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ENVIRONMENTAL

Environmental Impact Assessment for Sibanye Gold Limited's West Rand Tailings Retreatment Project

Flora and Fauna Report

Project Number:

GOL2376

Prepared for:

Sibanye Gold Limited

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I, Rudi Greffrath as duly authorised representative of Digby Wells and Associates (South Africa) (Pty) Ltd., hereby confirm my independence (as well as that of Digby Wells and Associates (South Africa) (Pty) Ltd.) and declare that neither I nor Digby Wells and Associates (South Africa) (Pty) Ltd. have any interest, be it business, financial, personal or other, in any proposed activity, application or appeal in respect of Sibanye Gold Limited, other than fair remuneration for work performed, specifically in connection with the proposed West Rand Tailings Retreatment Project, Gauteng Province.

This is undertaken under oath with respect to:

- the correctness of the information provided in the report;
- the inclusion of comments and inputs from stakeholders and I&APs;
- the inclusion of inputs and recommendations from other specialist reports, where
- relevant; and
- any information provided by the EAP to interested and affected parties and any responses by the EAP to comments or inputs made by interested or affected parties

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EXECUTIVE SUMMARY

Introduction

Digby Wells Environmental (Digby Wells) has been appointed by Sibanye Gold Limited (SGL) as the independent Environmental Assessment Practitioner (EAP) to conduct the Environmental Impact Assessment (EIA) according to the National Environmental Management Act, 1998 (Act 107 of 1998) (NEMA), as well as associated specialist studies for the SGL West Rand tailings retreatment project. This report details the fauna and flora component of the EIA process.

SGL's TSF holdings in the West Rand contain a number of historical TSFs, these will be reclaimed in a phased approach. The tailings material will be centrally treated in a Central Processing Plant (CPP), and deposited on the newly constructed Regional Tailings Storage Facility (RTSF).

The activities proposed to occur as part of this project is specifically the construction of new pipelines from the various TSF's to the CPP, and after treatment the newly arising tailings will be deposited on the RTSF. In addition various ancillary activities will also take place, including construction of roads, substations and power lines.

Methodology

A literature review and desktop study (Screening Study) were completed to determine the expected species composition or baseline conditions of the study area (all four MRA), before field work was conducted. Vegetation was then sampled with stratified random sampling and the use of the Braun-Blanquet assessment to define vegetation communities which were then mapped. In addition, a species list was compiled listing all species recorded in the field survey with particular emphasis on dominant species, alien invasive species and Species of Special Concern (SSC).

The study area (all four MRA's) was traversed by foot during two seasonal site visits, noting the presence of animals on site or evidence of animal activity such as pellets, spoor, nests, burrows and droppings. Suitable microhabitats, such as reed beds and rocky outcrops, were investigated. Visual sightings and ecological indications were used to identify the larger mammal inhabitants of the study area; this includes scats, tracks and habitat such as burrows and dens. Scats found were collected (if required), photographed with a scale along with any tracks observed and identified

Sensitivity of the study site was determined based on available information on both National and Provincial level. In addition to the field survey, an assessment of the biodiversity value was also undertaken, which informed the greater sensitivity mapping.

Study area

The project area is located in the Grassland Biome of South Africa. The study area is situated within an area vegetated by the Carletonville Dolomite Grassland, Gauteng Shale Mountain Bushveld, Rand Highveld Grassland and Soweto Highveld Grassland vegetation types according to Mucina & Rutherford 2006.

The study site can be divided into four main vegetation units: Grassland which include three variations, Wetland/Riparian areas, Disturbed areas which include alien plants and agricultural fields and Rocky outcrops/Ridges. The study area includes agricultural fields consisting of maize, buildings including farm houses and worker accommodation, alien invasive tree areas and roads. The study site is currently being used predominantly for commercial farming and gold mining.

A total of 204 plant species were recorded whilst walking all of the pipelines and infrastructure placement sites, over four site visits completed over two seasons. Of these, two are regarded as Species of Special Concern (SSC). Sixty invasive or alien species were recorded and categorised according to the Alien and Invasive Species Lists, 2014 (GN R599 in *GG* 37886 of 1 August 2014) of the NEMBA (Act 10 of 2004). Ten mammal species were recorded from the site, none are protected. 37 bird species were recorded, none of which are protected, one reptile and six amphibians were recorded, of which none are protected.

Sensitivity

Wetlands constitute High Sensitivity areas due to their role as process and habitat areas within the ecosystem. In addition, high sensitivity is given to areas designated as Threatened landscape features such as ridges, and those areas that were pristine or close to pristine with low or no anthropogenic impacts. Areas occurring within Highly Significant areas according to the C-Plan (2013) unless heavily degraded are also assigned a High Sensitivity.

Areas of medium sensitivity include those natural areas with some anthropogenic change or degradation, with high numbers of SSC and moderate rocky slopes.

Low sensitivity was assigned to areas completely transformed or heavily degraded, on relatively flat ground. The study area was found to be in different states of sensitivity, with the riparian and grassland areas designated as high and medium high respectively and alien trees being low sensitivity.

- Driefontein MRA: High sensitivity 13.8 ha /Medium sensitivity 65.3 ha
- Kloof MRA: High sensitivity 12.6 ha /Medium sensitivity 345 ha
- Ezulwini MRA: High sensitivity 9 ha /Medium sensitivity 17 ha
- Cooke MRA: High sensitivity 1.4 ha /Medium sensitivity 16 ha

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1 Introduction

Biodiversity is defined, according the National Environmental Management Biodiversity Act No. 10 of 2004 (NEMBA), as "*the variability among living organisms from all sources including, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part and also includes diversity within species, between species, and of ecosystems*". The NEMBA legislation upholds the country's commitment to the protection of South Africa's biological resources and it is imperative that development takes place in a sustainable way to achieve this.

Although 5.4% of South Africa's land surface area is currently formally conserved through the system of national and provincial protected areas, the protected area network is skewed towards certain biomes such as Grassland, in which the area of interest is located, leaving biomes such as Savanna and Succulent Karoo under-conserved (DEAT, 2005). Many of these under-conserved areas overlap with areas of high population density, high agricultural potential, mineral deposits and scenic beauty important for tourism. This can lead to conflict regarding decisions over land use allocations, for example, should land be used for mining or agricultural purposes. For this reason extensive consultation regarding land use changes is required, and areas considered irreplaceable for biodiversity conservation and important for ecosystem services, need to be set aside.

The faunal component of the Grassland biome is usually related directly to the vegetation types, which are in turn related to the soil types. Nutrient rich and nutrient poor soils produce different vegetation types, which support selective grazers and browsers. The remaining grasslands of Gauteng are mainly divided into commercial farms, which limit faunal movement and reduce the function of the ecosystem. Farms are commonly used for cultivation and livestock. As most of these farms are not managed for maintaining ecosystem function, but rather for maximum agricultural production, it is likely that the majority of the area is a modified ecosystem.

In many areas, especially in terrestrial ecosystems, it is not the direct use of biological resources that is threatening their sustainability, but rather indirect pressures such as changing land use and associated clearing of natural vegetation and habitat fragmentation.

The focus of this study is to inform environmental management decisions on site. For this to be accomplished, the primary objective of this investigation is to characterise the flora and fauna present and to investigate the potential impacts of the proposed project on the vegetation and animal life in the study area and thereafter to provide reasonable and achievable mitigations to either reduce or eliminate impacts. It is also necessary to suggest management measures that will mitigate the effects that construction and operation will have on the area, thereby striving for the attainment of the National Biodiversity Strategy goal. This report details field work findings of the Sibanye Gold Limited (SGL) tailings retreatment project study area, as well as an in depth description of the study area and expected impacts

1.1 Project Overview

There is a long history of gold and uranium mining in the broader West Rand area with an estimated 1.3 billion tonnes of tailings, containing in excess of 170 million pounds of uranium and 11 million ounces of gold. SGL currently owns the majority of the tonnage and its gold and uranium content. SGL plans to ultimately exploit all these resources to develop a strong, long life and high yield surface business. Key to the successful execution of this development strategy is the West Rand Tailings Retreatment Project (WRTRP). The concept of the WRTRP is well understood with an 8 year history of extensive metallurgical test work, feasibility studies and design by a number of major mining houses. A pre-feasibility study (PFS) completed during 2013 for the WRTRP has confirmed that there is a significant opportunity to extract value from the SGL surface resources in a cost effective sequence.

The ultimate WRTRP involves the construction of a large-scale Central Processing Plant (CPP) for the recovery of gold, uranium and sulfur from the available resources. The CPP, centrally located to the West Rand resources, will be developed in phases to eventually treat up to 4mt/month of tailings inclusive of current arisings. The resultant tailings will be deposited on a modern tailings storage facility (TSF) called the regional TSF (RTSF).

1.2 The Ultimate Project

Simplistically, SGL's historical TSF holdings in the West Rand can be divided into three blocks; the Northern, Southern and Western Blocks. Each of these blocks contains a number of historical TSFs. Each of the blocks will be reclaimed in a phased approach. Initially the Driefontein 3 TSF (Western Block) together with the Cooke TSF (Northern Block) will be reclaimed first. Following reclamation of Driefontein 3 TSF, Driefontein 5 TSF (Western Block) and Cooke 4 Dam south (C4S) (Southern Block) will be reclaimed.

- Western Block comprises: Driefontein 1, 2, 3, 4 and 5 TSF, and Libanon TSF. Once the Driefontein 3 and 5 TSFs have been depleted the remainder of the Driefontein TSFs, namely Driefontein 1, 2 and 4 and the Libanon TSF, will be processed through the CPP;
- Northern Block comprises: Cooke TSF, Venterspost North TSF, Venterspost South TSF and Millsite Complex (38, 39 and 40/41 and Valley). Venterspost North and South TSFs and Millsite Complex (38, 39 and 40/41 and Valley) will be processed with the concurrent construction of Module 2 float and gold plants; and
- Southern Block comprises: Kloof 1 TSF, Kloof 2 TSF, South Shaft TSF (future), Twin Shaft TSF (future), Leeudoorn TSF and C4S TSF. Following completion of the Module 3 float and gold plants, Kloof 1 and 2 TSFs, South Shaft TSF (future), Twin Shaft TSF (future) and Leeudoorn TSF will be reclaimed.

Once commissioned the project will initially reclaim and treat the TSFs at a rate of 1.5 Mt/m (1Mt/m from Driefontein 3 TSF (followed sequentially by Driefontein 5 and C4S TSFs) and 0.5 Mt/m from Cooke TSF). Reclamation and processing capacity will ultimately ramp up to 4

Mt/m over an anticipated period of 8 years. At the 4Mt/m tailings retreatment capacity, each of the blocks will be reclaimed and processed simultaneously.

The tailings material will be centrally treated in a CPP. In addition to gold and uranium extraction, sulfur will be extracted to produce sulphuric acid, an important reagent required for uranium leaching.

To minimise the upfront capital required for the WRTRP, only essential infrastructure will be developed during initial implementation. Use of existing and available infrastructure may be used to process gold and uranium until the volumetric increase in tonnage necessitates the need to expand the CPP.

The authorisation, construction and operation of a new deposition site for the residue from the CPP will be located in an area that has been extensively studied as part of the original West Wits Project (WWP) and Cooke Uranium Project (CUP). The “deposition area” on which the project is focussing, has been termed the RTSF and is anticipated to accommodate the entire tonnage from the district. The RTSF if proved viable will be one large facility as opposed to the two independent deposition facilities proposed by the WWP and CUP respectively.

Note: Amendments to various MWPs and EMPs will be applied for in due course pending the inclusion of additional TSFs as the WRTRP grows to process 4 Mt/m. The RTSF will be assessed for the complete footprint to ensure that the site is suitable for all future deposition requirements.

1.3 Initial Implementation

Due to capital constraints in developing a project of this magnitude, it needs to be implemented over time. The initial investment and development will be focused on those assets that will put the project in a position to partially fund the remaining development.

This entails the design and construction of the CPP (gold module, floatation plant, uranium plant, acid plant and a roaster), to retreat up to 1.5 Mt/m from the Driefontein 3 and 5 TSFs, C4S TSF and the Cooke TSF. Driefontein 3, 5 and C4S TSFs will be mined sequentially over 11 years, whilst the Cooke TSF will be mined concurrent to these for a period of 16 years. The resultant tailings will be deposited onto the new RTSF.

A high grade uranium concentrate, produced at the CPP, will be transported to Ezulwini (50k tonnes per month) for the extraction of uranium and gold. The tailings from this process will be deposited on the existing operational Ezulwini North TSF.

1.4 Terms of Reference

The agreed Terms of Reference (ToR) include a gap analysis a desktop review, field investigation and report compilation. The methodologies employed are discussed in Section 4.

An initial Gap Analysis was conducted, this report followed the review and study of various documents, reports and previous studies for the existing operation and which will form part of the proposed WRTRP and details what needs to be done to complete the various studies and applications successfully to ensure the successful execution of the project.

The Gap Analysis required a desktop review and analysis of relevant information and data provided. No field investigations was undertaken at this stage of the project. Documentation received was grouped according to various existing and proposed projects initiated by Gold One/Sibanye, Gold Fields and Rand Uranium respectively. These projects include the following:

- Central Treatment Plant (CTP);
- Historical Tailings Operation (HTO): Tailings Storage Facility (TSF);
- Cooke Uranium Project;
- Cooke Optimisation Project;
- Geluksdal Tailings Storage Facility;
- The West Wits Project, Kloof, Driefontein and South Deep; and
- Millsite Tailings Storage Facility.

From the results of the Gap Analysis, a scope of work was designed for the project; this included a screening assessment and impact assessment. During the screening assessment the baseline conditions of the project area was determined, which informed the planning of the impact assessment. The impact assessment that followed was conducted to determine the impacts of the project activities, and included mitigation measures.

