 2018) 21 amphibian species are expected to occur in the study area (Appendix E). One amphibian species of conservation concern should be present in the Project area (Table 11).

Table 11: List of amphibian species of conservation concern that may occur in the Project area as well as their global and regional conservation statuses (SANBI, 2016; IUCN, 2017).

Species	Common name	Conservation Status		
		Regional (SANBI, 2016)	IUCN (2017)	Likelihood of occurrence
Pyxicephalus adspersus	Giant Bull Frog	NT	LC	Moderate

The Giant Bull Frog (*Pyxicephalus adspersus*) is a species of conservation concern that will possibly occur in the Project area. The Giant Bull Frog is listed as Near Threatened on a regional scale. It is a species of drier savannahs. It is fossorial for most of the year, remaining buried in cocoons. They emerge at the start of the rains, and breed in shallow, temporary

waters in pools, pans and ditches (IUCN, 2017). The likelihood of occurrence in the Project area is regarded as moderate.

A study performed by the Scientific Aquatic Services in 2013 on the VDDC property found two amphibian species namely *Afrana angoloensis* (Common river frog) and *Xenopus laevis* (Platanna), they reported no species of conservation concern. They did not find the Giant Bull frog but did also note that its range intersects with the project area.

7.2 Field Survey

The field surveys for the VDDC project (flora and fauna (mammals, avifauna, amphibians and reptiles)) was conducted during the first week of August 2018 and during the last week of November 2018, with a third survey conducted in June 2019. During the surveys, the floral and faunal communities in the study area were assessed. The study area was ground-truthed on foot, which included spot checks in pre-selected areas to validate desktop data. Photographs were recorded during the site visits and some are provided under the Results section in this report. All site photographs are available on request.

7.2.1 Vegetation Assessment

The main habitat types identified across the study area were initially identified largely based on aerial imagery (Figure 19). These main habitat types were visited during the field survey in the dry season to confirm and identify the species compositions of these areas (Table 12).

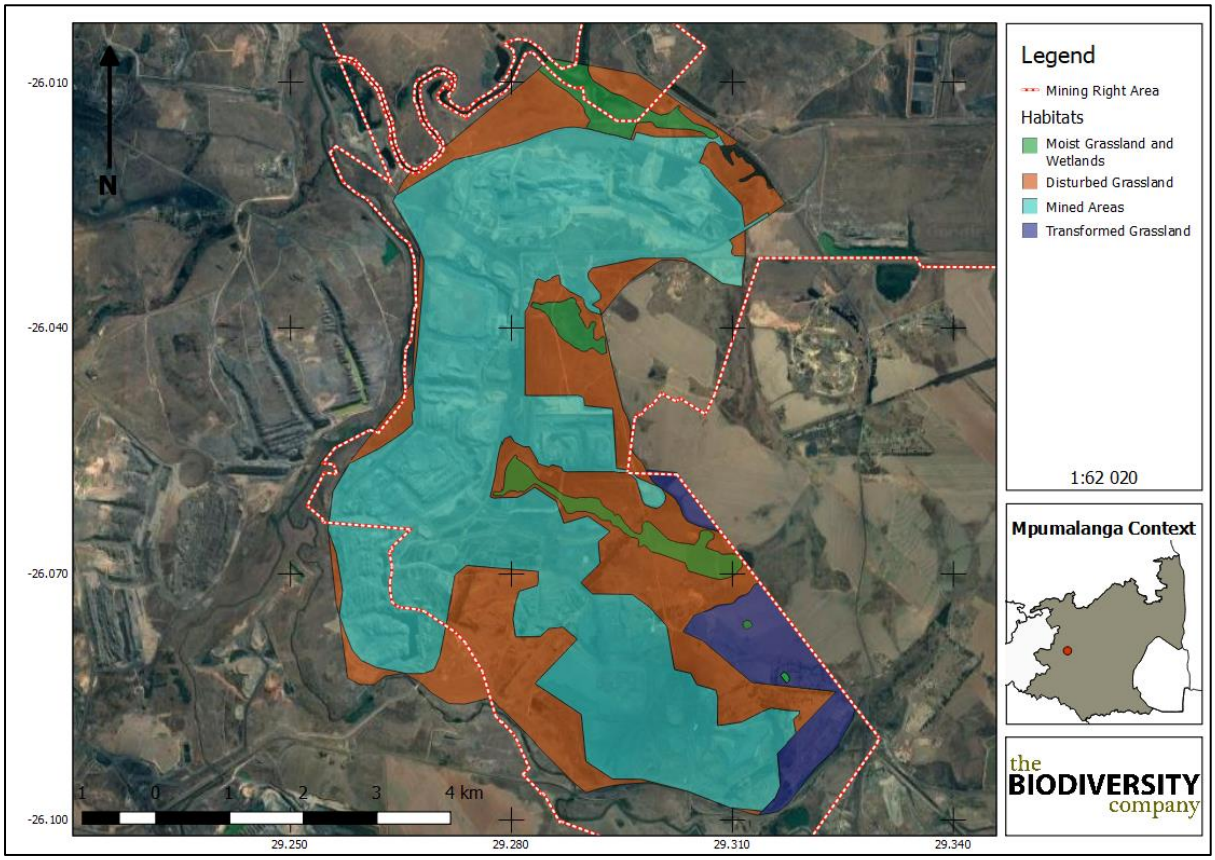

Figure 19 : The main habitat types identified across the study area

Emphasis was placed on limited timed meander searches within the areas regarded as most natural and therefore habitats with a higher potential of hosting SCC. Timed meander searches were therefore limited to the Mesic grassland mainly due to this being the dominating Veld type within the area. The remaining habitats were surveyed briefly, and time was mostly spent looking for obvious variation and/or areas of interest within these habitats, such as wetland areas. Each of the habitats identified are discussed in the sub-sections below (Figure 20).

The list of plant species recorded to date is therefore by no means comprehensive, and repeated surveys during phenological periods not covered, may likely yield up to 30% additional flora species for the project area.

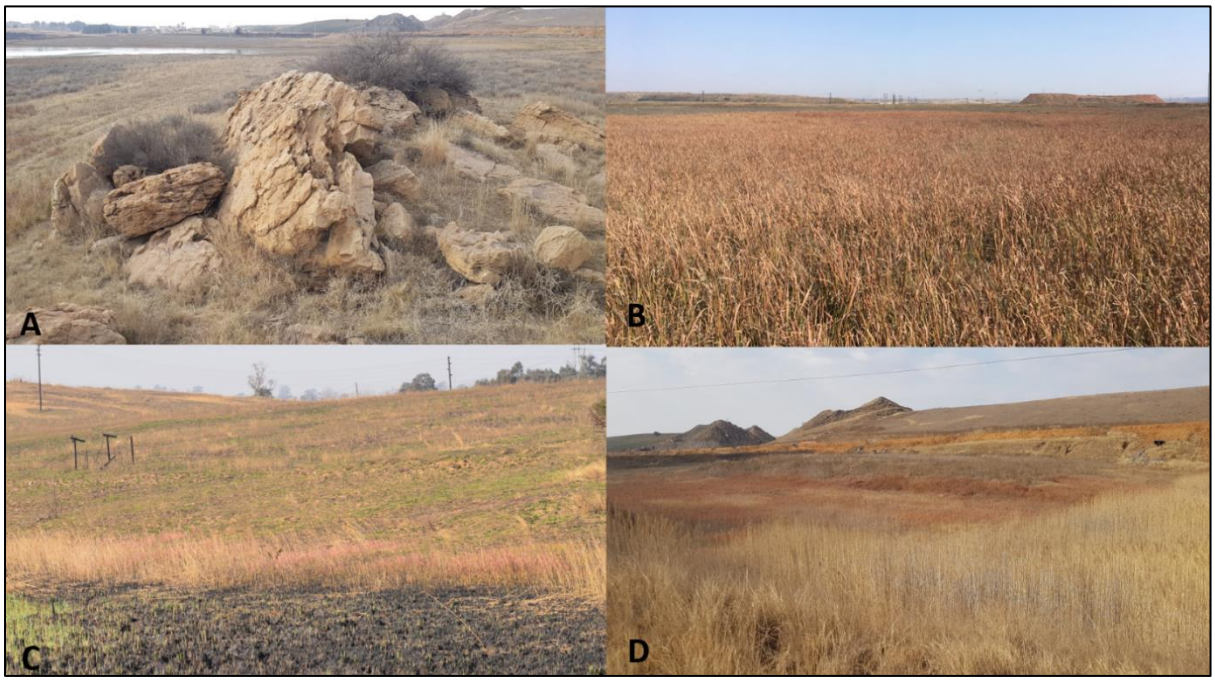

Figure 20: Photographs of the main habitat types on the study Area (August 2018): A) Moist Grassland; B& D) Moist Grassland wetland areas; and C) Disturbed Grassland.

A total of 115 tree-, shrub- and herbaceous plant species were recorded in the study area during the field verification (Table 12). Alien/Exotic/Invader plant species appear in blue text while the NEMBA Category 1 plants appear in green text.

Table 12: Plant species recorded during the dry season and wet season

Species	Common name	Threat Status (SANBI, 2017)	SA Endemic	NEMBA Category/Alien Category
Acacia mearnsii	**Black Wattle**			**Category 2**
Afrosciadium magalismontanum		LC	No	
Agrostis lachnantha var. lachnantha	Bent Grass	LC	No	
Alloteropsis semialata	Cockatoo Grass	LC	No	
Andropogon huillensis	Large Silver Andropogon	LC	No	
Argemone ochroleuca	**Mexican Poppy**			**NEMBA Category 1b**

Aristida junciformis	Gongoni Three-awn	LC	No	
Berkheya setifera	Buffalo-tongue Thistle	LC	No	
Bidens pilosa	**Black Jack**			**Naturalized exotic weed**
*Boophone disticha**	Century Plant	LC	No	
Brachiaria serrata	Velvet Signal Grass	LC	No	
Campuloclinium macrocephalum	**Pom-Pom Weed**			**NEMBA Category 1b**
Cenchrus ciliaris	Foxtail Buffalo Grass	LC	No	
Chamaecrista comosa	Trailing Dwarf Cassia	LC	No	
Chironia palustris	Cerise Stars	LC	No	
Chlorophytum fasciculatum		LC	No	
Cirsium vulgare	**Spear Thistle**			**NEMBA Category 1b.**
Cleome maculata	Spotted Cleome	LC	No	
Commelina africana var. krebsiana	Yellow Commelina	LC	No	
Conyza bonariensis	**Hairy Fleabane**			**Naturalized exotic weed**
Cortaderia selloana	**Pampas grass**			**NEMBA Category 1b**
Cotula anthemoides	Tuingras	LC	No	
Crassula capitella	Red flames	LC	Yes	
*Crinum bulbispermum**	Orange river lily	LC	No	
Cyanotis speciosa	Doll's Powderpuff	LC	No	
Cycnium tubulosum	Vlei ink-flower	LC	No	
Cymbopogon caesius	Turpentine grass	LC	No	
Cynodon dactylon	**Bermuda grass**			**Category 2**
Cyperus obtusiflorus var. flavissimus	Yellow Sedge	LC	No	
Datura ferox	**Large Thorn Apple**			**NEMBA Category 1b**
Dianthus mooiensis subsp. kirkii	Frilly Carnation	NE	-	
Digitaria eriantha	Finger Grass	LC	No	
Dimorphotheca spectabilis	Bloubietou	LC	Yes	
Diospyros lycioides	Bluebush	LC	No	
*Disa woodii**		LC	No	
Elionurus muticus	Wire grass	LC	No	
Eragrostis chloromelas	Blue Love Grass	LC	No	
Eragrostis curvula	Weeping Love Grass	LC	No	
Eragrostis gummiflua	Gum Grass	LC	No	
Eragrostis lehmanniana	Lehman Love Grass	LC	No	
Eragrostis racemosa	Narrow Heart Love Grass	LC	No	
Eragrostis superba	Flat-Seed Love Grass	LC	No	
Eriosema burkei		LC	No	
Erythrina zeyheri	Plough Breaker	LC	No	
Eucalyptus camaldulensis	**Red River Gum**			**NEMBA Category 1b**

Euphorbia striata	Milkweed	LC	No	
Felicia muricata	Wild Aster	LC	No	
Gazania krebsiana subsp. serrulata	Grassland Gazania	LC	No	
Gomphocarpus fruticosus	Cotton Milkweed	LC	No	
Haplocarpha sp.		LC	Yes	
Haplocarpha scaposa	False Gerbera	LC	No	
Harpochloa falx	Caterpillar Grass	LC	No	
Helichrysum acutatum	Sticky Everlasting	LC	No	
Helichrysum cephaloideum	Ibhade	LC	No	
Helichrysum coriaceum	Wild Tea	LC	No	
Helichrysum nudifolium	Hottentot's Tea	LC	No	
Helichrysum rugulosum	Marotole	LC	No	
Heliotropium amplexicaule	**Clasping Heliotrope**			**Not Indigenous**
Hermannia lancifolia		LC	Yes	
Hermannia transvaalensis		LC	Yes	
Hibiscus aethiopicus	Common Dwarf Wild Hibiscus	LC	No	
Hibiscus trionum	**Bladder Hibiscus**			**Naturalized exotic**
Hilliardiella oligocephala	Bicoloured-leaved Vernonia	LC	No	
Hyparrhenia hirta	Common Thatching Grass	LC	No	
Hypericum lalandii	Spindly Hypericum	LC	No	
Hypoxis argentea	Inongwe	LC	No	
*Hypoxis hemerocallidea**	Yellow Star	LC	No	
Hypoxis iridifolia	Moli-boea	LC	No	
Hypoxis rigidula	Silver-leaved Star-flowe	LC	No	
Imperata cylindrica	Beady Grass	LC	No	
Indigofera melanadenia		LC	No	
Ipomoea bathycolpos		LC	Yes	
Ipomoea crassipes	Wildewinde	LC	No	
Kohautia amatymbica	Tremble Tops	LC	No	
Kyllinga alba	Witbiesie	LC	No	
Ledebouria ovatifolia	Flat-Leaved African hyacinth	LC	No	
Lobelia flaccida	Wild Lobellia	LC	No	
Melinis repens	Natal Red Top	LC	No	
Melolobium wilmsii		LC	Yes	
Monopsis decipiens	Butterfly Monopsis	LC	No	
Nemesia fruticans	Mauve Nemesia	LC	No	
Ocimum obovatum	Cat's Whiskers	LC	No	
Oenothera rosea	**Pink Evening Primrose**			**Category 2**
Oldenlandia herbacea	False Spurry	LC	No	

Oxygonum dregeanum	Umdambane	LC	No	
Paspalum dilatatum	Dallis Grass	LC	No	
Paspalum urvillei	**Vasey Grass**			**Not Indigenous**
Pelargonium luridum	Variable Stork's Bill	LC	No	
Pennisetum clandestinum	**Kikuyu Grass**			**NEMBA Category 1b**
Pentanisia angustifolia	Wild Verbena	LC	No	
Perotis patens	Bottlebrush Grass	LC	No	
Phragmites australis	Commom Reed	LC	No	
Phytolacca octandra	**Forest Inkberry**			**NEMBA Category 1b**
Plantago lanceolata	Wild Sago	LC	No	
Polygala hottentotta	Small Purple Broom	LC	No	
Prunus persica	**Peach Tree**			**Not Indigenous**
Richardia brasiliensis	White-eye			**Not Indigenous**
Schkuhria pinnata	**Dwarf Marigold**			**Naturalized exotic weed**
Searsia dentata	Nana-Berry	LC	No	
Senecio affinis		LC	No	
Setaria sphacelata var sericea	Golden Bristle Grass	LC	No	
Solanum sisymbriifolium	**Thorned Bitter Apple**			**NEMBA Category 1b.**
Sporobolus africanus	Rush Grass	LC	No	
Stoebe plumosa	Slangbossie	LC	No	
Tagetes minuta	**Khaki Bush**			**Naturalized exotic weed**
Themeda triandra	Angle Grass	LC	No	
Trichoneura grandiglumis	Rolling Grass	LC	No	
Tristachya leucothrix	Hairy Trident Grass	LC	No	
Typha capensis	Common Cattail	LC	No	
Vachellia karroo	Sweet Thorn	LC	No	
Verbena bonariensis	**Wild Verbena**			**NEMBA Category 1b.**
Vernonia galpinii	Bloukwasbossie	LC	No	
Vigna vexillata	Narrow-Leaved Wild Sweet-Pea	LC	No	
Wahlenbergia undulata	African Bluebell	LC	No	
Ziziphus zeyheriana	Buffalo-Thorn	LC	No	

Figure 21 Photographs of flora identified within the study area. A) *Melolobium wilmsii*, B) *Crassula capitella*, C*) Cycnium tubulosum*, D) *Afrosciadium magalismontanum*, E) *Crinum bulbispermum*, F) *Helichrysum rugulosum*

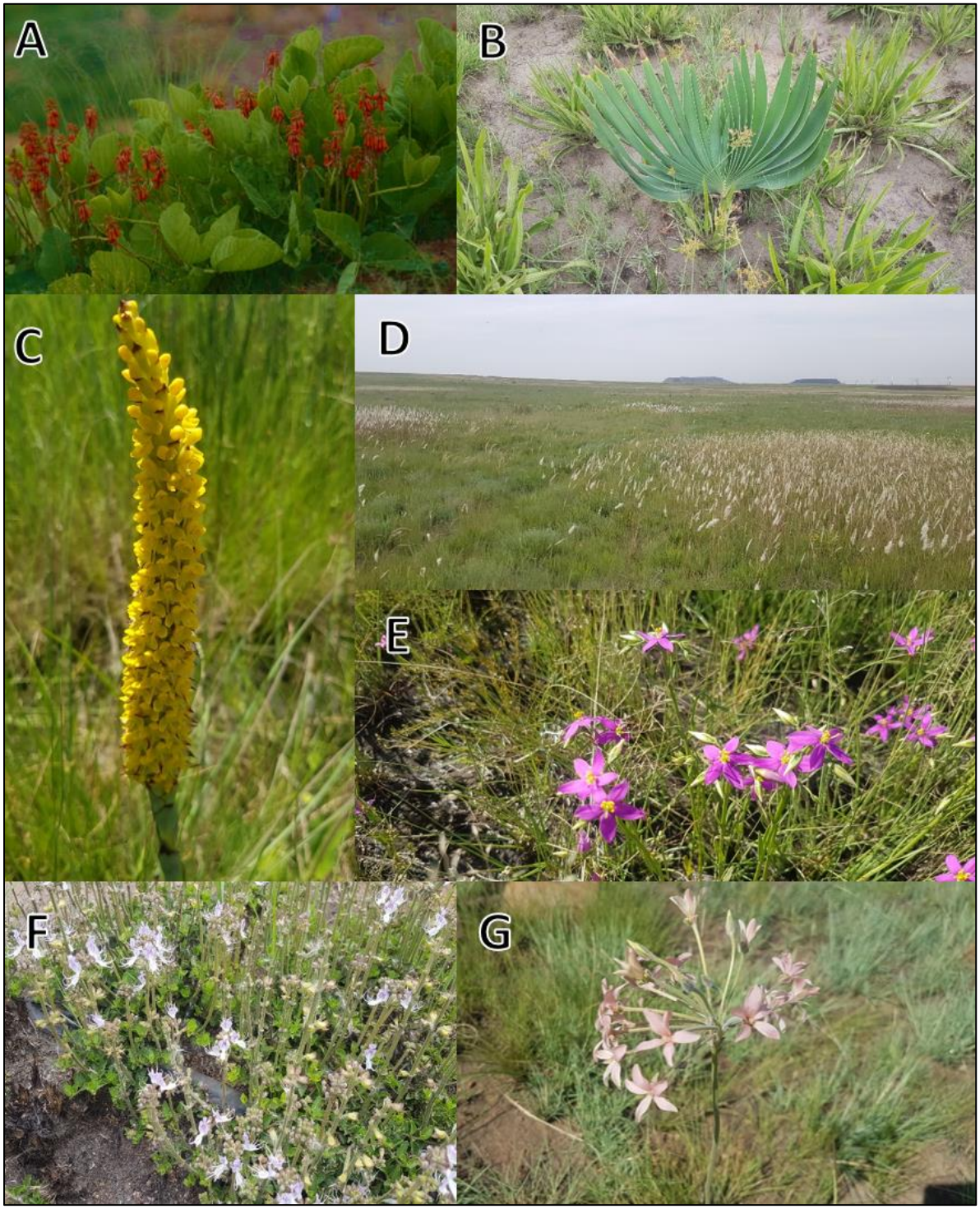

Figure 22 Photographs of flora identified within the study area. A) *Erythrina zeyheri*, B) *Boophone disticha*, C) *Disa woodii*, D) *Imperata cylindrica*, E) *Chironia palustris*, F) *Ocimum obovatum*, G) *Pelargonium luridum*.

Figure 23: Photographs of flora identified within the study area. A) *Hibiscus aethiopicus*, B) *Monopsis decipiens*, C) *Hypoxis hemerocallidea*, D) *Ipomoea bathycolpos*, E) *Kyllinga alba*, F) *Helichrysum coriaceum*, G) *Chlorophytum fasciculatum*, H) *Dimorphotheca spectabilis*

7.2.1.1 Moist Grassland and Wetlands

This habitat type is found mostly in areas that have not been mined and in many cases are also linked to aquatic habitats (i.e. wetlands and open water) found within the study area. These habitats ranged from being disturbed, to entirely intact (natural). This habitat type is regarded as primary grassland in many areas and therefore natural, but slightly disturbed due to grazing by livestock, but in most cases, is disturbed due to the current mining activities.

Although care was taken to cover as much of this habitat during the timed meanders as possible, none of the expected IUCN-listed species were recorded within this habitat. This could be attributed to the phenological season of the sampling where these plants are dormant but could also be attributed to grazing practices and other disturbances. However, several species that are protected by the Mpumalanga Schedule 11 was recorded.

Despite this, and due to its limited distribution in the landscape, this habitat is regarded as having a high sensitivity due to its role as being the only remaining habitat, foraging source and migratory corridor for various faunal species present.

7.2.1.2 Disturbed Grasslands

The condition of these grasslands ranges from heavily disturbed (largely due to previous and current mining activities) to moderately disturbed grassland. These areas are considered to have a low-medium sensitivity due to the fact that these areas are being used as a migration corridor and in many cases form a barrier between the moist grassland and the current mining activities.

7.2.1.3 Transformed Grasslands

This habitat consists of areas where agriculture and invasive tree clumps has completely altered the state of the area from its original condition. A low-medium sensitivity was given to this area as this section still provide foraging habitat for species.

7.2.1.4 Mining Areas

This habitat units represents the current coal mining portions (predominantly opencast) which are present across the study area. Due to the extremely altered nature of this habitat, it is regarded as having a very low sensitivity.

This habitat type represents all areas of mining and the existing infrastructure and includes houses, parking, camps, roads etc.

