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ENVIRONMENTAL

Environmental Impact Assessment for the Proposed Temo Rail Loop, Road Diversion and Pipeline Project, near Lephalale, Limpopo Province

Soil and Land Capability Assessment Report

Project Number:

NAM5335

Prepared for:

Temo Coal Mining (Pty) Ltd

February 2019

This document has been prepared by Digby Wells Environmental.

Report Type:	**Soil and Land Capability Assessment Report**
Project Name:	**Environmental Impact Assessment for the Proposed Temo Rail Loop, Road Diversion and Pipeline Project, near Lephalale, Limpopo Province**
Project Code:	**NAM5335**

Name	Responsibility	Signature	Date
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DECLARATION OF INDEPENDENCE

I, **Siphamandla Madikizela**, in my capacity as a specialist consultant, hereby declare that:

- I act as an independent specialist and I will comply with the Act, regulations and all other applicable legislation;
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the National Environmental Management Act, 1998 (Act No. 107 of 1998);
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I do not have any financial interest in the undertaking of the activity, other than remuneration for the work performed in terms of the National Environmental Management Act 1998 (Act 107 of 1998);
- I undertake to disclose to the client 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;
- I undertake to have my work peer reviewed on regular basis by a competent specialist in the field of study for which I am registered;
- 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;
- I have no, and will not engage in, conflicting interests in the undertaking of the activity; and
- Based on information provided to me by the project proponent and in addition to information obtained during the course of this study, have presented the results and conclusion within the associated document to the best if my professional judgement.

Title/ Position:	Soil Scientist
Qualification(s):	MSc in Soil Science
Experience (years):	5
Registration(s):	SACNASP (*Prof. Nat. Sci.: 400154/17*)
Signature:	

EXECUTIVE SUMMARY

Introduction

Temo Coal Mining (Pty) Ltd (hereinafter Temo Coal), proposes to construct ancillary infrastructure associated with their approved coal mining operation, the Temo Coal Mine ("Temo Mine"), near Lephalale in the Limpopo Province ("the Project"). The proposed ancillary infrastructure includes a road diversion, rail loop and water pipeline.

Digby Wells Environmental (Digby Wells) was commissioned by Temo Coal to perform a fauna and flora field survey to compile a report for the inclusion in an Environmental Impact Assessment (EIA) for Environmental Authorisation for Listed Activities as detailed in the EIA Regulations, under the National Environmental Management Act No. 7 of 1998 (NEMA).

This report presents the findings of a specialist soil impact assessment in support of the Environmental Impact Assessment (EIA) Process being undertaken in accordance with the National Environmental Management Act (Act No. 107 of 1998) (NEMA). This report presents the following relevant project components:

- Description of the soil forms;
- Determination of the current land capability and use;
- Identification and assessment of potential impacts on soils resulting from the existing and proposed activities; and
- Mitigation measures to minimise impacts associated with the existing and proposed activities.

Methodology

As part of the desktop assessment, baseline soil information was obtained from the South African land type data published with maps at a scale of 1:250 000 by the Institute for Soil, Climate and Water (ISCW) of the Agricultural Research Council (ARC). Soils were investigated by hand augering to a maximum depth of 1.2 m or to the depth of refusal. Soil survey positions were recorded as waypoints using a handheld Global Positioning System (GPS). At each observation point, the South African Taxonomic Soil Classification System was used to describe and classify the soils. Land use was determined from assessing aerial imagery and was ground-truthed during the site visit. The soil impact report discusses the approach and findings of a desktop and field survey carried out on 28 & 29 January 2019 in the study area. The following legislation was considered during the assessment:

- NEMA; and
- The Conservation of Agricultural Resources Act, 1993 (Act No. 43 of 1993), (CARA).

Findings

The land type data gathered suggested that the dominant land type on site were Ae252, Ae257, Ah86, Bc44 and Bd46 characterised by red yellow apedal, freely drained and upland duplex and margalitic soils rare; respectively. In summary the area is covered by thick red sandy soil. The land is confined almost exclusively to low intensity livestock grazing and game farming. The land capability is rated as low intensity grazing land potential and/or wilderness potential (Class VI).

Based on background information it is reported that the soils are inherently low in calcium and magnesium, have low to very low concentrations of organic carbon and return lower than average quantities of potassium and sodium. The soils are prone to erosion (low clay and organic carbon), albeit that the topography is generally flat to slightly undulating, a factor that tempers the erosion index to low.

Impact Assessment

During the construction phase site clearing is necessary for the preparation of surface infrastructure development where vegetation and topsoil will be removed. When soil is removed, the physical properties are changed, and the soils' chemical properties will deteriorate unless properly managed. Vehicles will drive on the soil surface during the construction phase, thereby causing compaction of the soils. The potential impacts associated with the project on soils include:

- Erosion due to exposed soil surfaces;
- Compaction of soils due to movement of heavy machinery and vehicles; and
- Soil contamination through hydrocarbon or oil spillages machinery and vehicles.

The impact of the project on the soils conditions will vary depending on the stage of mine and infrastructure development. There are negative, moderate and positive impacts of variable magnitudes. In general it appears that the project will have an overall minor to moderate negative impact on the land use and soils in the area. As a result of the foregoing, various mitigation measures and recommendations for their implementation have been proposed.

It is anticipated that the impact of construction of road, railway loop and pipeline on loss of soil as a resource - erosion and compaction will be of **moderate negative significance**. It is anticipated that the impact on soils will be of **moderate negative significance** during the construction, operational and decommissioning phases. It is anticipated that the impact on soils will be of **minor positive significance** during rehabilitation phase.

Recommendations

The following actions are recommended to minimise adverse effects of the proposed activities on soils:

- Runoff must be controlled and managed by use of proper stormwater management measures;
- If any erosion occurs, corrective actions must be taken to minimise any further erosion from taking place. Soil erosion might pose a problem once vegetation cover

is removed; thus, erosion monitoring should take place at regular intervals and after high rainfall events;

- Establishment of effective soil cover and adequate protection from wind and water;
- Soil chemical amelioration to enhance the growth capability of the soils;
- Return the land conditions capable of supporting prior land use or uses equal or better than prior land use to the extent feasible or practical;
- Compacted areas are to be ripped to loosen the soil structure and vegetation cover re-instated;
- Minimise unnecessary removal of the natural vegetation cover;
- All vehicles must be regularly inspected for potential hydrocarbon leaks;
- No re-fuelling is allowing on site; and
- Fuel and oils spills, should be remediated using commercially available emergency clean up kits. For major spills, if soils are contaminated they must be stripped and disposed of at a licensed waste disposal site.

LIST OF ACRONYMS

ARC	Agricultural Research Council
CARA	The Conservation of Agricultural Resources Act, 1983 (Act No. 43 of 1983)
DMR	Department of Mineral Resources
EA	Environmental Authorisation
ECO	Environmental Control Officer
EAP	Environmental Assessment Practitioner
EIA	Environmental Impact Assessment
EMPr	Environmental Management Programme
GIS	Geographical Information System
GPS	Global Positioning System
Ha	Hectares
IFC	International Finance Corporation
ISCW	Institute for Soil, Climate and Water
LEDET	Limpopo Department of Economic Development, Environment and Tourism
LLM	Lephalale Local Municipality
m	metres
MAP	Mean Annual Precipitation
mamsl	metres above mean sea level
MRA	Mining Right Area
NEMA	National Environmental Management Act, 1998 (Act No. 107 of 1998)
pa	per annum
SoW	Scope of Work
USA	United States of America
WDM	Waterberg District Municipality

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF APPENDICES

LIST OF PLANS

1 Introduction

Temo Coal Mining (Pty) Ltd (hereinafter Temo Coal), proposes to construct ancillary infrastructure associated with their approved coal mining operation, the Temo Coal Mine ("Temo Mine"), near Lephalale in the Limpopo Province ("the Project"). The proposed ancillary infrastructure includes a road diversion, rail loop and water pipeline.

Digby Wells Environmental (Digby Wells) was commissioned by Temo Coal to perform a fauna and flora field survey to compile a report for the inclusion in an Environmental Impact Assessment (EIA) for Environmental Authorisation for Listed Activities as detailed in the EIA Regulations, under the National Environmental Management Act No. 7 of 1998 (NEMA).

This report presents the findings of a specialist soil impact assessment that forms part of the EIA Process.

1.1 Project Applicant

Temo is a subsidiary of the Namane Group and is based in Pretoria. Temo has approval to begin mining the aforementioned Temo Mine in Limpopo which has not commenced to date. The details of the Applicant are summarised in Table 1-1.

Table 1-1: Details of the Applicant

Company Name	Temo Coal Mining (Pty) Ltd
Contact Person	Jan Britz
Physical Address	1st Floor, Block 5, Ashlea Gardens, 180 Garsfontein Road, Pretoria
Telephone	012 346 4662
Email	jan@namane.co.za

1.2 Project Background

Temo currently has an approved mining right (MR) which was authorised by the Department of Mineral Resources on 27 September 2013 (Reference Number: LP 30/5/1/2/2/199 MR). That Project was also authorised in terms of the National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA) and the Environmental Impact Assessment (EIA) Regulations thereunder, dated 18 June 2010 (which have since been repealed). The Environmental Authorisation was granted by the Limpopo Department of Economic Development, Environment and Tourism (LEDET) on 13 July 2015 (Reference Number: 12/1/9/2-W55).

Temo Mine is located approximately 60km from Lephalale in the Limpopo Province. This project considers applying for Environmental Authorisation, in terms of NEMA, and a Water Use Licence (WUL) in terms of the National Water Act, 1998 (Act No. 36 of 1998) (NWA) to construct a rail loop, road diversion and pipeline.

The farm portions on which the Temo Mine is situated comprise Verloren Valey 246 LQ, Duikerpan 249 LQ, Japie 714 LQ, Hans 713 LQ and Kleinberg 252 LQ. Temo proposes to mine coal using open pit methods and the open pit will be situated entirely within the Farm Verloren Valey 246 LQ.

In reference to this assessment, Temo proposes to divert the dirt road (D175) around the approved mining right area for mining to continue, to construct a rail loop for transportation of coal and construct a water pipeline to service the Temo mine. As detailed below:

- **Diversion of road D175:** The approved open pit area has a road, the D175, which transects the south-western corner of the future pit area and continues to exit the Mining Right boundary near the north-western corner. To facilitate continued mining and maximise the minable area at the Temo Mine, Temo proposes that the D175 be diverted around the mining area;
- **Proposed Rail Loop:** The purpose of the rail loop is to allow Temo to transport export-grade coal product to the Richards Bay Coal Terminal (RBCT), as well as for domestic use. The rail loop will include a loading loop which will be within the approved Mining Right boundary of the Temo Mine; and
- **Proposed Bulk Water Pipeline:** Construction of a bulk water pipeline (for which three different pipeline routes are proposed) connecting the Temo mine.

The abovementioned proposed developments requires an EIA Report and Environmental Management Programme, in terms of the new EIA Regulations, published in GN R982 dated 04 December 2014 (as amended December 2017).

1.3 Project Activities

The activities related to soils, land use and land capability have been divided by which phase each activity will take place; either the construction phase, operational phase, decommissioning phase or post-closure phase. The road diversion will be permanent and will therefore not be decommissioned. The following activities are to be undertaken which may require EA and are summarised in Table 1-2.

Table 1-2: Project Activities

Construction Phase Activities
Construction of access road(s)
Site clearing (removal of vegetation)
Topsoil and subsoil removal and stockpiling
Temporary storage of construction materials and hazardous material
Increased vehicular activity on road D175
Construction of the road diversion, rail loop and pipeline
Generation and removal of domestic and hazardous waste

Operation Phase Activities
Maintenance and repair of rail loop and pipeline
Vehicular activity on access roads and D175 main road
Operation of the rail loop and pipeline
Decommissioning Phase Activities (Rail loop and Pipeline)
Demolition of rail loop, pipeline and associated infrastructure
Rehabilitation of area
Generation and disposal of demolition waste
Rehabilitation of access road
Post-closure Phase (Rail loop and Pipeline)
Post-closure monitoring and rehabilitation will determine the level of success of the rehabilitation, as well as to identify any additional measures that have to be undertaken to ensure that the area associated with the rail loop and pipeline route is restored to an adequate state. Monitoring will include soil fertility and erosion, natural vegetation and alien invasive species and potential dust generation.

1.4 Project Alternatives

Temo Mine is located in an area that is water scarce and there is no reliable water source for the operation of the mine. Temo is currently looking at three pipeline routes to convey water from the Lephalale Waste Water Treatment Works (WWTW) to Temo Mine. Currently, Temo Coal is considering the three pipeline routing options which are detailed below:

1.4.1 Option 1

The pipeline alignment for Option 1 follows the following route:

- From the proposed pump station the pipeline runs on the western side of the Onverwacht Road reserve toward Nelson Mandela Drive;
- At the intersection of Onverwacht Road and Nelson Mandela Drive the pipeline alignment changes direction and runs on the southern side of the Nelson Mandela Drive road reserve toward Grootegeluk mine;
- At the intersection of Nelson Mandela Drive and district road D1675 the alignment changes direction to the northern side of the D1675 road reserve toward Steenbokpan; and
- At the intersection of D1675 and D175, the alignment changes direction to the eastern side of the D175 road reserve all the way up to the mine.

1.4.2 Option 2

The pipeline alignment for Option 2 follows the following route:

- From the proposed pump station the pipeline runs on the western side of the Onverwacht Road road reserve toward Nelson Mandela Drive;
- At the intersection of Onverwacht Road and Nelson Mandela Drive the pipeline alignment changes direction and runs on the southern side of the Nelson Mandela Drive road reserve toward Grootegeluk mine;
- At the intersection of Nelson Mandela Drive and district road D1675 the alignment changes direction to the northern side of the D1675 road reserve toward Steenbokpan;
- Before the intersection of D1675 and D175, the alignment changes direction to the eastern side of the railway reserve all the way up to the Mine; and
- This option is approximately 62.4 km in length. The water is pumped for the first 31.8 km and then gravitates down the remaining 30.6 km to Temo Mine.