2 Details of the Specialist

Rudi Greffrath, a senior fauna and flora specialist and Unit Manager of the fauna, flora and wetlands unit, achieved a Bachelor of Technology degree in Biodiversity Conservation at the Nelson Mandela Metropolitan University and is an environmental consultant specialising in both terrestrial ecology and environmental management. He is SACNASP affiliated in Ecological Science, Reg no. 200245/13. Experience includes biodiversity assessments, ecology field work such as flora and fauna surveys, Biodiversity Action Plans, species relocation and environmental rehabilitation of mined or impacted land. Furthermore, experience has been acquired in environmental Rehabilitation Monitoring, Rehabilitation Action Plans, Environmental Impact Assessment (EIA) and Environmental Management Plans (EMP). Project experience includes various countries such as Botswana, Sierra Leone, Mali, Mozambique, Ghana, Democratic Republic of the Congo, Namibia and throughout South Africa including the Mpumalanga, Limpopo, Gauteng, North West, Kwazulu Natal, Free State, Northern Southern and Western Cape.

A curriculum vitae is included in Appendix A.

Phil Patton (Pr.Sci.Nat.) is a High Conservation Value (HCV) accredited assessor in Ornithology and is the Manager of the Biophysical Department at Digby Wells. He holds a B.Sc Hons (EGS) from the University of Cape Town, and a B.Sc (Geology and Geography & Environmental Management) from the University of Port Elizabeth. He is an experienced Ornithologist, having recently completed major avifaunal surveys in Southern Africa and previously not surveyed areas in the Democratic Republic of Congo. Phil has been registered as a Professional Natural Scientist since 2012 and has over 17 years of consulting experience in ecological assessments and environmental auditing within the mining, and other similar industries. He has ornithological working experience across Africa, Europe and the Middle East.

Crystal Rowe (Pr. Sci. Nat.), flora specialist, achieved a Bachelor of Science and Honours in Botany at Nelson Mandela Metropolitan University (NMMU) and is an environmental consultant specialising in vegetation and wetland assessments. Experience includes ecological impact assessments, baseline vegetation assessments, estuarine ecological state assessments and wetland health assessments. Project experience includes various countries such as the Democratic Republic of Congo (DRC), Ethiopia, the Ivory Coast, Mali, Mozambique, Sierra Leone and extensively within South Africa.

Danie Otto (Pr. Sci. Nat) is a Director and Manager of the Natural Sciences Division at Digby Wells. The division includes water, air quality, rehabilitation, fauna & flora, aquatics, wetlands and soil. He holds an M.Sc in Environmental Management with B.Sc Hons (Limnology, Geomorphology, GIS and Environmental Management) and B.Sc (Botany and Geography & Environmental Management). He is a registered Professional Natural Scientist since 2002. Danie has 20 years of consulting experience within the mining industry undertaking environmental assessments and compiling Environmental, Water & Waste Management Plans. He has wetland and geomorphology working experience across Africa including specialist environmental input into various water resource related studies. These vary from studies of swamp forests in central Africa to alpine systems in Lesotho.

3 Aims and Objectives

This specialist study serves to undertake a basic ecological assessment of the local flora and fauna communities associated with the three Sibanye clusters, together referred to as the study areas, to determine the current state of these components. This study follows on the recommendations and results of the screening study conducted prior to the impact assessment. The screening assessment was completed for the areas associated with the ultimate project area to highlight any potential fatal flaws and significant impacts that may be realised by the full intent of the ultimate project. The study thereafter aimed to, in detail, assess the fauna and flora associated with the initial implementation of the project. Information generated from this survey has been used to address the impacts that the construction and operational activities of various pipelines, the CPP and the RTSF will have on this environment. To achieve this aim, the following objectives were considered:

- To delineate the various vegetation/habitat types present within the study areas and to describe their sensitivity;
- To determine if any flora and fauna species or assemblages will be directly impacted upon by the proposed pipelines and reclamation activities and their associated infrastructure, this includes flora and fauna communities present, the state of these communities, identification of possible Red Data species according to the IUCN, National and Provincial criteria; and
- To undertake an assessment of the impacts associated with various activities on the health of the flora and fauna species or assemblages and to recommend measures that should be included in the EMP to prevent or limit impacts to flora and fauna species or assemblages.

3.1 Legislation and Frameworks

The legislation applicable to this project is listed in Table 3-1.

Table 3-1: Legislation referenced and consulted in the development of this assessment

LEGISLATION	DESCRIPTION
International frameworks and best practice guidelines	Convention on Biological Diversity (Rio de Janeiro, 1992).
	United Nations Convention to Combat Desertification.
	The Bonn Convention on the Conservation of Migratory Species of Wild Animals.
	The International Union for the Conservation of Nature (IUCN).
National legislation and frameworks	The National Environmental Management Biodiversity Act (NEMBA) (Act No. 10 of 2004) affords threatened or protected species a legal status and protection.
	National Spatial Biodiversity Assessment: site specific findings.
	Additionally wetlands are protected under various Acts including the National Environmental Management Act, 1998 (Act No. 107 of 1998), National Water Act, 1998 (Act No. 36 of 1998), and the Conservation of Agricultural Resources Act, 1983 (Act No. 43 of 1983).
Provincial and municipal legislation and frameworks	Gauteng Department of Agriculture, Conservation and Environment (GDACE requirements, 2004).
	Gauteng Department of Agriculture and Rural Development (GDARD) Minimum Requirements for Biodiversity Assessments.
	Gauteng Conservation Plan 3.3

4 Methodology

4.1 Gap Analysis

Gaps identified were summarised according to the blocks in which the entire operation is divided into.

Northern and Southern blocks are only expected to be disturbed from a pipeline point of view, therefore fauna and flora studies for the pipeline routes are suggested.

The Western Block has relevant, yet outdated information covering the area, a fauna and flora sweep survey (abbreviated Fauna and Flora survey) is suggested here to verify and confirm the findings of the 2009 NSS report.

Phase 2 CTSF location: This area (Doornpoort, Doornpoort extension and B2/B3) also has relevant but outdated information available, the West Wits Ecology report, by Anthene ecological, covered the areas extensively. A fauna and flora sweep survey is suggested here to verify and confirm the findings of the 2009 Anthene report.

4.2 Screening Assessment

Methodology is described for this scoping level specialist study.

4.2.1 Literature Review and Desktop Assessment

The desktop review required compiling relevant information for the greater study area from reliable and recognised resources, including historical studies. Furthermore, this included the consulting of relevant national and international legislation and best practice approaches as well as the most recent aerial imagery. The desktop review considered the following:

- Potential species in the site area according to the South African National Biodiversity Institute (SANBI) and the South African Bird Atlas Project (SABAP2);
- Potential Red Data species and their current status;
- Expected vegetation type and community structure (Mucina and Rutherford 2006); and
- Current Biodiversity and Ecosystem Status.

As mentioned earlier previous studies that were considered for the literature review include:

- West Rand Gold Operation (WERGO) Witfontein Tailings Disposal Facility Ecological report;
- West Rand Gold Operation (WERGO) Witfontein Tailings Disposal Facility: Specialist Report on Localities of *Loudetia Simplex* veld outside the proposed footprint of Witfontein tailings disposal facility;
- West Rand Gold Operation (WERGO) Witfontein Tailings Disposal Facility: Appendix F Confirmation of *Khadia Beswickii*;

- Biodiversity assessment for Driefontein Gold Mine, Gold fields;
- Gold Fields West Wits Project: Ecology, Fauna and Flora report and
- Kloof Mine Environmental Management Program.

4.3 Field Investigation

Field investigations took place in summer (February 2015) and winter (July 2015) for:

- Western Block comprising: Driefontein 1, 2, 3, 4 and 5 TSF, and Libanon TSF;
- Northern Block comprises: Cooke TSF, Venterspost North TSF, Venterspost South TSF and Millsite Complex (38, 39 and 40/41 and Valley); and
- Southern Block comprises: Kloof No.1 TSF, Kloof No.2 TSF, South Shaft TSF (future), Twin Shaft TSF (future), Leeudoorn TSF and C4S TSF.

The agreed upon ToR for the field work component of the study were to include:

- Characterisation of vegetation in the study area in conjunction with an in-depth study including plant species lists, Species of Special Concern (SSC) and their locations, declared alien or invasive species present and areas of sensitivity. In addition, all species of ethnobotanical (medicinal or cultural use) importance were recorded;
- A thorough faunal investigation, including the identification of habitats, recording of evidence of faunal activity, live-trapping, opportunistic observations, setting of motion-sensitive cameras and random transects, was undertaken.
- Any SSC were recorded, and areas of sensitivity based on ecological function and SSC were identified. To delineate the various vegetation/habitat types and describe their sensitivity, present within the study area;
- To determine if any flora and fauna species or assemblages will be directly impacted upon by the proposed mining activities and its associated infrastructure, this includes flora and fauna communities present, the ecological state of these communities, identification of possible Red Data species (according to the International Union for the Conservation of Nature (IUCN)) as well as considering National and Provincial criteria, and;
- To determine mitigation measures for the identified impacts to reduce the severity of these impacts. In cases where impacts cannot be mitigated, areas may be regarded as ‘no-go’ owing to the presence of Species of Special Concern (SSC) or critical habitat.

4.3.1 Report Compilation

- Delineation of vegetation habitats on site and a description of the structure and condition of these habitats;
- Review of relevant legislation applicable to the study; and
- Explanation of the methodologies used.
- Results of the study including:

- A description of faunal diversity on site as well as their connection to the vegetation habitats identified.
- Listing of all SSC and their applicable national and international statuses.

- A sensitivity assessment of habitats identified;
- Maps throughout the report showing significant features of the study area; and
- An Impact Assessment (IA) where all impacts of the construction and operation of the proposed mine on the flora and fauna on site are discussed. This includes the impacts on the presence of certain important species as well as the impacts on habitat diversity. The influence on the ecosystems in the area and their interactions are assessed and discussed.

4.3.2 Literature Review and Desktop Study

A desktop study was undertaken, aiming to identify:

- Potential species in the site area according to the South African National Biodiversity Institute (SANBI);
- Potential Red Data species and their current status;
- Expected vegetation type and community structure, (Mucina and Rutherford 2006); and
- Current Biodiversity and Ecosystem Status.

Previous studies that were used to inform the Impact assessment are:

- West Rand Gold Operation (WERGO) Witfontein Tailings Disposal Facility Ecological report;
- West Rand Gold Operation (WERGO) Witfontein Tailings Disposal Facility: Specialist Report on Localities of *Loudetia Simplex* veld outside the proposed footprint of witfontein tailings disposal facility;
- West Rand Gold Operation (WERGO) Witfontein Tailings Disposal Facility: Appendix F Confirmation of *Khadia Beswickii*;
- Biodiversity assessment for Driefontein Gold Mine, Gold fields;
- Gold Fields West Wits Project: Ecology, Fauna and Flora report;
- Kloof Mine Environmental Management Program.

4.3.3 Vegetation Communities

Vegetation communities were broadly defined based on satellite imagery.

4.3.4 Species List

The species list was compiled from both the description of the vegetation type of the study area supplied by Mucina and Rutherford (2006) as well as the SANBI PRECIS (National Herbarium **Pre**toria (**PRE**) **C**omputerised **I**nformation **S**ystem) list.

Lists of expected faunal species were drawn up from several different sources and the IUCN Red Data species likely to be found on site determined. Lists were drawn up for mammals, birds, reptiles, amphibians and invertebrates. The full list of expected species can be found in the appendices.

4.3.5 Species of Special Concern

From the overall species list, a list of SSC can be drawn up. In order to be fully comprehensive, this list includes plants on each of the following lists:

- International Union for the Conservation of Nature (IUCN) red data list,
- The South African National Biodiversity Institute (SANBI) red data list,
- The South African Red Data lists for mammals, birds, butterflies,
- The National Forests Act (Act No. 84 of 1998) Protected Trees,
- The National Environmental Biodiversity Act (NEMBA), 2004 (Act 10 of 2004), and
- The Convention on International Trade In Endangered Species of Flora and Fauna (CITES) list.

An initial list of Species of Special Concern (SSC) expected to be found within the study area comprises Possible Species of Special Concern (PSSC). If any of these (and any additional species on the above lists) are recorded on site, they are ascribed the status Confirmed Species of Special Concern (CSSC).

The South African Red Data list uses the same criteria as that defined by the IUCN. According to the IUCN all species are classified in nine groups, set through criteria such as rate of decline, population size, area of geographic distribution, and degree of population and distribution fragmentation (IUCN, 2010). The categories are described in Table 4-1 below.

Table 4-1: Red Data Categories (taken from SANBI 2012)

CATEGORY		DESCRIPTION
Extinct	(EX)	No known individuals remaining.
Extinct in the Wild	(EW)	Known only to survive in captivity.
Critically Endangered	(CR)	Extremely high risk of extinction in the wild.
Endangered	(EN)	High risk of extinction in the wild
Vulnerable	(VU)	High risk of endangerment in the wild.

CATEGORY		DESCRIPTION
Near Threatened	(NT)	Likely to become endangered in the near future.
Least Concern	(LC)	Lowest risk. Does not qualify for a more at risk category. Widespread and abundant taxa are included in this category.
Data Deficient	(DD)	Not enough data to make an assessment of its risk of extinction.
Not Evaluated	(NE)	Has not yet been evaluated against the criteria.
	Extinct	**Threatened species** are species that are facing a high risk of extinction. Any species classified in the IUCN categories **CR, EN** or **VU** is a threatened species. **Species of conservation concern** are species that have a high conservation importance in terms of preserving South Africa's high floristic diversity and include not only threatened species, but also those classified in the categories**, NT, LC** and **DD**
	Threatened	
	Other categories of conservation concern	
	Other categories	

The online IUCN data base was referenced in order to identify Red Data species and their various threat status categorizations.

4.4 Fieldwork and Seasonal Influence

In accordance with the minimum requirements for biodiversity assessments, as stipulated by the Gauteng Department of Agriculture and Rural Development (GDARD), two field surveys were completed to account for seasonal variation.