7.2.1.5 MTPA comments

In their comment on the Consultation Scoping Report for the project, the MTPA indicated concern regarding two plant species as listed in Table 13, which was identified in a study at the Glencore Impunzi Complex located to the south-west of the Project area. Although these species were not recorded by the specialist in the VDDC study area during the dual season survey, there is a high confidence that the habitat identified as Moist Grassland and Wetlands is the only viable habitat left that these species could occur in. The habitat that these two species prefer, was not observed or is still existing in any other habitat than Moist Grassland and Wetlands within the VDDC study area.

Table 13: Plant species highlighted by the MTPA

Family	Taxon	Author	IUCN status	Habitat preference	Likelihood of occurrence
Orchidaceae	*Brachycorythis conica (subsp. transvaalensis*	(Summerh.) Summerh.	CR	Short, open grassland and wooded grassland, on sandy gravel overlying dolomite, sometimes also on quartzite, 1 000-1 705 m.	Moderate
Aizoaceae	*Frithia humilis*	Burgoyne	EN	Very shallow soils derived from coarse sediments, Irrigasie Formation of the Ecca group.	Moderate

7.2.2 Faunal Assessment

The faunal assessment was completed based on the desktop review and biodiversity surveys which were conducted across the Project area. Faunal surveys were conducted based on the following methodologies:

- Camera trapping;
- Active searching;
- Audio sampling for amphibians; and
- Sherman-trap sampling for small mammals.

7.2.3 Avifauna

Ninety-one (91) bird species were recorded in the study area during the August 2018 survey based on either direct observations, or the presence of visual tracks and signs (Table 14) (Figure 24).

During the November 2018 wet season survey, 31 additional species were added to the list (Figure 25 and Table 14).

None of the birds observed in the August or November 2018 surveys were species of conservation concern. However, based on the various wetland habitats encountered in the study area, the likelihood that bird SCC could occur there is rated as moderate to high. Some roosting and nesting sites were noted during the surveys around wetland and marsh areas.

Table 14: A list of avifaunal species recorded for the Project area (August 2018 and November 2018)

Species	Common name	Conservation Status	
		Regional (SANBI, 2016)	IUCN (2017)
Actitis hypoleucos	Sandpiper, Common	Unlisted	LC
Actophilornis africanus	Jacana, African	Unlisted	LC
Alopochen aegyptiacus	Goose, Egyptian	Unlisted	LC
Amblyospiza albifrons	Weaver, Thick-billed	Unlisted	LC
Anas capensis	Teal, Cape	Unlisted	LC
Anas platyrhynchos	Duck, Mallard	Unlisted	LC
Anas undulata	Duck, Yellow-billed	Unlisted	LC

Anthus caffer	Pipit, Bushveld	Unlisted	LC
Apus affinis	Swift, Little	Unlisted	LC
Ardea goliath	Heron, Goliath	Unlisted	LC
Ardea melanocephala	Heron, Black-headed	Unlisted	LC
Ardea purpurea	Heron, Purple	Unlisted	LC
Bostrychia hagedash	Ibis, Hadeda	Unlisted	LC
Burhinus capensis	Thick-knee, Spotted	Unlisted	LC
Cercomela familiaris	Chat, Familiar	Unlisted	LC
Ceryle rudis	Kingfisher, Pied	Unlisted	LC
Charadrius tricollaris	Plover, Three-banded	Unlisted	LC
Circaetus cinereus	Snake-eagle, Brown	Unlisted	LC
Cisticola lais	Cisticola, Wailing	Unlisted	LC
Columba arquatrix	Olive-pigeon, African	Unlisted	LC
Columba guinea	Pigeon, Speckled	Unlisted	LC
Columba livia	Dove, Rock	Unlisted	LC
Corvus albus	Crow, Pied	Unlisted	LC
Corythaixoides concolor	Go-away-bird, Grey	Unlisted	LC
Cossypha caffra	Robin-chat, Cape	Unlisted	LC
Creatophora cinerea	Starling, Wattled	Unlisted	LC
Dicrurus adsimilis	Drongo, Fork-tailed	Unlisted	LC
Dryoscopus cubla	Puffback, Black-backed	Unlisted	LC
Egretta alba	Egret, Great	Unlisted	LC
Egretta garzetta	Egret, Little	Unlisted	LC
Elanus caeruleus	Kite, Black-shouldered	Unlisted	LC
Emberiza tahapisi	Bunting, Cinnamon-breasted	Unlisted	LC
Euplectes afer	Bishop, Yellow-crowned	Unlisted	LC
Euplectes orix	Bishop, Southern Red	Unlisted	LC
Euplectes progne	Widowbird, Long-tailed	Unlisted	LC
Fulica cristata	Coot, Red-knobbed	Unlisted	LC
Haliaeetus vocifer	Fish-eagle, African	Unlisted	LC
Hirundo albigularis	Swallow, White-throated	Unlisted	LC
Indicator indicator	Honeyguide, Greater	Unlisted	LC
Lamprotornis nitens	Starling, Cape Glossy	Unlisted	LC
Laniarius ferrugineus	Boubou, Southern	Unlisted	LC
Lanius collaris	Fiscal, Common (Southern)	Unlisted	LC
Larus cirrocephalus	Gull, Grey-headed	Unlisted	LC
Lophaetus occipitalis	Eagle, Long-crested	Unlisted	LC
Lybius torquatus	Barbet, Black-collared	Unlisted	LC
Macronyx capensis	Longclaw, Cape	Unlisted	LC
Milvus aegyptius	Kite, Yellow-billed	Unlisted	Unlisted
Mirafra fasciolata	Lark, Eastern Clapper	Unlisted	LC
Motacilla capensis	Wagtail, Cape	Unlisted	LC

Myrmecocichla formicivora	Chat, Anteating	Unlisted	LC
Numida meleagris	Guineafowl, Helmeted	Unlisted	LC
Oenanthe monticola	Wheatear, Mountain	Unlisted	LC
Onychognathus morio	Starling, Red-winged	Unlisted	LC
Passer diffusus	Sparrow, Southern Grey-headed	Unlisted	LC
Passer melanurus	Sparrow, Cape	Unlisted	LC
Phalacrocorax africanus	Cormorant, Reed	Unlisted	Unlisted
Phoeniculus purpureus	Wood-hoopoe, Green	Unlisted	LC
Plectropterus gambensis	Goose, Spur-winged	Unlisted	LC
Plectropterus gambensis	Goose, Spur-winged	Unlisted	LC
Plegadis falcinellus	Ibis, Glossy	Unlisted	LC
Plocepasser mahali	Sparrow-weaver, White-browed	Unlisted	LC
Ploceus capensis	Weaver, Cape	Unlisted	LC
Ploceus cucullatus	Weaver, Village	Unlisted	LC
Ploceus velatus	Southern Masked-weaver	Unlisted	LC
Prinia subflava	Prinia, Tawny-flanked	Unlisted	LC
Pternistis swainsonii	Spurfowl, Swainson's	Unlisted	LC
Quelea quelea	Quelea, Red-billed	Unlisted	LC
Riparia paludicola	Martin, Brown-throated	Unlisted	LC
Saxicola torquatus	Stonechat, African	Unlisted	LC
Scopus umbretta	Hamerkop, Hamerkop	Unlisted	LC
Sigelus silens	Flycatcher, Fiscal	Unlisted	LC
Spermestes cucullatus	Mannikin, Bronze	Unlisted	Unlisted
Spreo bicolor	Starling, Pied	Unlisted	Unlisted
Streptopelia capicola	Turtle-dove, Cape	Unlisted	LC
Streptopelia capicola	Turtle-dove, Cape	Unlisted	LC
Streptopelia semitorquata	Dove, Red-eyed	Unlisted	LC
Streptopelia senegalensis	Dove, Laughing	Unlisted	LC
Tachybaptus ruficollis	Grebe, Little	Unlisted	LC
Terpsiphone viridis	Paradise-flycatcher, African	Unlisted	LC
Threskiornis aethiopicus	Ibis, African Sacred	Unlisted	LC
Trachyphonus vaillantii	Barbet, Crested	Unlisted	LC
Treron calvus	Green-pigeon, African	Unlisted	LC
Tringa nebularia	Greenshank, Common	Unlisted	LC
Turdus olivaceus	Thrush, Olive	Unlisted	LC
Tyto alba	Owl, Barn	Unlisted	LC
Upupa africana	Hoopoe, African	Unlisted	Unlisted
Uraeginthus angolensis	Waxbill, Blue	Unlisted	LC
Urocolius indicus	Mousebird, Red-faced	Unlisted	LC
Vanellus armatus	Lapwing, Blacksmith	Unlisted	LC
Vanellus coronatus	Lapwing, Crowned	Unlisted	LC
Vanellus senegallus	Lapwing, African Wattled	Unlisted	LC

Wet Season (November 2018)			
Acridotheres tristis	Myna, Common	Unlisted	LC
Anas erythrorhyncha	Teal, Red-billed	Unlisted	LC
Anas undulata	Duck, Yellow-billed	Unlisted	LC
Anhinga rufa	Darter, African	Unlisted	LC
Apus caffer	Swift, White-rumped	Unlisted	LC
Ardea purpurea	Heron, Purple	Unlisted	LC
Bubulcus ibis	Egret, Cattle	Unlisted	LC
Butorides striata	Heron, Green-backed	Unlisted	LC
Cisticola lais	Cisticola, Wailing	Unlisted	LC
Chlidonias hybrida	Tern, Whiskered	Unlisted	LC
Cuculus solitarius	Cuckoo, Red-chested	Unlisted	LC
Elanus caeruleus	Kite, Black-shouldered	Unlisted	LC
Euplectes axillaris	Widowbird, Fan-tailed	Unlisted	LC
Euplectes orix	Bishop, Southern Red	Unlisted	LC
Euplectes progne	Widowbird, Long-tailed	Unlisted	LC
Falco amurensis	Falcon, Amur	Unlisted	LC
Fulica cristata	Coot, Red-knobbed	Unlisted	LC
Hirundo cucullata	Swallow, Greater Striped	Unlisted	LC
Numida meleagris	Guineafowl, Helmeted	Unlisted	LC
Nycticorax nycticorax	Night-Heron, Black-crowned	Unlisted	LC
Plectropterus gambensis	Goose, Spur-winged	Unlisted	LC
Ploceus cucullatus	Weaver, Village	Unlisted	LC
Ploceus velatus	Masked-weaver, Southern	Unlisted	LC
Quelea quelea	Quelea, Red-billed	Unlisted	LC
Riparia paludicola	Martin, Brown-throated	Unlisted	LC
Saxicola torquatus	Stonechat, African	Unlisted	LC
Sphenoeacus afer	Grassbird, Cape	Unlisted	LC
Spreo bicolor	Starling, Pied	Unlisted	Unlisted
Streptopelia capicola	Turtle-dove, Cape	Unlisted	LC
Streptopelia senegalensis	Dove, Laughing	Unlisted	LC
Vanellus armatus	Lapwing, Blacksmith	Unlisted	LC
Vidua macroura	Whydah, Pin-tailed	Unlisted	LC

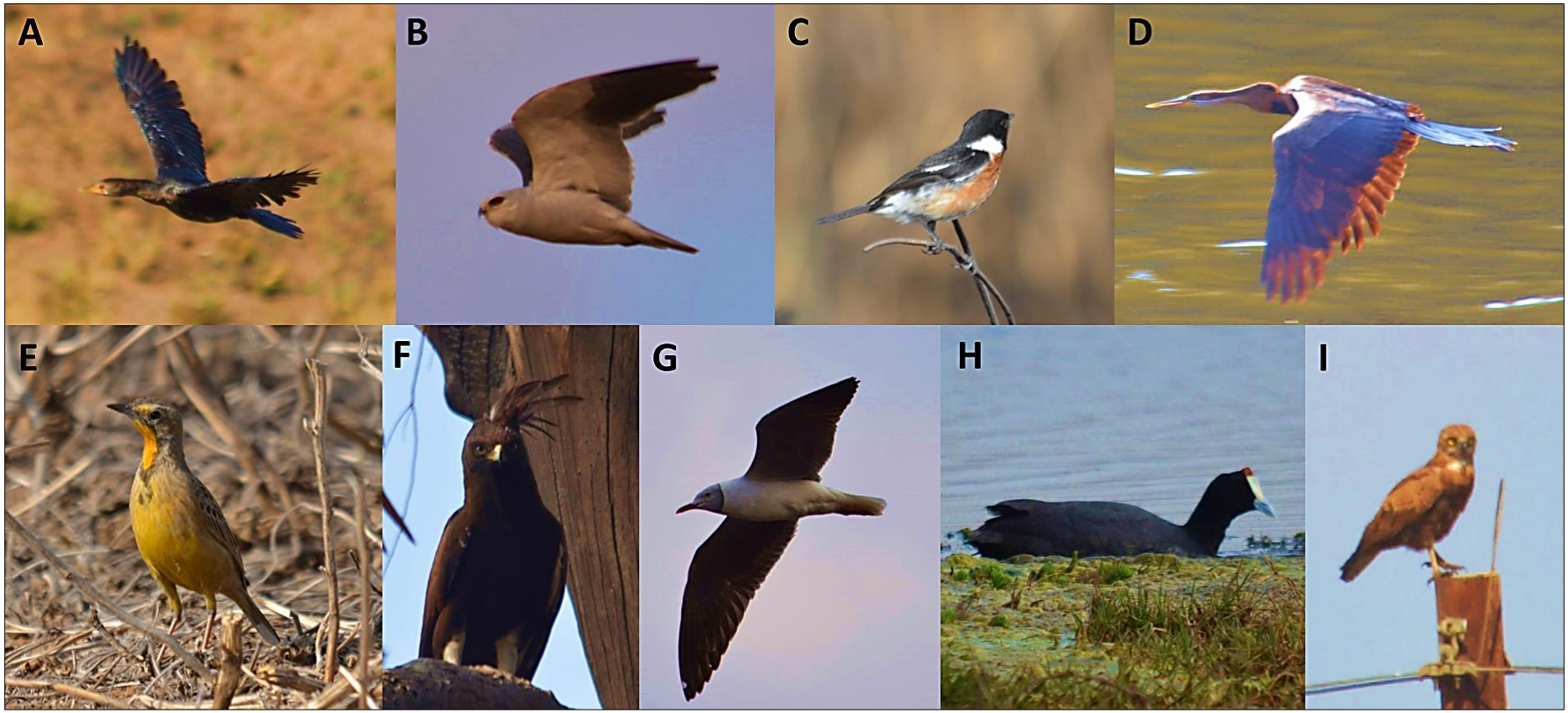

Figure 24: Some of the avifaunal species observed in the (August 2018) survey: A) Reed Cormorant *Phalacrocorax africanus*, B) Black-shouldered Kite *Elanus caeruleus*, C) African Stonechat *Saxicola torquatus*, D) Purple Heron *Ardea purpurea*, E) Cape Longclaw *Macronyx capensis*, F) Long-crested Eagle *Lophaetus occipitalis*, G) Grey-headed Gull *Larus cirrocephalus*, H) Red-knobbed Coot *Fulica cristata* and I) Brown Snake-Eagle *Circaetus cinereus*

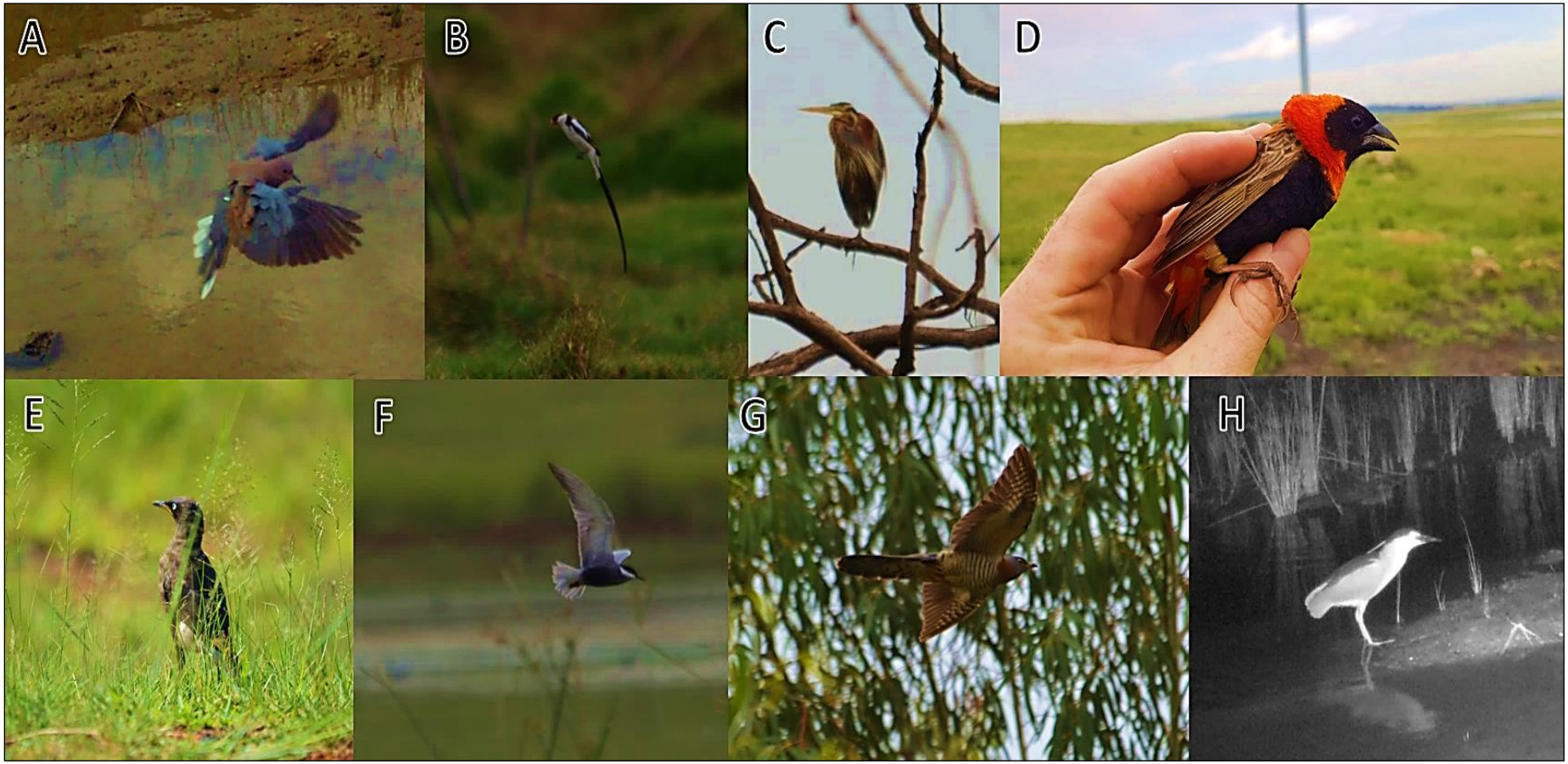

Figure 25: Some of the avifaunal species observed in the November 2018 survey; A) Laughing Dove (*Streptopelia senegalensis*), B) Pin-tailed Whydah (*Vidua macroura*), C) Purple Heron (*Ardea purpurea*), D) Southern Red Bishop (*Euplectes orix*), E) Pied Starling (Spreo bicolor), F) Whiskered Tern (*Chlidonias hybrida*), G) Red-chested Cuckoo (*Cuculus solitarius*) and H) Black-crowned Night-Heron (*Nycticorax nycticorax*)

7.2.4 Mammals

Eight (8) mammal species were recorded during the August 2018 survey based on either direct observation, camera trap photographs or the presence of visual tracks and signs (Table 15). Two SCC were observed, namely *Aonyx capensis* (Cape Clawless Otter) and *Leptailurus serval* (Serval). Family groupings of *Aonyx capensis* were observed in the northern portion of the project area and it is believed this species is therefore breeding in this area.

During the November 2018 survey, various individual *Leptailurus serval* were again recorded, and it is believed there are healthy populations of these species within the project area. In total, five (5) mammal species were recorded during the summer season surveys (Table 15 and Figure 27). Multiple individuals of this species were observed within the proposed infrastructure development areas.