1.4.3 Option 3

The pipeline alignment for Option 3 follows the following route:

- From the proposed pump station, the pipeline runs through farm portion of Paarl and joins Palala Drive on the western side;
- At the intersection of Palala Drive and Nelson Mandela Drive the pipeline alignment changes direction and runs on the southern side of the Nelson Mandela Drive road reserve toward Grootegeluk mine;
- At the intersection of Nelson Mandela Drive and district road D1675 the alignment changes direction to the northern side of the D1675 road reserve toward Steenbokpan;
- Before the intersection of D1675 and D175, the alignment changes direction to the eastern side of the railway reserve all the way up to the Mine; and
- This option is approximately 61.1 km in length.

2 Project Location

The Temo Mine is situated on the various farm portions, namely, Verloren Valey 246LQ, Duikerpan 249LQ, and Japie 714LQ, Hans 713LQ and Kleinberg 252LQ. The rail loop servitude falls on the farms, Draai Om 244LQ, Swelpan 245LQ, Verloren Valey 246LQ, Duikerpan 249LQ, Wildebeestvlakte 268LQ, Kleinpan 269LQ, Houwhoek 270LQ, and Groote-Zwart-Bult 290LQ. The road diversion servitude falls on the farms Dalyshope 232LQ, Draai Om 244LQ, Verloren Valey 246LQ, and Nazarov 685LQ. The proposed Rail Loop, Pipeline and Road Diversion Project are situated within the Waterberg Coalfield area. Temo is located approximately 60 km west of Lephalale town within Lephalale Local Municipality (LLM) and the Waterberg District Municipality (WDM), Limpopo Province. The location of Temo is summarised in Table 2-1 and illustrated in Figure 2-1 and Figure 2-2. The general layout of the site is shown in Figure 2-3.

Table 2-1: Summary of Project Location Details

Province	Limpopo Province
District Municipality	Waterberg District Municipality
Local Municipality	Lephalale Local Municipality
Nearest Town	Lephalale
Application Area (ha)	Rail loop: 55.6 Hectares (Ha); Road diversion: 8.4Ha; Pipeline: Option 1: 1.29 Ha; Pipeline: Option 2: 1.24 Ha and Pipeline: Option 3: 1.22 Ha Total Project area: 67.8 Ha

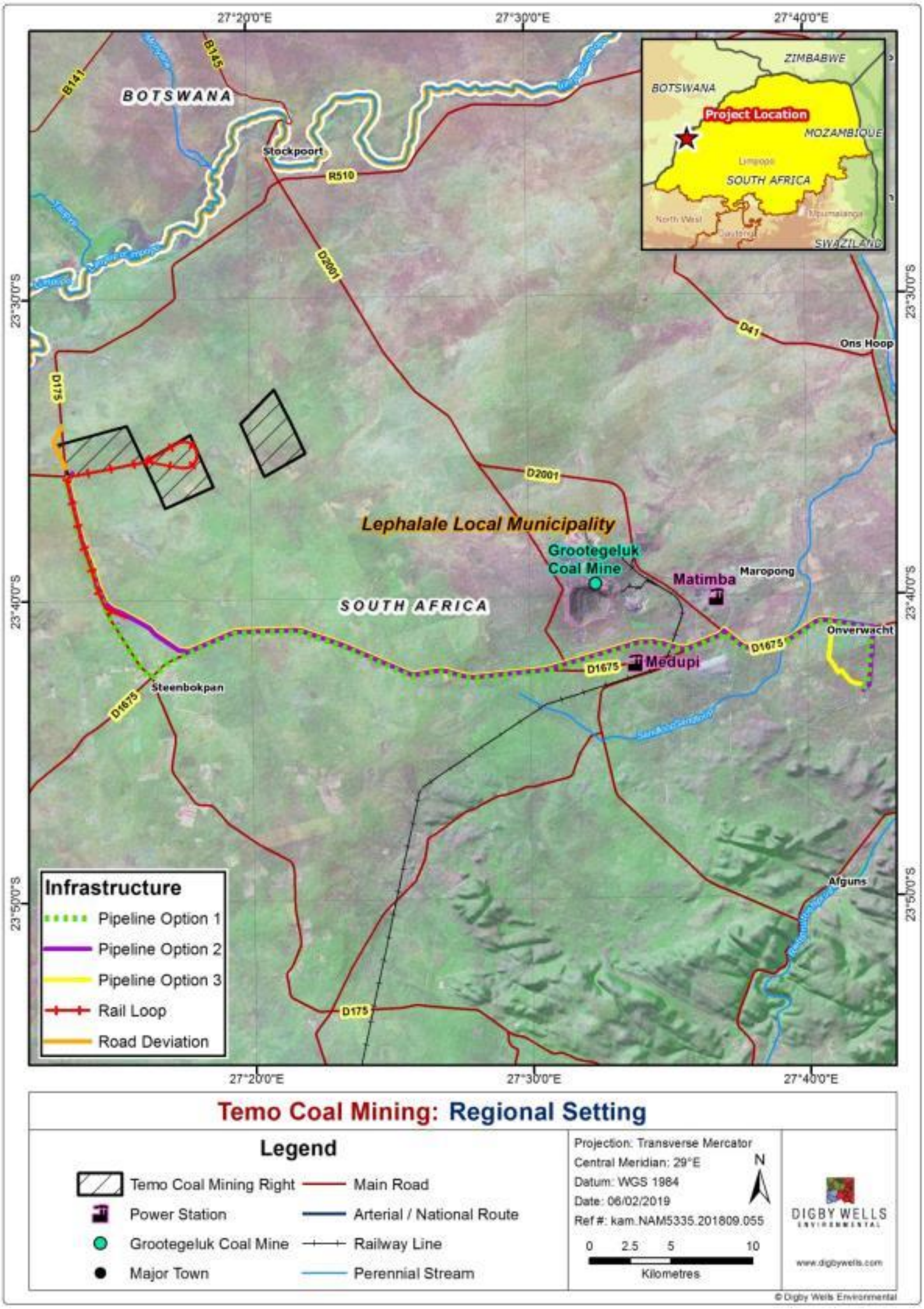

Figure 2-1: Regional Setting at Temo Coal

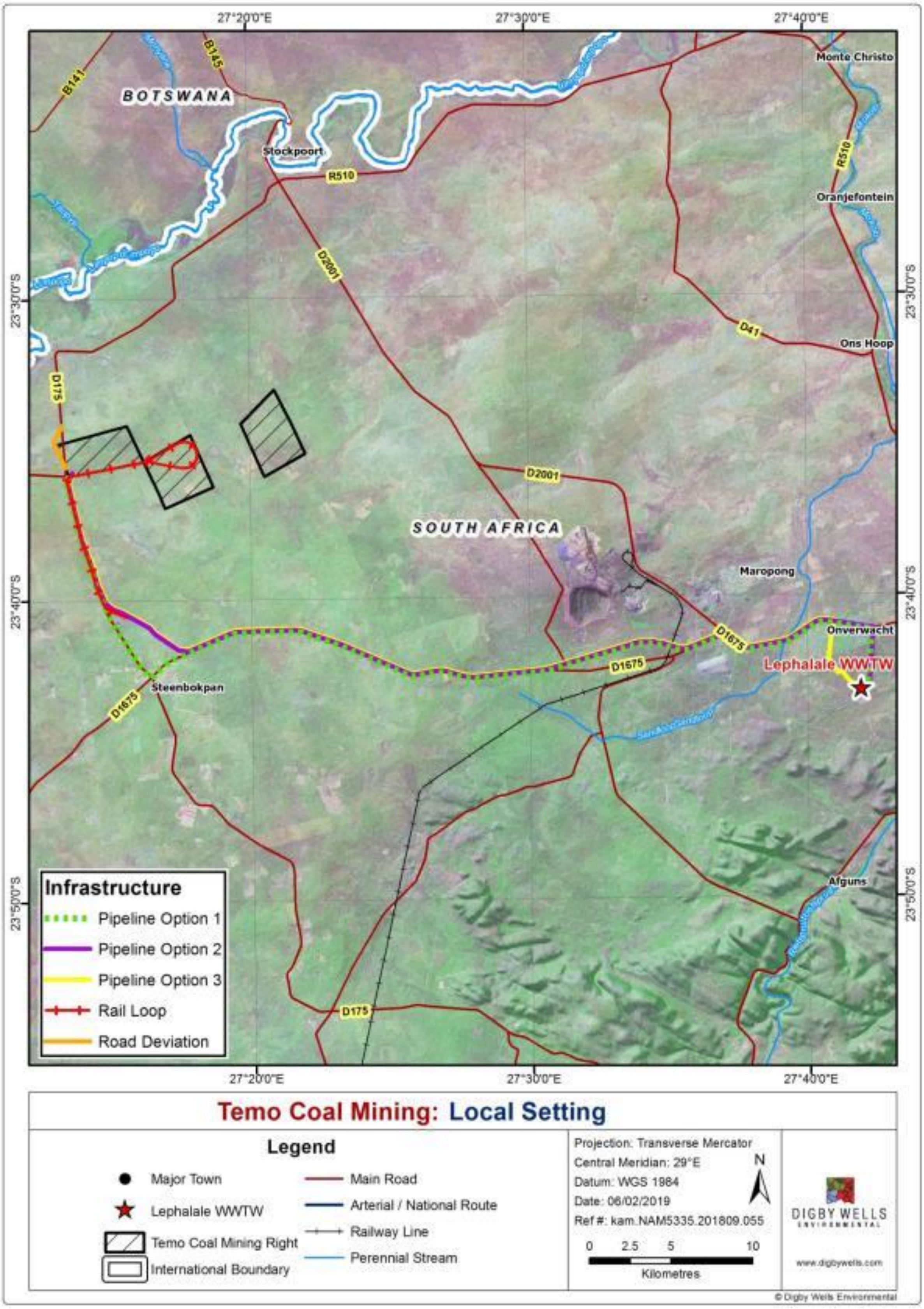

Figure 2-2: Local Setting at Temo Coal

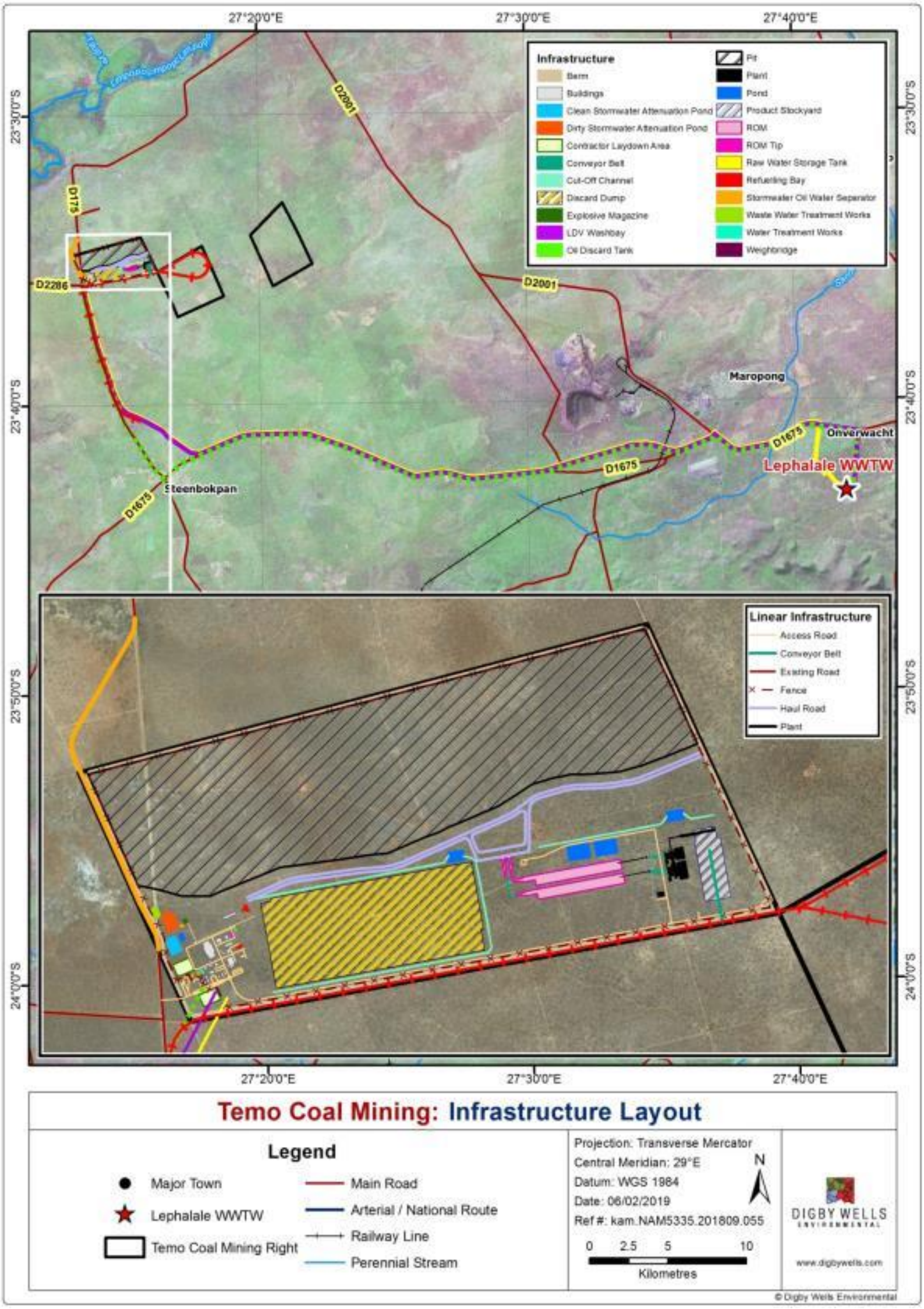

Figure 2-3: Proposed Infrastructure at Temo Coal

3 Scope of Work

Digby Wells' Scope of Work (SoW) includes:

- Review of all the existing available information;
- Soil survey of the soils occupying the road, railway and pipelines. A hand soil auger was used to survey the soil types present and survey positions were recorded as waypoints;
- Description and categorisation of soils using the South African Soil Classification: A Natural and Anthropogenic System for South Africa (Soil Classification Working Group, 2018);
- Land use/cover was mapped in conjunction with the soil survey;
- Land capability was assessed from the soil classification;
- Identification and assessment of potential impacts on soils resulting from the decommissioning of the infrastructure using the prescribed impact rating methodology; and
- Mitigation measures were recommended to minimise impacts associated with the proposed activities.