4.5 Vegetation Analysis

4.5.1 Sample Plots

As the sampling of the entire study area is not possible, representative samples of the vegetation were assessed. The vegetation was classified according to available aerial imagery as well as through an initial site inspection. The number of sample sites visited was determined by the time available for the study as well as the accessibility of each of the sample sites. Then, areas of each vegetation type classified before going to site were sampled randomly. This methodology allows for more efficient sampling than overall random sampling.

There is a method for determining the number of plots required for a statistically accurate sample for each vegetation type. The result is the sampling of as many plots as possible in each predetermined vegetation type. At each sample site, a plot size of 35m^2 was sampled. Each plot was described with topographical and environmental data recorded. In each plot; the species were identified in the field as far as possible. Plants that could not be identified in the field through the use of field guides, such as Pooley (1988) and Van Oudtshoorn (1999) were collected and photographed. These were identified later through the use of ispot

(www.ispot.org.za). The Braun-Blanquet method was used for the listing of species and their associated cover. The Braun-Blanquet method is the standard for phytosociological studies (plant description and mapping) in South Africa and is an internationally recognised method of surveying.

4.5.2 Vegetation Communities

Vegetation communities were defined using the data gathered from each sample plot. The presence of each of the different species in relation to environmental data defined several different vegetation types. Each of these vegetation types exhibits some diagnostic species.

4.5.3 Vegetation Mapping

Vegetation was mapped using the information gathered from the sample plots and resultant vegetation communities, as well as aerial imagery.

4.6 Flora

Through the sample plots, several aspects of the flora were identified. These included the Species list, list of Species of Special Concern, and the list of alien and invasive species.

4.6.1 Species List

The species list is compiled mainly from the data gathered from the sample plots. All species occurring in each of the sample plots were identified as far as possible, either during the site visit or afterwards from photographs. In addition, species seen within the study area, but not occurring within specific sample plots were also recorded. This allowed for the production of a species list representative of the entire study area.

4.6.2 Species of Special Concern

From the overall species list, a list of SSC can be drawn up. To be fully comprehensive, this list includes plants on each of the following lists:

- South African National Biodiversity Institute (SANBI) Red List of South African plants version 2012.1
- National Environmental Management Biodiversity Act, 2004 (Act No. 10 of 2004) (NEMBA) listed species;
- National Forests Act, 1998 (Act No. 84 of 1998) Protected Trees; and
- Gauteng Protected Plants.

An initial list of SSC expected to be found within the study area was compiled wich contained Possible Species of Special Concern (PSSC). If any of these (and any additional species on the above lists) are recorded on site, they are ascribed the status Confirmed Species of Special Concern (CSSC). It is likely that many of the PSSC do occur on site, but were not recorded in the two site visits.

The South African red data list uses the same criteria as that defined by the IUCN. According to the IUCN all species are classified in nine groups, set through criteria such as rate of decline, population size, area of geographic distribution, and degree of population and distribution fragmentation (IUCN, 2010). The categories are described in Table 4-2 below.

Table 4-2: Red Data Categories (IUCN, 2015)

Category		Description
Extinct	(EX)	No known individuals remaining.
Extinct in the Wild	(EW)	Known only to survive in captivity.
Critically Endangered	(CR)	Extremely high risk of extinction in the wild.
Endangered	(EN)	High risk of extinction in the wild
Vulnerable	(VU)	High risk of endangerment in the wild.
Near Threatened	(NT)	Likely to become endangered in the near future.
Least Concern	(LC)	Lowest risk. Does not qualify for a more at risk category. Widespread and abundant taxa are included in this category.
Data Deficient	(DD)	Not enough data to make an assessment of its risk of extinction.
Not Evaluated	(NE)	Has not yet been evaluated against the criteria.

The online IUCN data base was referenced to identify Red Data species and their various threat status categorizations.

4.6.3 Alien Invasive Species

Alien invasive species were recorded from each of the sample plots, as well as through opportunistic sightings throughout the study area. Alien invasive species are those that are classified by the Alien species in South Africa are categorised according to the Alien and Invasive Species Lists, 2014 (GN R599 in *GG* 37886 of 1 August 2014) of the NEMBA (Act 10 of 2004). Each of the categories defined by this Act has associated legislated control measures.

4.7 Fauna

A two season survey (winter and summer) was conducted for this project. A detailed desktop study was also conducted for mammals, birds, reptiles and frogs. All fauna species encountered on site were identified and recorded. The following methods were used during the survey:

4.7.1 Mammals

Visual sightings and ecological indications were used to identify the mammals of the study area; this includes scats, tracks and habitat such as burrows and dens. Scat found was collected (if required), photographed with a scale along with any tracks found and identified. For identification purposes the following field guides were used, Mammals of Southern Africa (Smithers, 1983), The Mammals of the Southern African Sub-region (Skinner & Chimimba, 2005), Red Data Book of the Mammals of South Africa (Friedman & Daly 2004) and The Kingdon field guide to African Mammals (Kingdon, 1997). The following was recorded:

- All mammals encountered, noted or captured during the survey;
- Animals listed in previous studies and observed by people residing in the study area;
- A list of the most prominent mammal species; and
- A list of threatened or protected species encountered during the survey.

Small mammal trapping was also applied by using Sherman traps. Sherman traps are collapsible traps (23 cm x 9 cm x 7.5 cm) which were baited and laid along transects. Areas where clear small mammal activity could be seen such as the presence of burrows were also used as sites for trapping. The traps were checked in the morning as small mammals are predominantly active at night. Captured animals were photographed, identified and released. Species of conservation concern and listed by the IUCN or by the South African Environmental legislation and Gauteng provincial as protected and endemic within the study area, took priority and the Red Data status identified and recorded.

4.7.2 Birds

The principal ornithological field survey technique used was transect surveys and random point surveys. Transect surveys were planned based on representative sites of different avifauna habitat, such as dams, wetlands, open areas and road reserves by simply following available roads and paths that transect over these habitat types. Transect procedures involve slow attentive walks along transects during which any bird seen or heard is identified and recorded; this was completed during diurnal surveys. Species observed during the vegetation surveys and other field trips were also recorded.

The following was recorded:

- All birds encountered or noted during the survey;
- All birds observed by people residing in the study area; and
- A list of rare and endangered species encountered.

Visual identification of birds was used to confirm bird calls where possible. Bird species were confirmed using Sinclair *et al* (1997) and Robert's birds (2009).

4.7.3 Reptiles and Amphibians

Herpetofauna include reptile and amphibian species. Direct/opportunistic observation was completed along trails or paths within the project area. Any herpetofauna species seen or heard along such paths or trails within the project area were identified and recorded. Another method used was refuge examinations using visual scanning of terrains to record smaller herpetofaunal species which often conceal themselves under rocks and in fallen logs, rotten tree stumps, under rocks, in leaf litter, rodent burrows, ponds, old termite mounds, etc. Amphibians and reptiles observed by people residing in the study area were also recorded. Branch (2001), Du Preez and Caruthers (2009) and Carruthers (2009) was used to confirm identification where necessary.

4.7.4 Red Data Faunal Assessment

The following parameters were used to assess the Probability of Occurrence of each Red Data species:

- Habitat requirements (HR) – Most Red Data animals have very specific habitat requirements and the presence of these habitat characteristics in the study area was evaluated.
- Habitat status (HS) – The status or ecological condition of available habitat in the area is assessed. Often a high level of habitat degradation prevalent in a specific habitat will negate the potential presence of Red Data species (this is especially evident in wetland habitats).
- Habitat linkage (HL) – Movement between areas for breeding and feeding forms an essential part of the existence of many species. Connectivity of the study area to surrounding habitat and the adequacy of these linkages are evaluated for the ecological functioning of Red Data species habitat within the study area.

Probability of occurrence is presented in four categories, namely:

- Low (unlikely to occur);
- Medium (could possibly occur);
- High (most likely could occur); or
- Recorded (does occur on site).

The IUCN Red Data categories are used for the status identification of mammals, birds, reptiles and amphibians globally.

4.8 Sensitivity Assessment

Following the field survey and vegetation classification, vegetation sensitivity analysis was quantified by subjectively assessing two factors, namely ecological function and conservation importance. These are defined as follows:

4.8.1 Ecological Function

- High ecological function: Sensitive ecosystems with either low inherent resistance or resilience towards disturbance factors or highly dynamic systems considered to be stable and important for the maintenance of ecosystem integrity (e.g. pristine grasslands, pristine wetlands and pristine ridges).
- Medium ecological function: Relatively important ecosystems at gradients of intermediate disturbances. An area may be considered of medium ecological function if it is directly adjacent to sensitive/pristine ecosystem.
- Low ecological function: Degraded and highly disturbed systems with little or no ecological function.

4.8.2 Conservation Importance

- High conservation importance: Ecosystems with high species richness which usually provide suitable habitat for a number of threatened species. Usually termed ‘no-go’ areas and unsuitable for development, and should be conserved.
- Medium conservation importance: Ecosystems with intermediate levels of species diversity without any threatened species. Low-density development may be accommodated, provided the current species diversity is conserved.
- Low conservation importance: Areas with little or no conservation potential and usually species poor (most species are usually exotic).

Ecological health is an indication of carrying capacity of an ecosystem and therefore its ability to perform ecological services. To gauge the ecological health of the study site adequately it was important to give a qualitative definition of the ‘perceived biodiversity value’ of the land. This is done at a broad level, simply to categorise the total area of land owned based on potential biodiversity value. Biodiversity Value is understood as being a combination of the conservation status and the functional status of the area.

Functional Status refers to an indication of the services provided by an area and includes both ecological and human related services. Functional Status depends on the degree to which the area or system still provides a noticeable service.

Conservation Status depends on:

- The amount of the area or system remaining (the extent);
- The diversity in terms of 1. Proportional species composition of the area of system, and 2. The presence of ecosystems/habitat and species which are endemic, threatened, vulnerable or have particularly high religious/cultural value; and
- The degree to which the area or system reflects/represents its original state.

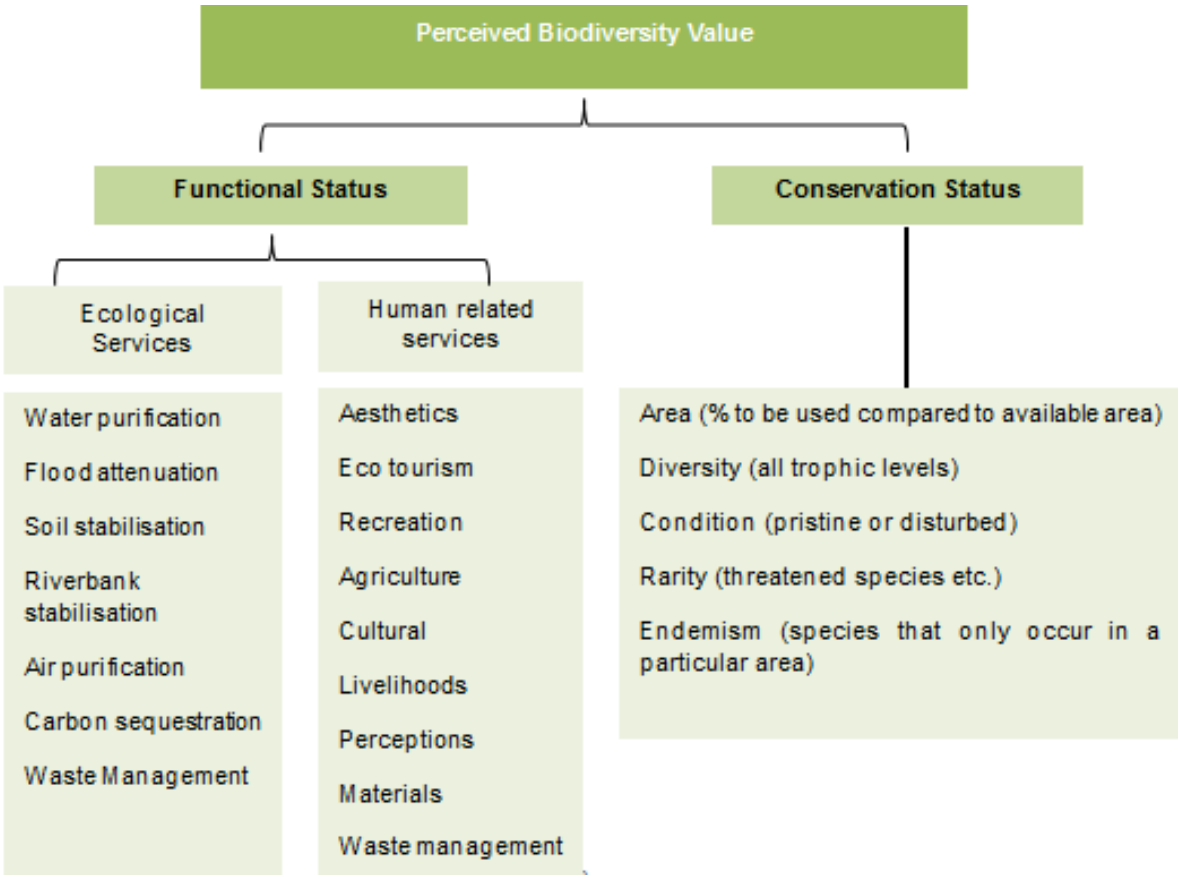

Figure 4-1: Perceived Biodiversity Value (Coombes, 2004)

The final decision on the biodiversity value of an area depends on the combination of the functional and conservation status (Coombes, 2004). In assessing the biodiversity value of the area various literature and data is referenced such as:

- International Union of the Conservation of Nature ,
- The Gauteng Biodiversity Conservation Plan (or C-Plan, 2013),
- The National Protected Areas Expansion Strategy,
- The National Vegetation Map (Mucina and Rutherford, 2006),
- The National List of Ecosystems that are Threatened and in need of Protection, and
- The National Spatial Biodiversity Assessment.

In addition, the data gathered from the field assessment allows for more fine-scale and accurate view of the vegetation in the study area. This data is pivotal for the determination of sensitivity of the area. Based on this approach the total land surface within the project area is categorised into the following biodiversity classes as listed in Table 4-3 below.