Table 15: Mammal species recorded in the study area during the August 2018 and November 2018 surveys (SCC are highlighted in red)

Species	Common Name	Conservation Status	
		Regional (SANBI, 2016)	IUCN (2017)
Aonyx capensis	Cape Clawless Otter	NT	NT
Canis mesomelas	Black-backed Jackal	LC	LC
Cynictis penicillata	Yellow Mongoose	LC	LC
Leptailurus serval	Serval	NT	LC
Lepus saxatilis	Scrub Hare	LC	LC
Otomys irroratus	Vlei Rat (Fynbos type)	LC	LC
Rhabdomys pumilio	Xeric Four-striped Mouse	LC	LC
Steatomys pratensis (cf)	Fat Mouse	LC	LC
Wet season			
Leptailurus serval	Serval	NT	LC
Aonyx capensis	Cape Clawless Otter	NT	NT
Canis mesomelas	Black-backed Jackal	LC	LC
Cynictis penicillata	Yellow Mongoose	LC	LC
Atilax paludinosus	Water Mongoose	LC	LC

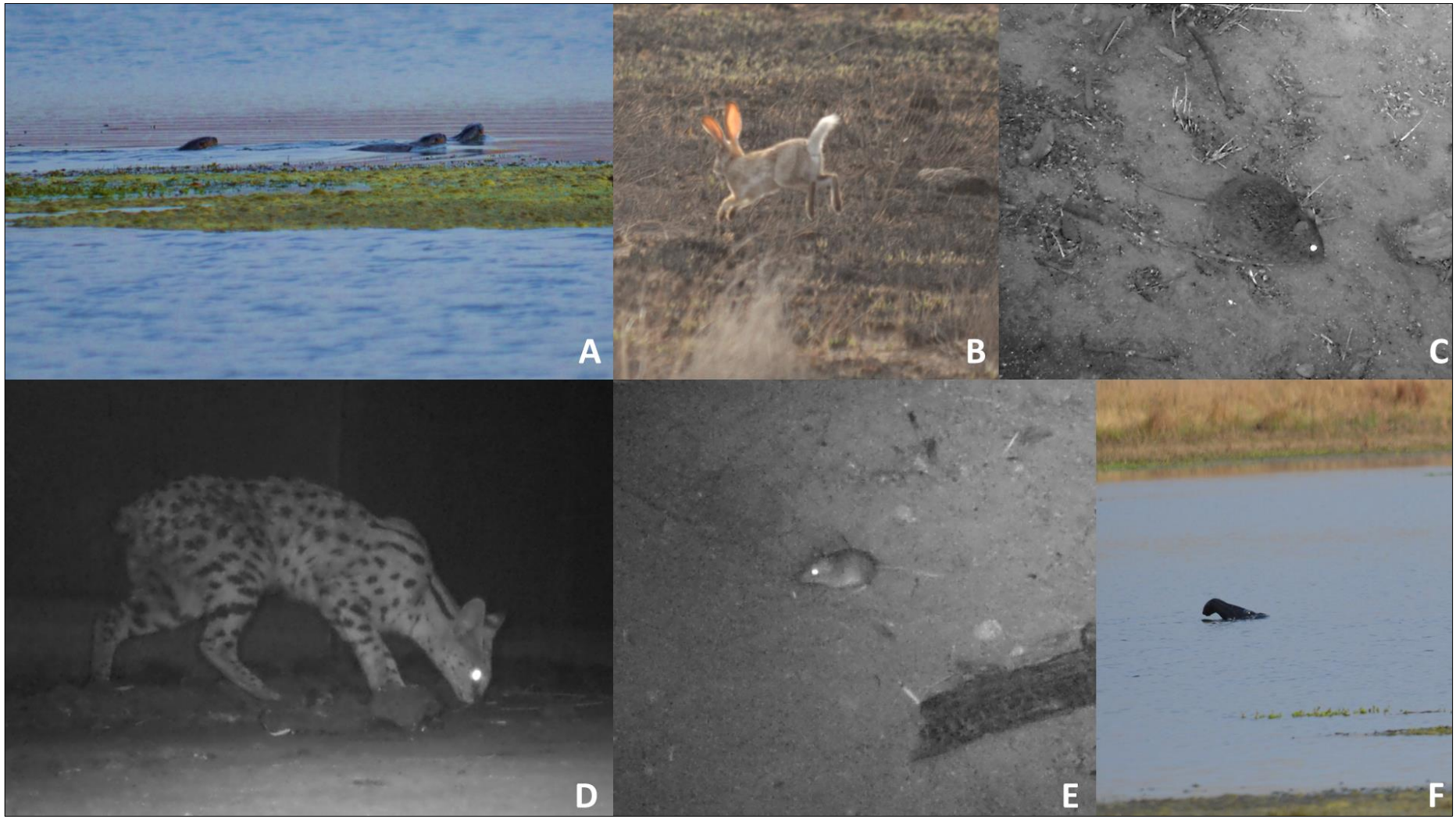

Figure 26: Some of the mammal species observed in the (August 2018): A & F) Cape Clawless Otter *Aonyx capensis*, B) Scrub Hare *Lepus saxatilis*, C) Vlei Rat *Otomys irroratus*, D) Serval *Leptailurus serval* and E) Fat Mouse *Steatomys pratensis* (*cf*)

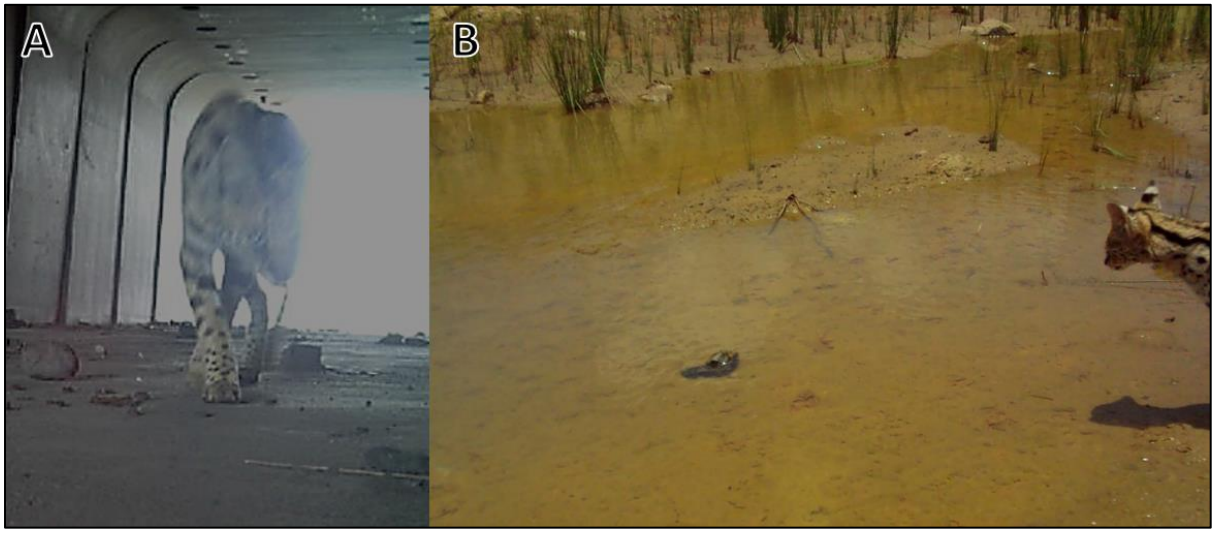

Figure 27: A and B) Serval (*Leptailurus serval*) observed during the November 2018 survey

7.2.5 Herpetofauna (Reptiles & Amphibians)

Three (3) reptile species were recorded in the study area during the August 2018 survey (Table 16) (Figure 28) and one (1) amphibian species was recorded in the study area during the August 2018 survey based on visual observations (Figure 28). Reptile diversity was considered to be low in the study area. This was attributed partly due to current disturbances (mining activities) and also the time of year that the survey was conducted.

Three (3) reptile species were recorded in the wet season survey (Figure 29 and Table 16), and three (3) amphibian species were recorded in the wet season survey. None of the recorded species were SCC.

Table 16: A list of herpetofauna recorded in the study area (August 2018 and November 2018)

Species	Common name	Conservation Status	
		Regional (SANBI, 2016)	IUCN (2017)
Dry Season			
Reptiles			
Psammophylax rhombeatus rhombeatus	Spotted Grass Snake	LC	Unlisted
Trachylepis punctatissima	Speckled Rock Skink	LC	LC
Trachylepis varia	Variable Skink	LC	LC
Amphibian			
Sclerophrys gutturalis	Guttural Toad	LC	LC
Wet Season			
Reptiles			
Leptotyphlops sp.	Thread Snake	LC	Unlisted
Psammophylax rhombeatus rhombeatus	Spotted Grass Snake	LC	Unlisted
Lygodactylus capensis capensis	Common Dwarf Gecko	LC	Unlisted
Trachylepis punctatissima	Speckled Rock Skink	LC	LC

Trachylepis varia	Variable Skink	LC	LC
Amphibians			
Amietia delalandii	Delalande's River Frog	LC	Unlisted
Amietia fuscigula	Cape River Frog	LC	LC
Cacosternum boettgeri	Common Caco	LC	LC

Figure 28: Some of the herpetofauna recorded during the survey (August 2018): A) Spotted Grass Snake (*Psammophylax rhombeatus rhombeatus*) and B) Guttural Toad (*Sclerophrys gutturalis*)

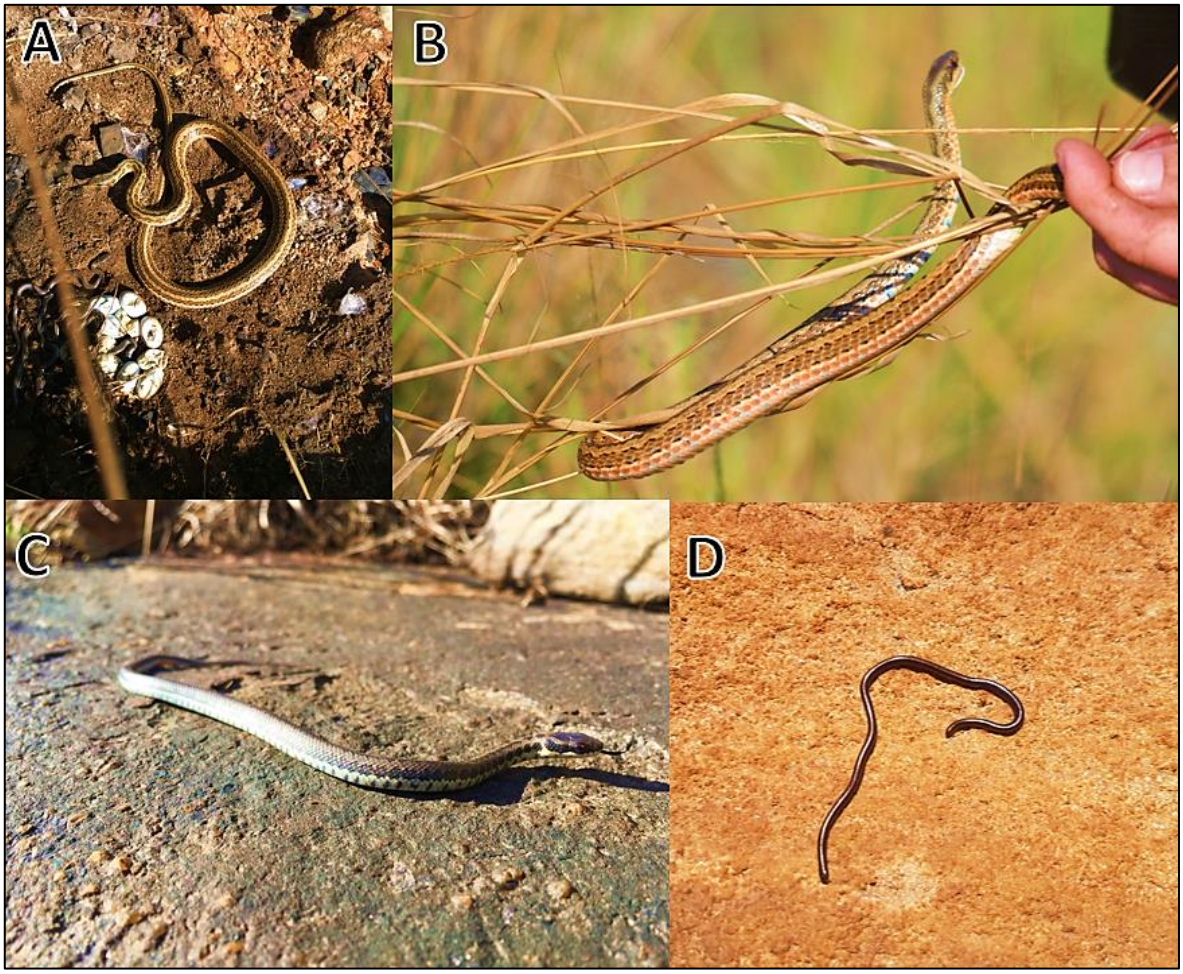

Figure 29: The reptile species recorded during the November 2018 survey; A-C) Spotted Grass Snakes (*Psammophylax rhombeatus rhombeatus*) and D) Thread snake (*Leptotyphlops sp*.)

7.2.6 Insects

Invertebrates are animals that neither possess nor develop a vertebral column (commonly known as a *backbone* or *spine*), derived from the notochord. Invertebrates play an important role in the ecosystem, they function as:

- Pollinators;
- Food for other species;
- Pest control;
- Decomposers; and
- Aerators of soil.

Some of the invertebrates observed in the project area are shown in Figure 30.

Figure 30: Two of the invertebrates that were observed during the November 2018 survey; A) African Monarch (*Danaus chrysippus*) and B) Brown-veined White (*Belenois aurota*)

7.3 Wetland Assessment

7.3.1 Wetland Identification

In addition to the completion of a desktop assessment, further geographic information system (GIS) processing was conducted to better understand the landscape and attempt to identify wetlands at a desktop level. The National Aeronautics and Space Administration (NASA) Shuttle Radar Topography Mission (SRTM) (V3.0, 1 arcsec resolution) Digital Elevation Model (DEM) was obtained from the United States Geological Survey (USGS) Earth Explorer website. Basic terrain analysis was performed on this DEM using the SAGA GIS software in order to detect flow accumulations and potential drainage lines, catchment areas and surface flow directions. Figure 31 presents an overview of the GIS processes completed for this assessment.

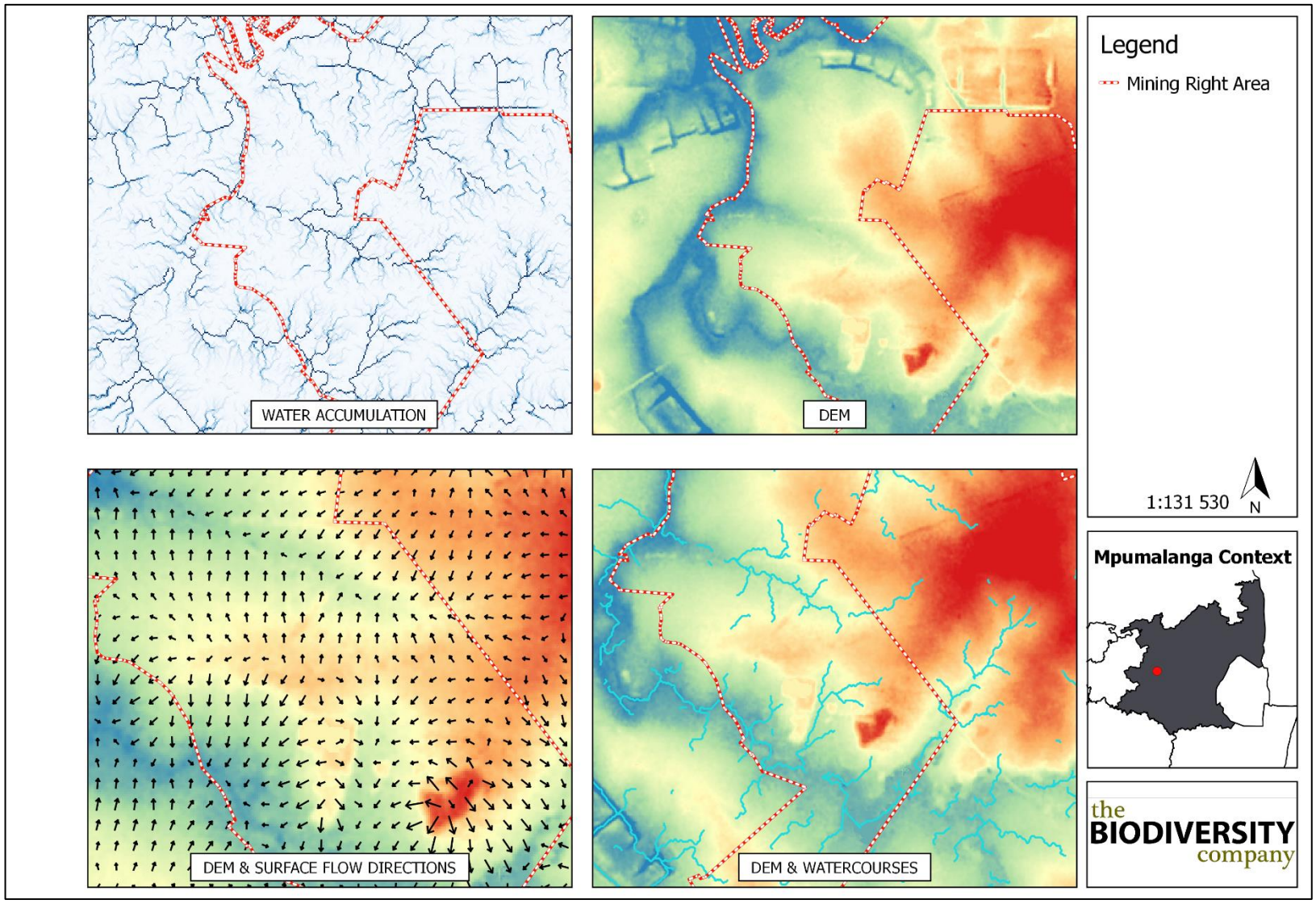

Figure 31. An overview of the GIS processes completed for this assessment to support the identification of wetland areas

7.3.2 Wetland Delineation

According to the DWAF (2005) wetland delineation guidelines, there are four main characteristics which are used to delineate wetlands, which includes the following;

- Hydromorphic/wetland soils;
- Terrain unit indicators (topography);
- The presence of hydrophytes; and
- A high-water table leading to hydromorphic soils.

However, only one of the abovementioned characteristics need to be present for an area to be classified as being a wetland, (DWAF, 2005). Taking into account the extent of mining within the Project area, previous study findings have been considered for the delineation and assessment of wetland systems. The wetland dataset created by Wetland Consulting Services (WetCS) (2004) is presented in Figure 32. It is evident from this dataset that a number of the wetland have already been mined out, and the general topography of the area altered considerably. The reports titled, “Baseline environmental study and impact assessment for the proposed Vandyksdrift South mining operation” (WetCS, 2008) was reviewed to assist with the delineation of wetland area south of the Olifants River.

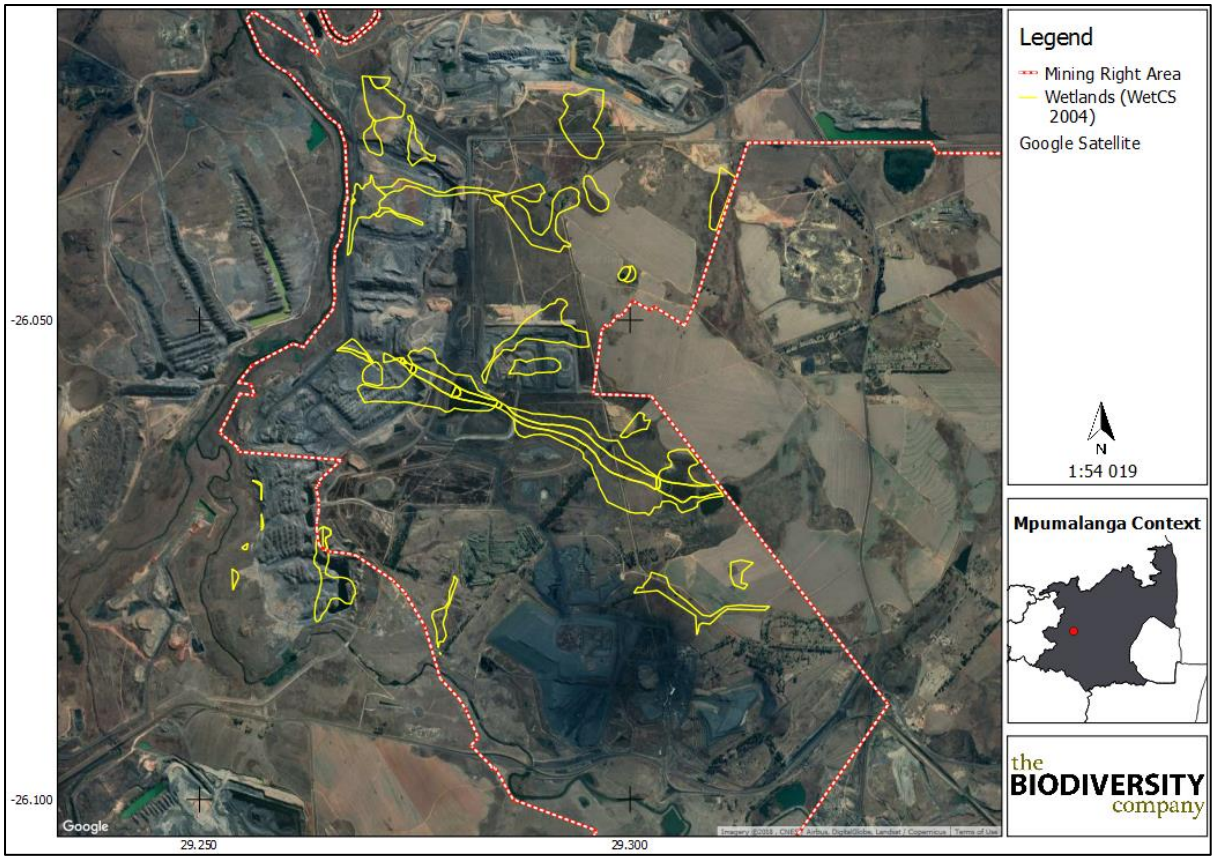

Figure 32: The wetland areas delineated in 2004 for the study area

The wetland areas were delineated in accordance with the DWAF (2005) guidelines. Due to the dry season survey, wetland vegetation was difficult to identify, and the focus was placed

on topography and soils. Large stands of *Imperata cylindrica* (on the slopes) were however easy to identify and were used to assist with the identification and delineation of wetland areas. The wetland classification as per the Ollis *et al.* (2013) guidelines is shown in Table 17. The extent of the delineated wetland areas is presented in Figure 36. The extent of delineated wetland areas in relation to project infrastructure are presented in Figure 37. Wetland that are expected to be directly impacted on by the proposed project were assessed. The ecological assessment has only been completed for the wetland systems that will either be directly impacted on by the proposed project or are at risk due to the systems being downslope of the Project area. Wetland areas located in Vandyksdrift South are located in a separate catchment to the Project area and have not been assessed. The following wetland types have been considered for the ecological assessment:

- Riparian area [5] (Olifants River);
- Channelled Valley Bottom (along the Olifants River);
- Unchannelled Valley Bottom;
- Hillslope seep (seep); and
- Depression (the area where treated water from the modular water treatment plants will be discharged and the old village area).

Conceptual illustrations of the wetlands, showing the typical landscape setting and the dominant inputs, throughputs and outputs of water are presented in Figure 34 (Ollis *et al*., 2013). Photographs of some of the wetland areas / types identified and delineated for this assessment are presented in Figure 35.

Table 17: Wetland classification as per SANBI guideline (Ollis *et al*., 2013)

Level 2		Level 3	Level 4		
Ecoregion/s	**NFEPA Wet Veg Group/s**	**Landscape Unit**	**4A (HGM)**	**4B**	**4C**
Highveld	Eastern Highveld Grassland	Valley Floor	River	-	-
Highveld	Eastern Highveld Grassland	Valley Floor	Channelled Valley Bottom	N/A	N/A
Highveld	Eastern Highveld Grassland	Valley Floor	Unchannelled Valley Bottom	N/A	N/A
Highveld	Eastern Highveld Grassland	Slope	Seep	-	-
Highveld	Eastern Highveld Grassland	Valley Floor	Depression	-	-

In addition to the abovementioned delineations and classifications, the following systems were identified, delineated and have been defined according to the following:

- **Artificial systems:** These systems are artificial systems, man-made and are associated with pollution control dams or stormwater ponds. These systems are often characterised by hydrophytes but are not natural wetland systems;

[5] The riparian area has been delineated for the project, and an ecological assessment of the Olifants River included in the aquatic assessment component of the project.

- **Dams:** These are man-made structures within channelled systems which have contributed to the modified status and functioning of these systems. Dams are considered as a driver of change for the respective system;
- **Previously mined:** These areas have been mined in the past, possibly for bulk sampling or quarries. These areas are now waterlogged, and are also not considered to be natural wetland systems;
- **Remnant wetland:** This system is no longer considered to be a wetland and has been directly impacted on by mining and lost as a result. This remnant system was associated with the flooding features of the Olifants River, but owing to the diversion channel that was constructed the remnant system was isolated from the river with wetland drivers being removed as a result; and
- **Riparian:** These systems are associated with the Olifants River and have been defined according to the DWAF (2005) guidelines. The delineation of the system has been presented in this section of the report, but the integrity of the riparian area is discussed in the aquatic ecology assessment.

The ecological assessment for this project only considered the natural wetland systems that would be directly impact on by the proposed project and the associated features.