4 Assumptions and Limitations

The following assumptions and limitations have been made:

- The information provided in this report is based on information gathered from the site visit undertaken on 28 & 29 January 2019 and information reviewed from previous studies;
- The information contained in this report is based on soil sampling points taken and visual observations on site; and
- The area surveyed is based on the layout presented by Temo.

5 Details of Specialists

The following is a list of Digby Wells' staff who was involved in the compilation and review of the soils and land capability report for Temo:

Siphamandla Madikizela is a Soil Scientist, completed his MSc in Soil Science at University of KwaZulu-Natal and is a Professional Natural Scientist (Registration no. 400154/17) in the Republic of South Africa. He is the part of the Closure, Rehab and Soils Division at Digby Wells Environmental. His role involves conducting soil surveys; soil, land capability and land use environmental impact assessments; soil and agricultural potential studies; soil contamination assessments; interpreting results of soil samples; soil management plans and writing detailed scientific reports in accordance to local legislation and International Finance

Corporation (IFC) Standards and World Bank Guidelines. Siphamandla has worked in projects in South Africa, Democratic Republic of the Congo, Malawi and Mali.

Danie Otto; is the Technical Director at Digby Wells. Danie holds an MSc in Environmental Management (Phytoremediation) with BSc Hons (Limnology, Geomorphology, GIS and Environmental Management) and BSc (Botany and Geography & Environmental Management). He is a bio-geomorphologist that specialises in ecology of wetlands and rehabilitation. He has been a registered Professional Natural Scientist since 2002. Danie has 20 years of experience in the mining industry in environmental and specialist assessments, management plans, audits, rehabilitation, and research.

6 Legislative Framework

The proposed Project will comply with the requirements of South African legislation and as well as the IFC Performance Standards. This section provides an overview of legislation pertaining to the undertaking of an impact assessment specific to the soils at the proposed Project infrastructure areas and surroundings. It summarises relevant national legislation as well as international best practice, in the form of the IFC policies and standards.

6.1 South African Legislation

The South African Environmental Legislation needs to be considered with reference to the management of soil and land use which includes:

- Soils and land capability are protected under the National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA). The NEMA requires that pollution and degradation of the environment be avoided, or, where it cannot be avoided be minimised and treated; and
- The Conservation of Agricultural Resources Act, 1983 (Act No. 43 of 1983) (CARA). The CARA requires that protection of land against soil erosion, the prevention of water logging and salinization of soils by means of suitable soil conservation works to be constructed and maintained.

6.2 IFC Performance Standards

The IFC's Performance Standards aim to manage social and environmental risks and impacts to enhance development opportunities in its private sector financing in member countries eligible for financing (IFC, 2012). Performance Standards related to soils, land use and land capability must be adhered to by Temo in managing risks and impacts associated with the proposed mining activities. The guidelines and standards relevant to the soil study as described by the IFC which have been considered for this study include the following:

- **Performance Standard 1**: Assessment and Management of Environmental and Social Risks and Impacts:
  - Potential soil erosion, land use and land capability changes due to the project impacts.

- **Performance Standard 3**: Resource Efficiency and Pollution Prevention:
  - Contaminated land may involve surface soils or subsurface soils that, through leaching and transport, may affect groundwater, surface water, and adjacent sites.
- **Performance Standard 6**: Biodiversity Conservation and Sustainable Management of Living Natural Resources:
  - Potential soil erosion, land use and land capability changes due to the project impacts.

7 Methodology

This section describes the methodology used in the compilation of the soils report as indicated in Figure 7-1.

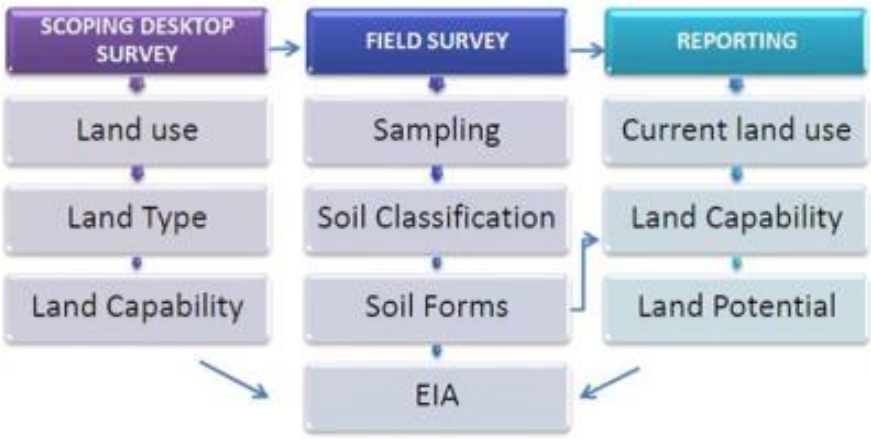

Figure 7-1: Soils, Land Capability and Use Assessment and Report Process

7.1 Literature Review and Desktop Assessment

Digby Wells conducted a literature review of all the existing baseline data related to the soil assessment. The following sources of information were reviewed and utilised for the compilation of this report:

- Soils and Land Capability Report. Namane Generation Independent Power Producer and Transmission Line Project, Lephalale, Limpopo. Namane Generation (Pty) Ltd. March 2016. Earth Science Solutions (Pty) Ltd;
- Updated Environmental Impact Assessment and Management Programme. Soils and Land Capability Report. Namane Generation Independent Power Producer and Transmission Line Project, Lephalale, Limpopo. June 2016. Digby Wells Environmental; and

- Scoping Report for the Proposed Rail Loop, Road Diversion and Pipeline Project for Temo Coal Mine (Pty) Ltd, near Lephalale, Limpopo Province. October 2018. Digby Wells Environmental.

A review of all available data and information was undertaken to determine the status quo of the soil environments on the site and the immediate surrounding areas. The desktop study aimed to determine the baseline conditions from existing studies conducted in the area as well as publicly available information.

Existing Land Type data was used to obtain generalised soil patterns and terrain types for the project site. Land Type data exists in the form of published 1:250 000 maps. These maps indicate delineated areas of relatively uniform terrain, soil pattern and climate (Land Type Survey Staff, 1972 - 2006). The maps and their accompanying reports provide a statistical estimate of the different soils expected in the area.

7.2 Field Survey

The field assessment and sampling was undertaken on 28 & 29 January 2019 and sampling procedure and methodology are summarised below.

7.2.1 Soil Classification

An assessment of the soils present at the road, railway, and pipeline was conducted during a field visit. The site was traversed on foot and a hand-held soil auger was used to determine the soil type and depth. Soils were investigated using a bucket auger to a maximum depth of 1.2 m or to the depth of refusal. Survey positions were recorded as waypoints using a handheld Global Positioning System (GPS). Other features such as existing open trenches were helpful to determine soil types and depth. The soil forms (types of soil) found was described using the South African Soil Classification System (Soil Classification Working Group, 2018).

7.2.2 Land Capability

Land capability was determined by assessing a combination of soil, terrain and climate features. Land capability is defined by the most sustainable land use under rain-fed conditions. The following approaches were used to determine land capability as they are used in agriculture and recommended in the industry. Land capability was assessed according to the United States of America (USA) Department of Agriculture's Land Capability Method (Klingebiel and Montgomery, 1961), which is based on eight classes (I, II, III-VIII), as well as the approach by Schoeman *et al* (2000) which was adapted for use with Geographic Information System (GIS) in South Africa. These approaches were used since there are no specific Malawian guidelines for the land capability assessment. Land capability involves consideration of the risks of land damage from erosion and other causes and the difficulties in land use owing to physical land characteristics including climate. Table 7-1 shows land capability classes in detail.

Table 7-1: Description of the Land and Soil Capability Classes

Class	Definition	Description
I	Land with no major limitation for use and suitable for a wide range of land uses.	Land in Class I has few limitations that restrict its use. It may be used safely and profitably for cultivated crops. The soils are nearly level and deep, generally well drained and are highly responsive to inputs of fertiliser.
II	Land with minor limitations for land use.	Land in Class II has some limitations that reduce the choice of plants or require moderate conservation practices. It may be used for cultivated crops with less latitude in the choice of crops or management practices in Class I.
III	Land with slight to moderate limitations for land use.	Land in Class III has limitations that reduce the choice of plants or require special conservation practices. It may be used for cultivated crops, but has more restrictions than Class II.
IV	Land with moderate limitations for land use.	Land in Class IV has limitations that restrict the choice of plants and require very careful management. It may be used for cultivated crops but more careful management is required than for Class III. Conservation practices are more difficult to apply and maintain.
V	Land with moderate to high limitations to land use.	Land in Class has limitations that are impractical to remove and limit its use largely to pasture and wildlife. Limitations restrict the choice of plants that can be grown and prevent normal tillage of cultivated crops.
VI	Land with a high degree of limitations for land use.	Land in Class VI has limitations that make land unsuited for cultivation and its use largely to pasture, wildlife and range. Limitations that cannot be corrected include steep slope, severe erosion hazard, shallow rooting zone and low water holding capacity.
VII	Land with high soil erosion hazard and extreme site limitations.	Land in Class VII has severe limitations that make the land unsuited for cultivation and restrict its use largely to grazing or wildlife. Restrictions are more severe than those in Class VI.

VIII	Land not suitable for any type of land use apart from nature conservation due to severe limitations.	Land in Class VIII has very severe limitations that preclude its use for commercial plant production and restrict its use to recreation and wildlife. Limitations that cannot be corrected may result from the effects of one or more of erosion hazard, stones, and low water holding capacity, salinity or sodicity.

7.2.3 Land Use

The current land use was identified using aerial imagery during the desktop assessment and verified through on-site visual inspection. The land use was classified as follows:

- Mines;
- Waterbodies;
- Wetlands;
- Urban built-up; and
- Cultivated areas.

8 Environmental Setting

Baseline information was sourced from the Updated Environmental Impact Assessment and Management Programme (Digby Wells, 2016) and Scoping Report (Digby Wells, 2018).

8.1 Climate and Rainfall

The region is characterised by warm to hot summers and cool winters. Summer season experiences long and dry afternoons, with an average sunshine duration of 65%. The maximum temperatures range from 36°C in summer to 24°C in winter. The annual maximum and average relative humidity are given as 100% and 63%, respectively. The average annual rainfall is between 350 mm to 400 mm, normally occurring during the mid-summer period. Rainfall in this region occurs mainly during the summer months and the average Mean Annual Precipitation (MAP) is 692 mm per annum (pa). The average Annual Potential Evaporation (APE) is 1949 mm and the higher evaporation rates are expected to be during the month of January whilst the lower evaporation rates are expected to be around September.

8.2 Topography

The project area and surrounds are relatively flat. The topographical model indicates that the elevation of the rail loop servitude ranges between 847 meters above mean sea level (mamsl) and 887 mamsl. The elevation of the road diversion servitude decreases from 845 mamsl in the south to 836 mamsl in the north.

8.3 Geology

The project area is underlain by sediments of the Karoo Supergroup and Dwyka Group formations, as illustrated in Figure 8-1. Table 8-1 summarises the geology within the area which consists of sandstone, carbonaceous shale, grit, dull coal, tillite and glacial sediments.

Table 8-1: Stratigraphy in the Mine Reserve Area

Sequence	Group	Formation	Lithology
Karoo	Ecca	Vryheid	Sandstone, grit and carbonaceous shale
		Dwyka	Tillite, glacial sediments

8.4 Flora

The project area falls within the Limpopo Sweet Bushveld vegetation type which is located within the Bushveld biome (Mucina & Rutherford, 2006), as illustrated in Figure 8-2. The vegetation is characterised by grassland, bushes and trees. The vegetation of the project area and surrounds is relatively dense and has an average height of 5 metres (m). Four major vegetation types occur in the Project area. Three of these are types of Bushveld with different dominant species, and the fourth the very distinctive wetland vegetation of the ephemeral pans. The four identified vegetation communities are:

- *Vachellia* Thornveld;
- *Combretum* woodland;
- *Terminalia* woodland; and
- Ephemeral Pan Vegetation.

8.5 Soil Chemical Characteristics

These soils are characteristically:

- Neutral to slightly acid, with a wide pH range of between 4,4 and 7,6;
- Low to moderate reserves of calcium and magnesium associated with the sands;
- Lower than required quantities of Magnesium (Mg), Zinc (Zn), Copper (Cu), and Potassium (K);
- Extremely low clay contents (<3%) associated with the deep sands, and at best moderate clay contents for the in-situ derived materials (10% to 18%); and
- Very low organic carbon (0, 07% – 0, 17%) for all but the chemically altered soils.