Table 4-3: Score table describing the Biodiversity value scores

Score	Biodiversity Value	Percentage Score
1	Very High Biodiversity Value	0 - 25%
2	High Biodiversity Value	25-50%
3	Moderate Biodiversity Value	50 – 75%
4	Low Biodiversity Value	75 – 100%

5 Assumptions and Limitations

A conservative assumption is made that all new pipelines are within new servitudes and above ground. Furthermore that the servitude in which the new pipelines will be constructed was assumed to be 20m wide. Therefore the current vegetation or habitat types present will be disturbed, and calculations on areas of disturbance is based on these assumptions. The areas of disturbance for each MRA takes into account the infrastructure within this MRA as well as the entire pipeline route that originates within the specific MRA, even if this pipeline crosses onto the mining right of another MRA.

The information from previous studies (listed under methodology: gap analysis), used in this report to describe areas where the current study will not complete field work is depended upon as being accurate and correct. Brief site visits were undertaken in areas covered by previous studies in order for the specialist to verify the previous work.

Avifaunal activity is reduced due to the lack of the summer migrants that generally start arriving in South Africa in October and early November. This also coincides with the breeding of most of the Southern African species.

The faunal sampling assessment was intended to document any faunal activity or evidence thereof on site. It is likely that some cryptic, nocturnal or migrant species may not have been recorded during the faunal survey.

Whilst every effort to document all plant species was made, it is possible that the emerging period (including flowering or seed-bearing phases of plant life-cycles) of some plants may not have coincided with the time of sampling. In this case, the absence of these plants from the species list does not imply that they do not occur on site at all.

The project was assessed according to the project activities listed herein (that were made available to Digby Wells by the client). Any changes to these after the assessments were done would not be captured in this report.

6 Screening Assessment

6.1 Regional Vegetation

The study area falls within four vegetation types according to (Mucina and Rutherford, 2006) as described below. Figure 6-1 represents the regional vegetation types in relation to the study site.

6.1.1 Carletonville Dolomite Grassland

This vegetation unit mainly occurs in the North-West Province but also in Gauteng and marginally into the Free State Province. It is distributed in the region of Potchefstroom, Ventersdorp and Carletonville, extending westwards to the vicinity of Ottoshoop, but also occurring as far east as Centurion and Bapsfontein in Gauteng Province. The altitude ranges from 1360-1620 m.

This vegetation occurs on slightly undulating plains dissected by prominent rocky chert ridges. It forms a complex mosaic pattern dominated by many species. Grasses such as: *Loudetia simplex* (Common Russet Grass), *Hyparrhenia hirta* (Common Thatching Grass), *Brachiaria serrata* (Velvet Signal Grass) and *Heteropogon contortus* (Spear Grass) are prominent while shrubs such as: *Euclea undulata* (Common Guarri), *Searsia magalismontana* (Berg Taaibos), *Zanthoxylon capense* (Small Knobwood) and *Diospyros lycioides* (Bluebush) are scattered in protected places (e.g. among rocks and boulders). The geology of this vegetation unit consists of dolomites and cherts of the Malmani subgroup from the Transvaal super group.

Conservation status is currently considered vulnerable, with only a small extent conserved in statutory reserves (Sterkfontein Caves, part of the Cradle of Humankind World Heritage Site, Oog Van Malmani, Abe Bailey, Boskop Dam, Schoonspruit, Krugersdorp, Olifantsvlei, Groenkloof) and in at least six private conservation areas. Almost a quarter of the vegetation type has already been transformed by cultivation, urban sprawl or by mining activity as well as the building of the Boskop and Klerkskraal Dams. Erosion is considered to be very low (84%) and low (15%).

6.1.2 Gauteng Shale Mountain Bushveld

This vegetation unit occurs in Gauteng and North-West Provinces, mainly on the ridge of the Gatsrand south of Carletonville–Westonaria–Lenasia and at altitudes from 1300-1750 m. It occurs on low broken ridges varying in steepness and generally with a high surface rock cover. The vegetation is a short (3-6 m), semi-open thicket, dominated by a variety of woody species such as: *Acacia caffra*, *Searsia leptodictya*, *Cussonia spicata* and *Englerophytum magalismontanum*. The understory is dominated by grasses such as: *Cymbopogon pospischilii* and *Digitaria eriantha*. Some of the ridges form plateaus that carry scrubby grassland. The geology consists of shale and andesite from the Pretoria group (Transvaal supergroup).

Conservation status is currently considered to be Vulnerable, statutorily conserved in Skanskop and Hartebeesthoek Nature Reserves, Magaliesburg Nature Area and Groenkloof National Park. Approximately 21% transformed mainly by urban and built up areas, mines and quarries, cultivation and plantations. Wattle is a common invader plant species.

6.1.3 Rand Highveld Grassland

Rand Highveld Grassland is found in the highly variable landscape with extensive sloping plains and ridges in the Gauteng, North-West, Free State and Mpumalanga Provinces. The vegetation type is found in areas between rocky ridges from Pretoria to Witbank, extending onto ridges in the Stoffberg and Roossenekal regions as well as in the vicinity of Derby and Potchefstroom, extending southwards and north-eastwards from there. The vegetation is characterised by species rich, sour grassland alternating with low shrubland on rocky outcrops. The most common grasses on the plains belong to the genera *Themeda, Eragrostis, Heteropogon* and *Elionurus*. High numbers of herbs belonging to the Asteraceae family are also found. In rocky areas, shrubs and trees also prevail and are mostly *Protea caffra, Acacia caffra, Celtis africana* and *Searsia* spp.

This vegetation type is poorly conserved (approximately 1 %) and has a target of 24 % of the vegetation type to be conserved. Due to the low conservation status, this vegetation type is classified as Endangered. Almost half of the vegetation type has been transformed by cultivation, plantations, urbanisation or dam-building. Scattered aliens (most prominently *Acacia mearnsii*) are present in the unit.

6.1.4 Soweto Highveld Grassland

This vegetation unit occurs in Mpumalanga, Gauteng (and to a very small extent also in neighbouring Free State and North-West) Provinces. It lies in a broad band roughly delimited by the N17 road between Ermelo and Johannesburg in the north, Perdekop in the southeast and the Vaal River (border with the Free State) in the south. It extends further westwards along the southern edge of the Johannesburg Dome (including part of Soweto) as far as the vicinity of Randfontein. In southern Gauteng it includes the surrounds of Vanderbijlpark and Vereeniging as well as Sasolburg in the northern Free State. The altitude ranges from 1420-1760 m.

The vegetation occurs on gently to moderately undulating landscape on the Highveld plateau supporting short to medium high, dense, tufted grassland dominated almost entirely by *Themeda triandra* (Rooi grass) and accompanied by a variety of other grasses such as *Elionurus muticus* (Wire grass), *Eragrostis racemosa* (Small heart grass), *Heteropogon contortus* (Spear grass) and *Tristachya leucothrix* (Trident grass).

Only small scattered wetlands, narrow streams and occasional ridges or rocky outcrops interrupt the continuous grassland cover. The geology of the Soweto Integration consists mainly of shale, sandstone or mudstone of the Madzarinwe formation (Karoo Supergroup).

The conservation status is currently considered to be Endangered, only a handful of patches are statutorily conserved (Waldrift, Krugersdorp, Leeuwkuil, Suikerbosrand, and Rolfe's Pan

Nature Reserves) or privately conserved (Johanna Jacobs, Tweefontein, Gert Jacobs, Nikolaas and Avalon Nature Reserves, Heidelberg Natural Heritage Site). Almost half of the area already transformed by cultivation, urban sprawl, mining and building of road infrastructure. Some areas have been flooded by dams (Grootdraai, Leeukuil, Trichardtsfontein, Vaal and Willem Brummer dams). Erosion is generally very low (93%).

6.1.5 Possible Plant Species of Special Concern

The Sibanye study site lies within three Quarter Degree Square (QDS) grids, namely 2627AD and 2627BC and 2627DA. According to the PRECIS, no Red Data species are expected to occur for the QDS for each of the sites. The list of expected plant species in the study area can be found in Appendix B.

The Plants of South Africa (http://posa.sanbi.org) website list was obtained from the SANBI website, which lists all the Red Data plant species officially recorded by SANBI for the QDS grid. For a plant species to be included in this list, a specimen collected in this grid must be supplied to SANBI. This list is therefore not a comprehensive list representing only those species that may occur in these grids, but rather a guideline as to what is likely to occur here. The sites sampled are also only a very small portion of the whole grid and habitats suitable for certain species in these POSA lists may not be present at the sites sampled. It is therefore not unusual for species in the POSA list to be absent from the sampling sites.

Certain species included in the below list were confirmed by scrutinising previous specialist studies that were undertaken in the past, as well as consulting the expected species list provided by GDARD (Lorraine Mills - www.gdace.gpg.gov.za.). SSC likely to occur on site are listed in Table 6-1.

Table 6-1: Plant SSC likely to occur on site

Plant species	Status
Kniphofia typhoides	NT
Trachyandra erythrorrhiza	NT
Hypoxis hemerocallidea	Declining
Eucomis autumnalis subsp. clavata	Not Evaluated
Boophone disticha	Declining
Adromischus umbraticola subsp. umbraticola	NT
Drimia sanguinea	NT
Khadia beswickii	VU
Gunnera perpensa	Declining
Lithops lesliei subsp.lesliei	NT

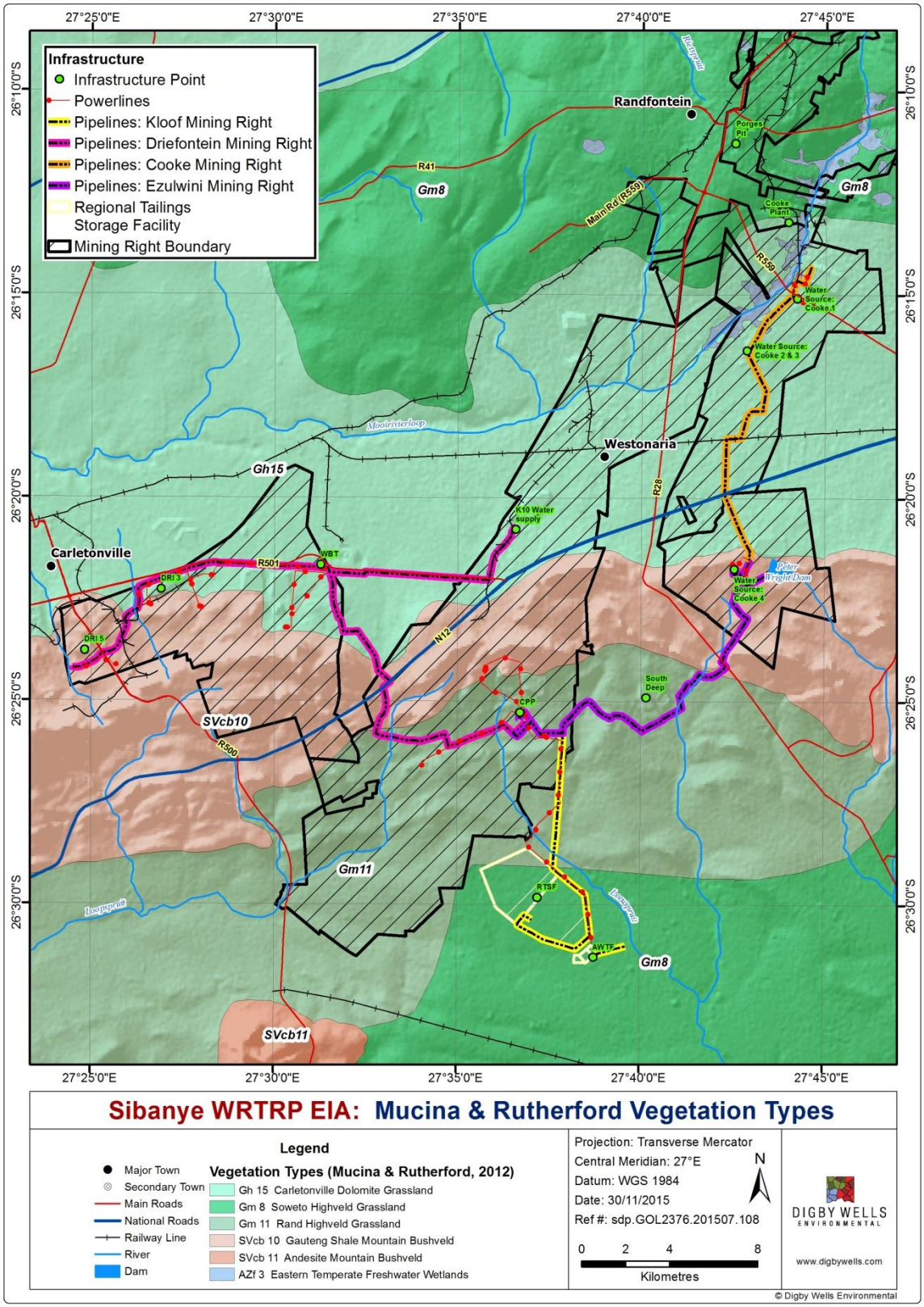

Figure 6-1: Regional Vegetation

6.2 Fauna

Fauna expected to occur on site include assemblages within terrestrial and wetland ecosystems: mammals, birds, reptiles, amphibians and invertebrates. Each of these assemblages occurs within unique habitats and the ecological state of these habitats directly relates to the number of species found within them. The main habitats occurring in the project area are grassland plains and pans, with little altitudinal variation.

6.2.1 Mammals

A database search was conducted for mammal species that have been recorded in the three QDSs (2627 AD, 2627 BC and 2627 DA) on the virtual museum of the Animal Demography Unit (http://www.adu.org.za). This database forms part of the Department of Biological Science at the University of Cape Town. No recent records of mammals have been recorded in the study area. Mammal species that have been recorded in the Gauteng Province, and could possibly occur in the area of interest are discussed below.