Figure 33: The wetland indicators considered for the assessment (August 2018); A) Topography, valley bottoms; B) Vegetation, *Phragmites australis*; C) Vegetation, *Typha capensis*; D) Vegetation, *Imperata cylindrica*; E) Soil wetness, mottles; F) Soil wetness, mottles

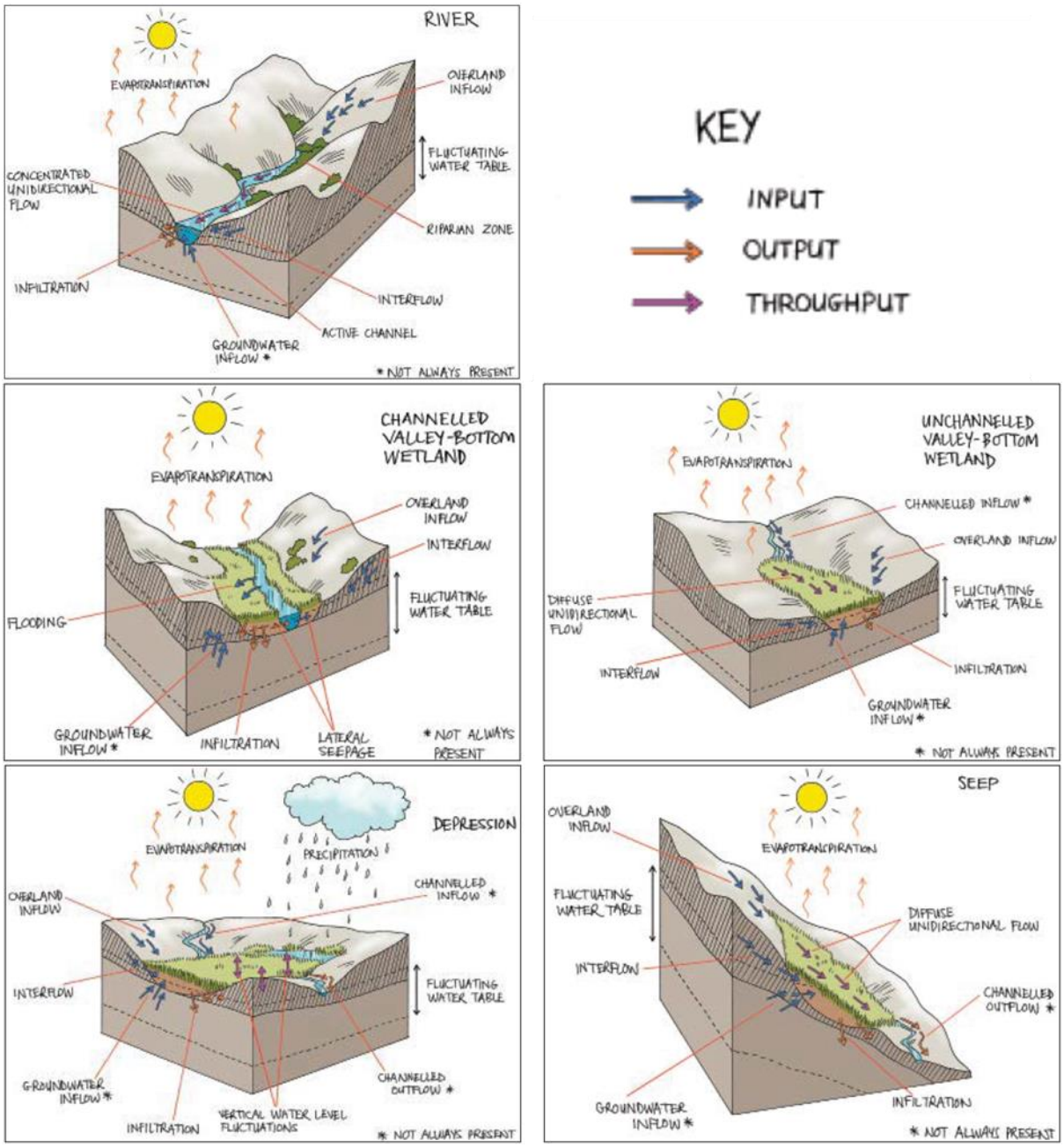

Figure 34: Conceptual illustrations of the wetlands, showing the typical landscape setting and the dominant inputs, throughputs and outputs of water (Ollis *et al*. 2013)

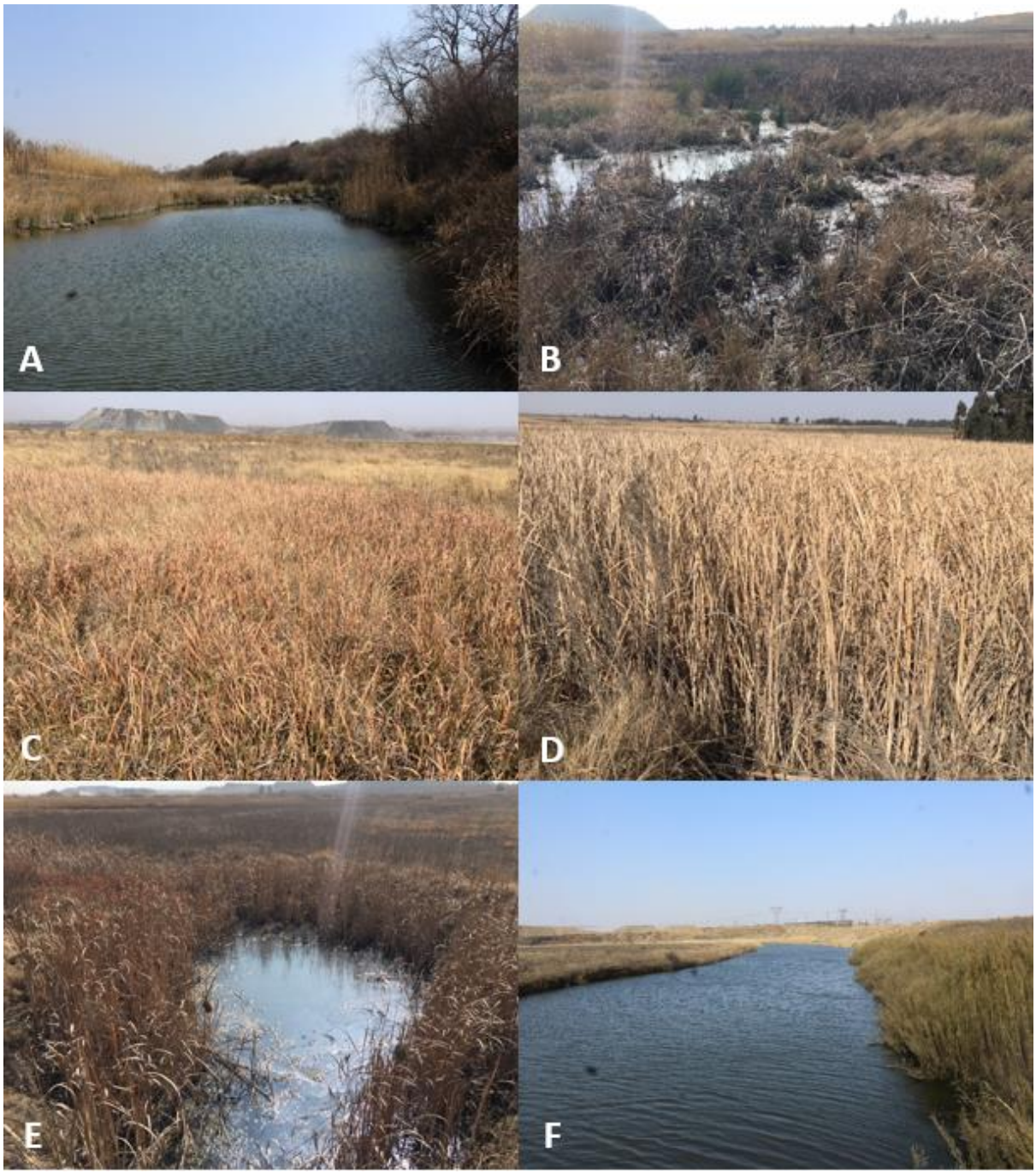

Figure 35: Wetland types identified (August 2018): A) Channelled Valley Bottom (Olifants River); B) Unchannelled Valley Bottom; C) Seep, D) Dam; E) Dam (outlet); F) Riparian area (Olifants River)

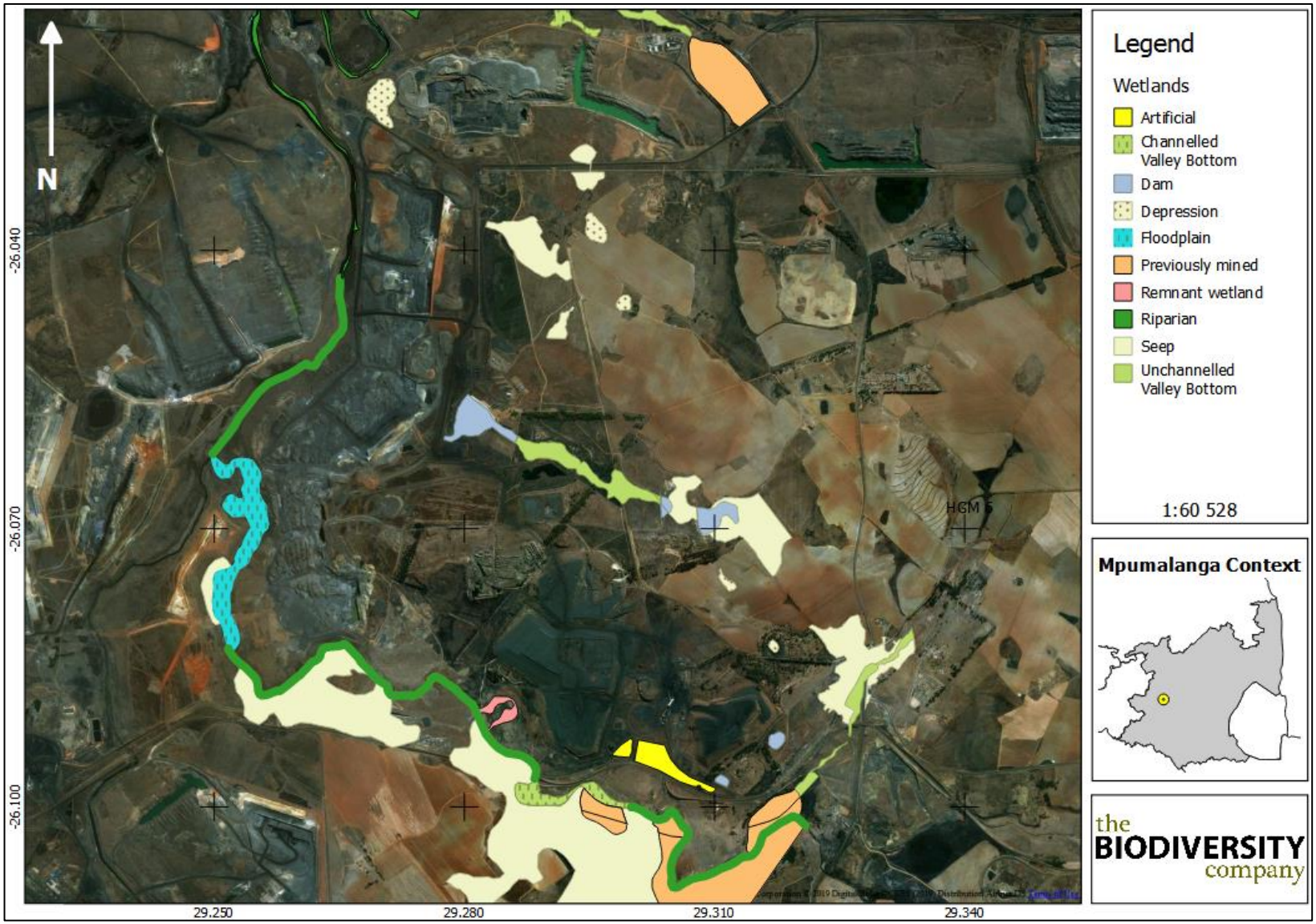

Figure 36: The wetland areas delineated for the study area

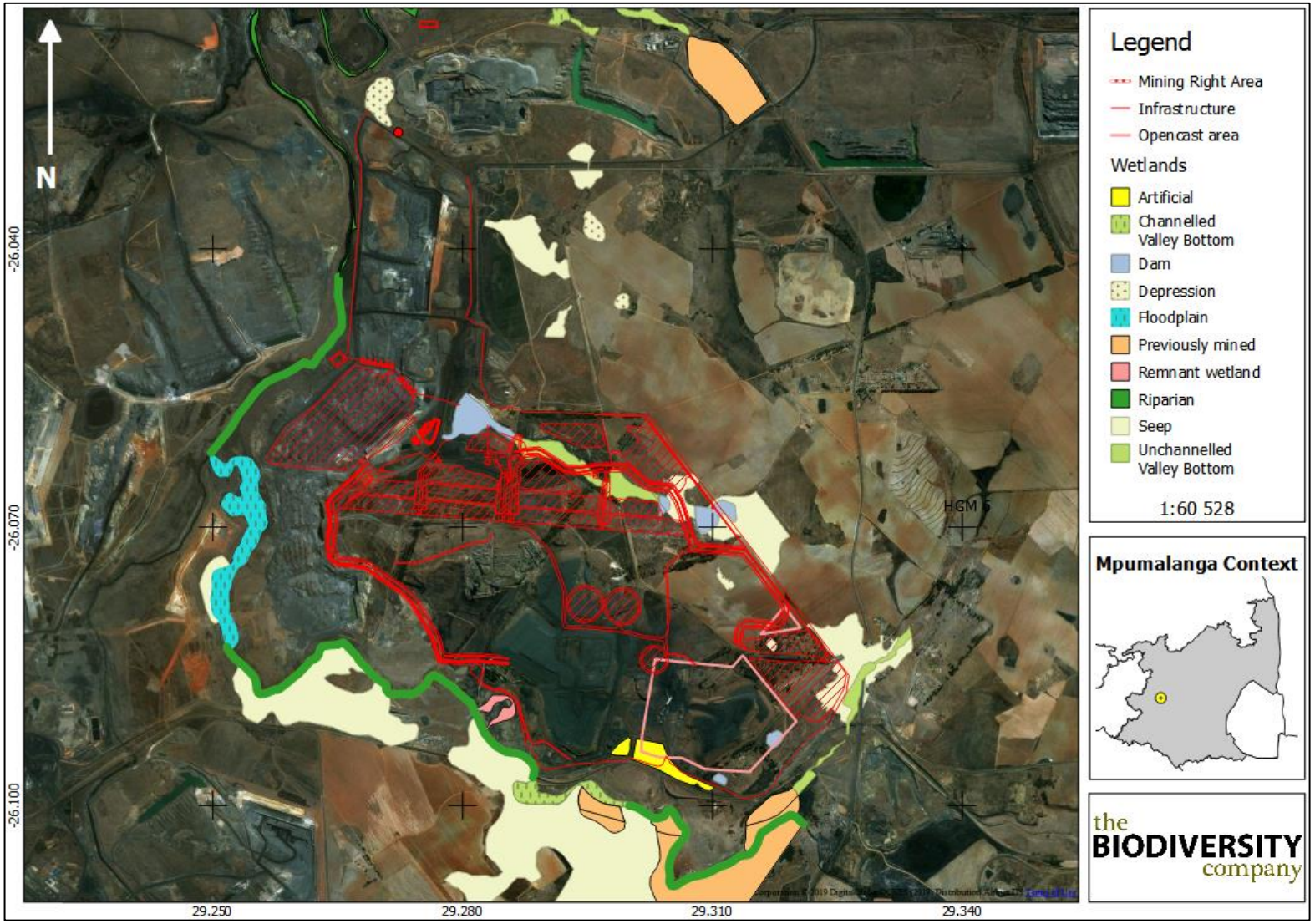

Figure 37: The wetland areas in relation to project infrastructure (red lines) for the study area

7.3.3 Wetland PES

The PES for the assessed HGM units is shown in Table 18 (refer to Table 2 for an explanation of the categories). Photographs of aspects that were identified on site and have likely contributed to the altered (or impacted) state of the wetlands are presented in Figure 38.

Figure 38: Aspects identified as potential contributors to impacted wetland health (August 2018) A) Mining infrastructure & development; B) Mining rehabilitation & dams; C) Alien vegetation, *Datura sp*; D) Access routes & crossings; E) Stormwater management; F) Sedimentation & erosion

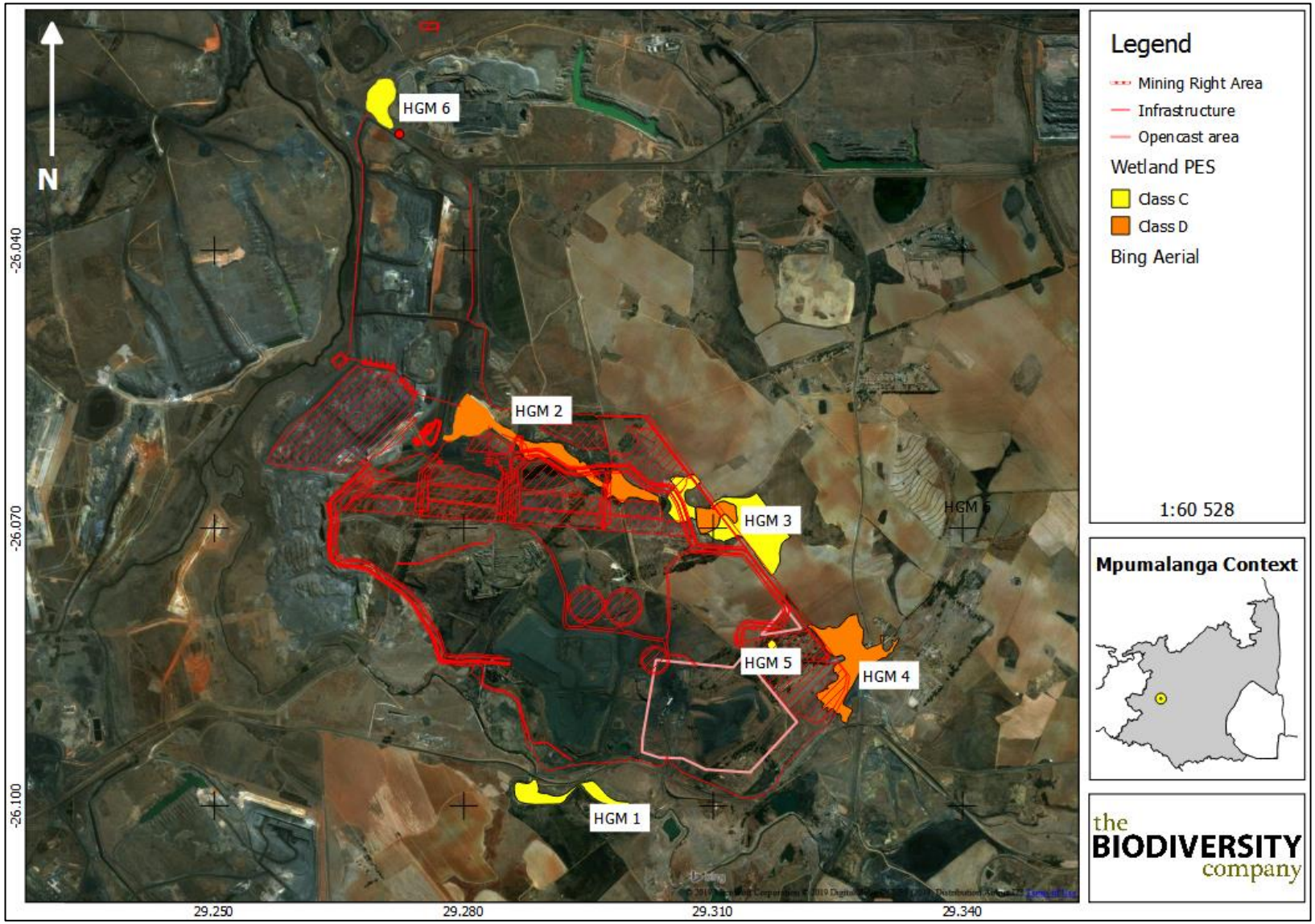

Figure 39: The PES of the wetland areas assessed for the study area

Table 18: The wetland PES for the assessed systems

Wetland	Hydrology		Geomorphology		Vegetation	
	Rating	Score	Rating	Score	Rating	Score
Channelled Valley Bottom (HGM 1)	C: Moderately Modified	3.5	C: Moderately Modified	3.0	C: Moderately Modified	3.8
Overall PES Score	3.4		Overall PES Class		C: Moderately Modified	
Unchannelled Valley Bottom (HGM 2)	D: Largely Modified	4.7	D: Largely Modified	5.2	C: Moderately Modified	3.5
Overall PES Score	4.5		Overall PES Class		D: Largely Modified	
Hillslope Seep (HGM 3)	C: Moderately Modified	3.5	C: Moderately Modified	2.2	C: Moderately Modified	2.6
Overall PES Score	2.9		Overall PES Class		C: Moderately Modified	
Hillslope Seep (HGM 4)	E: Seriously Modified	6.5	C: Moderately Modified	2.8	E: Seriously Modified	7.2
Overall PES Score	5.6		Overall PES Class		D: Largely Modified	
Depression (Pan) (HGM 5)	C: Moderately Modified	3.5	C: Moderately Modified	2.5	C: Moderately Modified	3.5
Overall PES Score	3.2				C: Moderately Modified	
Depression (Pan) (HGM 6)	D: Largely Modified	4.7	C: Moderately Modified	2.8	C: Moderately Modified	2.5
Overall PES Score	3.5		Overall PES Class		C: Moderately Modified	

The six (6) HGM units comprising four (4) wetland HGM types have all been impacted on by the historical and current (predominantly) mining operations in the area, with local agricultural activities also impacting on the systems, specifically the systems associated with the Olifants River. The mining operations have altered the topography of the landscape considerably, which has resulted in altered flow dynamics of the catchment areas. The geohydrology of the area has also been altered due to the mining operations. In an attempt to manage water for these areas, watercourses have been diverted, trenches dug to intercept flows and dams (impoundments) constructed to attenuate flows, these have all also had an impact on the hydrology of these systems. The development of the catchment area and the altered hydrology have collectively contributed to the modified geomorphology of these systems. These modifications include wetland areas being encroached upon the system extent being reduced, and wetland area extent being increased due to stormwater inputs, and channelled systems now characteristic of unchanneled systems due to the placement of dams within these systems. Vegetation has also been altered, this is largely due to vegetation being cleared and alien vegetation being established in the area. A Google Earth time series of the area is presented in Figure 40. A Google Earth image (dated 2012) depicts historical mining activities in the (now classified) unchanneled valley bottom area (Figure 41). Figure 41 presents a wetland system which forms part of the dirty water system with approval. A summary of key aspects that have contributed to the impacted state of the wetlands includes the following:

- The operation, decommissioning and rehabilitation of mining areas within the Project area;

- Agricultural cultivation on the periphery of the Project area, and south of the Olifants River;
- Development of the catchment area, including roads, dams and crossings;
- The management of water within the Project area, including diversions, stormwater management and control dams; and
- The invasion of alien vegetation.