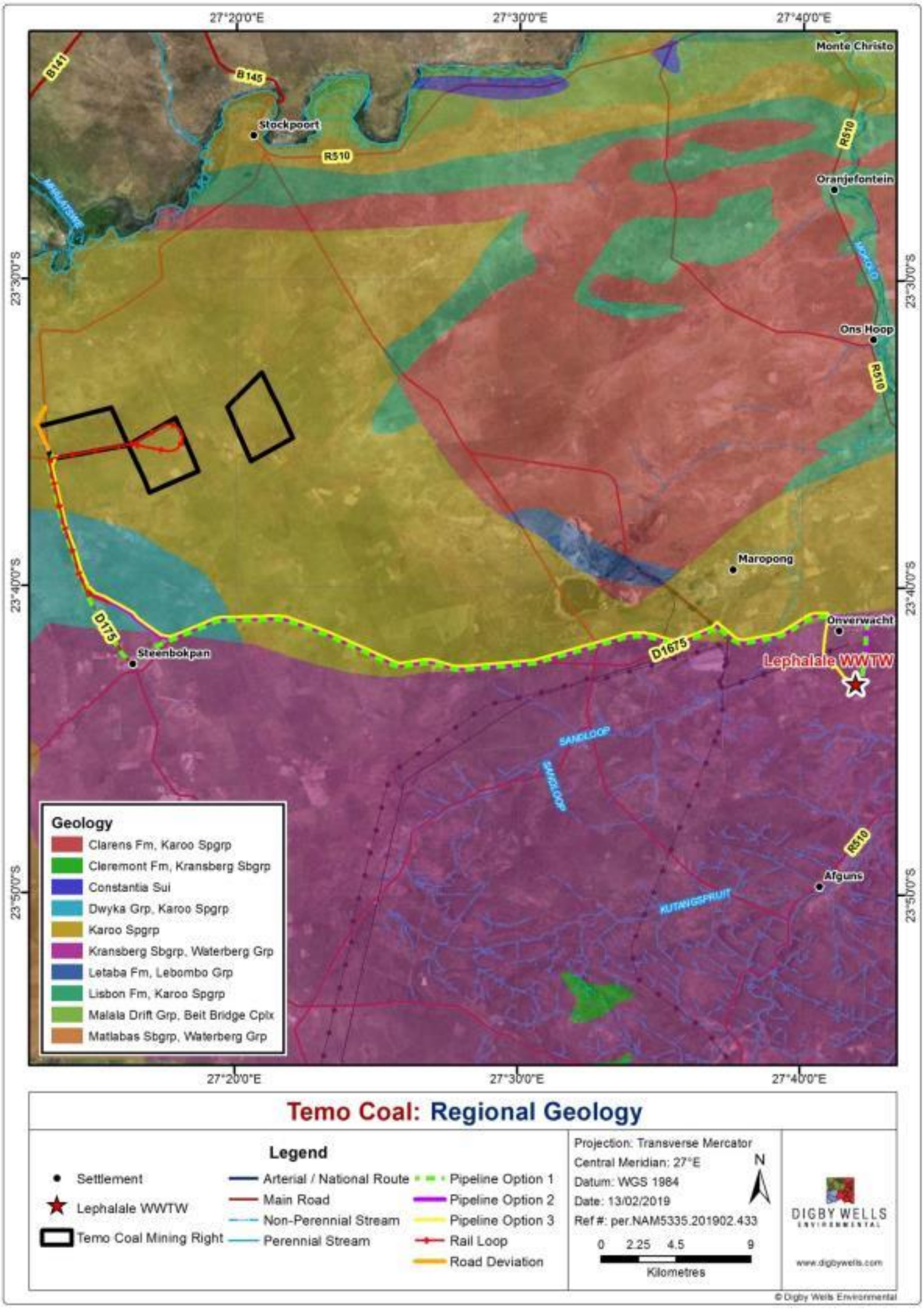

Figure 8-1: Regional Geology at Temo Coal

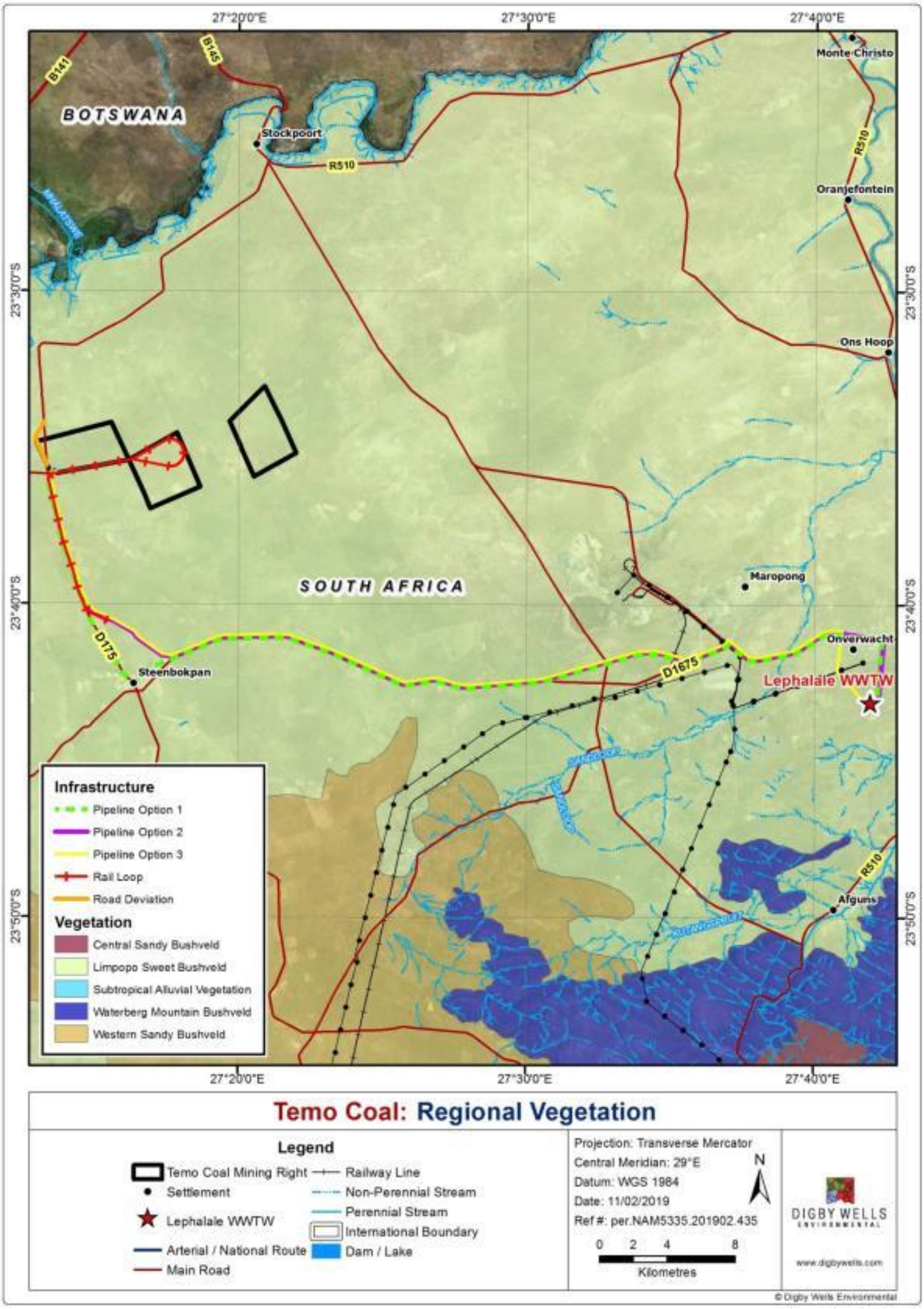

Figure 8-2: Regional Vegetation at Temo Coal

9 Visual Observations

A site visit was conducted on the 28 & 29 January 2019 to physically assess the conditions of the road, railway and pipeline to be constructed, operated and decommissioned later.

The following rehabilitation measures are recommended after decommissioning:

- Remove remaining waste in contractors area after moveable structures and equipment have been removed by contractors;
- Rip footprint areas to alleviate compaction;
- Reseed with indigenous grasses and improve species diversity by planting species;
- Monitor and maintain vegetation establishment;
- Remove all rubble and materials from site;
- All erosion noted within the decommissioning footprints should be remedied immediately and included as part of an ongoing rehabilitation;
- Remove alien invasive vegetation; and
- Remove coal contamination and any other residues and dispose of it at the appropriate facility.

Plan 9-1: Areas where road diversion will occur

Plan 9-2: Areas where railway loop will be constructed

Plan 9-3: Areas where the pipeline will be crossing

10 Findings

Information related to the soils associated with the project area is discussed in this section. The land type data gathered suggested that the dominant land type on site were Ae252, Ae257, Ah86, Bc44 and Bd46 characterised by red yellow apedal, freely drained and upland duplex and margalitic soils rare; respectively, as illustrated in Figure 10-1. Further information related to the soils within the project area is discussed in Section 10.1.

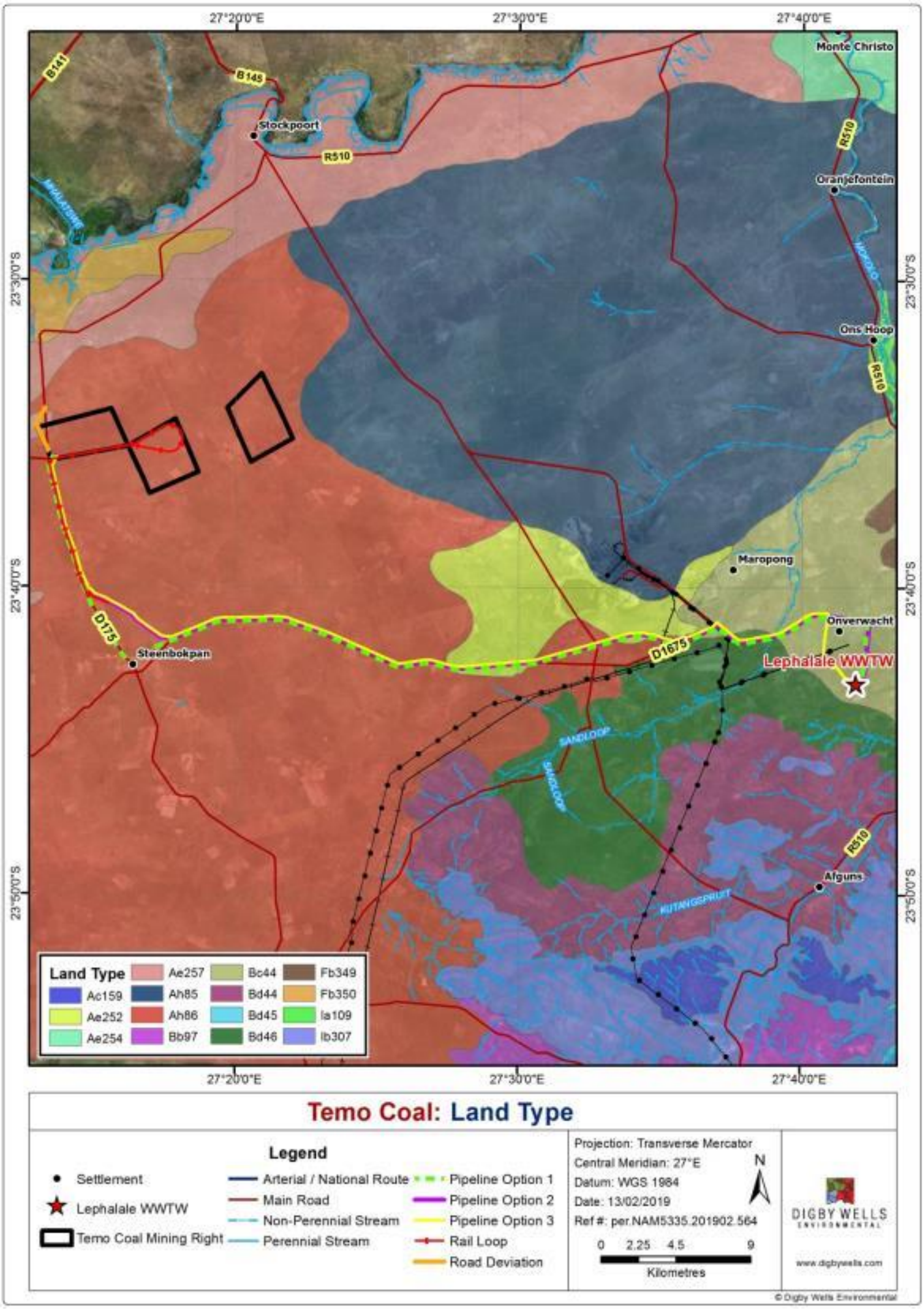

Figure 10-1: Land Type at Temo Coal

10.1 Land Type and Soil Forms

Table 10-1 shows dominant land types and soil forms found along the road diversion, railway loop and pipeline with visual representation depicted in Figure 10-2.

Table 10-1: Dominant Land Types and Soils

Land Type	Description	Agricultural Potential
Ae252	Red, structureless and sandy soils. Mainly used for grazing due to climatic constraints for crop production.	Low due low rainfall and high evaporation.
Ae257	Red, structureless and sandy soils. Mainly used for grazing due to climatic constraints for crop production.	Low due low rainfall and high evaporation.
Ah86	Red and yellow, deep sandy soils. Mainly used for grazing due to climatic constraints for crop production.	Low due low rainfall and high evaporation.
Bc44	Red, plinthic soils and well drained. Unleached soils with plinthite.	Low due low rainfall and high evaporation.
Bd46	Yellow, plinthic soils with variable depth. Mainly used for grazing due to climatic constraints for crop production.	Low due low rainfall and high evaporation.