Mammal species expected to occur in the area of interest include 5 species of which 4 would have been re-introduced into areas that can sustain large grazing mammal species. Table 6-2 as per ADU database searches. The variety of vegetation types occurring in the area of interest ensures an ecologically diverse assemblage of plant species which in turn could support a variety of mammal species, therefore the current expected species list could be more extensive than is currently thought.

Table 6-2: Mammal species that occur on the site

Genus	Common name	IUCN (2015-4) Red list category	Likely to be re-introduced
Xerus (Geosciurus) inauris	South African Ground Squirrel	LC	
Taurotragus oryx	Eland	LC	X
Hippotragus niger	Sable	LC	X
Antidorcas marsupialis	Springbuck	LC	X
Kobus ellipsiprymnus	Water Buck	LC	X

6.2.2 Avifauna

Birds have been viewed as good ecological indicators, since their presence or absence tends to represent conditions pertaining to the proper functioning of an ecosystem. Bird communities and ecological condition are linked to land cover. As the land cover of an area changes, so do the types of birds in that area (The Bird Community Index, 2007). Land cover is directly linked to habitats within the study area. The diversity of these habitats should give rise to many different species. According to the South African Bird Atlas Project (SABAP2), 324 species of birds have been identified in the area (Appendix A of the screening report);

the majority of these birds are comprised of Grassland species. All birds that could be present within QDS 2627 AD, 2627 BC and 2627 DA are listed in Appendix E of the screening report. Of these species, 10 have been assigned an international Red Data status with one endangered, six near threatened, and three vulnerable species recorded. These species are listed in the Table 6-3 below.

Table 6-3: Red Data bird species that could occur on site

Common Name	Scientific Name	Red Data Status
Maccoa Duck	*Oxyura maccoa*	Near threatened
Lesser Flamingo	*Phoenicopterus minor*	Near threatened
Grass Owl	*Tyto capensis*	Vulnerable
Black-winged Pratincole	*Glareola nordmanni*	Near threatened
Blue Korhaan	*Eupodotis caerulescens*	Near threatened
European Roller	*Coracias garrulus*	Near threatened
Pallid Harrier	*Circus macrourus*	Near threatened
White Backed Vulture	*Gyps africanus*	Endangered
Cape Vulture	*Gyps coprotheres*	Vulnerable
Secretarybird	*Sagittarius serpentarius*	Vulnerable

6.2.3 Reptiles

Reptiles are ectothermic (cold-blooded) meaning they are organisms that control body temperature through external means. As a result reptiles are dependent on environmental heat sources. Due to this many reptiles regulate their body temperature by basking in the sun, or in warmer areas. Substrate is an important factor determining which habitats are suitable for which species of reptile. The presence of many rocky out crops within the central study area could mean more reptile species are present.

According the Animal demography unit's virtual museum a total of 40 species have been recorded in the QDS's in the past (http://sarca.adu.org.za/). These species are listed in Table 6-4. Four species in this list are designated as endemic.

Table 6-4: Expected Reptiles

Genus	Species	Common name	Status	Endemic
Agama	*Aculeate, distanti*	Distant's Ground Agama	NE	Yes
Agama	*atra*	Southern Rock Agama	NE	0
Aparallactus	*capensis*	Black-headed Centipede-eater	NE	0
Rhinotyphlops	*lalandei*	Delalande's Beaked Blind Snake	NE	Yes

Genus	Species	Common name	Status	Endemic
Crotaphopeltis	*hotamboeia*	Red-lipped Snake	NE	0
Boaedon	*capensis*	Brown House Snake	NE	0
Dasypeltis	*scabra*	Rhombic Egg-eater	NE	0
Lamprophis	*aurora*	Aurora House Snake	NE	Yes
Pachydactylus	*affinis*	Transvaal Gecko	NE	Yes
Pachydactylus	*capensis*	Cape Gecko	NE	0
Gerrhosaurus	*flavigularis*	Yellow-throated Plated Lizard	NE	0

6.2.4 Amphibians

Amphibians are viewed as good indicators of changes to the whole ecosystem because they are sensitive to changes in the aquatic and terrestrial environments (Waddle, 2006). Most species of amphibians are dependent on the aquatic environment for reproduction (Duellman and Trueb 1986). Additionally, amphibians are sensitive to water quality and ultra violet radiation because of their permeable skin (Gerlanc and Kaufman 2005). Activities such as feeding and dispersal are spent in terrestrial environments (Waddle, 2006). According to Carruthers (2001), a number of factors influence the distribution of amphibians, but because amphibians have porous skin they generally prosper in warm and damp habitats. The presence of suitable habitat within the study area should provide a number of different species of amphibians.

According to Carruthers (2001), frogs occur throughout southern Africa. A number of factors influence their distribution, and they are generally restricted to the habitat type they prefer, especially in their choice of breeding site. The choices available of these habitats coincide with different biomes, these biomes in turn, are distinguished by means of biotic and abiotic features prevalent within them. Therefore a collection of amphibians associated with the Grassland biome will all choose to breed under the prevailing biotic and abiotic features present. Further niche differentiation is encountered by means of geographic location within the biome, this differentiation includes, banks of pans, open water, inundated grasses, reed beds, trees, rivers and open ground, all of which are present within the area of interest. No previous records of amphibians that occur on site were found on the SARCA website (http://sarca.adu.org.za/).

6.2.5 Invertebrates

Butterflies are a good indication of the habitats available in a specific area (Woodhall 2005). Although many species are eurytropes (able to use a wide range of habitats) and are widespread and common, South Africa has many stenotrope (specific habitat requirements with populations concentrated in a small area) species which may be very specialised (Woodhall 2005). Butterflies are useful indicators as they are relatively easy to locate and catch, and to identify. Red Data species expected to occur on site are the Marsh sylph

(*Metisella meninx*), Roodepoort Copper (*Aloeides dentatis dentatis VU*) and Highveld Blue (*Lepidochrysops praeterita EN*).

6.3 Sensitivity and Conservation Planning Tools

There are several assessments for South Africa as a whole, as well as on provincial levels that allow for detailed conservation planning as well as meeting biodiversity targets for the country's variety of ecosystems. These guides are essential to consult for development projects, and will form an important part of the sensitivity analysis. Areas earmarked for conservation in the future, or that are essential to meet biodiversity and conservation targets should not be developed, and have a high sensitivity as they are necessary for overall functioning. In addition, sensitivity analysis in the field based in much finer scale data can be used to ground truth the larger scale assessments and put it into a more localised context.

6.3.1 Gauteng C-Plan

Knowledge of the distribution of biodiversity, the status of species, the approach for dealing with aspects such as climate change, methods of data analysis, and the nature of threats to biodiversity within a planning region are constantly changing, especially in the Gauteng province which is developing at an extremely rapid rate. This requires that the conservation plan be treated as a living document with periodic review and updates.

The Gauteng Conservation Plan (C-Plan) is based on the systematic conservation principles outlined by Margules and Pressey (2000): complementarity, efficiency, defensibility and flexibility, irreplaceability, retention, persistence and accountability. The Gauteng C-Plan is a living document that is constantly reviewed and updated and documents the distribution of conservation important areas for biodiversity. According to the Gauteng C-Plan, the study area contains Ecological Support Areas, Important Areas, and Irreplaceable areas (Figure 6-2). Ecological Support Areas contain buffered wetlands, buffered rivers, ridges within 1500 m of CBAs, dolomite, corridors and low cost metropolitan areas and are regarded as being worthy of protection. In this instance, it coincides with certain pipeline routes. Irreplaceable areas also occur on site, the pipeline leading to the RTSF crosses such an area.

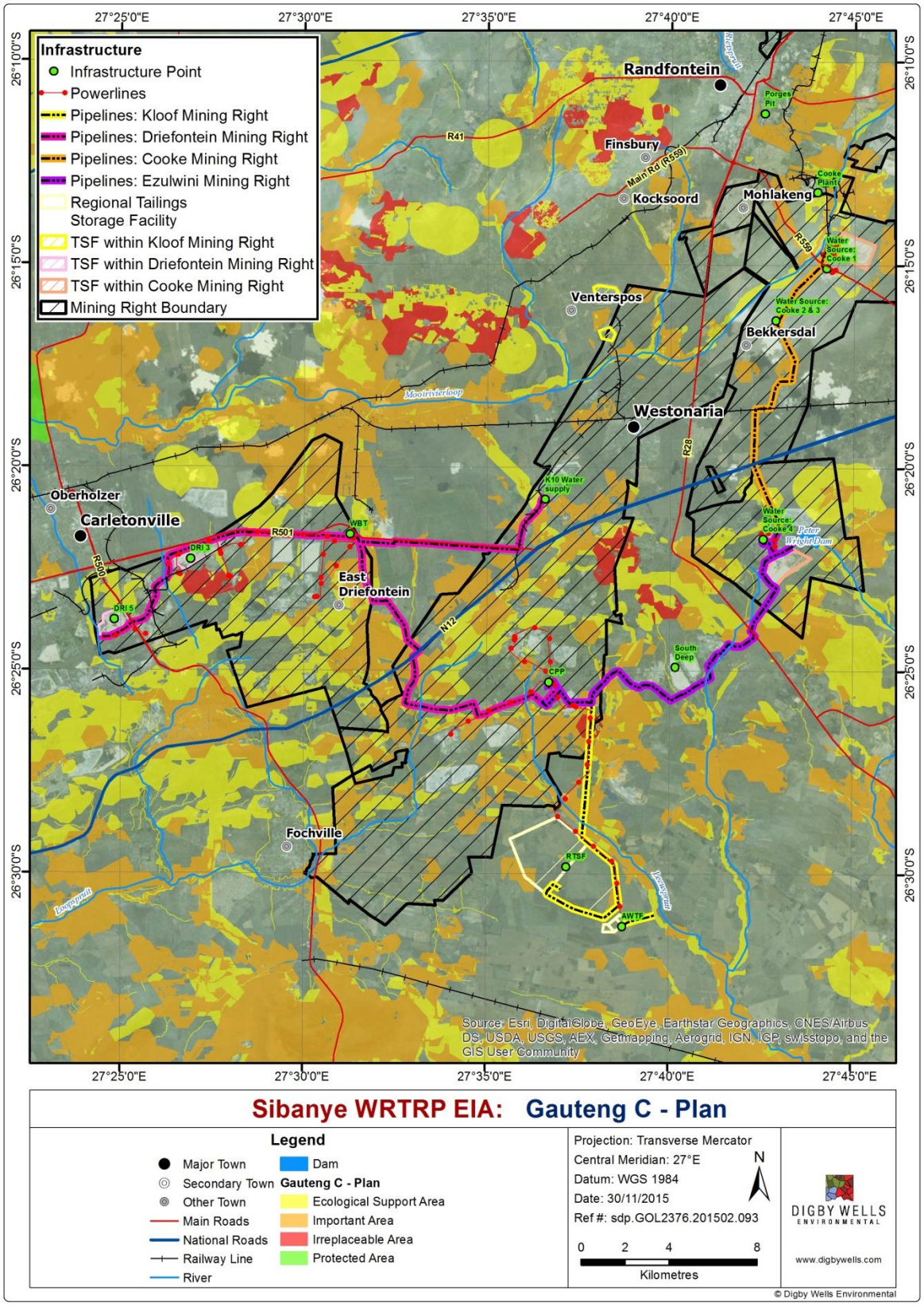

Figure 6-2: Gauteng C-Plan

6.3.2 Protected areas

Officially protected areas, either Provincially or Nationally that occur close to a project site could have consequences as far as impact on these areas are concerned. For the Sibanye TSF sites, and the associated pipeline routes however, there are no protected areas in close proximity to the study area, apart from the Abe Bailey Provincial Nature Reserve, approximately 4km north (Figure 6-3).

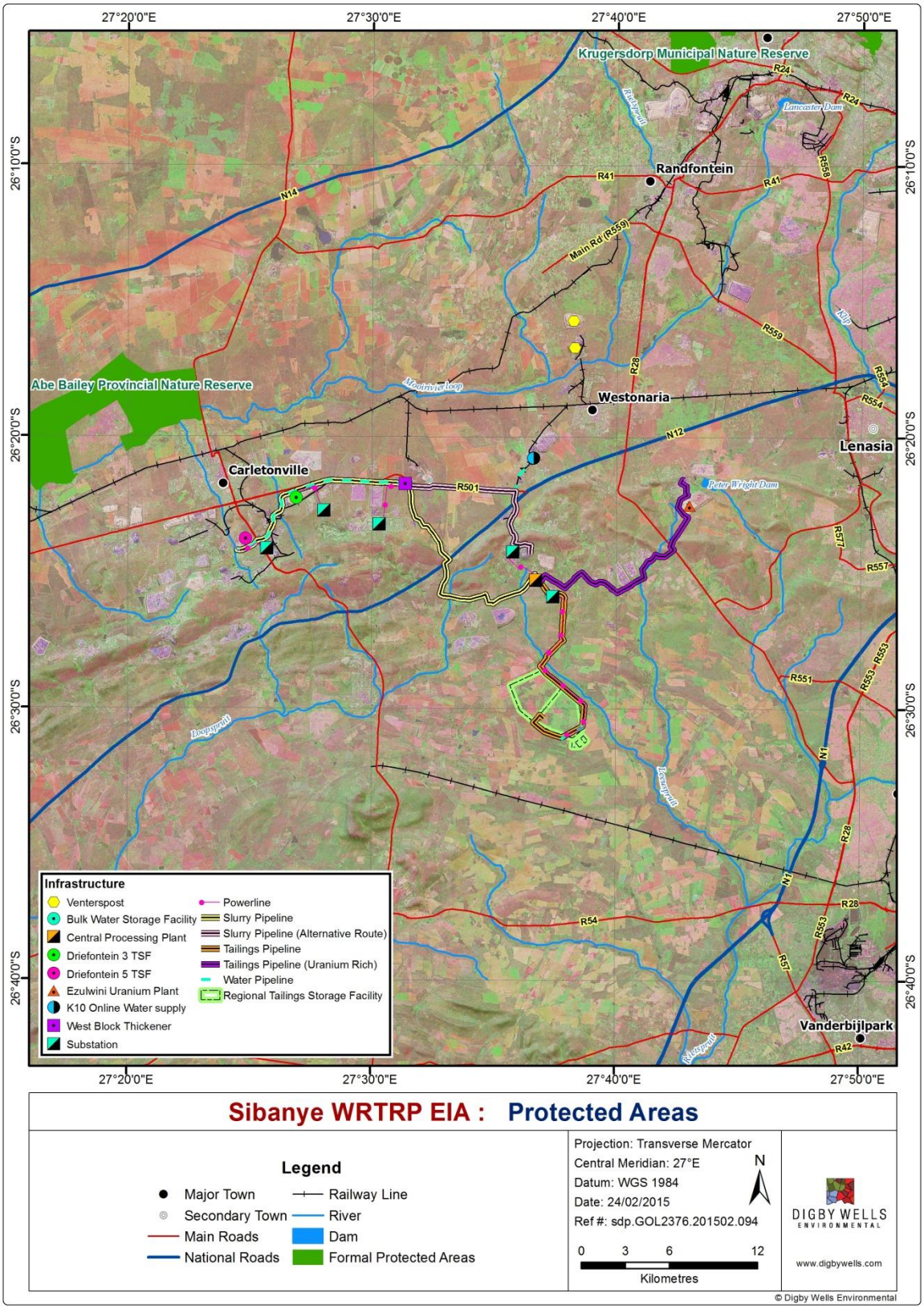

Figure 6-3: Protected Areas

6.3.3 Important Bird Areas

An Important Bird Area (IBA) is an area recognised as being globally important habitat for the conservation of bird populations. Currently there are about 10,000 IBAs worldwide. At present, South Africa has 124 IBA's, covering over 14 million hectares of habitat for our threatened, endemic and congregatory birds. Yet only a million hectares of the total land surface covered by our IBA's is legally protected. The BirdLife SA IBA programme continues a programme of stewardship which will ultimately achieve formal protection (Birdlife, 2013).