Figure 40: A Google Earth time series depicting the extent of change to the area

Figure 41: A Google Earth (2012) image depicting mining activities in a delineated wetland area (white border)

7.3.4 Wetland Ecosystem Services

All of the wetland units scored an overall intermediate service rating, with the unchanneled valley bottom (HGM 2) and northernmost depression (HGM 6) system having an overall moderately low service rating. The highest ratings (predominantly moderately high) for all the HGM units is associated with the indirect benefits, specifically for the enhancement of water quality, streamflow regulation and the enhancement of biodiversity. Table 19 presents the level of benefit provided for each of the evaluated ecosystem services (refer to Table 1for an explanation of the categories).

Table 19: The level of ecosystem benefits provided by the assessed wetland units

Wetland Unit					HGM1	HGM 2	HGM 3	HGM 4	HGM 5	HGM 6
Ecosystem Services Supplied by Wetlands	Indirect Benefits	Regulating and supporting benefits	Flood attenuation		1.7	2.1	1.1	1.4	1.3	1.6
			Streamflow regulation		2.1	2.2	2.8	1.3	2.7	1.4
			Water Quality enhancement benefits	Sediment trapping	1.5	1.8	2.4	1.4	2.5	1.5
				Phosphate assimilation	1.3	1.7	2.5	1.8	2.4	1.6
				Nitrate assimilation	1.3	1.7	2.8	1.7	2.7	1.6
				Toxicant assimilation	1.4	1.6	2.6	1.8	2.6	1.7
				Erosion control	1.1	1.6	2.2	1.4	1.5	1.5
			Carbon storage		1.5	1.3	1.7	1.6	0.7	1.4
	Direct Benefits	Biodiversity maintenance			1.2	1.1	3.0	2.0	1.8	2.0
		Provisioning benefits	Provisioning of water for human use		1.8	0.6	1.8	0.8	1.6	0.6
			Provisioning of harvestable resources		1.1	0.2	0.8	1.0	0.8	0.8
			Provisioning of cultivated foods		1.5	0.0	1.8	0.2	1.8	0.0
		Cultural benefits	Cultural heritage		1.1	0.0	0.0	0.0	0.0	0.0
			Tourism and recreation		1.6	0.0	0.9	0.8	1.0	0.6
			Education and research		1.7	0.0	0.8	1.1	0.8	0.5
Overall					21.9	15.9	27.1	20.2	23.9	16.8
Average					1.5	1.1	1.8	1.3	1.6	1.1

7.3.5 Wetland EIS

The EIS assessment was applied to the wetland units in order to assess the levels of sensitivity and ecological importance of the systems. The results of the assessment are shown in Table 20 and Figure 42. Authorisation was granted in 2007 for the mining of HGM 2. The EIS for the two (2) valley bottom systems and HGM 3 were rated as high. The EIS of the remaining wetland systems were rated as moderate. This “high” rating is partially attributed to the location of the Project area within the Olifants River catchment. The catchment is under stress due to mining, power stations, urbanization and agriculture, and the ability of these systems to contribute towards water quality enhancement and regulation, a high importance and conservation value

is placed on these systems. The following findings were also considered for the EIS classification:

- According to the Mpumalanga Highveld Wetlands (MPHG) dataset, the wetlands associated with the Project area are predominantly in a moderately to largely modified state. In addition to this, no true ecological priority wetland systems are expected for the Project area.
- The moist grassland is regarded as having a high sensitivity due to its role as being the only remaining habitat, foraging source and migratory corridor for various faunal species present.
- None of the birds were species of conservation concern. Based on the various wetland habitats encountered in the Project area, the likelihood that bird SCC occur there is rated as moderate to high.
- Overall, mammal diversity in the Project area was moderate to high, with eight (8) mammal species being recorded during the August 2018 survey. Two (2) mammal SCC were recorded in the Project area, these were sighted in the vicinity of HGM 2.
- One (1) amphibian species was recorded in the Project area during the August 2018 survey based on visual observations.
- The hydrological and direct human benefits were rated as moderately low for all four (4) wetland units.

Table 20: The EIS for the assessed wetland units

Wetland Importance and Sensitivity	HGM 1	HGM 2	HGM 3	HGM 4	HGM 5	HGM 6
Ecological Importance & Sensitivity	2.2	2.3	2.3	1.6	1.7	1.7
Hydrological / Functional Importance	1.5	1.8	2.3	1.6	2.0	1.6
Direct Human Benefits	1.4	1.6	1.1	1.6	1.0	0.4

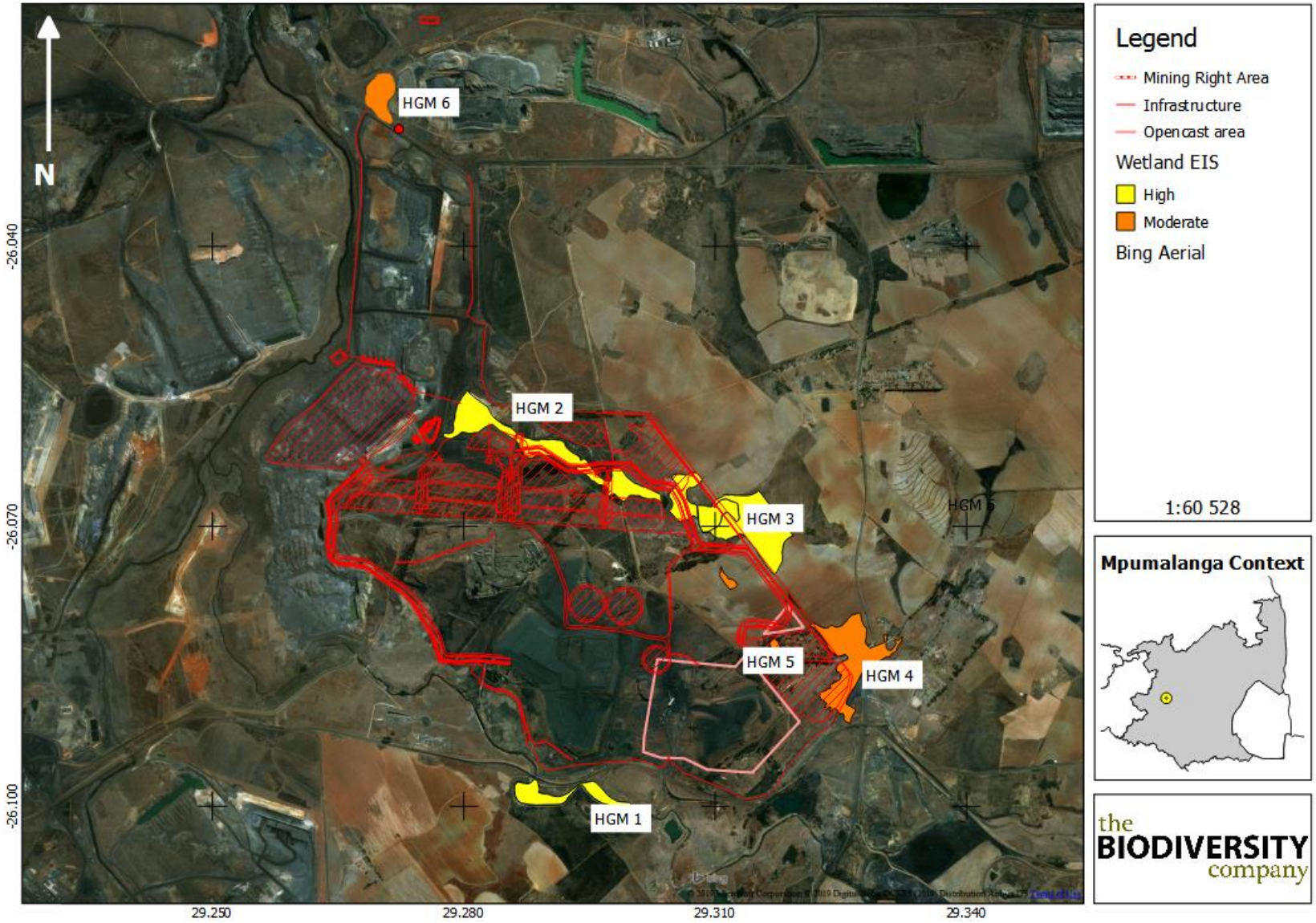

Figure 42: The EIS of the wetland areas assessed for the study area

7.4 Riverine Ecology Assessment

The Project area is located in the Olifants Water Management Area (WMA) within the B11B, B11F and B11G quaternary catchments. The Sub Quaternary Reaches (SQR) potentially affected by the proposed project include the B11B-1304 (Olifants River), B11F-1274 (Olifants River) and the B11G-1225 (Olifants River). As described above, the central watercourse, which will potentially be impacted, is the Olifants River. The Olifants River within the Project area is classed as a lowland river system (class F) within the Southern Temperate Highveld Freshwater Ecoregion. The current Project area does not fall within a Freshwater Ecological Priority Area (FEPA) designated catchment area (Nel *et al*. 2011).

A total of 5 aquatic sampling points were selected for the riverine baseline assessment and are presented in Figure 43. Details pertaining to the location of the various sampling points are provided in Table 21. Although several separate SQR's will potentially be impacted, this river health assessment will focus from the upstream site (O1) to the downstream point (O5). The spatial layout of this PES assessment therefore covers this river reach and should be directly consulted for future assessments.

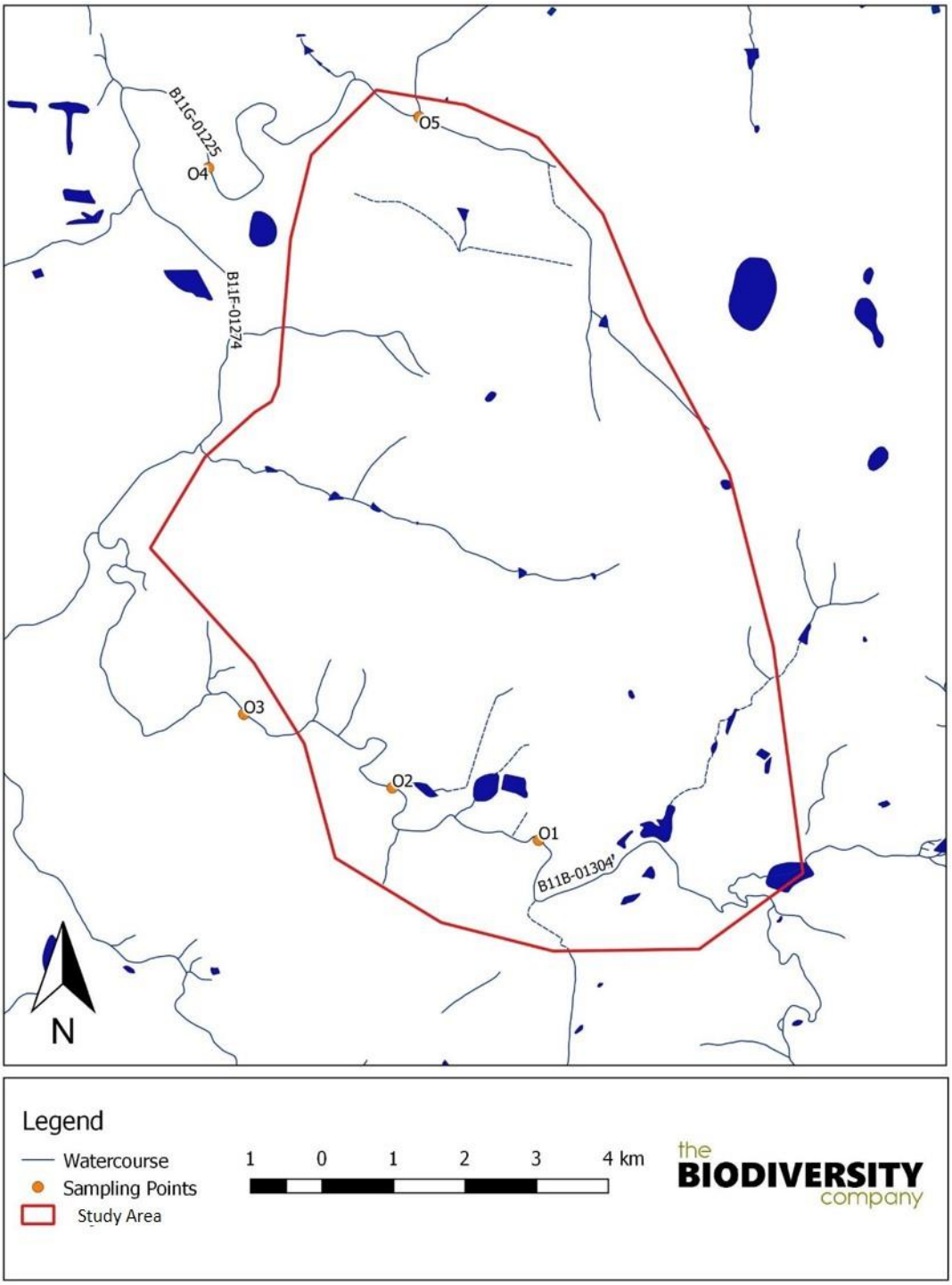

Figure 43: Layout of the selected aquatic sampling points

Table 21: Details pertaining to the riverine aquatic ecology sampling points (August 2018)

Site	Location	Photograph (downstream)	Description
O1	-26.101001° 29.305366°		Upstream Site to determine reference condition. Sub Quaternary Reach B11B-1304 on the Olifants river
O2	-26.094437° 29.287002°		Midstream Site. Sub Quaternary Reach B11B-1304 on the Olifants river
O3	-26.085205° 29.268350°		Midstream Site to act as a monitoring site. Sub Quaternary Reach B11B-1304 on the Olifants river

O4	-26.016790° 29.263897°		Site located adjacent/downstream to planned activities. Sub Quaternary Reach B11G-1225 on the Olifants River
O5	-26.010391° 29.290372°		Downstream monitoring point on Sub Quaternary Reach B11G-1255 on the Olifants River

7.4.1 Water Quality

In situ water quality analysis results from the August 2018 survey are provided in Table 22.

Table 22: Water Quality Results August 2018

Site	pH	Conductivity (mS/m)	DO (mg/l)	Temperature (°C)
TWQR*	6.5-9.0	N/A	>5.00	5-30
O1	7.8	97	5.6	15
O2	7.9	90	6.4	15
O3	8.0	113	6.8	14
O4	8.3	76	6.1	18
O5	7.4	79	6.4	17
*TWQR – Target Water Quality Range (DWAF, 1996)				

The results of the *in situ* water quality assessment indicated pH ranges from 7.4 at O5 to 8.3 at O4. The levels of pH were within the recommended guidelines values for aquatic ecosystems of between 6.5-9.0 (DWAF, 1996). These guideline values were selected considering their direct applicability to local aquatic ecology. The levels of conductivity were recorded to range from

76 mS/m at O4 to 113 mS/m O3 indicating the level of dissolved solids. Although no limits have been prescribed for the concentration of dissolved solids and their effect on aquatic ecology, elevated concentrations of dissolved solids are indicative of catchment landuse modification. The alteration of land use in the catchment exposes soils and various minerals to increased weathering which typically results in an increase in dissolved solid concentrations in watercourses. Based on the geomorphological layout of the considered watercourse and the extensive coal mining and power generation activities within the catchment area, the levels of dissolved solids would be considered to be in excessive concentration. The spatial trends of dissolved solids indicated a decrease downstream of the confluence with the Steenkoolspruit (B11F-1273) at the monitoring point O4. The decrease can be attributed to a water transfer scheme from the Grootdraai Dam on the Vaal River system into the Steenkoolspruit. The levels of dissolved oxygen were found to range from 5.6 mg/l at O1 to 6.8 mg/l at O3. The levels of dissolved oxygen would not present an adverse condition to aquatic ecology. The water temperatures were found to range from 14 °C at O3 to 18 °C at O4. The water temperatures observed during this study would not negatively impact on local aquatic ecology.

The water quality results obtained during this assessment corroborate the results obtained in the bi-annual biomonitoring assessments completed by Grant and Repinga (2017).

7.4.2 Intermediate Habitat Integrity Assessment

The IHIA was completed on a reach basis as described in the IHIA methodology component of this study. The results of the IHIA for the reach of the Olifants River are presented in Table 23.

Table 23: Instream Intermediate Habitat Integrity Assessment for the Olifants River

Criterion	Average Score	Score
Instream		
Water abstraction	5.00	2.80
Flow modification	21.67	11.27
Bed modification	20.00	10.40
Channel modification	21.67	11.27
Water quality	15.00	8.40
Inundation	20.00	8.00
Exotic macrophytes	13.33	4.80
Exotic fauna	10.00	3.20
Solid waste disposal	5.00	1.20
Total Instream Score		**38**
Instream Category		**class E**
Riparian		
Indigenous vegetation removal	13.33	6.93
Exotic vegetation encroachment	15.00	7.20
Bank erosion	11.67	6.53
Channel modification	18.33	8.80

Water abstraction	5.00	2.60
Inundation	16.67	7.33
Flow modification	16.67	8.00
Water quality	15.00	7.80
Total Riparian Score		**44**
Riparian Category		**class D**

The results of the IHIA for the Olifants River indicated seriously modified (class E) instream habitat. The degree of modification can be attributed to several factors including flow, bed and channel modification (Figure 44 and Figure 45). The modification of the various components of the instream habitat can be attributed to historical activities such as river diversions for open pits and incline shafts adjacent to the river channel. Riparian habitats in the Olifants River reach were found to be largely modified (class D). Similar to the instream habitat, channel modification and inundation also negatively impacted the riparian habitat structure. Stands of alien invasive *Populus alba* (Poplar) were observed in several areas in proximity to the river reach. In addition, stands of alien invasive *Myriophyllum aquaticum* (Parrots feather) were also observed in the marginal zones of the Olifants River (Figure 46).

Figure 44: Significant channel and bed modification upstream of O3 (August 2018)

Figure 45: Impounded reach resulting in flow modification of the Olifants River at O4 (August 2018)

Figure 46: Stands of *Myriophyllum aquaticum* (Parrots Feather) in the Olifants River , which was found throughout the river system, with high concentrations at O4 (August 2018)

7.4.3 Aquatic Macroinvertebrate Assessment

7.4.3.1 Macroinvertebrate Habitat

Biological assessments were completed at representative sites in the considered river reaches. The invertebrate habitat at each site was assessed using the South African Scoring System version 5 (SASS5) biotope rating assessment as applied in Tate and Husted (2015). The results of the biotope assessment are provided below (Table 24).

Table 24: Biotope Scores in the Olifants River during the August 2018 Survey

Biotope	Weighting	O1	O2	O3	O4	O5
Stones in current	10	0	0	2	0	0
Stones out of current	10	0	1	3	0	0
Bedrock	3	0	2	3	0	0
Aquatic Vegetation	5	1	0	1	2	3
Marginal Vegetation In Current	5	0	0	2	0	0
Marginal Vegetation Out Of Current	5	4	4	3	3	4
Gravel	4	0	1	0	0	0
Sand	2	0	2	2	0	0
Mud	1	3	2	2	2	3
Biotope Score		**8**	**12**	**18**	**7**	**10**
Weighted Biotope Score (%)		12	20	42	12	17
Biotope Category (Tate and Husted, 2015)		**F**	**F**	**D**	**F**	**F**

Habitat availability within the assessed watercourse was rated as largely poor. The low biotope score can be attributed to low diversity/abundance of both the stones in current and vegetation biotopes. This is an anticipated result for the considered river reaches due to the impacts of inundation and channel modification. Only one site (O3) was determined to have a fair habitat diversity due to the presence of stones in current.

7.4.3.2 Macroinvertebrate Community Assessment

The results of the SASS5 results for the sites located in the Olifants River are presented in Table 25.

Table 25: Macroinvertebrate Assessment Results Recorded in the Olifants River

Site	SASS5	Taxa	ASPT	*Class (Dallas, 2007)
O1	61	14	4.3	**class D***
O2	76	18	4.2	**class C**
O3	103	22	4.6	**class B**
O4	64	15	4.2	**class D***
O5	55	13	4.3	**class D***
*Highveld Lower Ecoregion **SASS5 Interpretation Not Applicable due to Impoundment Conditions				

The results of the SASS5 invertebrate index indicated SASS5 scores, which ranged from 55 at O5 to 103 at O3. The amount of taxa obtained at the sites ranged from 13 at O5 to 22 at O3. The ASPT values obtained at the sites ranged from 4.2 at O2 and O4 to 4.6 at O3. The ecological classes defined by Dallas (2007) were found to range from class D (largely modified) at O1, O4 and O5 to class B at O3.

A small component of the taxa sampled during the assessment were moderately sensitive to water quality impairment, these included Atyidae, Aeshnidae and Ecnomidae. However, the invertebrate assemblage at the sites were largely tolerant to water quality impairment. There were no taxa sampled which would represent sensitive families during the survey. It is noted that the SASS5 interpretation is not applicable at sites classified as impoundments. Therefore, the SASS5 interpretations at O1, O4 and O5 are not applicable. Despite this, the standard methods can still serve to effectively monitor the watercourse for future monitoring assessments. The results of the reach based MIRAI is presented in Table 26.

Table 26: Macroinvertebrate Response Assessment Index for the Olifants River reach based on results obtained in August 2018

Invertebrate Metric Group	Score Calculated
Flow Modification	47
Habitat	43
Water Quality	28
Ecological Score	39
Invertebrate Category	class D/E

The results of the reach based MIRAI indicate a largely/seriously modified (class D/E) ecological category. The primary driver for the impaired conditions can be attributed to water quality modification. This result confirms the water quality results obtained during this study. It is likely that diffuse runoff from extensive coal mining activities compounded by urban and agricultural runoff has negatively impacted on the water quality of the Olifants River. Further, habitat quality in the watercourse was also determined to be negatively impacted. This has cumulatively impacted on the local invertebrate assemblage in that littoral habitats such as marginal vegetation in current has been lost due to inundation. This has resulted in the reduced Frequency of Occurrence of invertebrate families across the considered river reach.

The macroinvertebrate assessment results obtained during this assessment corroborate the results obtained in the bi-annual biomonitoring assessments completed by Grant and Repinga (2017).

7.4.4 Fish Community

Although no fish sampling was completed for this assessment, detailed studies completed in Grant and Repinga (2017) provide sufficient details on the baseline fish community structure. The results of the fish species which are expected in the watercourse are provided in Table 27.

Table 27: Expected fish species in the Olifants River Reach (Grant and Repinga, 2017)

Scientific Name	Conservation Status (IUCN, 2018)
Enteromius anoplus	LC
Enteromius cf. neefi	NE
Enteromius paludinosus	LC
Enteromius trimaculatus	LC
Chiloglanis pretoriae	LC
Clarais gariepinus	LC
Coptodon rendalli	LC
Labeo cylindricus	LC
Labeo molybdinus	LC
Labeobarbus marequensis	LC
Labeobarbus polylepis	LC
Pseudocrenilabrus philander	LC
Tilapia sparrmanii	LC
Non-native fish species	
Labeobarbus aeneus	-
Labeo capensis	-
Labeo umbratus	-
Alien fish species	
Cyprinus carpio	-
Gambusia affinis	-
Micropterus salmoides	-

As noted above, no listed fish species are expected in the considered river reach. Of the thirteen expected indigenous fish species in the river reach, eight have been captured in the river reach since 2001. The cumulative impacts identified in the IHIA and MIRAI have impacted on the local fish community.