Figure 10-2: Example of structureless soils found site

10.2 Present Land Use

The present land use was identified using satellite images and visual observations during the site visit. The main land uses in the area are grassland for grazing, as illustrated in Figure 10-3. The land is confined almost exclusively to low intensity livestock grazing and game farming.

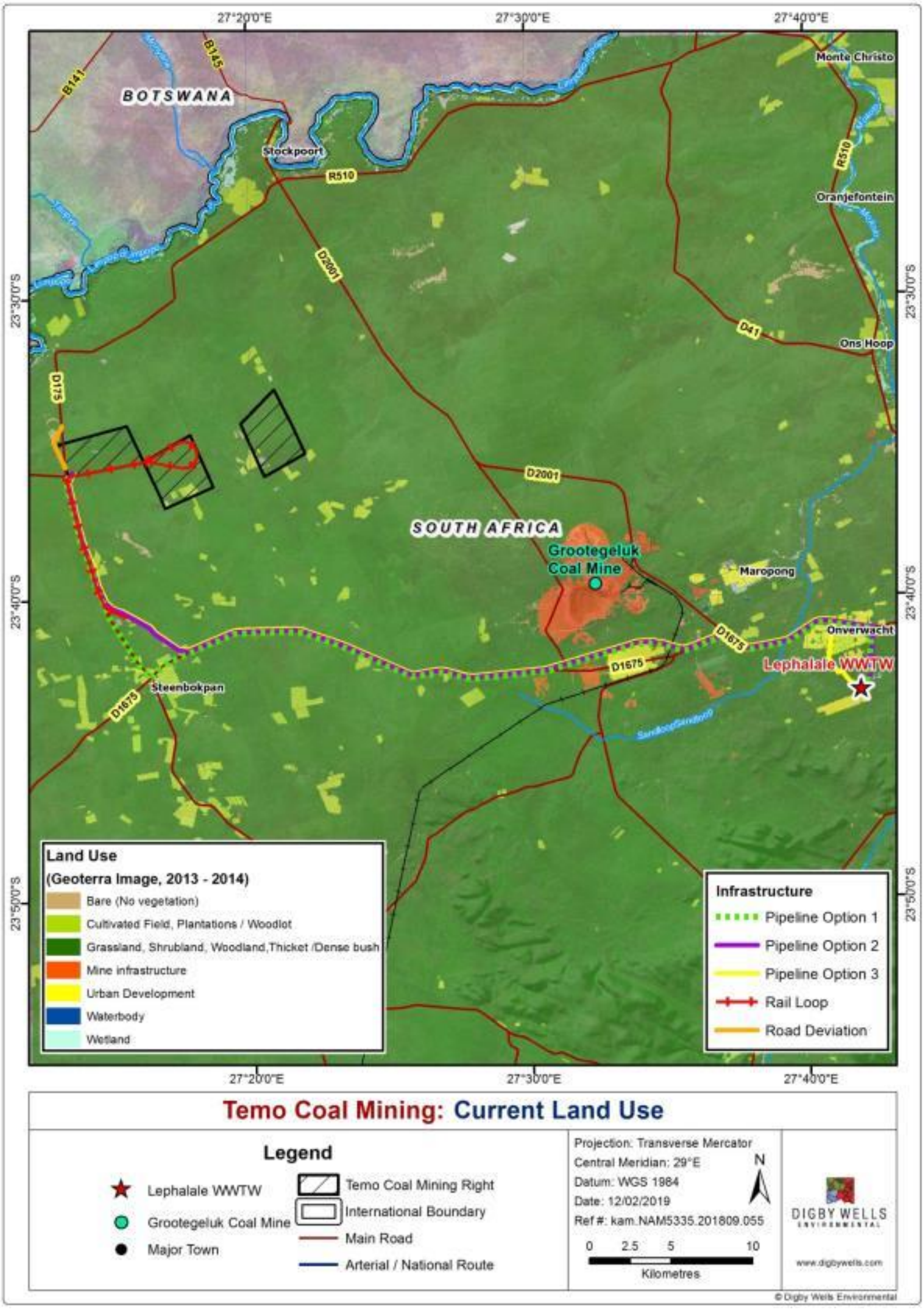

Figure 10-3: Current Land Use at Temo Coal

10.3 Present Land Capability

Land capability was determined by assessing a combination of soil, terrain and climate features. The land classes were identified based on soil forms, texture and fertility. The low rainfall of this area limits the utilization potential of the study area to low intensity grazing and wildlife conservation. The land capability class was identified as Class VI, as summarised in Table 10-2 and illustrated in Figure 10-4. Land in Class VI has limitations that make land unsuited for cultivation and its use largely to pasture, wildlife and range. Limitations that cannot be corrected include severe erosion hazard and low water holding capacity.

Table 10-2: Land Capability Classification

Land Type	Land Capability Class	Agricultural Potential
Ae252	VI – Grazing	Low.
Ae257	VI – Grazing	Low.
Ah86	VI – Grazing	Low.
Bc44	VI – Grazing	Low.
Bd46	VI – Grazing	Low.

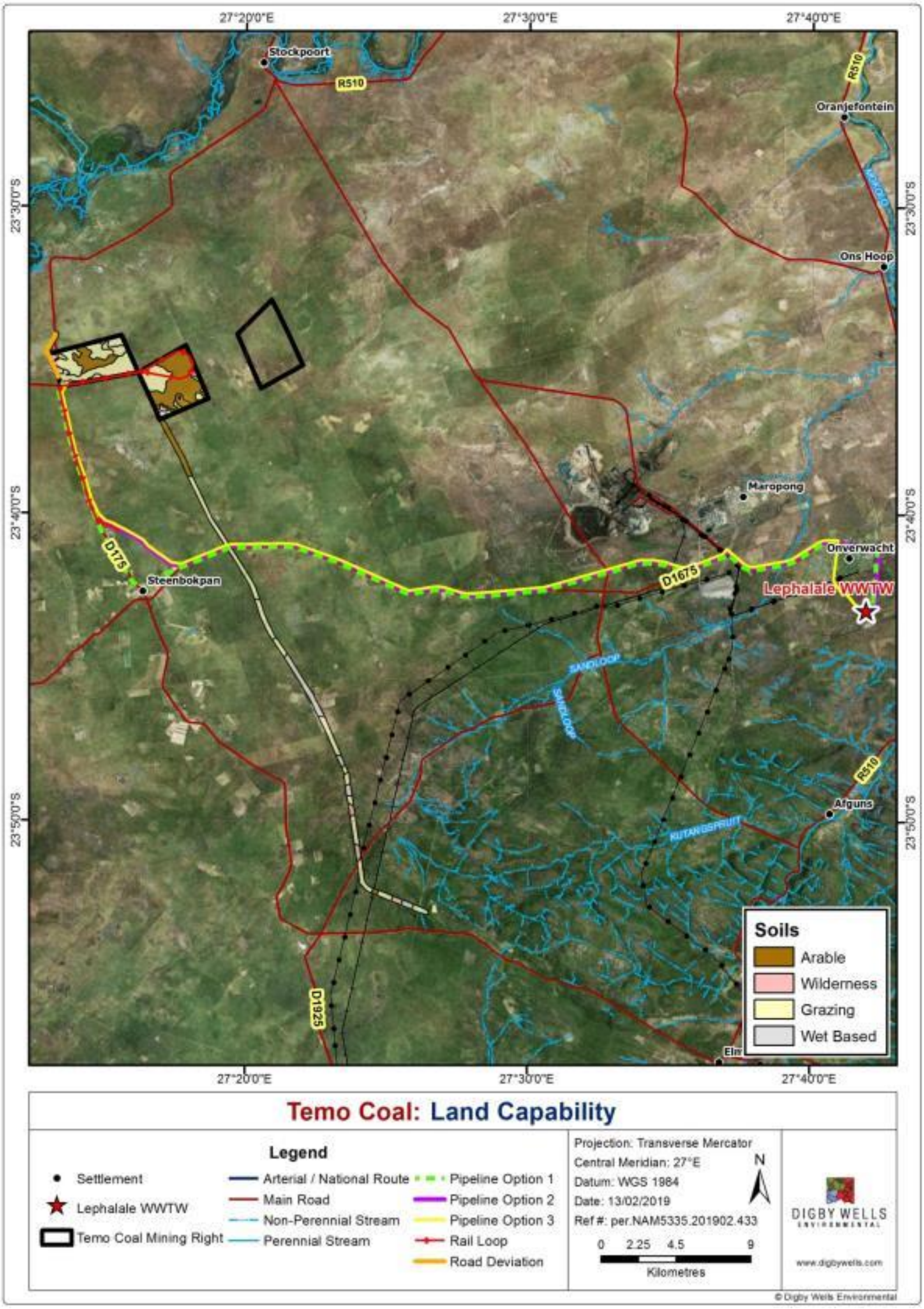

Figure 10-4: Land Capability at Temo Coal

11 Sensitivity

Figure 11-1 shows the site sensitivities based on the soils investigation and land capability assessment. Further input and discussion should be considered with the wetlands scientists regarding the "Highly Sensitive" and "No Go" areas in terms of the ecology and wetland status and the legal implications and process that are to be followed. The concerns around the soil and land capability are varied. They range from soil rooting depths and restrictions due to the deep sandy profiles with little to no clay, low nutrient levels, poor water holding capabilities and high erosion indices. The mitigation and management will require forward planning and a long term strategy based on the proposed end land use and results of the baseline findings.

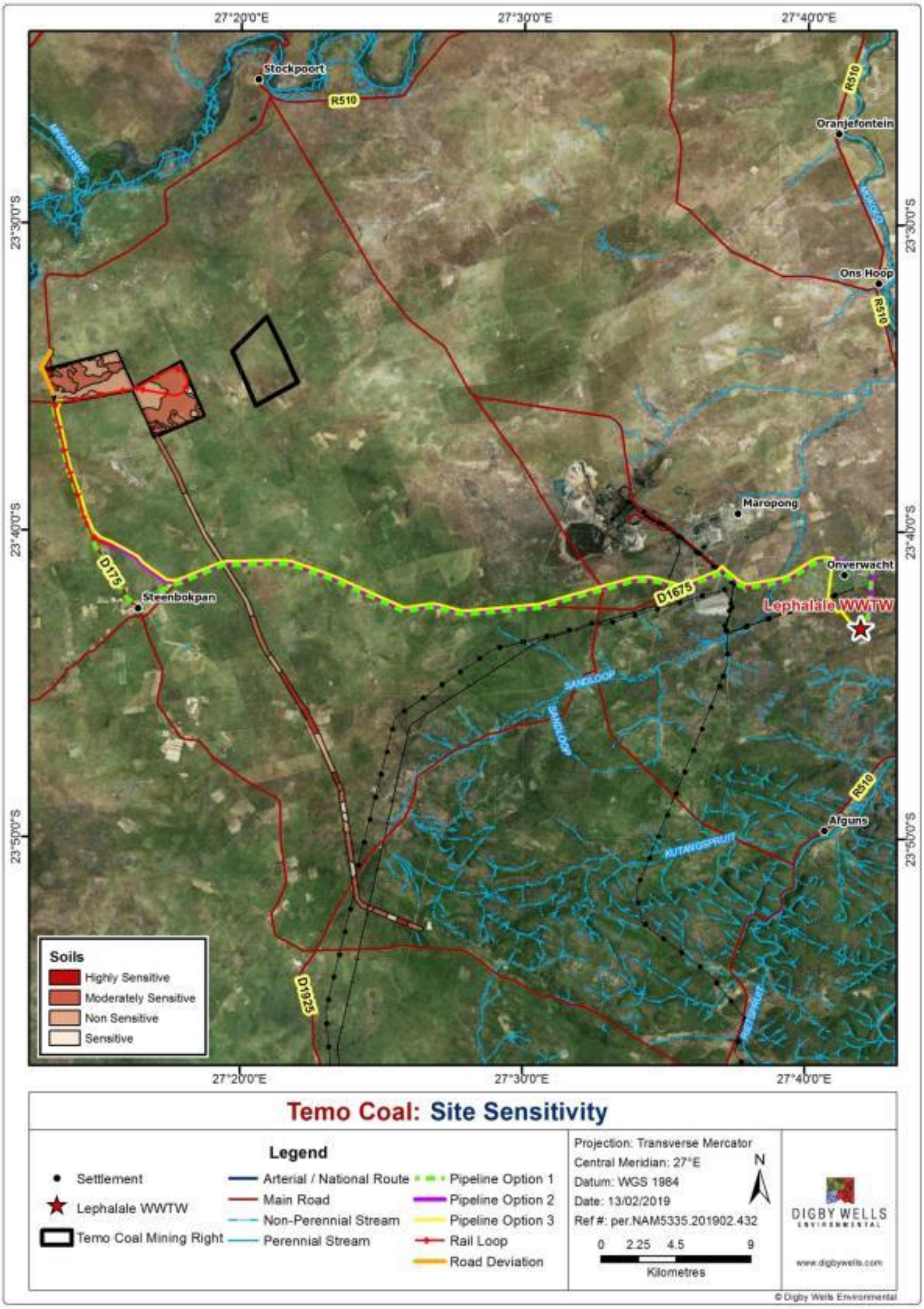

Figure 11-1: Sensitivity Analysis at Temo Coal

12 Impact Assessment

The impacts are assessed based on the impact's magnitude as well as the receiver's sensitivity, concluding in an impact significance rating which identifies the most important impacts that require management. Based on the international guidelines and legislation, the following criteria will be considered when examining potentially significant impacts relating to soils and land use:

- Nature of impacts (direct/indirect and positive/negative);
- Duration (short/medium/long-term, permanent (irreversible)/temporary (reversible) and frequent/seldom);
- Extent (geographical area and size of affected population/species);
- Intensity (minimal, severe and replaceable/irreplaceable);
- Probability (high/medium/low); and
- Measures to mitigate avoid or offset significant adverse impacts.