These areas are identified by BirdLife International. These sites are small enough to be entirely conserved and differ in their character, habitat or ornithological importance from the surrounding habitat. Often IBAs form part of a country's existing protected area network, and so are protected under national legislation. There is no formal National IBA Conservation Strategy for this area within South Africa (Birdlife, 2013).

The study sites (TSF's), including the pipeline routes, do not coincide with any Important Bird Areas (IBA's), however, the Magaliesberg and Witwatersrand and Suikerbosrand IBA's are located approximately 30 km north of the site (Figure 6-4). The Magaliesberg and Witwatersrand IBA falls mostly within the Magaliesburg Protected Natural Environment and is protected according to the NEMA (Act 107 of 1998). Bird species typical of this IBA include: Martial Eagle (*Polemaetus bellicosus*) (although in lesser numbers than in the past), Striped Kingfisher (*Halcyon chelicuti)*, Burnt-necked Eremomela (*Eremomela usticollis*), Barred Wren-Warbler (*Calamonastes fasciolatus),* Marico Flycatcher (*Melaenornis mariquensis*), Crimson-breasted Shrike (*Laniarius atrococcineus*), Scaly-feathered Finch (*Sporopipes squamifrons*), Violet-eared Waxbill (*Granata granatina*), Black-cheeked Waxbill (*Estrilda erythronotos*), Striped Pipit (*Anthus lineiventris*) and Short-toed Rock Thrush (*Monticola brevipes*). The study area may provide refuge for some of these species as they move across the landscape in search of resources.

The Suikerbosrand IBA is located 50 km south of Johannesburg, Suikerbosrand lies between the towns of Heidelberg and Meyerton in Gauteng's industrialised Highveld. The reserve has been expanded in recent years by the addition of an extension northward to the R550 and east up to the N3. The new section includes a large area of grassland, wetlands along the Rietspruit and drainage lines. This extension is extremely valuable as it contains habitats suitable for African Grass Owl (*Tyto capensis)* and Secretarybird (*Sagittarius serpentarius)*.

The reserve is dominated by Suikerbos Ridge, which runs from west to east, rising from the surrounding plateau (1500 m a.s.l.) to reach its greatest height (1918 m a.s.l.) in the form of knolls on the central plateau east of Kareekloof. The ridge is broken by numerous seasonal streams, and the associated well-wooded kloofs and steep cliffs (varying in height from 15 to 45 m) contrast with the predominantly open grassy plains. Two important areas are the aloe forest near Kareekloof and, in the south-west, the vegetation community dominated by *Vachellia* (formerly *Acacia*) *karoo* trees.

The diversity of habitats in the reserve has resulted in more than 270 species being recorded according to SABAP2. It is not certain how many White-bellied Korhaans (*Eupodotis senegalensis*) occur and further research is needed to obtain exact numbers. The inclusion of the extended area into the reserve has ensured that African Grass Owl *(Tyto capensis)* remains listed as a key species.

Melodius Lark (*Mirafra cheniana)* has been added as a key species because it has been reported regularly in this IBA since 2007. Up to 50 individuals have been recorded at one time.

Secretarybirds breed in the reserve and two pairs have been recorded here in recent years. Sentinel Rock Thrush *(Monticola exploratory)* occurs in the east and Kalahari Scrub Robin *(Erythropygia paean)*, Red-headed Finch *(Amadina erythrocephala)*, Black-faced Waxbill *(Estrilda erythronotos)* and Violet-eared Waxbill (*Uraeginthus granatinus)* are regularly reported. Independent observers as well as those participating in SABAP2 have recorded Blue Korhaan *Eupodotis caerulescens*, Corn Crake *(Crex crex)* and African Marsh Harrier *(Circus ranivorus)*.

Two globally threatened species occur in the IBA: African Grass Owl (12–30 individuals) and Secretarybird (two pairs). Regionally threatened species are Melodious Lark *(Mirafra cheniana)*, Blue Korhaan *(Eupodotis caerulescens)* and Corn Crake *(Crex crex)*. Kalahari Scrub Robin (*Erythropygia paena*) and White-bellied Sunbird (*Cinnyris talatala)* are the only biome-restricted species in this IBA.

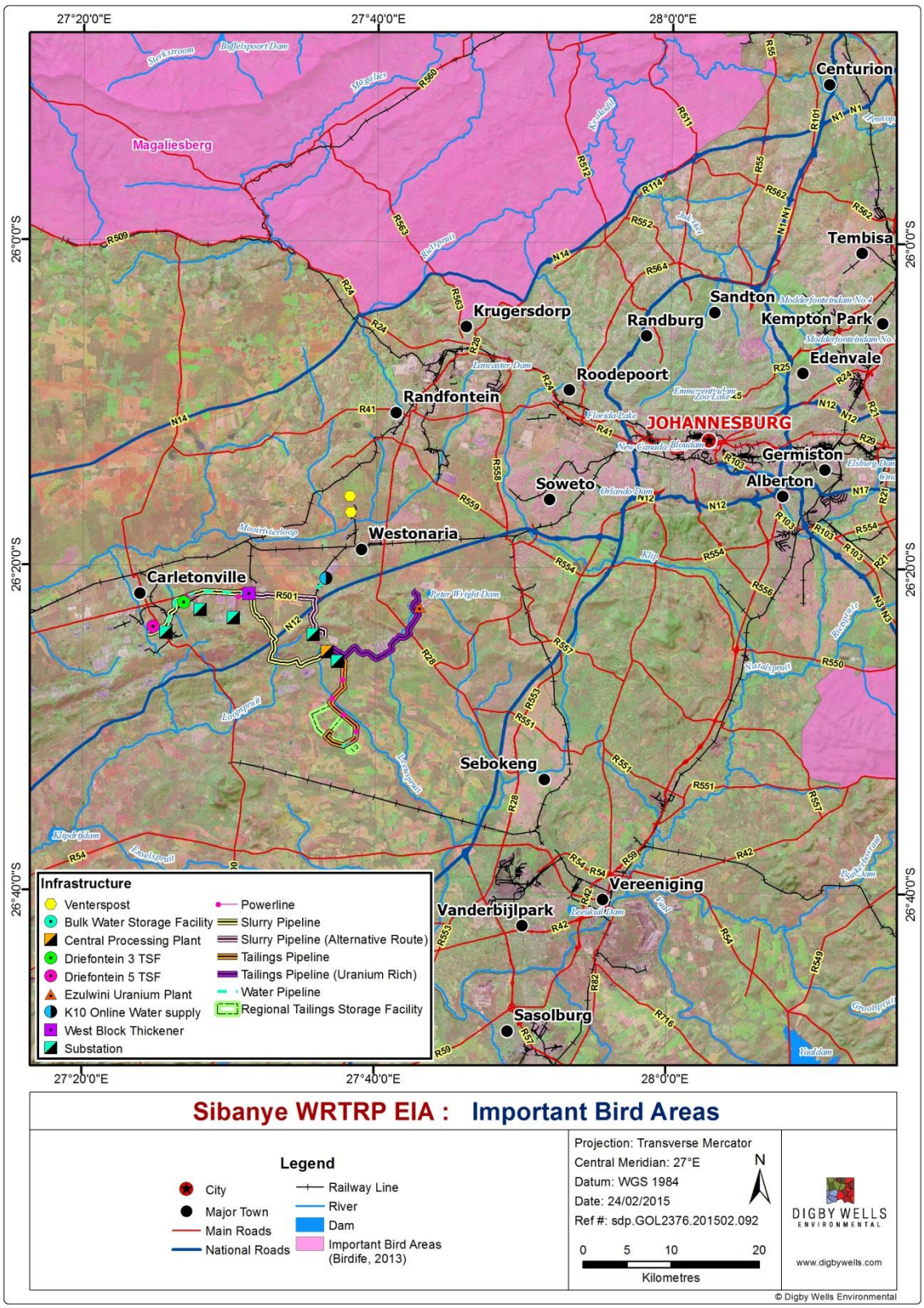

Figure 6-4: Important Bird Areas

6.3.4 Nationally Threatened Ecosystems

The list of national Threatened Ecosystems has been gazetted (NEM:BA: National list of ecosystems that are threatened and in need of protection) and result in several implications in terms of development within these areas. Four basic principles were established for the identification of threatened ecosystems. These include:

- The approach must be explicit and repeatable;
- The approach must be target driven and systematic, especially for threatened ecosystems;
- The approach must follow the same logic as the IUCN approach to listing threatened species, whereby a number of criteria are developed and an ecosystem is listed based on its highest ranking criterion; and
- The identification of ecosystems to be listed must be based on scientifically credible, practical and simple criteria, which must translate into spatially explicit identification of ecosystems.

Areas were delineated based on as fine a scale as possible and are defined by one of several assessments:

- The South African Vegetation Map (Mucina and Rutherford 2006);
- National forest types recognised by the Department of Water Affairs and Forestry (DWAF);
- Priority areas identified in a provincial systematic biodiversity plan; and
- High irreplaceability forest patches or clusters identified by DWAF.

The criteria for identifying threatened terrestrial ecosystems include six criteria overall, two of which are dormant due to lack of data (criteria B and E). The criteria are presented Table 6-5 below.

Table 6-5: Criteria for the listing of National Threatened Ecosystems

Criterion	Details
A1	Irreversible loss of natural habitat
A2	Ecosystem degradation and loss of integrity
B	Rate of loss of natural habitat
C	Limited extent and imminent threat
D1	Threatened plant species associations
D2	Threatened animal species associations
E	Fragmentation

Criterion	Details
F	Priority areas for meeting explicit biodiversity targets as defined in a systematic biodiversity plan

These areas are essential for conservation of the country's ecosystems as well as meeting conservation targets. The study area occurs within two Threatened ecosystems below, the Rand Highveld Grassland and the Soweto Highveld Grassland (Figure 6-5). This designation must however be seen in context, as preliminary field investigations have proven that very little natural habitat still remains within the study areas.

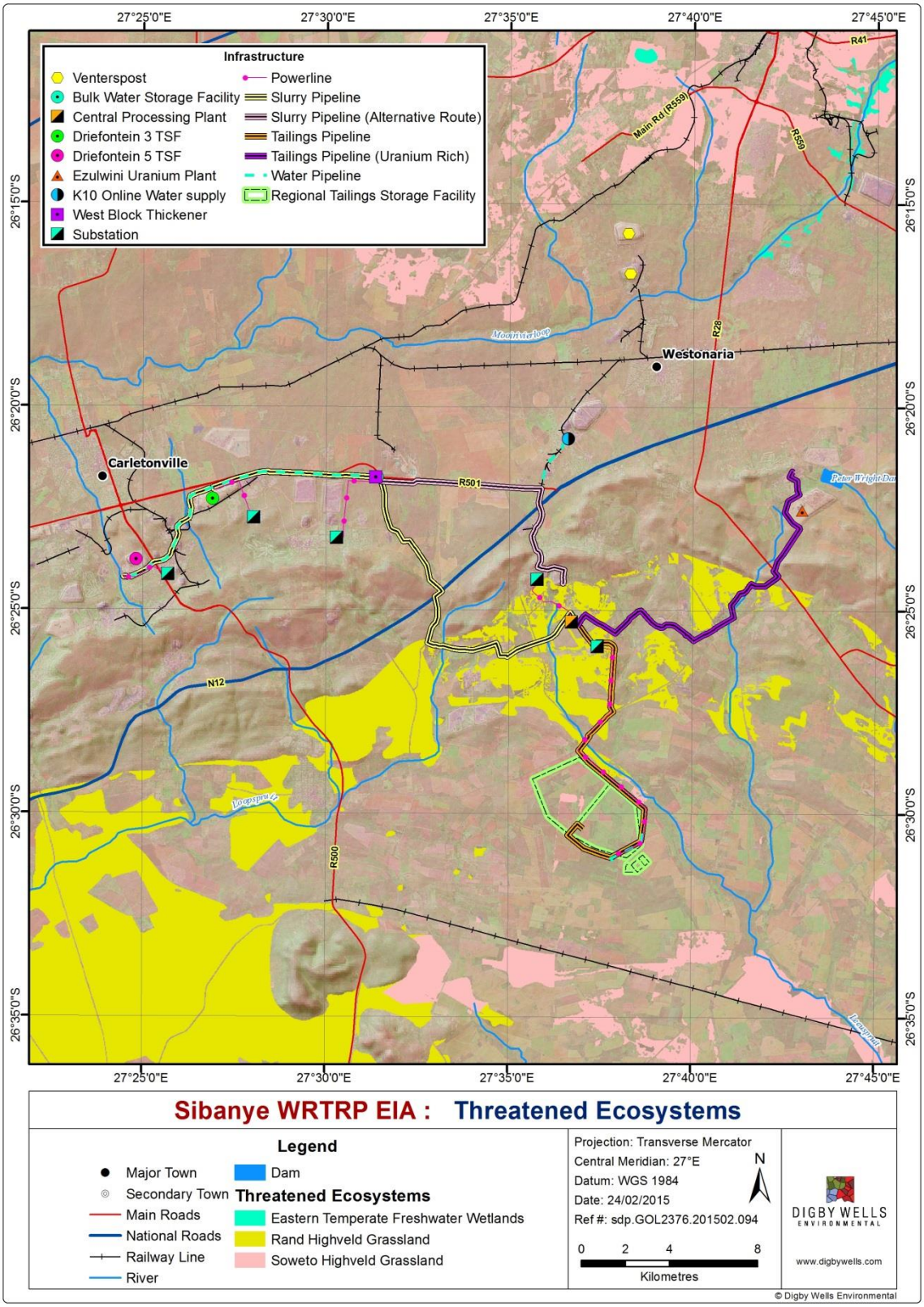

Figure 6-5: Threatened Ecosystems

6.3.5 National Protected Areas Expansion Strategy (NPAES)

The NPAES are areas designated for future incorporation into existing protected areas (both National and informal protected areas). These areas are large, mostly intact areas required to meet biodiversity targets, and suitable for protection. They may not necessarily be proclaimed as protected areas in the future and are a broad scale planning tool allowing for better development and conservation planning. There are no areas earmarked for conservation within the proposed development, however the north and west of the site, two NPAES areas do occur (Figure 6-6).