7.4.5 Overall Aquatic Ecology Present Ecological Status

The results of the PES assessment for the Olifants River are provided in Table 28.

Table 28: Present Ecological Status of the Olifants River assessed in the August 2018 survey

Aspect Assessed	Ecological Category
Instream Ecological Category	38
Riparian Ecological Category	44
Aquatic Invertebrate Ecological Category	39
Ecostatus	**class E**

The results of the PES assessment derived seriously modified (class E) conditions in the Olifants River reach considered in this assessment. Instream habitat modification has resulted

in modified biological responses. Instream habitat modification can be attributed to extensive coal mining and power generation activities in the Olifants River catchment compounded by diffuse agricultural and urban runoff.

8 Habitat Sensitivity Mapping

As per the terms of reference for the project, a GIS sensitivity map is required in order to identify sensitive features in terms of the relevant specialist discipline/s within the project area, especially in reference to the defined infrastructure areas. The sensitivity scores identified during the field survey for each habitat were then visually mapped (Figure 47).

Areas that were classified as having low or moderate sensitivities are those areas which were deemed by the specialists to have been most impacted upon and/or were modified from their original condition due to factors such as over-grazing, mining activities, agriculture, human activity and/or presence of alien invasive species.

The areas given a high sensitivity rating are those areas with existing natural vegetation, are classified as a functional CBA/ESA or areas that have the capacity to serve as habitat or important corridors for various species (especially SCC). The areas in the centre of the project area associated with the Vleishaft tributary are classified as highly sensitive were granted approval in 2007 to be mined. Freshwater ecosystems such as rivers and wetlands are generally the lowest point in a landscape, and therefore particularly vulnerable to pollution from waste, sedimentation and pollutants present in runoff. This, combined with the strong connectivity of freshwater ecosystems makes them highly susceptible to upstream and downstream impacts. Vegetative buffers areas have a significant impact on pollution control and the associated water quality in nearby water bodies, soil erosion control, and provide wildlife habitat and movement corridors for species such as Water Monitors, Serval and Otters.

The width of a vegetative buffer around a river or wetland depends on many factors such as the risk the proposed development poses to the water resource and receiving environment, the sensitivity of the water resource to diffuse-source impacts, the impact on other water users, and the requirements of the associated biodiversity – to name but a few. On a national scale, the recommended buffer width around FEPA rivers in areas where mining takes place is 1 km.

For this project, the majority of the overall area was prescribed a low sensitivity due to the extent of current and previous mining activities and associated disturbances. Semi-disturbed grassland areas that are still host to a healthy diversity of faunal and floral species were given a low – moderate rating. Many of these areas, although altered, were given a moderate sensitivity rating due to the important role this are area functions as from an ecological point (corridor and an ESA).

Importantly, a number of high sensitivity areas were identified within the project area. Predominantly, these areas are significant wetlands and/or are areas considered to have a high biodiversity value or where meaningful numbers of SCC where recorded. The most significant high sensitivity area occurs across the central part (Velishaft tributary) of the project area and intersects with many of the proposed infrastructure development areas. As mentioned, this tributary has been partially mined and has been approved to be mined out entirely. Sections of the system currently forms part of the dirty water management system.

It is important to note that this map does not replace any local, provincial or government legislation relating to these areas or the land use capabilities or sensitivities of these environments.

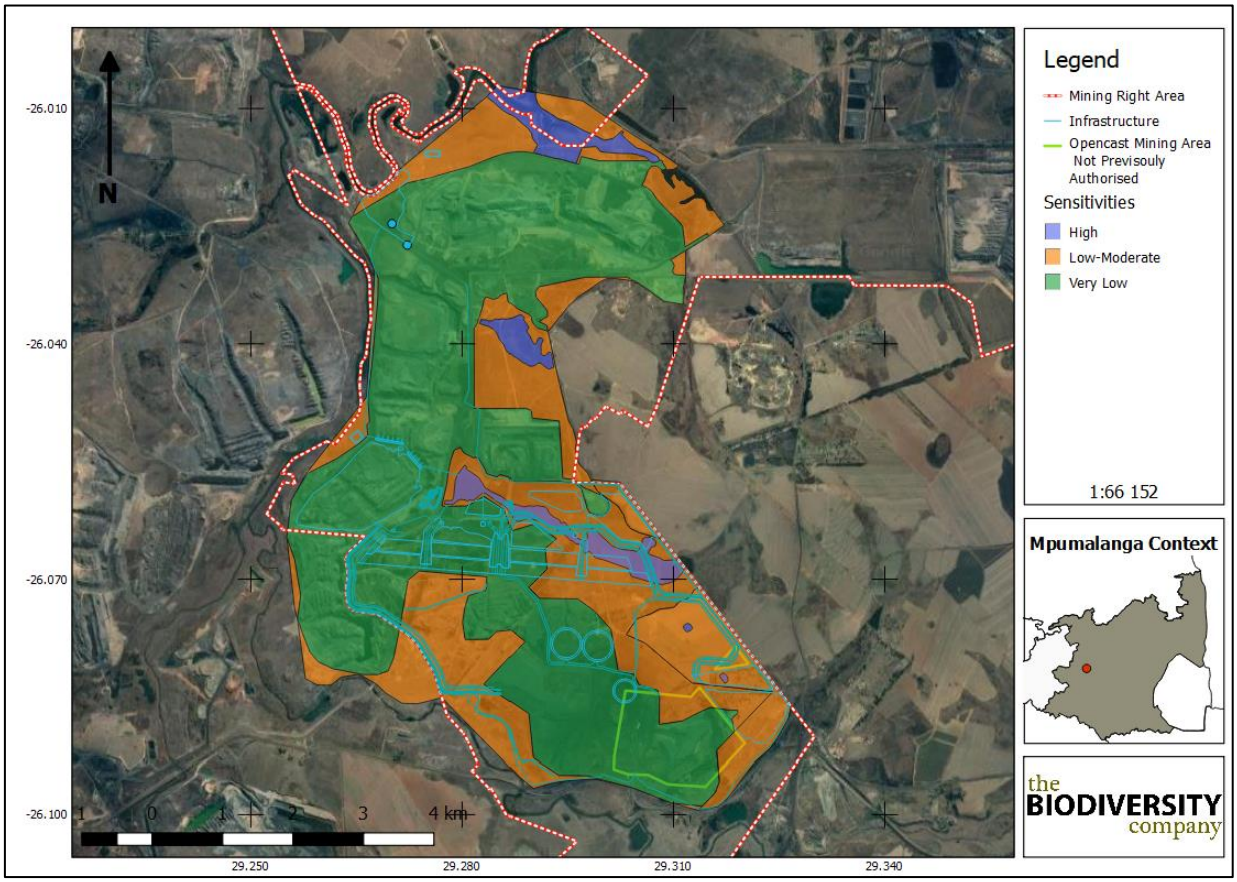

Figure 47: Habitat sensitivity map of the study area

9 Impact Assessment

9.1 Impact Assessment Methodology

In order to ensure uniformity, a standard impact assessment methodology was utilised so that a wide range of impacts can be compared. The impact assessment methodology makes provision for the assessment of impacts against the following criteria:

- Significance;
- Spatial scale;
- Temporal scale;
- Probability; and
- Degree of certainty.

A combined quantitative and qualitative methodology was used to describe the impacts for each of the aforementioned assessment criteria. A summary of each of the qualitative descriptors along with the equivalent quantitative rating scale for each of the aforementioned criteria is given in Table 29.

Table 29: Quantitative rating and equivalent descriptors for the impact assessment criteria

Rating	Significance	Extent Scale	Temporal Scale
1	Very Low	Isolated Corridor / Proposed Corridor	Incidental
2	Low	Study Area	Short-Term
3	Moderate	Local	Medium-Term
4	High	Regional / Provincial	Long-Term
5	Very High	Global / National	Permanent

9.1.1 Significance Assessment

Significance rating (importance) of the associated impacts embraces the notion of extent and magnitude but does not always clearly define these since their importance in the rating scale is very relative. For example, the magnitude (i.e. the size) of the area affected by atmospheric pollution may be extremely large (1 000 km^2) but the significance of this effect is dependent on the concentration or level of pollution. If the concentration is great, the significance of the impact would be HIGH or VERY HIGH, but if it is diluted it would be VERY LOW or LOW. Similarly, if 60 ha of a grassland type are destroyed the impact would be VERY HIGH if only 100 ha of that grassland type were known. The impact would be VERY LOW if the grassland type was common. A more detailed description of the impact significance rating scale is given in Table 30.

Table 30: Description of the significance rating scale

Rating		Description
5	Very High	Of the highest order possible within the bounds of impacts which could occur. In the case of adverse impacts: there is no possible mitigation and/or remedial activity which could offset the impact. In the case of beneficial impacts, there is no real alternative to achieving this benefit.
4	High	Impact is of substantial order within the bounds of impacts, which could occur. In the case of adverse impacts: mitigation and/or remedial activity is feasible but difficult, expensive, time-consuming or some combination of these. In the case of beneficial impacts, other means of achieving this benefit are feasible but they are more difficult, expensive, time-consuming or some combination of these.
3	Moderate	Impact is real but not substantial in relation to other impacts, which might take effect within the bounds of those which could occur. In the case of adverse impacts: mitigation and/or remedial activity are both feasible and fairly easily possible. In the case of beneficial impacts: other means of achieving this benefit are about equal in time, cost, effort, etc.
2	Low	Impact is of a low order and therefore likely to have little real effect. In the case of adverse impacts: mitigation and/or remedial activity is either easily achieved or little will be required, or both. In the case of beneficial impacts, alternative means for achieving this benefit are likely to be easier, cheaper, more effective, less time consuming, or some combination of these.
1	Very Low	Impact is negligible within the bounds of impacts which could occur. In the case of adverse impacts, almost no mitigation and/or remedial activity is needed, and any minor steps which might be needed are easy, cheap, and simple. In the case of beneficial impacts, alternative means are almost all likely to be better, in one or a number of ways, than this means of achieving the benefit. Three additional categories must also be used where relevant. They are in addition to the category represented on the scale, and if used, will replace the scale.
0	No Impact	There is no impact at all - not even a very low impact on a party or system.

9.1.2 Spatial Scale

The spatial scale refers to the extent of the impact i.e. will the impact be felt at the local, regional, or global scale. The spatial assessment scale is described in more detail in Table 31.

Table 31: Description of the spatial scale

Rating		Description
5	Global/National	The maximum extent of any impact.
4	Regional/Provincial	The spatial scale is moderate within the bounds of impacts possible and will be felt at a regional scale (District Municipality to Provincial Level). The impact will affect an area up to 50km from the proposed site / corridor.
3	Local	The impact will affect an area up to 5km from the proposed route corridor / site.
2	Study Area	The impact will affect a route corridor not exceeding the boundary of the corridor / site.
1	Isolated Sites / proposed site	The impact will affect an area no bigger than the corridor / site.

9.1.3 Temporal Scale

In order to accurately describe the impact, it is necessary to understand the duration and persistence of an impact in the environment. The temporal scale is rated according to criteria set out in Table 32.

Table 32: Description of the temporal rating scale

Rating		Description
1	Incidental	The impact will be limited to isolated incidences that are expected to occur very sporadically.
2	Short-term	The environmental impact identified will operate for the duration of the construction phase or a period of less than 5 years, whichever is the greater.
3	Medium term	The environmental impact identified will operate for the duration of life of the project.
4	Long term	The environmental impact identified will operate beyond the life of operation.
5	Permanent	The environmental impact will be permanent.

9.1.4 Degree of Probability

The probability or likelihood of an impact occurring is described, as shown in Table 33 below.

Table 33: Degree of Probability Ratings

Rating	Description
1	Practically impossible
2	Unlikely
3	Could happen
4	Very Likely
5	It's going to happen / has occurred

9.1.5 Quantitative Description of Impacts

To allow for impacts to be described in a quantitative manner in addition to the qualitative description given above, a rating scale of between 1 and 5 was used for each of the assessment criteria. Thus, the total value of the impact is described as the function of significance, spatial and temporal scale as described below.

$$\textit{Impact Risk} = \frac{(\text{SIGNIFICANCE} + \textit{Spatial} + \text{Temporal})}{3} \times \frac{\text{Probability}}{5}$$

The impact risk is then classified according to 5 classes as described in Table 34.

Table 34: Significance Classes

Rating	Impact Class	Description
0.1 – 1.0	1	Very Low
1.1 – 2.0	2	Low
2.1 – 3.0	3	Moderate
3.1 – 4.0	4	High

Rating	Impact Class	Description
4.1 – 5.0	5	Very High

9.2 Impacts to Fauna and Flora

Mining and related activities have significant impacts on biodiversity and ecosystem services, often causing irreversible and large-scale habitat loss across large areas or areas important for the provision of important ecosystem services.

Depending on the mining methods adopted, mining activities can cause considerable environmental degradation. These disturbances have numerous direct, indirect, short- and long-term potentially adverse effects on the landscape and nearby human communities.

Key impacts commonly associated with opencast mining activities and construction of mining infrastructure and overburden dumping are discussed below. The significance (quantification) of potential environmental impacts has been assessed in terms of the Guideline Documentation on EIA Regulation; Department of Environmental Affairs and Tourism, 2014 (Impact Assessment Methodology, Appendix 6).

By its very nature, open pit mining and construction of permanent mine dumps is environmentally destructive, even if mitigation measures are applied and the site is restored to a condition said to “resemble” its natural state. Complete disruption of the surface always occurs, which impacts on soil, fauna, flora, surface water and land use. The opportunities for land use following extensive mining operations are often limited.

The biodiversity impact assessment report includes the following:

- Assess impacts of ongoing and proposed activities on biodiversity of the project area;
- Assess whether proposed activities are likely to have significant impacts on biodiversity and specifically species of conservation concern;
- Identify practically implementable mitigation measures to reduce the significance of proposed activities on biodiversity; and
- Assess residual and cumulative impacts after implementation of mitigation measures.

9.2.1 Impact Assessment Methodology

Potential impacts were evaluated against the data captured during the desktop-and field assessment to identify relevance to the study area. The relevant impacts associated with the proposed development were then subjected to a prescribed impact assessment methodology, as described above.

Impacts were assessed in terms of the construction, operational, closure, rehabilitation and post-closure phases. Mitigation measures were only applied to impacts deemed relevant based on the impact analysis.

9.2.2 Detailed Potential Impacts

Based on the information provided, the following infrastructure will be developed:

- Storm water management structures, pollution control berms and canals;

- ;
- ROM coal stockpile area
- Overburden dumps;
- Mixed ROM coal and slurry stockpile facilities;
- Topsoil stockpile following clearance of vegetation;
- Pipelines for the conveyance of water;
- Haul roads and service roads;
- Water management measures for the management of mine impacted water (Including evaporators and mobile WTP) and
- Opencast pit (Area that has not previously been authorised).

Where the proposed activities footprint and natural areas overlap, the proposed activities will result in direct loss of habitats, direct mortalities and displacement of fauna and flora. The removal of natural vegetation to accommodate these activities will reduce the habitat available for fauna species, populations and ecological compositions within the project area.

The project area considered in this study was noted to be inhabited by several plant, mammal, reptile and bird species. Although it is assumed that the majority of fauna species will relocate to different areas as a result of disturbance, many fauna species have very specific habitat requirements, and the destruction of their habitats could result in their displacement to less optimal habitats. This will result in a decline in species numbers which may ultimately affect the conservation status of specific species on global, national and provincial scales.

As mentioned previously, a number of high sensitivity areas were identified within the project area. Predominantly, these areas are significant wetlands and/or are areas considered to have a high biodiversity value or are areas where meaningful numbers of SCC where recorded. The most significant high sensitivity area occurs across the central part of the project area and intersects with many of the proposed infrastructure development areas. Approval was, however granted in 2007 for this area to be mined.

Some other risks associated with the proposed activities:

- Clearing of land destroys landscapes, and wildlife habitats at the site of the development when trees, plants, and topsoil are removed or when topsoil and overburden dumps are developed. This in turn can lead to soil erosion and destruction of agricultural land;
- When rain washes the loosened topsoil into streams, sediments pollute watercourses. This can lead to fish die-offs and smother plant life downstream and cause disfiguration of river channels and streams which leads to flooding; and
- The listed activities may cause dust pollution when topsoil is disrupted with heavy machinery and coal dust is created in mines or from mining vehicles. Dust fall-out could impact watercourses and the aquatic ecosystem.

The potential impacts associated with the various project stages are discussed below.

9.2.2.1 Construction Phase

The following potential impacts were considered on terrestrial vegetation communities:

- Destruction and fragmentation of the vegetation community (including portions of an Endangered vegetation type, a Vulnerable ecosystem type, wetlands, corridors and areas classified as ESAs).

Potential impacts on faunal communities include:

- Displacement of faunal community (including threatened or protected species) due to habitat loss, disturbance (noise, dust and vibration), destruction of corridors and/or direct mortalities.

9.2.2.2 Operational Phase

The following potential impacts were considered on terrestrial vegetation communities:

- Continued removal and fragmentation of an Endangered vegetation type (including portions of wetlands and areas classified as ESAs) due to the proposed activities and encroachment by alien invasive plant species; and
- Potential leaks, discharges, and pollutants from mining activities leaching into the surrounding environment.

Potential impacts on faunal communities include:

- Continued displacement and fragmentation of the faunal community (including threatened or protected species) due to ongoing anthropogenic disturbances (noise, dust and vibrations) and habitat degradation (litter, road mortalities and/or poaching).

9.2.2.3 Closure & Decommissioning Phase

The following potential impacts were considered on terrestrial vegetation communities:

- Continued encroachment of an indigenous and Endangered vegetation community by alien invasive plant species;

Potential impacts on faunal communities include:

- Continued displacement and fragmentation of the faunal community (including threatened or protected species) due to ongoing anthropogenic disturbances (noise, dust and vibrations) and habitat degradation (litter, road mortalities and/or poaching).

9.2.3 Impact Assessment Results

9.2.3.1 Construction Phase

Table 35 shows the significance of potential impacts associated with the proposed development on vegetation communities before and after implementation of mitigation measures. Prior to implementation of mitigation measures, the significance of impacts was rated as High (Table 35). Implementation of avoidance measures as mitigation reduced the significance of potential impact on the vegetation community to a Moderate level (Table 35).

The significance of potential impacts associated with the development on faunal communities before and after mitigation is presented in Table 35. Prior to implementation of mitigation measures the significance of impacts were rated as High. Implementation of avoidance measures as mitigation reduced the significance of potential impact on the faunal communities to a Moderate level (Table 35).

Due to the nature of this type of development and the associated land clearance that will be required, and due to the intact nature of some of the habitats, corridors and wetlands, the impacts on identified threatened faunal species and sensitive vegetation communities remain at a moderate level, even after mitigation.

The opencast pit's main impacts will be on the areas that have not been previously impacted by mining activities (it has however previously been approved for mining). This will be a major change in these areas of remaining habitat and the impact was rated as High pre-mitigations. Post mitigations this impact on the vegetation was reduced to moderate. (Table 35). The impact of the opencast mining on fauna was rated as somewhat lower as the species can move into surrounding areas should the mitigations be followed.

9.2.3.2 Operational Phase

Table 36 shows the significance of potential operational phase impacts on vegetation communities before and after implementation of mitigation measures. The significance of the continued removal and fragmentation of an Endangered vegetation community (including portions of wetlands and areas classified as ESAs) due to the proposed activities and encroachment by alien invasive plant species was rated as High prior to mitigation (Table 36). Implementation of mitigation measures in the form an alien invasive plant management plan and rehabilitation of project footprint after completion of the proposed activities reduced the significance of the impact to Moderate levels (Table 36).

Table 36 shows the significance of potential operational phase impacts of potential leaks, discharges and/or pollutants from mining and mining associated infrastructure and activities into the surrounding environment. The significance was rated as High pre-mitigation, and as Low post-mitigation (Table 36).

The significance of operational phase impacts (both surface infrastructure and opencast pit) on terrestrial fauna communities was rated as High prior to mitigation and Moderate post mitigation (Table 36). This impact was attributed to the expected continued loss and fragmentation of the vegetation community in the project area and the associated loss of the faunal community which it supports unless definitive measures are taken. These measures include:

1. Awareness of the sensitivity of this community (in particular the Endangered vegetation type and the possibility of occurrence of certain threatened species);
2. A commitment to safely and properly relocate any threatened faunal species encountered during the operational phase and that will not disperse of their own accord, including any reptile, amphibian, bird or mammal SCC;
3. Storm water from the mining areas must be carefully managed and should include mitigation measures that will contain water from the dirty area;

4. Clean and dirty water must be separated as per GN 704, and dirty water is to be contained and re-used on-site; and
5. Limiting the operational area to the defined project areas and only impacting those areas where it is unavoidable to do so otherwise.

9.2.3.3 Decommissioning & Closure Phase

Table 37 shows the significance of potential impacts associated with the decommissioning phase of the development on vegetation communities before and after implementation of mitigation measures. Prior to implementation of mitigation measures the significance of impacts was rated as Moderate (Table 37). Implementation of avoidance measures as mitigation reduced the significance of potential impact on the vegetation community to a Low level (Table 37).

Opencast mining will have a greater effect on the vegetation due to the highly disturbed impact on the soils which will likely result in both alien vegetation infestation and erosion. This if the mitigations in the form of an alien invasive plan and erosion control plan is followed can be reduced to a low rating.

The significance of potential impacts associated with the decommissioning phase of the developments (surface infrastructure and opencast mine) on faunal communities before and after mitigation is presented in Table 37. Prior to implementation of mitigation measures the significance of impacts was rated as Moderate. Implementation of avoidance measures as mitigation reduced the significance of potential impact on the faunal communities to a Low level (Table 37).