12.1 Methodology used in Determining and Ranking the Nature, Significance, Consequence, Extent, Duration and Probability of Potential Environmental Impacts and Risks

Impacts and risks have been identified based on a description of the activities to be undertaken. Once impacts have been identified, a numerical environmental significance rating process will be undertaken that utilises the probability of an event occurring and the severity of the impact as factors to determine the significance of an environmental impact.

The severity of an impact is determined by taking the spatial extent, the duration and the severity of the impacts into consideration. The probability of an impact is then determined by the frequency at which the activity takes place or is likely to take place and by how often the type of impact in question has taken place in similar circumstances.

Following the identification and significance ratings of potential impacts, mitigation and management measures will be incorporated into the Environmental Management Programme (EMPr). Details of the impact assessment methodology used to determine the significance of physical, bio-physical and socio-economic impacts are provided below. The significance rating process follows the established impact/risk assessment formula:

Significance = Consequence x Probability x Nature

Where

Consequence = Intensity + Extent + Duration

And

Probability = Likelihood of an impact occurring

And

Nature = Positive (+1) or negative (-1) impact

Note: In the formula for calculating consequence, the type of impact is multiplied by +1 for positive impacts and -1 for negative impacts

The matrix calculates the rating out of 147, whereby intensity, extent, duration and probability are each rated out of seven as indicated in Table 12-3. The weight assigned to the various parameters is then multiplied by +1 for positive and -1 for negative impacts.

Impacts are rated prior to mitigation and again after consideration of the mitigation proposed in this report. The significance of an impact is then determined and categorised into one of seven categories, as indicated in Table 12-2, which is extracted from Table 12-1. The description of the significance ratings is discussed in Table 12-3.

It is important to note that the pre-mitigation rating takes into consideration the activity as proposed, i.e. there may already be certain types of mitigation measures included in the design (for example due to legal requirements). If the potential impact is still considered too high, additional mitigation measures are proposed.

Table 12-1: Impact Assessment Parameter Ratings

Rating	Intensity/ Replicability		Extent	Duration/Reversibility	Probability
	Negative Impacts (Nature = -1)	Positive Impacts (Nature = +1)			
7	Irreplaceable loss or damage to biological or physical resources or **highly** sensitive environments. Irreplaceable damage to **highly sensitive** cultural/social resources.	Noticeable, on-going natural and / or social benefits which have improved the overall conditions of the baseline.	International The effect will occur across international borders.	Permanent: The impact is irreversible, even with management, and will remain after the life of the project.	Definite: There are sound scientific reasons to expect that the impact will occur. >80% probability.
6	Irreplaceable loss or damage to biological or physical resources or **moderate to highly** sensitive environments. Irreplaceable damage to cultural/social resources of **moderate to highly** sensitivity.	Great improvement to the overall conditions of a large percentage of the baseline.	National Will affect the entire country.	Beyond project life: The impact will remain for some time after the life of the project and is potentially irreversible even with management.	Almost certain / Highly probable: It is most likely that the impact will occur.>65 but <80% probability.

Rating	Intensity/ Replicability		Extent	Duration/Reversibility	Probability
	Negative Impacts (Nature = -1)	Positive Impacts (Nature = +1)			
5	Serious loss and/or damage to physical or biological resources or **highly** sensitive environments, limiting ecosystem function. Very serious widespread social impacts. Irreparable damage to highly valued items.	On-going and widespread benefits to local communities and natural features of the landscape.	Province/ Region Will affect the entire province or region.	Project Life (>15 years): The impact will cease after the operational life span of the project and can be reversed with sufficient management.	Likely: The impact may occur. <65% probability.
4	Serious loss and/or damage to physical or biological resources or **moderately** sensitive environments, limiting ecosystem function. On-going serious social issues. Significant damage to structures / items of cultural significance.	Average to intense natural and / or social benefits to some elements of the baseline.	Municipal Area Will affect the whole municipal area.	Long term: 6-15 years and impact can be reversed with management.	Probable: Has occurred here or elsewhere and could therefore occur. <50% probability.

Rating	Intensity/ Replicability		Extent	Duration/Reversibility	Probability
	Negative Impacts (Nature = -1)	**Positive Impacts (Nature = +1)**			
3	Moderate loss and/or damage to biological or physical resources of **low to moderately** sensitive environments and, limiting ecosystem function. On-going social issues. Damage to items of cultural significance.	Average, on-going positive benefits, not widespread but felt by some elements of the baseline.	Local Local including the site and its immediat surrounding area.	Medium term: 1-5 years and impact can be reversed with minimal management.	Unlikely: Has not happened yet but could happen once in the lifetime of the project, therefore there is a possibility that the impact will occur. <25% probability.
2	**Minor loss and/or effects** to biological or physical resources or low sensitive environments, not affecting ecosystem functioning. Minor medium-term social impacts on local population. Mostly repairable. Cultural functions and processes not affected.	Low positive impacts experience by a small percentage of the baseline.	Limited Limited extending only as far as the development site area.	Short term: Less than 1 year and is reversible.	Rare / improbable: Conceivable, but only in extreme circumstances. The possibility of the impact materialising is very low because of design, historic experience or implementation of adequate mitigation measures. <10% probability.

Rating	Intensity/ Replicability		Extent	Duration/Reversibility	Probability
	Negative Impacts (Nature = -1)	Positive Impacts (Nature = +1)			
1	**Minimal to no loss** and/or effect to biological or physical resources, not affecting ecosystem functioning. Minimal social impacts, low-level repairable damage to commonplace structures.	Some low-level natural and / or social benefits felt by a very small percentage of the baseline.	Very limited/Isolated Limited to specific isolated parts of the site.	Immediate: Less than 1 month and is completely reversible without management.	Highly unlikely / None: Expected never to happen. <1% probability.

Table 12-2: Probability/Consequence Matrix

Probability	Significance																																					
7	-147	-140	-133	-126	-119	-112	-105	-98	-91	-84	-77	-70	-63	-56	-49	-42	-35	-28	-21	21	28	35	42	49	56	63	70	77	84	91	98	105	112	119	126	133	140	147
6	-126	-120	-114	-108	-102	-96	-90	-84	-78	-72	-66	-60	-54	-48	-42	-36	-30	-24	-18	18	24	30	36	42	48	54	60	66	72	78	84	90	96	102	108	114	120	126
5	-105	-100	-95	-90	-85	-80	-75	-70	-65	-60	-55	-50	-45	-40	-35	-30	-25	-20	-15	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	105
4	-84	-80	-76	-72	-68	-64	-60	-56	-52	-48	-44	-40	-36	-32	-28	-24	-20	-16	-12	12	16	20	24	28	32	36	40	44	48	52	56	60	64	68	72	76	80	84
3	-63	-60	-57	-54	-51	-48	-45	-42	-39	-36	-33	-30	-27	-24	-21	-18	-15	-12	-9	9	12	15	18	21	24	27	30	33	36	39	42	45	48	51	54	57	60	63
2	-42	-40	-38	-36	-34	-32	-30	-28	-26	-24	-22	-20	-18	-16	-14	-12	-10	-8	-6	6	8	10	12	14	16	18	20	22	24	26	28	30	32	34	36	38	40	42
1	-21	-20	-19	-18	-17	-16	-15	-14	-13	-12	-11	-10	-9	-8	-7	-6	-5	-4	-3	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
	-21	-20	-19	-18	-17	-16	-15	-14	-13	-12	-11	-10	-9	-8	-7	-6	-5	-4	-3	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
	Consequence																																					

Table 12-3: Significance Rating Description

Score	Description	Rating
109 to 147	A very beneficial impact that may be sufficient by itself to justify implementation of the project. The impact may result in permanent positive change	Major (positive) (+)
73 to 108	A beneficial impact which may help to justify the implementation of the project. These impacts would be considered by society as constituting a major and usually a long-term positive change to the (natural and / or social) environment	Moderate (positive) (+)
36 to 72	A positive impact. These impacts will usually result in positive medium to long-term effect on the natural and / or social environment	Minor (positive) (+)
3 to 35	A small positive impact. The impact will result in medium to short term effects on the natural and / or social environment	Negligible (positive) (+)
-3 to -35	An acceptable negative impact for which mitigation is desirable. The impact by itself is insufficient even in combination with other low impacts to prevent the development being approved. These impacts will result in negative medium to short term effects on the natural and / or social environment	Negligible (negative) (-)
-36 to -72	A minor negative impact requires mitigation. The impact is insufficient by itself to prevent the implementation of the project but which in conjunction with other impacts may prevent its implementation. These impacts will usually result in negative medium to long-term effect on the natural and / or social environment	Minor (negative) (-)
-73 to -108	A moderate negative impact may prevent the implementation of the project. These impacts would be considered as constituting a major and usually a long-term change to the (natural and / or social) environment and result in severe changes.	Moderate (negative) (-)
-109 to -147	A major negative impact may be sufficient by itself to prevent implementation of the project. The impact may result in permanent change. Very often these impacts are immitigable and usually result in very severe effects. The impacts are likely to be irreversible and/or irreplaceable.	Major (negative) (-)

12.2 Impact Rating

This section aims to rate the significance of the identified potential impacts pre-mitigation and post-mitigation. The potential impacts identified in this section are a result of both the environment in which the proposed project activities takes place, as well as the actual activities. The impacts that could affect the soils and land capability within the areas where activities will be undertaken are:

- Loss of the soil resource due to change in land use and removal of the soil. The construction of these facilities will change land utilization potential (land capability) resulting in the complete loss of the soils resource for the life of the activity;
- Loss of the soil resource due to wind and water erosion of unprotected soils;
- Change in soil characteristics (soil texture) due to compaction of areas during construction;
- Contamination of the soil resource due to hydrocarbons spillages; and
- Loss of the soil resource due to the disturbance and clearing of vegetation.

12.2.1 Construction Phase

During the construction phase site clearing is necessary for the preparation of surface infrastructure development where vegetation will be removed along with topsoil. When soil is removed, the physical properties are changed, and the soils' chemical properties will deteriorate unless properly managed. When organic matter has been removed either by the clearing of an area for development or by erosion; the soils' fertility is reduced, or soil acidity could increase.

Vehicles will drive on the soil surface during the establishment phase, thereby causing compaction of the soils. This reduces infiltration rates and ability for plant roots to penetrate the compacted soil.

Soil will be prone to erosion where vegetation has been removed during the construction phase. The loss of vegetation cover will exacerbate the impact as runoff potential will be increased and leading to erosion. Once the soil is eroded it reduces the overall soil depth and as a result the land capability reduces. Surface water flow may be altered and groundwater infiltration will be minimised in compacted areas. There is a chance of hydrocarbons or oils spillages from vehicles or other machinery during construction, operational and decommissioning phases which could have an impact on soils.

Soils should be handled like a resource and with care from the construction phase through to the decommissioning phase.

12.2.1.1 Impact Rating

The construction phase impacts are rated in Table 12-4 and Table 12-5.

Table 12-4: Potential Impacts for the Loss of Soils as a Resource: Erosion and Compaction

Dimension	Rating	Motivation	Significance
Activity and Interaction: Site clearing and topsoil removal			
Impact Description: The movement of heavy machinery on the soil surface causes compaction which reduces the vegetation's ability to grow and as a result erosion could occur.			
Prior to Mitigation/Management			
Duration	4	The impact on soil erosion and compaction will occur until the soils have been fully rehabilitated (>10 years).	Moderate (negative) - 78
Extent	4	Loss of soil will only occur within project area and its surroundings.	
Intensity	5	Loss of soil resource due to erosion. Once the resource has been lost on the landscape it cannot be recovered.	
Probability	6	By moving equipment on the soil surface, soils will certainly be compacted and erosion will definitely occur.	
Nature	Negative		
Post-Mitigation			
Duration	3	With mitigation measures, impact can be reversible.	Minor (negative) - 36
Extent	3	Loss of soil is limited only within project area and surroundings.	
Intensity	3	If mitigations are not implemented, resource cannot be recoverable.	
Probability	4	If mitigation measures are not followed it is likely that the impact will occur.	
Nature	Negative		

Table 12-5: Potential Impact – Pollution of Soils by Oil or Hydrocarbon Spillages from Vehicles

Dimension	Rating	Motivation	Significance
Activity and Interaction: Site clearing and topsoil removal			
Impact Description: Soil chemical pollution as a result of potential oil and fuel spillages from vehicles during decommissioning. The impact will be localised within area.			

Dimension	Rating	Motivation	Significance
Prior to Mitigation/Management			
Duration	6	The impact on soils will take long term.	Moderate (negative) - 78
Extent	1	The impact will be localised within project area.	
Intensity	6	The impact on soils is significant as the wetland soils are sensitive and protected by law.	
Probability	6	Oil or fuel spillages will definitely occur during decommissioning phase.	
Nature	Negative		
Post-Mitigation			
Duration	4	The duration of the impact on soils can be reduced with proper mitigation measures.	Minor (negative) - 36
Extent	1	Impact on soils will occur within the removed infrastructure.	
Intensity	4	With proper mitigation measures the impact can be reduced to low significance.	
Probability	4	The impact on soil resources will likely occur if mitigation measures are not implemented.	
Nature	Negative		

12.2.1.2 Management Actions

The following mitigation and management measures have been prescribed for the construction phase:

- Runoff must be controlled and managed by use of proper stormwater management measures;
- Re-fuelling must take place on a sealed surface area away from soils to prevent ingress of hydrocarbons;
- Establishment of effective soil cover and adequate protection from wind and water;
- If any erosion occurs, corrective actions must be taken to minimise any further erosion from taking place at regular intervals and after high rainfall events;
- Restriction of vehicle movement over sensitive areas to reduce compaction;

- Minimise unnecessary removal of the natural vegetation cover;
- All vehicles must be regularly inspected for potential hydrocarbon leaks; and
- Fuel and oils spills should be remediated using commercially available emergency clean up kits. For major spills, if soils are contaminated they must be stripped and disposed of at a licensed waste disposal site.