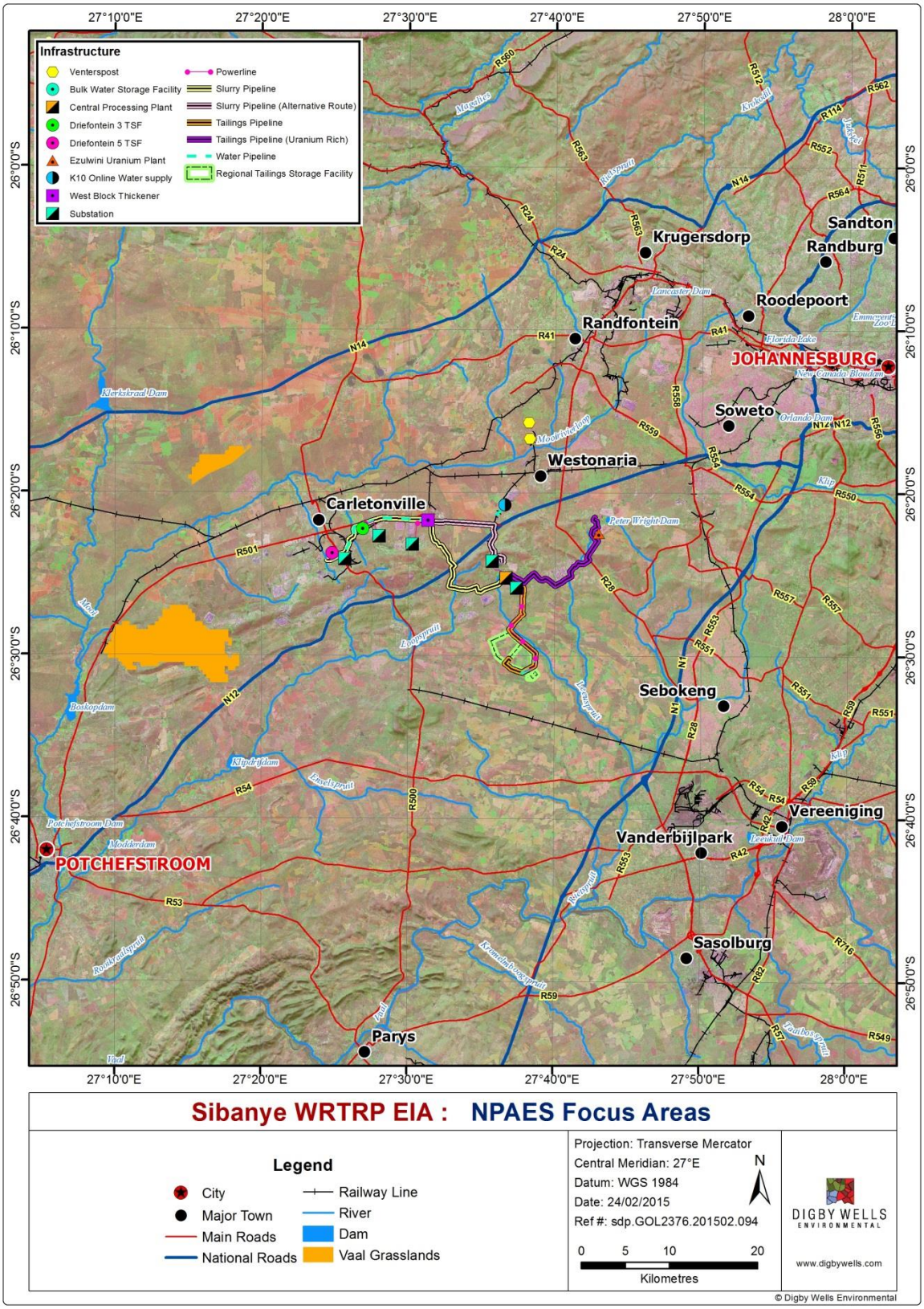

Figure 6-6: NPEAS

6.3.6 Conclusion

With the screening phase the information available on the entire study area (all four MRA's was collated and all impacts foreseen to occur due to project activities identified and potential fatal flaws highlighted. The information used comprised of previous reports and baseline data, as mentioned in this methodology of the screening assessment. Fatal flaws were investigated with regards to species of special concern, both fauna and flora that could potentially be present, as well as sensitive landscapes, such as ridges and wetlands.

The activities and their impacts for the proposed project was rated and explained in detail and found that there is reasonable chance of encountering SSC both plants and animals, and that sensitive landscapes will be impacted upon.

7 Baseline Environment

7.1 Flora

The Sibanye RTSF and pipeline infrastructure project area is regarded to be a combination of natural and modified habitat. Within certain areas that are not impacted directly by current land use practices, grassland vegetation can be found, which occurs on undulating plains interspersed by ridges and riparian habitat. Ridge areas exist within these grasslands, comprising of rocky, dolomitic outcrops which rise above the grassland plains, and sit at a higher altitude. These create suitable refuge and habitat for a number of species and have generally escaped transformation and anthropogenic disturbances. As a result they are generally regarded to have high biodiversity and integrity. Wetland vegetation and riparian vegetation features occur prominently in the area, with Bullrushes (*Typha capensis*), Reeds and Red Cotton Wool Grass (*Imperata cylindrica*) being obvious indicators of wet areas. Alien vegetation in the form of plantations of Gum trees (*Eucalyptus camaldulensis)*, Willow trees (*Salix babylonica*) and Poplars (*Populus* × *canescens*) feature extensively in residential and transformed areas.

Current and historical land use practices have had a major influence on the natural habitat types that were historically present. The general practice is to transform large tracts of grassland for various land uses including residential development, mining and agriculture. The proximity of this area to the metropolitan area and various towns around has similarly added increasing pressure through urban sprawl (the spreading of urban developments (as houses and shopping centres) on undeveloped land near a city). Mining has completely altered the landform and surface in places specifically through the establishment of large tailings storage facilities, most of which are many hectares in size.

This has resulted in the establishment of a number of alien vegetation species, on or surrounding these facilities. Agriculture, including the cultivation of Maize, Soya beans and Sunflowers has transformed the vegetation of the area associated with the RTSF. Furthermore, uncontrolled and unplanned grazing of livestock in many areas of the larger study area and surrounds has resulted in a decrease in biodiversity in areas through selective grazing and bulk grazing.

7.1.1 Vegetation Communities

The vegetation communities delineated within the project area through field work procedures include remnant natural vegetation communities and vegetation which has been largely and completely transformed. The exact sizes in hectares that will be disturbed within each MRA as well as the specific infrastructure that will cause the destruction is displayed in Table 7-1, and is supported visually by Figure 7-1 to Figure 7-8..