Table 35: Impact Assessment for Terrestrial Ecology – Construction Phase

ACTIVITY	ASPECT AFFECTED	POTENTIAL IMPACT	PRE-MITIGATION	Score	Rating	MITIGATION	POST-MITIGATION	Score	Rating
Surface infrastructure associated with opencast mining	Vegetation and Habitat Quality	Destruction of, and fragmentation of, the vegetation community (including portions of an Endangered vegetation type, a Vulnerable ecosystem type, wetlands, corridors and areas classified as ESAs).	Significance	5	4,00	See Mitigation Measures below.	Significance	2	2,13
			Magnitude - Spatial	3			Magnitude - Spatial	2	
			Magnitude - Temporal	4			Magnitude - Temporal	4	
			Probability	5			Probability	4	
Surface infrastructure associated with opencast mining	Faunal Habitat Quality	Displacement of faunal community (including threatened or protected species) due to habitat loss, disturbance (noise, dust and vibration), destruction of corridors and/or direct mortalities.	Significance	4	4,00	See Mitigation Measures below.	Significance	2	2,13
			Magnitude - Spatial	4			Magnitude - Spatial	2	
			Magnitude - Temporal	4			Magnitude - Temporal	4	
			Probability	5			Probability	4	
Opencast Pit (Area not previously authorised)	Vegetation and Habitat Quality	Destruction of, and fragmentation of, the vegetation community (including portions of an Endangered vegetation type, a Vulnerable ecosystem type).	Significance	5	4,00	See Mitigation Measures below.	Significance	4	2,67
			Magnitude - Spatial	4			Magnitude - Spatial	3	
			Magnitude - Temporal	3			Magnitude - Temporal	3	
			Probability	5			Probability	4	
Opencast Pit (Area not previously authorised)	Faunal Habitat Quality	Displacement of faunal community (including threatened or protected species) due to habitat loss, disturbance (noise, dust and vibration), destruction of corridors and/or direct mortalities.	Significance	4	3,67	See Mitigation Measures below.	Significance	4	2,40
			Magnitude - Spatial	4			Magnitude - Spatial	3	
			Magnitude - Temporal	3			Magnitude - Temporal	2	
			Probability	5			Probability	4	

Table 36: Impact Assessment for Terrestrial Ecology – Operational Phase

ACTIVITY	ASPECT AFFECTED	POTENTIAL IMPACT	PRE-MITIGATION	Score	Rating	MITIGATION	POST-MITIGATION	Score	Rating
Surface infrastructure associated with opencast mining	Vegetation and Habitat Quality	Continued removal and fragmentation of an Endangered vegetation community (including portions of wetlands and areas classified as ESA) due to the prescribed activities and encroachment by alien invasive plant species.	Significance	4	4,00	See Mitigation Measures below.	Significance	2	2,13
			Magnitude - Spatial	3			Magnitude - Spatial	2	
			Magnitude - Temporal	5			Magnitude - Temporal	4	
			Probability	5			Probability	4	
Surface infrastructure associated with opencast mining	Water Quality	Potential leaks, discharges, pollutant from mining activities leaching into the surrounding environment influencing the drinking water of faunal species as well as influencing the soil quality for the flora growth structure.	Significance	4	4,00	See Mitigation Measures below.	Significance	2	1,40
			Magnitude - Spatial	3			Magnitude - Spatial	2	
			Magnitude - Temporal	5			Magnitude - Temporal	3	
			Probability	5			Probability	3	
Surface infrastructure associated with opencast mining	Faunal Habitat Quality	Continued displacement and fragmentation of the faunal community (including threatened or protected species) due to ongoing anthropogenic disturbances (noise, dust and vibrations) and habitat degradation/loss (litter, road mortalities and/or poaching).	Significance	4	4,00	See Mitigation Measures below.	Significance	2	2,13
			Magnitude - Spatial	3			Magnitude - Spatial	2	
			Magnitude - Temporal	5			Magnitude - Temporal	4	
			Probability	5			Probability	4	
Opencast Pit (Area not previously authorised)	Vegetation and Habitat Quality	Continued removal and fragmentation of an Endangered vegetation community due to the prescribed activities and encroachment by alien invasive plant species.	Significance	5	4,67	See Mitigation Measures below.	Significance	4	2,93
			Magnitude - Spatial	4			Magnitude - Spatial	3	
			Magnitude - Temporal	5			Magnitude - Temporal	4	
			Probability	5			Probability	4	
Opencast Pit (Area not previously authorised)	Water Quality	Potential leaks, discharges, pollutant from mining activities leaching into the surrounding environment influencing the drinking water of faunal species as well as influencing the soil quality for the flora growth structure.	Significance	4	4,00	See Mitigation Measures below.	Significance	2	1,40
			Magnitude - Spatial	3			Magnitude - Spatial	2	
			Magnitude - Temporal	5			Magnitude - Temporal	3	
			Probability	5			Probability	3	
Opencast Pit (Area not previously authorised)	Habitat Quality	Continued displacement and fragmentation of the faunal community (including threatened or protected species) due to ongoing anthropogenic disturbances (noise, dust and vibrations) and habitat	Significance	4	3,67	See Mitigation Measures below.	Significance	3	2,67
			Magnitude - Spatial	3			Magnitude - Spatial	3	
			Magnitude - Temporal	4			Magnitude - Temporal	4	
			Probability	5			Probability	4	

		degradation/loss (litter, road mortalities and/or poaching).							

Table 37: Impact Assessment for Terrestrial Ecology – Closure & Decommissioning Phase

ACTIVITY	ASPECT AFFECTED	POTENTIAL IMPACT	PRE-MITIGATION	Score	Rating	MITIGATION	POST-MITIGATION	Score	Rating
Surface infrastructure associated with opencast mining	Vegetation and Habitat Quality	Continued encroachment of an indigenous and Endangered vegetation community by alien invasive plant species as well as Erosion due to disturbed soils.	Significance	4	2,93	See Mitigation Measures below.	Significance	3	1,40
			Magnitude - Spatial	3			Magnitude - Spatial	2	
			Magnitude - Temporal	4			Magnitude - Temporal	2	
			Probability	4			Probability	3	
Surface infrastructure associated with opencast mining	Faunal Habitat Quality	Continued displacement and fragmentation of the faunal community (including threatened or protected species) due to ongoing anthropogenic disturbances (noise, dust and vibrations) and habitat degradation/loss (litter, road mortalities and/or poaching).	Significance	3	3,00	See Mitigation Measures below.	Significance	3	1,40
			Magnitude - Spatial	3			Magnitude - Spatial	2	
			Magnitude - Temporal	3			Magnitude - Temporal	2	
			Probability	5			Probability	3	
Opencast Pit (Area not previously authorised)	Vegetation and Habitat Quality	Continued encroachment of an indigenous and Endangered vegetation community by alien invasive plant species as well as Erosion due to disturbed soils.	Significance	4	3,20	See Mitigation Measures below.	Significance	3	1,40
			Magnitude - Spatial	4			Magnitude - Spatial	2	
			Magnitude - Temporal	4			Magnitude - Temporal	2	
			Probability	4			Probability	3	
Opencast Pit (Area not previously authorised)	Faunal Habitat Quality	Continued displacement and fragmentation of the faunal community (including threatened or protected species) due to ongoing anthropogenic disturbances (noise, dust and vibrations) and habitat degradation/loss (litter, road mortalities and/or poaching).	Significance	3	3,00	See Mitigation Measures below.	Significance	3	1,40
			Magnitude - Spatial	3			Magnitude - Spatial	2	
			Magnitude - Temporal	3			Magnitude - Temporal	2	
			Probability	5			Probability	3	

9.2.4 Mitigation Actions

The impacts are considered to last indefinitely, as such a dramatic change in topography - from a wetland to an overburden dump, for example, is not considered reversible. As such, there are no mitigation measures which will be able to reduce this impact or return the vegetation or habitat to even a semi-natural condition or function. The opencast pit (area not previously authorised) falls mainly on an area that has been previously altered by mining activities, portions in the east are classified as having a low-moderate sensitivity.

Therefore, the mitigation measures mentioned below are based upon a situation where authorisation to proceed (with the associated infrastructure layouts as provided) is approved by a competent authority.

The focus of mitigation measures should be to reduce the significance of potential impacts associated with the infrastructure development and the opencast mining and thereby to:

- Minimise the destruction and fragmentation of the vegetation community (including portions of an Endangered vegetation type, wetlands, corridors and areas classified as ESAs).
- Prevent the loss of the faunal community (including occurring species of conservation concern) associated with this vegetation community.

9.2.4.1 Mitigation Measures for Impacts on Vegetation Communities

From an ecological perspective, the development is situated close to and within various natural and semi-disturbed habitats that play an important role within this area. Although somewhat disturbed, it has been shown that these areas support various faunal species, including SCC and there is a strong likelihood that other SCC may occur there.

The mitigation measures proposed below should only come in to effect if environmental authorisation is approved for this project.

It is recommended that an extensive alien plant management plan be compiled to remove all alien vegetation from within the project area, should the project receive authorisation. An erosion control plan must be compiled and implemented for the open cast area.

Mitigation and rehabilitation measures include the following:

- It is recommended that areas to be developed be specifically demarcated so that during the construction phase, only the demarcated areas be impacted upon and preventing movement of workers into sensitive surrounding environments;
- Speed should be restricted and lights must be turned on in all vehicles (day and night), driving at night should be restricted as far as possible and feasible in order to reduce or prevent wildlife road mortalities which occur more frequently during this period;
- Drivers must attend driver awareness training to prevent the unnecessary road killing of animals;
- The areas rated as highly sensitive outside of the project development area (See Figure 47) as defined in this report should be declared a ‘no-go’ area during the construction and operational phases and all efforts must be made to prevent access to this area from

construction workers and machinery. This should be implemented with the exception of those mining areas in which authorisation for mining has been granted;

- Where possible, existing access routes and walking paths must be made use of, and the development of new routes limited;
- All laydown, storage areas etc should be restricted to within the project area;
- A qualified environmental control officer must be on site when construction begins to identify species (all species but more specifically SCCs) that will be directly disturbed and to relocate fauna/flora that is found during construction;
- Areas that are denuded during construction and where no future mining will occur, need to be re-vegetated with indigenous vegetation to prevent erosion during flood events. This will also reduce the likelihood of encroachment by alien invasive plant species;
- Compilation of and implementation of an alien vegetation management plan for the entire site. The use of herbicide needs to be monitored and only be used by a qualified person as several species that are protected by the Mpumalanga Schedule 11 was recorded; and
- Appropriate fire breaks should be implemented to restrict the impact fire might have on the endangered vegetation.

9.2.4.2 Mitigation Measures for Impacts on Faunal Communities

Recommended mitigation and rehabilitation measures for faunal communities hinge largely on protecting their habitats and ensuring it remains intact.

Specific mitigation measures for mammal species

- Two SCCs were observed on the project area: Serval (*Leptailurus serval)* and Cape Clawless Otter (*Aonyx capensis*), an ad hoc monitoring programme should be implemented with sightings recorded for these two species to specifically monitor their breeding success and distribution.

In additional to this the following measures are recommended:

- During vegetation clearance, methods should be employed to minimise potential harm to fauna species. Clearing has to take place in a phased manner and to maximise the potential for mobile species to move to adjacent areas;
- Prior and during vegetation clearance any larger fauna species noted should be given the opportunity to move away from the construction machinery;
- Waste management must be a priority and all waste must be collected and stored adequately. It is recommended that all waste be removed from site on a weekly basis to prevent rodents and pests entering the site;
- No trapping, killing or poisoning of any wildlife is to be allowed on site, including snakes, birds, lizards, frogs, insects or mammals;
- Noise and vibrations must be kept to a minimum to reduce the impact of the development on the fauna residing on the site;

- Staff should be educated about the sensitivity of faunal species and measures should be put in place to deal with any species that are encountered;
- Wherever possible, corridor areas (which links the CBA, ONA and ESAs) (refer to Figure 5) must be maintained to facilitate the movement of wildlife within and between any natural areas and wetlands; and
- Construction activities and vehicles could cause spillages of lubricants, fuels and construction material which could then be transported to the river, impacting on the water quality, the functioning of the systems and habitats of terrestrial organisms. All vehicles and equipment must be maintained, and all re-fuelling and servicing of equipment is to take place in demarcated areas.

9.2.5 No-go Options

The no-go areas for the fauna and flora can be based on the sensitivity map and are classified as highly sensitive (Figure 47). Where the highly sensitive areas i.e. the wetlands and moist grasslands should be avoided, unless authorisation has previously been granted by the authorities to mine such areas.

9.3 Impacts to Wetlands/Watercourses

9.3.1 Sensitive Landscapes

A number of wetland types with varying levels of ecological integrity (health) and importance are associated with the study area. Some of these wetland areas are remnants of larger systems which have already been lost due to the progressive mining in the general area. In addition to this, these wetlands do offer a limited level of ecosystem services and are also regarded as intermediately important for the maintenance of biodiversity in this area. It is evident from the proposed infrastructure layout that there will be further loss to these wetland areas, resulting in the subsequent degradation in wetland integrity and loss of ecological services. It is worth noting that approval for the mining of these wetlands has already been granted.

9.3.2 No-go Option

The assessment indicated large scale, catchment-wide cumulative impacts to and loss of wetland areas. This has contributed to the degradation of overall wetland integrity and also the degradation and loss of ecosystem services for this area. Due to the progress of mining in the larger area, it is anticipated that there will be further degradation to some wetland areas, with other wetland systems being completely lost as a result. Where feasible, the wetlands should be avoided, unless authorisation has previously been granted by the authorities to mine such areas.

9.3.3 Detailed Potential Impacts Anticipated for the Proposed Project

The proposed project activities were determined to have two primary impacts which have been considered for this assessment. Firstly, there is expected to be a loss (or partial loss) of four wetland HGM types, namely HGM 2, HGM 3, HGM 4 and HGM 5. Authorisation was granted in 2007 for the mining HGM 2. This loss is a result of the placement of infrastructure in these wetland areas. The second consideration is deterioration of the channelled valley bottom system associated with the Olifants River as a result of sedimentation, impaired water quality and altered hydrology; each of these will be assessed separately.

9.3.3.1 Construction Phase

The placement of infrastructure which includes servitudes, overburden and mixed ROM coal and slurry stockpile areas, as well as storm water diversion measures will result in direct impacts to selected wetland areas, resulting in the expected loss of these areas. A total wetland area of 198.9 ha was delineated for this project, with 120 ha expected to be lost. This representing a 60% loss of wetland area, which would need to be compensated for. The total wetland area associated with HGM 2 is approximately 53 ha, and authorisation was granted in 2007 for the mining of this system. A wetland offset strategy was compiled for the 2007 approval to compensate for the loss of these wetlands. No mitigation is possible for the loss of wetland areas, and the implementation of the wetland offset strategy is required to compensate for these losses. Reaches of these systems that will not be directly impacted on and will be remaining will have altered flows. Surface and sub-surface flows will be intercepted and/or diverted from these areas. The development of the area in general will result in modifications to the catchment area as a whole, also resulting in the loss of wetland reporting to these wetland systems. No direct impacts are expected for the unchanneled valley bottom wetland which is associated with HGM 4, and any indirect impacts may be mitigated due to the presence of the railway line and also existing pollution control dams. These structures are likely to intercept any contaminated surface run-off, preventing contamination of the unchanneled system.

Due to the loss of wetland areas, the resultant loss of water, increased sedimentation of these systems and the impaired water quality will result in the degradation of the remaining wetland reaches. The ecological integrity and functioning of the channelled valley bottom wetland associated with the Olifants River is likely to be unaffected by the project.

9.3.3.2 Operation Phase

As discussed in the construction phase, there will already be a loss of wetland areas, and the resultant loss of water, increased sedimentation of these systems and the impaired water quality will result in the degradation of the remaining wetland reaches. It is possible that due to these impacts, changes to the catchment topography and the resultant wetland fragmentations being formed, there will be further wetland loss for these remaining isolated systems. The ecological integrity and functioning of the channelled valley bottom wetland associated with the Olifants River is likely to be unaffected by the project. The planned opencast mining does pose an indirect risk to the local water resources and the mine operation must be such to ensure that the cone of dewatering caused from open pit mining does not lead to a reduction of streamflow or dewatering of any water resources, and in particular the Olifants River.

9.3.3.3 Decommissioning Phase

The removal of infrastructure and rehabilitation activities will be a large-scale operation, but it will not necessarily result in the restoration of wetland areas. Taking into account the cumulative impact of the planned mining activities and decommissioning of the project it is unlikely that rehabilitation of the area will result in the creation of the lost wetland areas and associated ecosystem services. It is recommended wetland offset strategy for the area be implemented.

9.3.3.4 Post Closure Phase

Typically, following the cessation of coal mining activities groundwater returns to the voids created by the mining process. This process results in the contamination of the groundwater resource. Following this influx of groundwater, seepage and decant at specific locations can

result in the ingress of contaminated water in wetland systems, but without the ability to enhancement the overall water quality, the water quality of downstream systems will be affected. The loss of wetland areas and the associated ecosystem services is likely to result in the degradation of the environment in general, due to aspects which include impacted habitat, altered community structures, impaired water quality and reduced wetland extent.

9.3.4 Impact Assessment Results

The results of the impact assessment for the wetland assessment is presented in Table 38 for the construction phase, Table 39 for the operation phase and Table 40 for the decommissioning/closure phase.

The most notable impact for the project is the expected loss of wetland areas and the associated ecosystem services, which is considered to have a high significance rating both with and without mitigation. There is no mitigation for the loss of wetland areas, and a recommendation has been made to implement the wetland offset strategy. The aspects associated with the sedimentation of water resources, impaired water quality, changes to hydrology and the altered catchment generally pose a moderate risk pre-mitigation and a low risk post-mitigation.

Taking into account the cumulative impact (Table 40) of the project and the resultant loss of wetland areas, the significance rating is very high pre-mitigation and high post-mitigation.

Table 38: Impact Assessment for Wetlands – Construction Phase

ACTIVITY	ASPECT AFFECTED	POTENTIAL IMPACT	PRE-MITIGATION	Score	Rating	MITIGATION	POST-MITIGATION	Score	Rating
Site clearing, vegetation removal & stripping of top soil	Loss and degradation of wetland systems	Loss of wetland ecosystem services, or degradation of these services. A considerable cumulative impact considering the extent of mining and development in the area, and the already lost wetland areas and associated services.	Significance	4	3.33	See Mitigation Measures below.	Significance	3	2.33
			Magnitude - Spatial	3			Magnitude - Spatial	2	
			Magnitude - Temporal	3			Magnitude - Temporal	2	
			Probability	5			Probability	5	
			Magnitude - Spatial	3			Magnitude - Spatial	3	
			Magnitude - Temporal	3			Magnitude - Temporal	2	
			Probability	5			Probability	3	
Site clearing, vegetation removal & stockpiling of top soil	Erosion and sedimentation of wetland areas	The exposed (or bare) grounds are susceptible to erosion due to wind and run-off, resulting in sedimentation of downstream watercourses. Stockpiles and dumps are also susceptible to erosion.	Significance	4	2.67	See Mitigation Measures below.	Significance	4	1.80
			Magnitude - Spatial	4			Magnitude - Spatial	3	
			Magnitude - Temporal	2			Magnitude - Temporal	2	
			Probability	4			Probability	3	
The use and maintenance of machines, vehicles and equipment.	Water quality impairment and further deterioration	Spills and leaks from machinery, equipment and vehicles will also impact on water quality. The storage and mixing of substances on site also pose a risk to local water resources.	Significance	4	2.40	See Mitigation Measures below.	Significance	4	1.80
			Magnitude - Spatial	3			Magnitude - Spatial	3	
			Magnitude - Temporal	2			Magnitude - Temporal	2	
			Probability	4			Probability	3	
Site preparation and placement of infrastructure, stormwater structures and access roads	Altered and lost hydro-dynamics and flow regimes for the catchment area	The development of the area will require sloping and landscaping to accommodate infrastructure, this will alter the infiltration of the catchment, reduce the availability of water, increase run-off and change surface flow characteristics.	Significance	3	2.40	See Mitigation Measures below.	Significance	3	1.60
			Magnitude - Spatial	4			Magnitude - Spatial	3	
			Magnitude - Temporal	4			Magnitude - Temporal	4	
			Probability	4			Probability	3	

Table 39: Impact Assessment for Wetland – Operation Phase

ACTIVITY	ASPECT AFFECTED	POTENTIAL IMPACT	PRE-MITIGATION	Score	Rating	MITIGATION	POST-MITIGATION	Score	Rating

Developed infrastructure	Loss and degradation of wetland systems	Loss of wetland ecosystem services, or degradation of these services. A considerable cumulative impact considering the extent of mining and development in the area, and the already lost wetland areas and associated services.	Significance	5	4.00	See Mitigation Measures below.	Significance	4	3.33
			Magnitude - Spatial	3			Magnitude - Spatial	2	
			Magnitude - Temporal	4			Magnitude - Temporal	4	
			Probability	5			Probability	5	
Stockpiling of topsoil	Erosion and sedimentation of wetland areas	The stockpiles are susceptible to wind and run-off erosion, resulting in sedimentation of downstream watercourses.	Significance	4	2.93	See Mitigation Measures below.	Significance	4	2.00
			Magnitude - Spatial	4			Magnitude - Spatial	3	
			Magnitude - Temporal	3			Magnitude - Temporal	3	
			Probability	4			Probability	3	
The use and maintenance of machines, vehicles and equipment.	Water quality impairment and further deterioration	The erosion of stockpiles and dumps will result in sedimentation of watercourses. Spills and leaks from machinery, equipment and vehicles will also impact on water quality. The storage and mixing of substances on site also pose a risk to local water resources.	Significance	4	2.67	See Mitigation Measures below.	Significance	4	2.00
			Magnitude - Spatial	3			Magnitude - Spatial	3	
			Magnitude - Temporal	3			Magnitude - Temporal	3	
			Probability	4			Probability	3	
Operation of infrastructure, stormwater structures and access roads	Altered and lost hydro-dynamics and flow regimes for the catchment area	The sloping and landscaping will alter the infiltration of the catchment, reduce the availability of water, increase run-off and change surface flow characteristics.	Significance	3	2.67	See Mitigation Measures below.	Significance	3	1.80
			Magnitude - Spatial	4			Magnitude - Spatial	3	
			Magnitude - Temporal	3			Magnitude - Temporal	3	
			Probability	4			Probability	3	
Opencast mining	Dewatering of wetlands	Opencast mining must lead to dewatering of systems due to a reduction in streamflow or dewatering of wetland areas. There will be a change to the geo-hydrodynamics of the area.	Significance	3	2.40	See Mitigation Measures below.	Significance	4	1.80
			Magnitude - Spatial	3			Magnitude - Spatial	3	
			Magnitude - Temporal	3			Magnitude - Temporal	2	
			Probability	4			Probability	3	
Water Discharge	Water Quality	Altered hydrology and flow regimes	Significance	1	0.8	See Mitigation Measures below.	Significance	1	0.8
			Magnitude - Spatial	1			Magnitude - Spatial	1	
			Magnitude - Temporal	1			Magnitude - Temporal	1	
			Probability	4			Probability	4	

Table 40 Impact Assessment for Wetlands – Closure Phase

ACTIVITY	ASPECT AFFECTED	POTENTIAL IMPACT	PRE-MITIGATION	Score	Rating	MITIGATION	POST-MITIGATION	Score	Rating
Ripping of compacted areas, replacement of soil and shaping	Erosion and sedimentation of wetland areas	The exposed (or bare) grounds are susceptible to wind and run-off erosion, resulting in sedimentation of downstream watercourses.	Significance	3	2.00	See Mitigation Measures below.	Significance	2	1.60
			Magnitude - Spatial	4			Magnitude - Spatial	3	
			Magnitude - Temporal	3			Magnitude - Temporal	3	
			Probability	3			Probability	3	
The use and maintenance of machines, vehicles and equipment.	Water quality impairment and further deterioration	Sedimentation from rehabilitated areas. Spills and leaks from machinery, equipment and vehicles will also impact on water quality.	Significance	3	2.40		Significance	3	1.80
			Magnitude - Spatial	3			Magnitude - Spatial	3	
			Magnitude - Temporal	3			Magnitude - Temporal	3	
			Probability	4			Probability	3	
Backfilling of voids, shaping and contouring of the area	Altered and lost hydro-dynamics and flow regime for the catchment area	The sloping and landscaping will restore to some extent the hydro-dynamics of the catchment, but this will not be natural.	Significance	3	2.67		Significance	3	1.80
			Magnitude - Spatial	4			Magnitude - Spatial	3	
			Magnitude - Temporal	3			Magnitude - Temporal	3	
			Probability	4			Probability	3	

Table 41: Cumulative Impact Assessment

ACTIVITY	ASPECT AFFECTED	POTENTIAL IMPACT	PRE-MITIGATION	Score	Rating	MITIGATION	POST-MITIGATION	Score	Rating
Surface coal mining activities	Loss and degradation of wetland systems	Loss of wetland ecosystem services, or degradation of these services. A considerable cumulative impact considering the extent of mining and development in the area, and the already lost wetland areas and associated services.	Significance	5	4.33	None, but recommendation to implement the wetland offset strategy	Significance	4	4.00
			Magnitude - Spatial	4			Magnitude - Spatial	4	
			Magnitude - Temporal	4			Magnitude - Temporal	4	
			Probability	5			Probability	5	

9.3.5 Mitigation Actions

The mitigation actions provided below are important to consider with other specialist assessment which include but are not limited to the following specialist studies: Groundwater, and Surface Water. These mitigation measures should be implemented in the Environmental Management Programme (EMPr) should the project go-ahead. The mitigation hierarchy was considered for this study. The mitigation measures are largely associated with the expected indirect impacts expected for the project, and not the loss of wetland areas which received mining approval in 2007.