12.2.2 Operational Phase

During the operational phase the following activities will impact on the soils:

- Maintenance and use of access roads;
- Maintenance of pipeline; and
- Dust from the roads.

Access roads will also be utilised to gain access to the Project site from the southern route. The access road along the pipeline route will also be used to carry out maintenance on the pipeline. The movement of heavy machinery on the soil surface causes compaction which reduces the vegetation's ability to grow and as a result the risk of erosion will increase. The loss of topsoil will have a negative impact and the natural regeneration of few millimetres of topsoil takes hundreds of years, thus it is important to try and conserve this valuable resource.

12.2.2.1 Impact Rating

The operational impacts described are rated in Table 12-6 and Table 12-7.

Table 12-6: Potential Impacts for the Maintenance of Roads

Dimension	Rating	Motivation	Significance
Activity and Interaction: Maintenance of access roads			
Impact Description: Topsoil losses will occur during the operational phase as a result of rainwater runoff and wind erosion from roads. Compaction of soils during operational phase will occur.			
Prior to Mitigation/Management			
Duration	6	Haul roads will be used for the length of this operation therefore posing an impact on soils of not mitigated accordingly	Moderate significance (negative) – 98
Extent	3	Potential Loss of topsoil will occur within project area	
Intensity	5	Loss of usable topsoil will result in loss of land capability and land use. Soil regeneration takes a very long time.	

Dimension	Rating	Motivation	Significance
Probability	7	Compaction and erosion of soil if mitigations are not implemented will definitely occur	
Nature	Negative		
Post-Mitigation			
Duration	5	The roads will used for the project life	Minor significance (negative) – 36
Extent	2	Loss of soil will only occur within project area	
Intensity	3	If access and haul roads are not maintained, the impact on the soils will be minimal	
Probability	4	Impact on soils will probable occur if haul roads and topsoil stockpiles are not maintained	
Nature	Negative		

Table 12-7: Maintenance of the Pipeline Route

Dimension	Rating	Motivation	Significance
Activity and Interaction: Pipeline routes			
Impact Description: The maintenance and inspections of the pipeline route will cause a loss of topsoil as a resource through erosion and compaction.			
Prior to Mitigation/Management			
Duration	5	When the soil has eroded the impact will be permanent and is potentially irreversible	Minor (negative) - 36
Extent	4	Compaction and erosion will occur on a limited scale	
Intensity	3	Impact will be reduced if mitigation measures are implemented	
Probability	3	Impact is unlikely to occur if mitigation measures are implemented	
Nature	Negative		
Mitigation/Management Actions			
▪ Maintenance and inspections on the pipeline must be done on to minimise compaction and erosion			
Post-Mitigation			

Dimension	Rating	Motivation	Significance
Duration	2	Impact on soil can be less than a year if mitigation measures are implemented	Negligible (negative) - 14
Extent	2	Compaction and erosion will occur on a very limited scale	
Intensity	3	Intensity of the impact on soils will be reduced if mitigation measures are implemented	
Probability	2	Impact will rarely occur if mitigation measures are followed	
Nature	Negative		

12.2.2.2 Management Actions

The following management actions and targets are provided for this phase:

- Ensure designed storm water management plans are in place;
- If any erosion occurs, corrective actions must be taken to minimise any further erosion from taking place; and
- Only the designated access routes are to be used to reduce any unnecessary compaction.

12.2.3 Decommissioning Phase

During the decommissioning phase, the following activities will take place:

- Demolition of railway loop and pipeline;
- Top soiling of all disturbed areas;
- Ripping (300mm) of compacted areas to loosen soil; and
- Vegetation establishment in all disturbed areas.

Soil will be prone to erosion where vegetation cannot grow or has been removed. The loss of vegetation cover will exacerbate the impact as runoff potential will be increased, leading to soil erosion. Once the soil is eroded it reduces the overall soil depth and as a result the land capability reduces. Surface water flow may be altered and groundwater infiltration will be minimised in compacted areas.

12.2.3.1 Impact Rating

The decommissioning phase potential impacts are rated in Table 12-8.

Table 12-8: Potential Impact – Compaction of Soils and Soil Erosion

Dimension	Rating	Motivation	Significance
Activity and Interaction: Decommissioning of the infrastructure			
Impact Description: The movement of heavy machinery on the soil surface causes compaction which reduces the vegetation's ability to grow and as a result erosion could occur.			
Prior to Mitigation/Management			
Duration	5	The impact on soil erosion and compaction will occur until the soils have been fully rehabilitated (>10 years).	Moderate (negative) - 78
Extent	4	Loss of soil will only occur within project area and its surroundings.	
Intensity	4	Loss of soil resource due to erosion. Once the resource has been lost on the landscape it cannot be recovered.	
Probability	6	By moving equipment on the soil surface, soils will certainly be compacted and erosion will definitely occur.	
Nature	Negative		
Post-Mitigation			
Duration	4	With mitigation measures, impact can be reversible.	Minor (negative) - 40
Extent	3	Loss of soil is limited only within project area and surroundings.	
Intensity	3	If mitigations are not implemented, resource cannot be recoverable.	
Probability	4	If mitigation measures are not followed it is likely that the impact will occur.	
Nature	Negative		

12.2.3.2 Management Actions

The following mitigation and management measures have been prescribed for the decommissioning phase:

- Runoff must be controlled and managed by use of proper stormwater management measures;
- Establishment of effective soil cover and adequate protection from wind and water;

- If any erosion occurs, corrective actions must be taken to minimise any further erosion from taking place at regular intervals and after high rainfall events;
- Restriction of vehicle movement over sensitive areas to reduce compaction;
- Minimise unnecessary removal of the natural vegetation cover;
- All vehicles must be regularly inspected for potential hydrocarbon leaks;
- No re-fuelling is allowed on site;
- Fuel and oils spills should be remediated using commercially available emergency clean up kits. For major spills, if soils are contaminated they must be stripped and disposed of at a licensed waste disposal site; and

Surface inspection on the fully rehabilitated areas must be undertaken to ensure a surface profile that allows good drainage.

12.2.4 Rehabilitation Phase

With proper waste management and immediate clean up spill kits, the significance of chemical pollution on soils can be reduced and improve residual soil status. Soil ripping will alleviate compaction in surface soil layers and have little to no effect on deeper soil compaction. Successful re-vegetation of all disturbed area with indigenous vegetation species can reduce the significance of erosion and compaction to low; therefore improving soil status.

The management objectives are to limit the impacts that could occur on the site. Rehabilitated areas must be assessed for compaction, fertility and possible erosion, corrected and protected immediately.

12.2.4.1 Impact Rating

The rehabilitation phase potential impacts are rated in Table 12-9.

Table 12-9: Potential Impact – Rehabilitation of the road, pipeline and railway loop

Dimension	Rating	Motivation	Significance
Activity and Interaction: Rehabilitation of the disturbed areas			
Impact Description: After decommissioning, there will be less movement of heavy machinery on the soil surface leading to less soil compaction and vegetation's ability to regrow and as a result erosion will be minimised. Other excavations will be re-filled. This will eventually lead to improved soil status			
Prior to Mitigation/Management			
Duration	6	The impact will extend long after the project life span.	Minor (positive) - 72
Extent	2	The effects of reduced loss of top soil will occur within project area.	

Dimension	Rating	Motivation	Significance
Intensity	4	Less movement of heavy machinery on the surface will result in ability for vegetation to regrow and soil development at a moderate rate.	
Probability	6	By implementing site restoration activities, their impacts on the soil and loss of topsoil are certain.	
Nature	Positive		
Post-Mitigation			
Duration	4	These mitigation measures might have a long term effect. Effects will occur long after the project life.	Minor (positive) - 45
Extent	2	Loss of soil will be local and extend across the project area if mitigations are not implemented.	
Intensity	3	Loss of soil will take place if mitigations measures are not implemented.	
Probability	5	Loss of topsoil as a resource will occur if mitigations are not implemented.	
Nature	Positive		

12.2.4.2 Management Actions

The following mitigation and management measures have been prescribed for the rehabilitation phase:

- Effective soil cover and adequate protection from wind and water;
- Soil chemical and physical amelioration to enhance the growth capability of the soils;
- Only the designated access routes are to be used to reduce any unnecessary compaction;
- Return the land conditions capable of supporting prior land use or uses equal or better than prior land use to the extent feasible or practical; and
- Compacted areas are to be ripped (300mm) to loosen the soil structure and vegetation cover re-instated.

12.2.5 Post Closure Phase

The post closure phase occurs once all the decommissioning activities have stopped. It is assumed that all activities will have ceased by the post closure phase of the project. No movement of heavy machinery, roads would be fully rehabilitated, soils will have been ripped to alleviate compaction, spillages would have been cleaned-up and re-vegetation would have taken place. Only after care and maintenance will remain post closure. There will be no further impacts on soil during the post closure phase.

13 No-Go Areas

If the road diversion does not to go ahead, the production of coal at the Temo Mine would not be viable. If the rail loop does is not constructed, the cost to Temo for the transportation of coal would be increased due to transporting export coal via coal trucks. The road network will also be negatively impacted due to the increased usage of the roads by coal trucks.

The pipeline not going ahead would mean that the Temo Mine will not be able to be operational as there is no other water supply to the Temo mine to run operations.

14 Cumulative Impact

Cumulative impacts may be defined as changes to the environment that are caused by an action in combination with other past, present and future actions Hegmann *et al* (1999).

Development of a mine at the Temo will trigger a number of other developments in the area such as new, access roads, transmission lines and changes to the present land uses and perhaps increased pressure as a result of increased population around the mine site. This implies that the cumulative effects in the area will increase. One of the negative impacts associated with long term development is the disturbance of the soil environment, the naturally occurring layers of decomposed rock and accumulations of eroded materials as soil horizons. However, there are existing pipelines and rail line to town along the Steenbokpan road.

It is important to take into consideration the following general steps (IFC, 2013) as a way of dealing with these impacts:

- Effective application of and adherence to the mitigation measures as proposed in section 10; and
- Multi-stakeholder collaborative approach to implementing management actions those are beyond the capacity of the individual projects.

15 Unplanned Events and Low Risks

There is a risk of accidental spillages of hazardous substances which can result in soil contamination, for example hydrocarbons or oils from vehicles or other machinery during construction, operational and decommissioning phases.

15.1 Emergency Procedures

Hydrocarbon spills or leaks can occur; therefore, emergency procedures need to be put in place for remediation (Table 15-1). These procedures can include the following:

- Contractors must ensure that all employees are aware of the procedure for dealing with spills and leaks and properly trained to deal with such incidents;
- Ensure that emergency spill equipment is available to site personnel;
- All machines should be serviced at the workshop and refuelled at a diesel filling station on site; and
- Fuel and oil spills should be remediated using commercially available emergency clean up kits. For major spills, if soils are contaminated they must be stripped and disposed of at a licensed waste disposal site.

Table 15-1: Unplanned Events and their Management Measures

Unplanned event	Potential impact	Mitigation/Management/Monitoring
Hydrocarbon leaks from vehicles and machinery or hazardous materials	Soil Contamination	▪ Place drip trays where the leak is occurring if vehicles are leaking; ▪ All vehicles should be serviced at the workshop location specifically designed for servicing of machinery; ▪ Machinery must be parked within hard park areas and. Further the machinery must be inspected daily for fluid leaks; ▪ If a spill occurs it should be cleaned up (Drizit spill kit/ Enertech type spill kit, Oil or Chemical spill kit) immediately and if applicable reported to the appropriate authorities; and ▪ Emergency response plans should be in place.
Hazardous substance spillage from waste storage	Soil Contamination	▪ Prevent any spills from occurring; ▪ If a spill occurs it should be cleaned up (Drizit spill kit/ Enertech type spill kit, Oil or Chemical spill kit) immediately and if applicable reported to the appropriate authorities; and ▪ Emergency response plans should be in place.

16 Supervision and Responsibilities

Close supervision and monitoring of the stripping process is required to ensure that soils are stripped correctly. Table 16-1 provides roles and responsibilities of the people that will be responsible for implementing excavations and stockpiling procedures. The responsibilities of the contractor need to be documented in contract documents.

Table 16-1: Responsibilities

Environmental Aspect	Measures and Actions	Responsibility	Timeframes
Waste management	Bins must be provided for disposal of waste during construction	Contractors, Environmental Control Officer and Project Manager	During construction, operational and decommissioning phase
Equipment and storage areas	Equipment maintenance must be done offsite. Storage areas must be within the fenced area and located away from all sensitive areas	Contractors, Environmental Control Officer and Project Manager	During construction, operational and decommissioning phase
Hazardous materials	Spillage plan must be developed. Refuelling must be done offsite to prevent potential soil pollution from spillage	Contractors and Environmental Control Officer	During construction, operational and decommissioning phase
Soil erosion and sediment control	Clearing activities must be restricted to the footprint of the plant, pits, RWD, TSF	Contractors, Environmental Control Officer and Project Manager	During construction, operational and decommissioning phase
Erosion and sediment control	Removed soil must be stored away from drainage areas	Contractors, Environmental Control Officer and Project Manager	During construction, operational and decommissioning phase
Soil management	Topsoil and sub soil must be stored separately. Soil must not be stockpiled for more than 6 months. However, if stockpiled for more than 6 months the topsoil must be ameliorated prior to remediation.	Contractors, Environmental Control Officer and Project Manager	During construction and operational phase

17 Rehabilitation Actions

The potential risks identified in this section are a result of both the environment in which the project activities take place, as well as the actual activities. These activities along with the rehabilitation actions can be seen as indicated in Table 17-1.