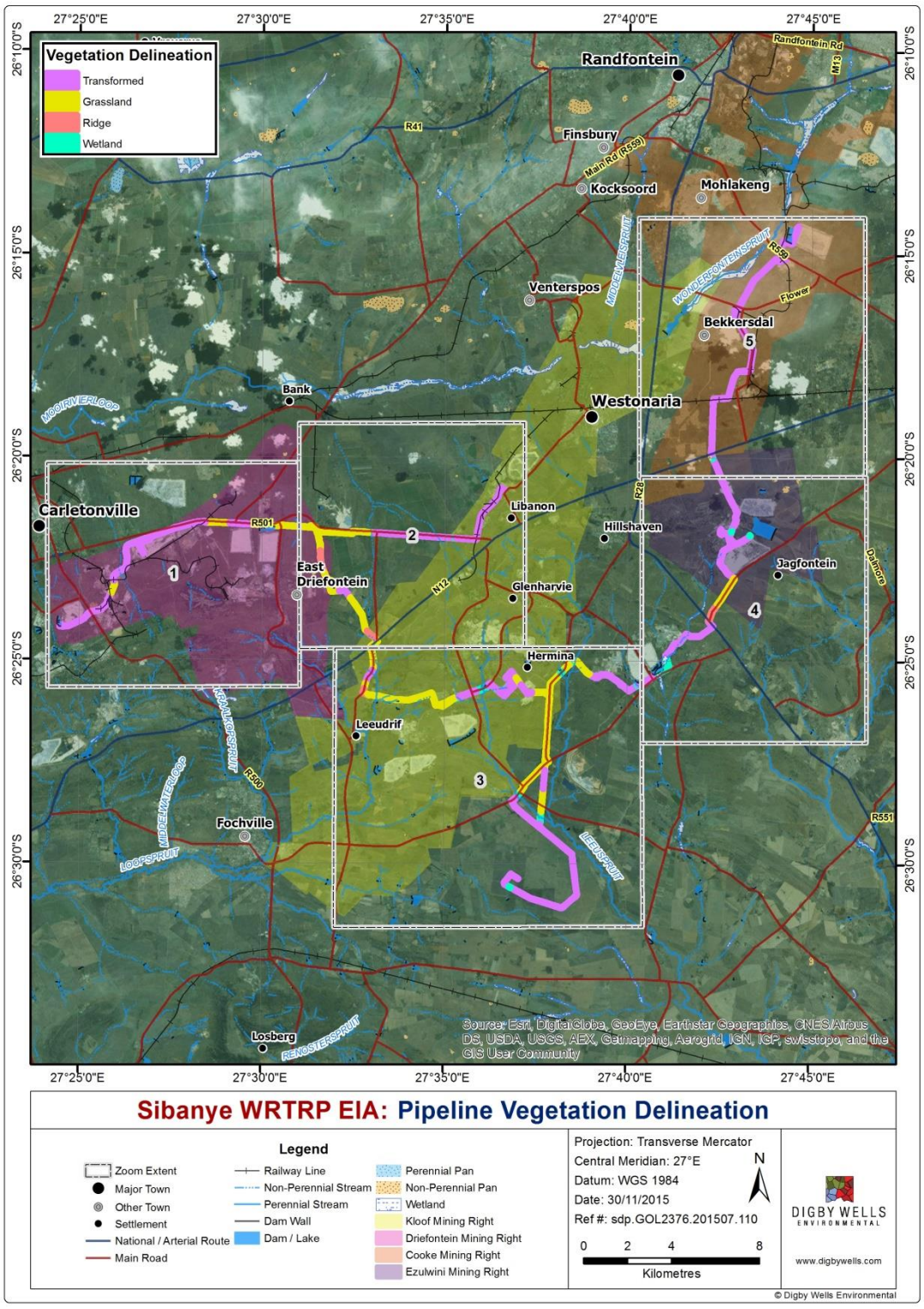

Figure 7-1: Vegetation Delineation of the Pipeline Infrastructure

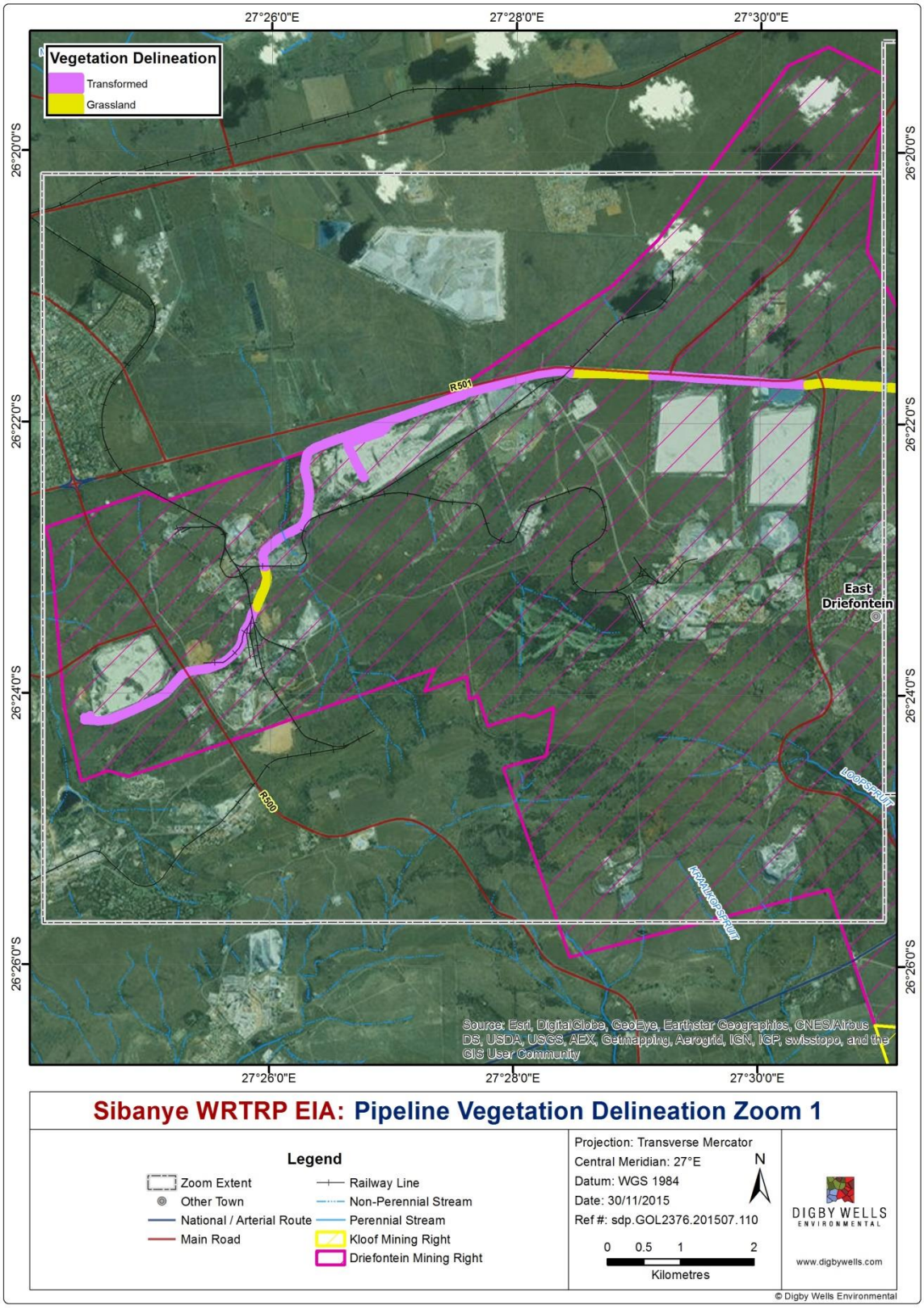

Figure 7-2: Pipeline Vegetation Zoom 1

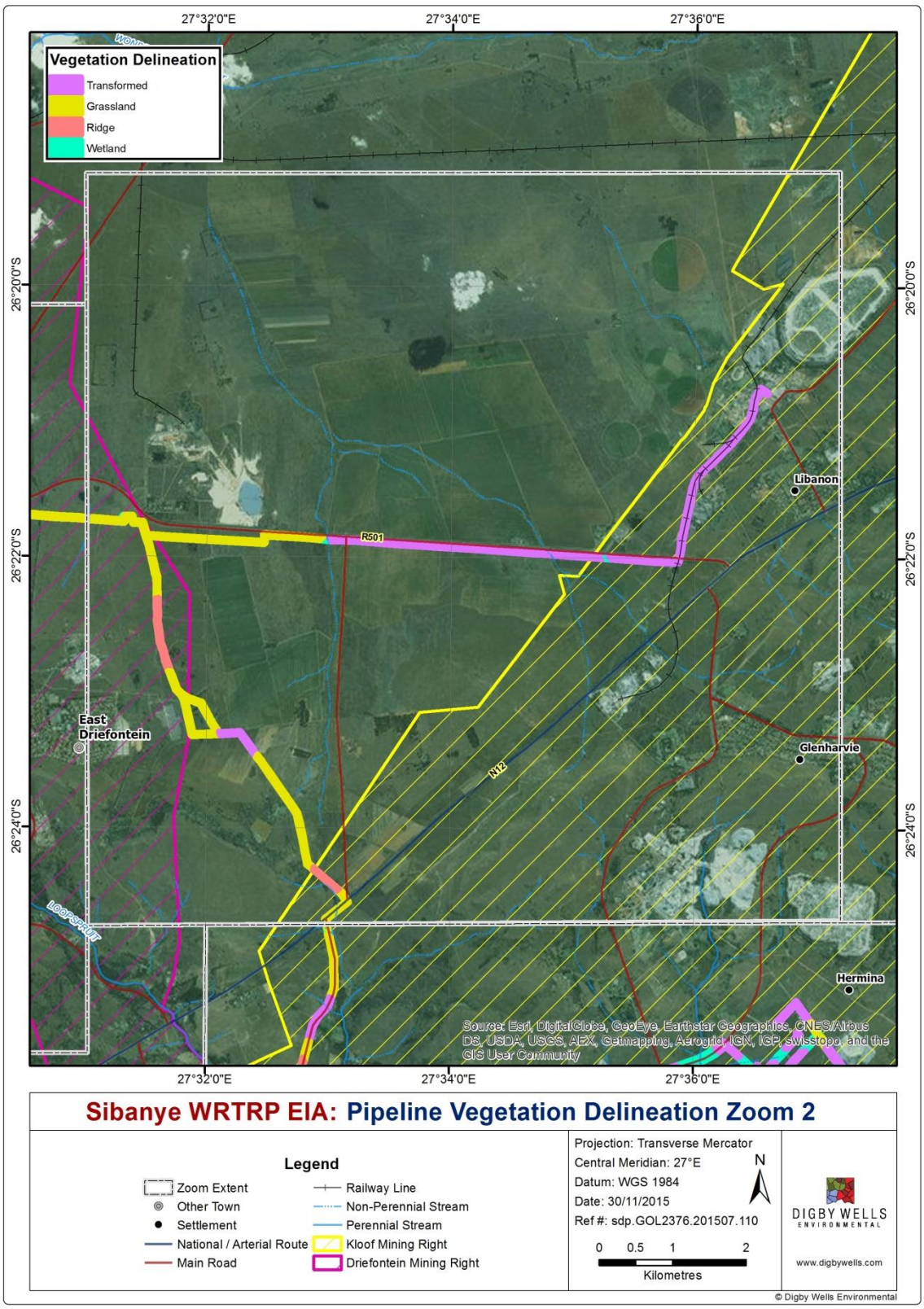

Figure 7-3: Pipeline Vegetation Zoom 2

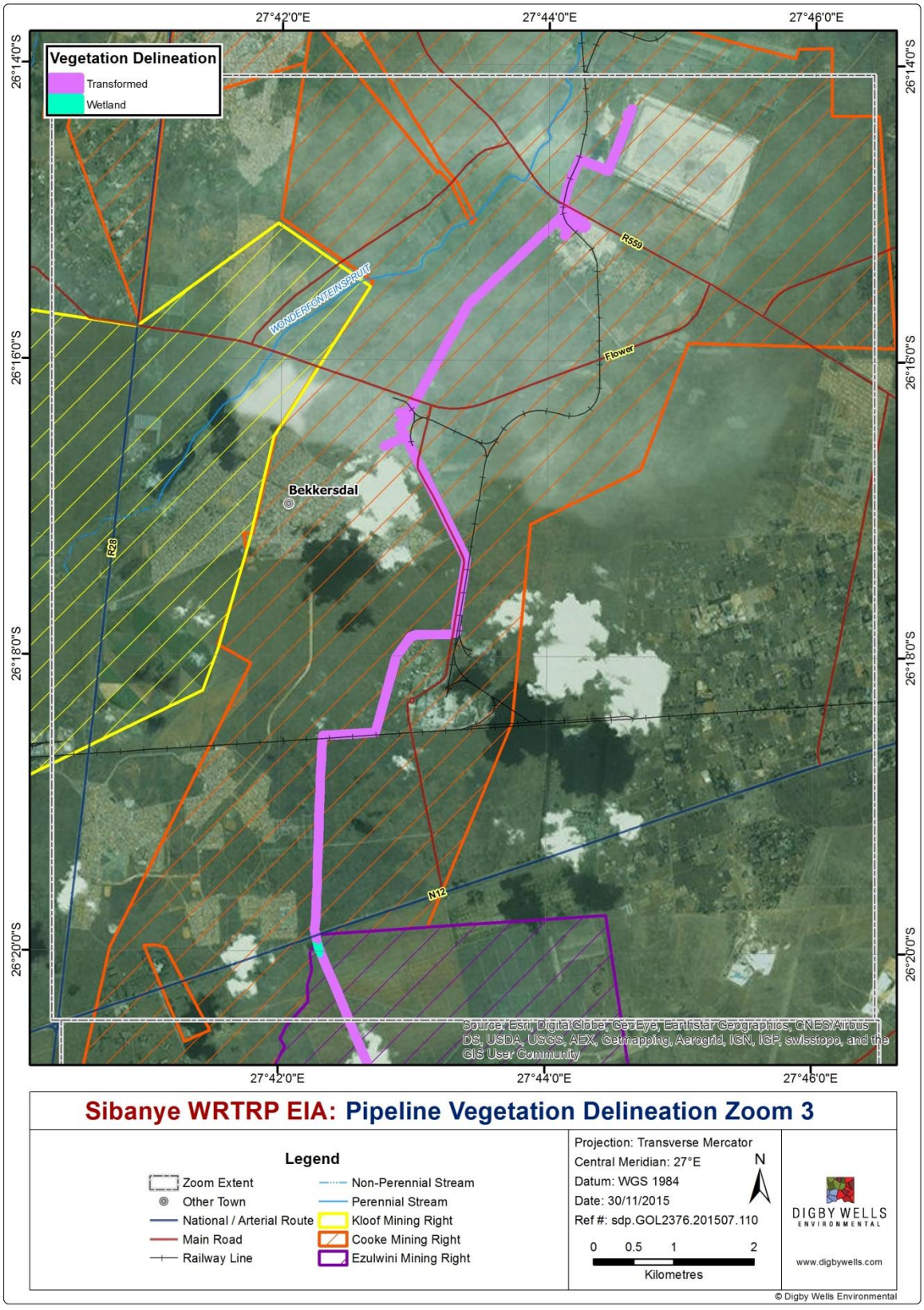

Figure 7-4: Pipeline Vegetation Zoom 3

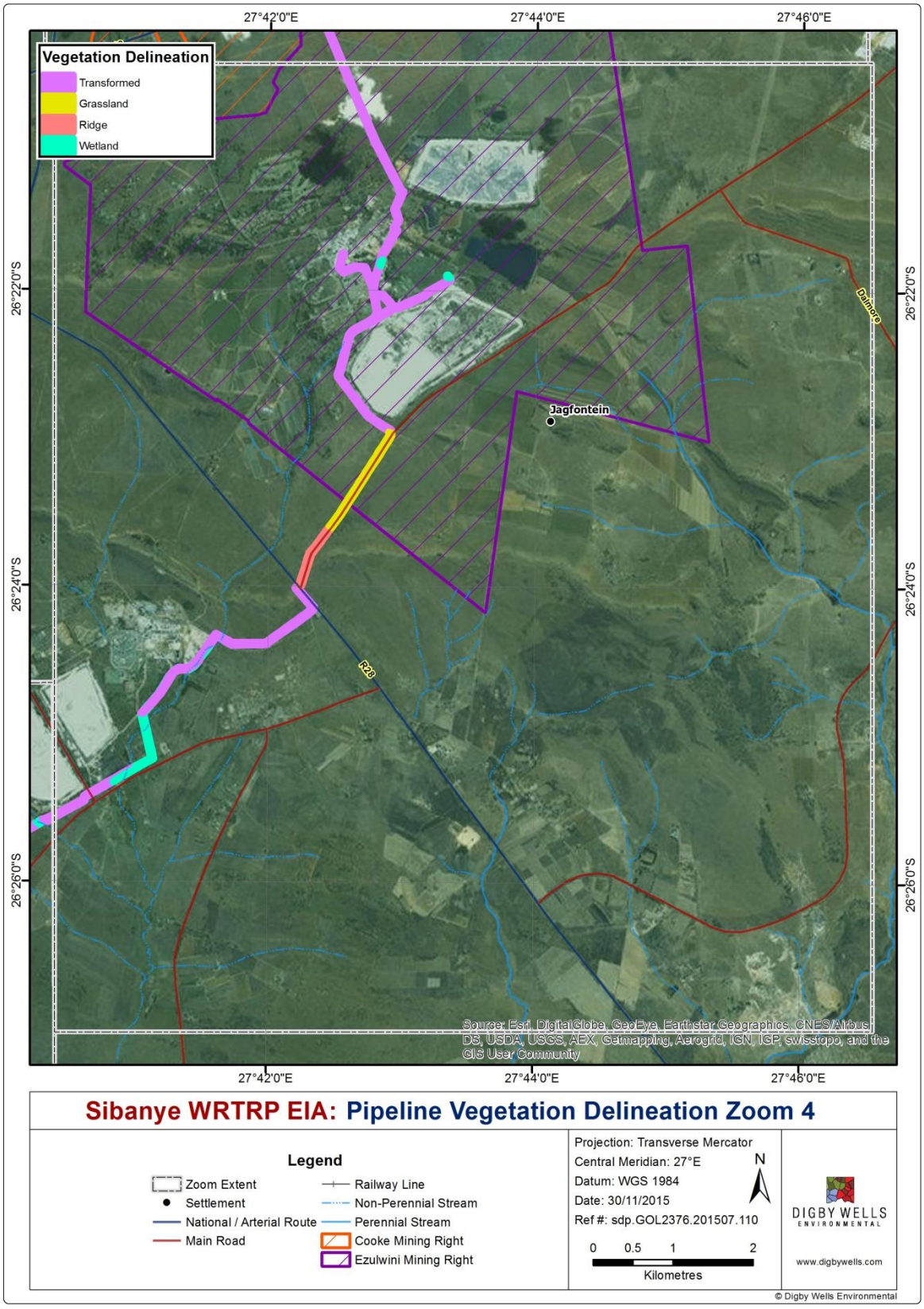

Figure 7-5: Pipeline Vegetation Zoom 4