9.3.5.1 Project Duration

The project specific mitigation measures applicable to all project phases include:

- Make use of existing access routes where possible;
- Separate clean and dirty water. Clean water must be diverted and directed around working areas, and measures or structures created to manage the discharge to avoid scouring and erosion;
- Ablution facilities must be provided for all staff and maintained for proper and correct use. Use of the facilities must be enforced;
- The Contractor should supply appropriate waste collection bins and all solid waste collected shall be disposed of at a licensed waste disposal facility;
- Refuse waste must be collected in bins / skips to accommodate volumes, these bins must be serviced. Recycling of waste must be encouraged, and in the event waste cannot be recycled, the waste must be disposed of at a licenced facility;
- Dust suppression must be implemented, and mine driving rules must be maintained;
- Any possible spills of hydrocarbons, concrete or concrete water must be avoided. Spill kits must be available and on hand to clean these spills;
- Where applicable, hazardous materials must be stored in leak-proof, sealable containers or packaging. Materials must also be stored in bunded areas which can accommodate the required volumes;
- Drip trays or any form of oil absorbent material must be placed underneath vehicles/machinery and equipment when leaking or when being serviced;
- No servicing of equipment on natural or rehabilitated areas;
- Leaking equipment shall be repaired immediately or be removed from site to facilitate repair;
- All vehicles and equipment must be well maintained to ensure that there are no oil or fuel leakages;
- All contaminated soil shall be removed and be placed in containers. Contaminated soil may only be disposed of in a licenced facility;

- A specialist Contractor shall be used for the bio-remediation of contaminated soil where the required remediation material and expertise is not available on site;
- All personnel and contractors to undergo Environmental Awareness Training. A signed register of attendance must be kept for proof.;
- An alien invasive plant management plan needs to be compiled and implemented prior to construction and continued through the life of the mine, to control and prevent the spread of invasive aliens;
- Compile a suitable stormwater management plan, which must be implemented from the onset of the project, and continued for the life of the project;
- Demarcate footprint areas to be cleared to avoid unnecessary clearing. Exposed areas must be ripped and vegetated to increase surface roughness; and
- Should AMD result from the project, mitigation measures proposed by geohydrological specialist assessment also be considered.

9.3.5.2 Construction Phase

Mitigation measures include:

- Topsoil and sub-soil remove for this phase of the project should be used for rehabilitation of the area;
- Minimising the disturbance footprint area, and the duration of the construction phase;
- Demarcate footprint areas to be cleared to avoid unnecessary clearing. Exposed areas must be ripped and vegetated to increase surface roughness; and
- Create energy dissipation at discharge areas to prevent scouring. Temporary and permanent erosion control methods may include silt fences, retention basins, detention ponds, interceptor ditches, seeding and sodding, riprap of exposed areas, erosion mats, and mulching.

9.3.5.3 Operation Phase

Mitigation measures include:

- Dirty water must be contained in suitable containment facilities. Water that is required to be released, it is advisable that the water quality be within the target requirements for aquatic ecosystems (DWAF,1996); and
- Measures prescribed in the groundwater study must be considered.

9.3.5.4 Decommission Phase

Mitigation measures include:

- Rehabilitation of the area and shaping of the topography must minimise the ingress of water into the Project area. Other measures must also be considered such as the construction of wetlands at likely decant areas, and the planting of indigenous trees to reduce groundwater recharge; and

- Decommission cut-off berms and drains last to restore surface flow dynamics.

9.4 Impacts to Riverine Aquatic Ecology

9.4.1 Sensitive Landscapes

The instream and delineated riparian areas are regarded as sensitive riverine habitats. No direct contact between the delineated instream, riparian area or the proposed infrastructure are anticipated for the proposed project. Aside for the discharge pipeline infrastructure from the from the WTP, no other direct interactions between riparian habitat and the infrastructure could be anticipated.

9.4.2 No-go Option

The baseline assessment conducted in this study indicated large scale, catchment wide cumulative impacts which have rendered the riverine ecosystems in the study seriously modified. It is anticipated that within the larger catchment area of the Olifants River there will be a further increase in the number of small agricultural impoundments, possible future increased abstractions – and further water quality impacts stemming from the cessation of coal mining activities. This will further exacerbate the existing poor levels of connectivity and water quality and would further degrade the PES of the river system. In conclusion, the no-go scenario indicates continued degradation of the assessed watercourses in this study.

9.4.3 Detailed Potential Impacts Anticipated for the Proposed Project

The proposed project activities were determined to have two primary impacts to the associated aquatic ecology. The first was determined to be related to the conditions within the physical make-up of the considered river reaches. This includes the riverine substrates, banks, riparian vegetation and water column. These physical components of a watercourse determine the quality of the aquatic habitats. Therefore, modification of these physical components would result in a habitat quality impact.

The second impact was determined to be related to the chemical properties of water. Considering aquatic biota have requirements for habitat, as well as sensitivity to changes in water chemistry, an overall impact for a change to water quality was assessed.

9.4.3.1 Construction Phase

Although no direct impacts to the riverine areas are anticipated during the construction phase, diffuse runoff and seepage from the activities are likely to have an impact.

The activities anticipated during the construction phase have the potential to degrade water and habitat quality within the considered river system. Water quality impacts may include increased dissolved/suspended solids, as well as potential persistent pollutants within the water column and sediments. Considering this, general water chemistry modification may occur as a result of changed salt balances and the influx of runoff/seepage from a modified catchment.

Habitat quality impacts are likely to include sedimentation, bed, channel and flow modification. The modification to land topography via opencast mining activities alters natural hydrological pathways. The change of topography can result in the alteration of infiltration rates and groundwater drawdown which in-turn effects water quantities in local surface water. The alteration of local hydrological patterns can result in the modification of the associated functional

status of the riverine and wetland eco-systems. It is recommended that the groundwater component of the overall application is utilised for effective descriptions of the potential impacts related to this impact as a result of the proposed project.

Runoff and seepage from exposed carboniferous materials in the coal product and overburden stockpiles can have elevated concentrations of sulphate, manganese and aluminium which have the potential to degrade local surface water.

Although the PES (baseline) of the river reach assessed was derived to be modified from reference conditions, further deterioration is possible and thus a potential decline in the PES could be observed. Thus, impacts described above will result in reduced biodiversity on a catchment scale.

9.4.3.2 Operation Phase

As discussed in the construction phase, the activities and interactions listed above have the potential to degrade water and habitat quality within the associated river systems. The storage, conveyance and processing of carboniferous material presents a risk to contaminate the downstream river reaches. During rainfall events runoff which has been in contact with this material may enter local aquatic ecosystems. Once rainwater is in contact with the carboniferous material, dissolved substances will alter downstream water chemistry resulting in the loss of sensitive aquatic biota.

There is a planned treated water discharge into a modified wetland feeding into the Olifants River system. Given the impounded nature of the downstream river reaches, this discharge will serve to increase overall water volumes in the Olifants River, which may serve to inundate additional riverine habitat. This impact is dependent on the existing water levels in the Olifants River. It is noted that following the inundation of additional habitats associated with discharge of treated water volumes, an equilibrium would be established within the short term and therefore this habitat impact is not rated for the entirety of the discharge period.

As noted in the assumptions and limitations component of this report, it is assumed that the quality of the treated water discharge would be good. The discharge of the treated water would therefore likely serve to reduce the salinities in the Olifants River, which would be a positive impact to the watercourse.

9.4.3.3 Decommissioning Phase

Similarly to the construction phase, the removal of infrastructure and rehabilitation activities will be a large scale operation and thus has the potential to contaminate surface water.

9.4.3.4 Post Closure Phase

Typically, following the cessation of coal mining activities groundwater returns to the voids created by the mining process. This process results in the contamination of the groundwater resource. Following this influx of groundwater, seepage and decant at specific locations can result in the ingress of contaminated water in downstream river systems, thus severely degrading the local PES.

9.4.4 Impact Assessment Results

The results of the impact assessment for the riverine ecology is presented in Table 42 for the construction phase, Table 43 for the operation phase and Table 44 for the decommissioning/closure phase.

The results of the impact assessment for the construction phase indicate moderate impacts to water and habitat quality before mitigation. Following the implementation of mitigation actions, low and very low significance ratings were derived. During the operation phase moderate impacts to habitat and water quality were derived before mitigation, with moderate and low impacts derived following the implementation of mitigation.

During the closure and decommissioning phase, high ratings were determined before mitigation as a result of the potential decant of Acid Mine Drainage. However, following the implementation of water treatment, a very low significance rating was determined. It is further recommended that the mitigation measures proposed by geohydrological specialist assessment also be considered.

Table 42: Impact Assessment for the Riverine Ecology – Construction Phase

Activity	Aspect Affected	Potential Impact	Pre-Mitigation	Score	Rating	Mitigation	Post-Mitigation	Score	Rating
Surface infrastructure associated with opencast mining	Water Quality	Increased dissolved solids, increased dissolved metals, alteration of pH, increased suspended solids	Significance	4	2.67	See Mitigation Measures below.	Significance	4	2,00
			Magnitude - Spatial	3			Magnitude - Spatial	3	
			Magnitude - Temporal	3			Magnitude - Temporal	3	
			Probability	4			Probability	3	
Surface infrastructure associated with opencast mining	Habitat Quality	Alteration of drainage resulting in modification of hydrology, erosion and sedimentation	Significance	3	2,13	See Mitigation Measures below.	Significance	3	1,07
			Magnitude - Spatial	2			Magnitude - Spatial	2	
			Magnitude - Temporal	3			Magnitude - Temporal	3	
			Probability	4			Probability	2	
Opencast mining	Habitat Quality	Topography alteration and loss of catchment	Significance	3	2.40	See Mitigation Measures below.	Significance	3	1,60
			Magnitude - Spatial	2			Magnitude - Spatial	2	
			Magnitude - Temporal	4			Magnitude - Temporal	3	
			Probability	4			Probability	3	

Table 43: Impact Assessment for the Riverine Ecology – Operation Phase

Activity	Aspect Affected	Potential Impact	Pre-Mitigation	Score	Rating	Mitigation	Post-Mitigation	Score	Rating
Surface infrastructure associated with opencast mining	Water Quality	Increased dissolved solids, increased dissolved metals, alteration of pH, increased suspended solids	Significance	4	2,93	See Mitigation Measures below.	Significance	4	1.47
			Magnitude - Spatial	3			Magnitude - Spatial	3	
			Magnitude - Temporal	4			Magnitude - Temporal	4	
			Probability	4			Probability	2	
Surface infrastructure associated with opencast mining	Habitat Quality	Alteration of drainage resulting in modification of hydrology, erosion and sedimentation	Significance	3	2,40	See Mitigation Measures below.	Significance	3	1,20
			Magnitude - Spatial	2			Magnitude - Spatial	2	
			Magnitude - Temporal	4			Magnitude - Temporal	4	
			Probability	4			Probability	2	
Opencast mining	Habitat Quality	Topography alteration and loss of catchment	Significance	3	2.13	See Mitigation Measures below.	Significance	3	1.60
			Magnitude - Spatial	2			Magnitude - Spatial	2	
			Magnitude - Temporal	3			Magnitude - Temporal	3	
			Probability	4			Probability	3	
Water Discharge	Habitat Quality	Habitat inundation as a result of additional water volumes	Significance	1	0.80	See Mitigation Measures below.	Significance	1	0.80
			Magnitude - Spatial	1			Magnitude - Spatial	1	
			Magnitude - Temporal	1			Magnitude - Temporal	1	
			Probability	4			Probability	4	
Water Discharge	Water Quality	Reduced salinity	Significance	1	0.40	See Mitigation Measures below.	Significance	1	0.40
			Magnitude - Spatial	1			Magnitude - Spatial	1	
			Magnitude - Temporal	1			Magnitude - Temporal	1	
			Probability	2			Probability	2	

Table 44 Impact Assessment for the Riverine Ecology – Closure Phase

Activity	Aspect Affected	Potential Impact	Pre-Mitigation	Score	Rating	Mitigation	Post-Mitigation	Score	Rating
Surface infrastructure associated with opencast mining	Water Quality	Increased dissolved solids, increased dissolved metals, alteration of pH, increased suspended solids	Significance	5	3,73	See Mitigation Measures below.	Significance	3	0,73
			Magnitude - Spatial	4			Magnitude - Spatial	3	
			Magnitude - Temporal	5			Magnitude - Temporal	5	
			Probability	4			Probability	1	

Table 45: Cumulative Impact Assessment

Activity	Aspect Affected	Potential Impact	Pre-Mitigation	Score	Rating	Mitigation	Post-Mitigation	Score	Rating
Surface infrastructure associated with opencast mining	Water Quality	Increased dissolved solids, increased dissolved metals, alteration of pH, increased suspended solids	Significance	2	2,67	See Mitigation Measures below.	Significance	2	2,67
			Magnitude - Spatial	3			Magnitude - Spatial	3	
			Magnitude - Temporal	5			Magnitude - Temporal	5	
			Probability	4			Probability	4	

9.4.5 Cumulative Impact

The results of the cumulative impact assessment are provided in Table 45. This impact assessment has considered the baseline conditions established in this study. The cumulative impact assessment has considered the established PES of this study. The impact of the proposed project on a cumulative scale was completed with the assumption that the proposed mitigation measures are successfully implemented.

The cumulative impact to the local aquatic ecology prior to the project go-ahead was rated as high. The impact after the go-ahead will remain high due to baseline catchment wide modifications. Despite the go-ahead of the proposed project, it is unlikely that catchment wide modification will cease and therefore a high rating after the project go-ahead was derived.

An important consideration for cumulative regional scale impacts includes the assessment of the salt loading potential of the potential Acid Mine Drainage should it enter into the Olifants Water Management Area. It is likely that salt loads in the watercourses will be altered should this occur. This modification will have an influence on the management decisions for water resource objectives. The defined Resource Quality Objectives for the considered river reach are presented below (Table 46).

Table 46: Resource Quality Objectives for the Relevant River Reach (Government Notice 619 -2015)

Integrated Unit of Analysis	RQO	Numerical Limits
1. Upper Olifants River catchment	Instream habitat must be a largely modified or better condition to support the ecosystem. Instream biota must be in a largely modified or better condition. Low and high flows must be suitable to maintain the river habitat for the ecosystem condition or ecotourism. The nutrient concentrations must be improved to an prevent nuisance conditions for ecotourism The salt concentrations must be maintained at levels where they do not render the ecosystem unsustainable.	Instream IHIA ≥ D (≥42); Fish ecological category ≥ D (42); Macroinvertebrate category ≥ D (≥42) Instream Ecostatus category ≥ D (≥42)

9.4.6 Mitigation Actions

The mitigation actions provided below are important to consider with other specialist assessment which include but are not limited to the following specialist studies: Groundwater, Surface Water and Wetlands. These mitigation measures should be implemented in the Environmental Management Programme (EMPr) should the project go-ahead. The mitigation hierarchy proposed by Macfarlane *et al*., (2016) was considered for this study.

The establishment of a clearly marked buffer zone from the delineated riparian area where no authorisation has been granted to actively mine, which is defined as a region of natural vegetation between the rivers/wetlands and the proposed activity, is the primary management action that should take place. Literature suggests that a buffer zone can reduce aquatic habitat and water quality impacts of large developments, making this management action of particular importance (WRC, 2014). According to WRC (2014) the efficacy of a buffer is related to the distance between the river system and the zone of disturbance. Therefore, by increasing the length of a buffer, the potential aquatic modification related to the proposed activity is reduced.

The delineated river systems were designated a buffer zone of 100m based on the existing GN704 regulations (Government Notice No. 704 of the National Water Act – Regulations on the Use of Water for Mining and Related Activities Aimed at the Protection of Water Resource. The designated buffer zones should then be visibly demarcated.

During the various phases of the proposed project, waste generated and stored can result in the runoff and seepage of contaminated water from the various activities which can cause degradation of the aquatic ecosystems PES. In order to prevent this, the compilation of a stormwater management plan is advised, this would typically form a component of the surface water assessment.

The construction of linear infrastructure such as roadways and haul roads must consider the following mitigation actions when encountering drainage lines and watercourses:

- Structures must not be damaged by floods exceeding the magnitude of those which may occur on average once in every 50 years;
- The indiscriminate use of heavy vehicles and machinery within the instream and riparian habitat will result in the compaction of soils and vegetation and must be controlled;
- Erosion prevention mechanisms such as gabions must be employed to ensure the sustainability of all structures to prevent instream sedimentation;
- The crossing points should be unobtrusive (outside riparian and instream habitat) to prevent the obstruction and subsequent habitat modification of downstream portions;
- Diversion trenches and berms should convey dirty water to temporary ditches so as to contain runoff;
- Soils adjacent to the river that have been compacted must be loosened to allow for germination; and
- Stockpiling of removed soil and sand must be done outside the 1:100 floodline or delineated riparian habitat (whichever is greater). This will prevent solids from washing into the river.

The removal of vegetative cover has been recognised as being responsible for increased runoff, sedimentation and subsequent water and habitat quality degradation in downstream portions of river systems (WRC, 2014). As such the careful management of vegetation removal and sedimentation control should take place. This can be achieved through the brief points below:

- Minimise the removal of vegetation in the infrastructure footprint area;
- Re-vegetation of denuded areas as soon as possible;
- Where storm water enters river systems, sediment/silt and debris trapping, as well as energy dissipation control measures must be put in place;
- Storm water must be diverted from construction activities and managed in such a manner to disperse runoff and prevent the concentration of storm water flow; and
- Sequential removal of the vegetation (not all vegetation immediately).

During the operational phase of the proposed project, the storage and handling of carboniferous material can result in the degradation of downstream aquatic ecosystems. In order to prevent this, the use of diversion and containment management is of importance. This can be achieved through effective groundwater and surface water management as per the surface and groundwater studies; however important management actions are briefly listed below:

- Diversion trench and berm systems which diverts clean storm water around pollution sources and convey and contain dirty water in appropriate dirty water management systems;
- Barrier systems, including synthetic, clay and geological or other approved mitigation methods to minimise contaminated seepage and runoff from stockpiles from entering the local aquatic systems;
- Where storm water enters river systems from disturbed sites, sediment and debris trapping, as well as energy dissipation control measures must be put in place; and

The discharge of treated water during the operational phase will have negligible impacts to local riverine ecology. The impact determined in the water quality component of the impact assessment was derived to be a local positive impact through the reduction of salinities. It is however recommended that the quality of the treated water discharge is monitored on a weekly basis.

As described in the potential impacts of this proposed project, there is potential for Acid Mine Drainage to develop as a result of mining activities. The only mitigation possible for potential mine water decant is the use of passive or active water treatment. This is therefore recommended, should it be required.

9.4.7 Monitoring Programme

Based on the outcomes of this study, the further actions are recommended. The monitoring programme proposed is presented in Table 47.

- Stormwater Management Plan; and
- Bi-annual Aquatic Biomonitoring as per the programmes already completed.

Table 47: Riverine Environmental Monitoring Programme

Location	Monitoring objectives	Frequency of monitoring	Parameters to be monitored
Current sites used in the existing biomonitoring programme.	Overall PES	Bi-annual	Standard River Ecosystem Monitoring Programme (Ecostatus) methods
Current sites used in the existing biomonitoring programme.	Determine if water quality deterioration is occurring.	Bi-annual	SASS5 scores should not decrease as and be related to mining activities.
Site used in this study and the surface water assessment.	Determine if water quality deterioration is occurring.	Monthly	Standard water quality monitoring, as per the surface water specialist report.

Location	Monitoring objectives	Frequency of monitoring	Parameters to be monitored
Current sites used in the existing biomonitoring programme.	Determine if water/habitat quality deterioration is occurring.	Bi-annual	Monitor for presence of fish.
Treated Water Discharge	Determine quality of discharge water	Weekly	Standard Chemical water quality in line with the surface water report.

10 Specialist Opinion

A reasoned opinion as to whether the proposed project should be authorised and if the proposed project should be authorised, any avoidance, management and mitigation measures that should be included in the EMPr, and where applicable, the closure plan.

Based on the findings of this assessment, the majority of the overall area was prescribed a low sensitivity due to the extent of current and previous mining activities and associated disturbances. A number of high sensitivity areas were identified within the project area, these areas are wetlands and/or are areas considered to have a high biodiversity value or where meaningful numbers of SCC where recorded. The most significant high sensitivity area occurs across the central part of the project area and intersects with many of the proposed infrastructure development areas. Authorisation to mine this area was however granted in 2007.

In terms of aquatic ecology, no direct impacts to riverine ecology from the proposed project are anticipated. The most significant potential impact arising from the project can be attributed to the potential decant of acid mine drainage during the closure phase. Following the completion of the impact assessment, no significant fatal flaws could be identified through the completion of this study.

11 Recommendations

These recommendations may supplement the prescribed mitigation measures, but these recommendations must be investigated prior to the issuing of environmental authorisation. These recommendations must be investigated for the feasibility to realistically achieve what is intended for this project. The following recommendations are applicable for this project:

1. Owing to the fact that wetland areas will be lost due to the placement of infrastructure within these systems, no buffer width has been formally determined for this project. However, despite this, a 100m buffer width is recommended for all remaining wetland and riparian areas and all non-essential structures and activities may not be permitted within these areas.
2. Due to the expect loss of wetland areas resulting from the placement of the proposed infrastructure, implementation of the wetland offset (mitigation) strategy is required. It is recommended that the wetland offset strategy compiled for the approval of the DMO project be implemented.
3. It is recommended that environmental authorisation for the project only be considered on the acceptance of a rehabilitation plan.

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