Table 17-1: Rehabilitation Actions

Phase	Project Activity	Rehabilitation (Remediation) Actions
Construction, Operational and Decommissioning	▪ Site clearing, including the removal of topsoil and vegetation	▪ Special care must be taken to ensure that excessive loss of vegetation must is avoided by restricting construction activities to the project foot point area ▪ The removal of any, soils, fauna and flora from the site must be strictly prohibited unless unavoidable and essential for construction activities related to the project; ▪ During construction, the construction footprint must be kept to a minimum as far possible and as much of the natural vegetation must be retained where possible, to assist in preventing erosion.
	▪ Stockpiling of soil once excavated	▪ Use stockpiled soils and topsoil during the construction phase; ▪ Reseed with unpalatable grasses and improve species diversity; ▪ Monitoring of erosion; and ▪ Remove alien invasive vegetation.
	▪ Temporary storage of hazardous products, including waste and fuel	▪ Remove diesel tanks and associated infrastructure from site (it is assumed that all potential contamination is removed during operations); ▪ Keep spill kits on site; ▪ Dispose of contaminated material at a hazardous waste facility; ▪ Once the site has been cleared of all infrastructure and rubble and no contamination is present, the exposed area should be reshaped to create a gently sloping, free-draining topography; ▪ Reseed with unpalatable grasses and improve species diversity. Additionally, replant species that were relocated during construction phase; ▪ Monitor and maintain vegetation establishment; and ▪ Remove alien invasive vegetation.

Phase	Project Activity	Rehabilitation (Remediation) Actions
	▪ Utilise existing roads to access the various sections	▪ The footprint area should be ripped to alleviate compaction and to assist with vegetation establishment; ▪ Reseed with unpalatable grasses and improve species diversity. Additionally, replant species that were relocated during construction phase; ▪ Monitor and maintain vegetation establishment; and ▪ Remove alien invasive vegetation.

18 Monitoring Requirements

A monitoring programme is essential as a management tool to detect negative impacts as they arise and to ensure that the necessary mitigation measures are implemented together with ensuring effectiveness of the management measures in place. The following items should be monitored quarterly for the 1st year and bi-annually for the 2nd year to final closure:

- Soils:
  - Erosion status;
  - Compaction;
  - Runoff; and
  - Contamination.
- Vegetation:
  - Vegetation cover;
  - Alien species invasion; and
  - Species diversity.

Table 18-1summarises the soil monitoring requirements for Temo.

Table 18-1: Soil Monitoring Requirements

Aspect	Activities	Impacts requiring monitoring programmes	Functional requirements for monitoring	Roles and responsibilities (For the execution of the monitoring programmes)	Monitoring and reporting frequency and time periods for implementing impact management actions	Type of Requirement (Monitoring, Auditing and/or Reporting)
Flora	Soil disturbance	Establishment of alien invasive plant species	Alien invasive plant monitoring	Qualified botanist	Quarterly monitoring until two years	Monitoring
Soils	Decommissioning and Post-closure	Erosion, loss of soil fertility, compaction	The rehabilitated area must be assessed for compaction, fertility, and erosion and must meet the Chamber of Mines Guidelines	The soils must be assessed by a soil specialist yearly (during the dry season so that recommendations can be implemented before the start of the wet season) so as to correct any nutrient deficiencies.	The rehabilitated area must be assessed once a year for compaction, fertility, and erosion during the dry season	Monitoring
Wetlands	All activities	All impacts and	Monitoring of activities through all	The closure officer of the	**Environmental**	Monitoring

Aspect	Activities	Impacts requiring monitoring programmes	Functional requirements for monitoring	Roles and responsibilities (For the execution of the monitoring programmes)	Monitoring and reporting frequency and time periods for implementing impact management actions	Type of Requirement (Monitoring, Auditing and/or Reporting)
(also see Wetland Specialist report)		threats to wetlands, predicted or not.	phases to ensure all impacts are remediated as soon as possible; thus preventing and long term residual impacts to the system that compromises wetland functionality.	mine should monitor the wetlands at all times as part of managing the site and the surrounding area. Independent wetland specialist should carry out monitoring on a regular basis during all phases of the mining project and provide recommended remedial actions where required.	**Control Officer (ECO):** Internal monitoring should be done as often as possible according to the management practices of the mine. **Independent wetland specialist:** regularly and when needed, i.e. after an incident.	

19 Conclusions and Recommendations

The land type data gathered suggested that the dominant land type on site were Ae252, Ae257, Ah86, Bc44 and Bd46 characterised by red yellow apedal, freely drained and upland duplex and margalitic soils rare; respectively. In summary the area is covered by thick red sandy soil. The land is confined almost exclusively to low intensity livestock grazing and game farming. The land capability is rated as low intensity grazing land potential and/or wilderness potential (Class VI).

Based on background information it is reported that the soils are inherently low in calcium and magnesium, have low to very low concentrations of organic carbon and return lower than average quantities of potassium and sodium. The soils are prone to erosion (low clay and organic carbon), albeit that the topography is generally flat to slightly undulating, a factor that tempers the erosion index to low.

Compaction and loss of soil structure commonly occurs, as well as a loss of biological activity if topsoil is deeply stockpiled long term. The potential impacts associated with proposed mining are:

- Loss of Topsoil as a resource – erosion, compaction and chemical and physical alterations;
- Loss of land use; and
- During rehabilitation and decommissioning phase, the potential impacts associated are the risk of hydrocarbon spills, erosion and compaction.

It is anticipated that the impact of construction of road, railway loop and pipeline on loss of soil as a resource - erosion and compaction will be of **moderate negative significance**. It is anticipated that the impact on soils will be of **moderate negative significance** during the construction, operational and decommissioning phases. It is anticipated that the impact on soils will be of **minor positive significance** during rehabilitation phase.

The followings actions are recommended to minimise adverse effects of mining and the proposed activities on soils:

- Runoff must be controlled and managed by use of proper stormwater management measures;
- If any erosion occurs, corrective actions must be taken to minimise any further erosion from taking place. Soil erosion might pose a problem once vegetation cover is removed; thus, erosion monitoring should take place at regular intervals and after high rainfall events;
- Establishment of effective soil cover and adequate protection from wind and water;
- Soil chemical and physical amelioration to enhance the growth capability of the soils;
- Return the land conditions capable of supporting prior land use or uses equal or better than prior land use to the extent feasible or practical;

- Compacted areas are to be ripped (300mm) to loosen the soil structure and vegetation cover re-instated;
- Minimise unnecessary removal of the natural vegetation cover;
- All vehicles must be regularly inspected for potential hydrocarbon leaks;
- No re-fuelling is allowed on site; and
- Fuel and oils spills, should be remediated using commercially available emergency clean up kits. For major spills, if soils are contaminated they must be stripped and disposed of at a licensed waste disposal site.

20 Comments and Responses

No comments have been received yet on the Soils and Land Capability Assessment from the public and if received, this section of the report will be updated to include the comments and responses provided.

21 Reasoned Opinion of the Specialist

Soil management measures should be followed and mitigation measures implemented as outlined in this report and disturbed land needs to be rehabilitated to prevent possible soil erosion, contamination and compaction.

It is anticipated that the impact of construction of road, railway loop and pipeline on loss of soil as a resource - erosion and compaction will be of **minor to moderate negative significance**. It is anticipated that the impact on soils will be of **minor to moderate negative significance** during the construction, operational and decommissioning phases. It is anticipated that the impact on soils will be of **minor positive significance** during rehabilitation phase.

Based on the baseline of information and the impact assessment ratings of significance, it is the opinion of the specialist that this project is feasible and should be considered if the management and mitigation measures tabled are rigorously adhered to for the project to minimise potential impacts on the soils and to maintain their land capability for future land use. Soil management measures and monitoring requirements as set out in this report should form part of the conditions of environmental authorisation and be included in the EMPr.

22 References

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Appendix A: CV

Mr Siphamandla Madikizela

Soil Scientist

Mine Closure and Rehabilitation Services

Digby Wells Environmental

Education

- 2012 – 2014: MSc in Soil Science – University of KwaZulu-Natal.
- 2011 – 2011: BSc Honours in Soil Science – University of KwaZulu-Natal.
- 2008 – 2010: BSc in Hydrology and Soil Science – University of KwaZulu-Natal.

Employment

- March 2016 – Present: Digby Wells Environmental - Soil Scientist.
- August 2013 – March 2016: EcoPlanet Bamboo (Pty) Ltd - Assistant Plantation Manager.
- 2010 – 2013: University of KwaZulu-Natal - Student demonstrator (2nd and 3rd years majoring in Soil Science).
- 2012: Jeffares & Green Consulting Company - Field Assistant.

Experience

Siphamandla Madikizela is a Soil Scientist and completed his MSc in Soil Science at University of KwaZulu-Natal. Prior to his employment at Digby Wells, Siphamandla worked as an Assistant Plantation Manager for EcoPlanet Bamboo southern Africa. He joined Digby Wells in March 2016 and is part of the Terrestrial and Mine Department. His role involved conducting soil surveys, soil contamination assessment, and identification of soil forms, interpreting results of soil samples, land use and land capability environmental impact assessments and writing detailed scientific reports.

Project Experience

- Scoping and Environmental Impact Reporting for Proposed Palmietkuilen Colliery near Springs – Canyon Resources (Pty) Ltd – Soil Scientist.
- Scoping and Environmental Impact for an Environmental Authorisation Application in support of the Prospecting Right Applications – Anglo American Platinum Ltd – Soil Scientist.
- Scoping and Environmental Impact for Grootvlei TSF Reclamation Project - Ergo Mining (Pty) Ltd – Soil Scientist.
- Risk Assessment and Associated Water Use License Application for the Proposed KPSX Northern Bypass, in Mpumalanga – South32 SA Coal Holdings (Pty) Limited – Soil Scientist.

- Environmental and Social Impact Assessment Update for the Sadiola Sulphides Project (2016), Mali - Société d'Exploitation des Mines d'Or de Sadiola S.A – Soil Scientist.
- Environmental Impact Assessment for the proposed infrastructure expansion at Grootegeluk Coal Mine – Exxaro Reductants (Pty) Ltd – Soil Scientist.
- Gap analysis for the Environmental Authorisation for the Rietspruit Rehabilitation Project – South32 SA Coal Holdings (Pty) Ltd – Soil Scientist.
- Reviewing of the Soils, land capability and land use Environmental Impact Assessment for Hendrina Reserve – Glencore Operations South Africa (Pty) Ltd – Soil Scientist.
- Rehabilitation Guidelines for Sedibelo West – Sedibelo Platinum Mines Limited – Soil Scientist.
- Contamination Assessment for Konskilde Warehouse, Boksburg, Johannesburg, South Africa – EDF Fenice – Soil Scientist.
- Soil and Agricultural Potential Assessment for Training Facility and Firestation Project, Gauteng – Savannah Environmental (Pty) Ltd – Project Manager and Soil Scientist.
- Agricultural Potential Study, Gumu, Kibali, DRC – Randgold Resources – Project Manager and Soil Scientist.
- Basic Assessment for proposed Borrow Pits near Lephalale – Ledjadja Coal (Pty) Ltd – Soil Scientist.
- Klipspruit Environmental Management Programme Consolidation – South 32 SA Coal Holdings (Pty) Ltd – Soil Scientist.
- Extension on Farm Middelbult for the Universal Kangala Coal Mine – Universal Kangala Coal Mine – Soil Scientist.
- Soil, Land Capability and Land Use Assessment for Vaalkop Area, Mpumalanga – Sasol Mining (Pty) Ltd – Soil Scientist.
- Environmental and Social Impact Assessment for Bougouni Lithium Project, Mali – Birimian Gold Limited – Soil Scientist.

Research

- The Use of Hydrogel Application at Planting for *Bambusa Balcooa* Species at different rates – EcoPlanet Bamboo southern Africa – Assistant Plantation Manger.
- The Effect of Herbicide Application on *Bambusa Balcooa* – EcoPlanet Bamboo southern Africa – Assistant Plantation Manager.

- The Effect of Plastic Mulch on Growth and Yield on *Bambusa Balcooa* - EcoPlanet Bamboo southern Africa – Assistant Plantation Manager.
- Effect of Nitro-S fertilizer on growth and yield of *Bambusa Balcooa* and *Oxytenanthera Abyssinica*.

Responsibilities

- Plant management including adaptive fertilizer applications, pest management and irrigation schemes.
- Managing daily operations including the oversight of large staff teams of unskilled and semi-skilled workers, scheduling of operations and maintenance of farm equipment.
- Managing a schedule of community development activities
- Managing weekly activities in the nursery, including staff and overseeing the arrival and transplanting of new plants.
- Tracking and recording productivity data of the general workers and prepare the weekly KPI's for the corporate office.
- Adherence to international certification standards, in particular the Forest Stewardship Council (FSC), through plantation planning and administrative work.

Short Courses

- Certificate of Attendance: Wild Fire Suppression – Proto team (1-2 June 2015, Bathurst, Port Alfred).
- Certificate of Attendance: Basic Labour Relations (2 September 2015, Cape Town).
- Certificate of Attendance: Conflict Management Workshop (26 October 2015, Port Elizabeth).
- Certificate of Completion: Technical Report Writing (21&22 November 2016)
- Project Management

Professional Affiliations

- Soil Science Society of South Africa (SSSA).

Professional Registration

- 2013: Registered as a Candidate Natural Scientist with The South African Council for Natural Scientific Professions. Registration number: 100033/13.