mineral resources

Department:
Mineral Resources
REPUBLIC OF SOUTH AFRICA

Environmental Impact Assessment And Environmental Management Plan

for Listed Activities Associated with the Proposed Dagsoom Coal Mining Project near Ermelo, Mpumalanga Province

DMR Reference Number: MP30/5/1/2/2/10236MR

DRAFT REPORT FOR PUBLIC REVIEW

SUBMITTED FOR ENVIRONMENTAL AUTHORIZATIONS IN TERMS OF THE NATIONAL ENVIRONMENTAL MANAGEMENT ACT, 1998 AND THE NATIONAL ENVIRONMENTAL MANAGEMENT WASTE ACT, 2008 IN RESPECT OF LISTED ACTIVITIES THAT HAVE BEEN TRIGGERED BY APPLICATIONS IN TERMS OF THE MINERAL AND PETROLEUM RESOURCES DEVELOPMENT ACT, 2002 (MPRDA) (AS AMENDED).

Name of Applicant:	Dagsoom Coal Mining (Pty) Ltd
Tel no:	0824538007
Fax no:	-
Postal Address:	P O Box 1222, Cramerview, 2060
Physical Address:	17 Fleming Street, Mill Hill, Bryanston, 2060
File Reference Number SAMRAD:	**MP30/5/1/2/2/10236MR**

This document has been prepared by Digby Wells Environmental.

Report Type:	**Draft Environmental Impact Assessment and Environmental Management Plan Report**
Project Name:	**Integrated Environmental Impact Assessment for the Proposed Dagsoom Coal Mining Project near Ermelo, Mpumalanga Province**
Project Code:	**DAG5603**

Name	**Responsibility**	**Signature**	**Date**
Anela Sotashe	Report Administrator		October 2019
Xanthe Taylor	Project Manager		October 2019
Barbara Wessels	Project Sponsor		October 2019

IMPORTANT NOTICE

In terms of the Mineral and Petroleum Resources Development Act (Act 28 of 2002 as amended), the Minister must grant a prospecting or mining right if among others the mining "will not result in unacceptable pollution, ecological degradation or damage to the environment".

Unless an Environmental Authorisation can be granted following the evaluation of an Environmental Impact Assessment and an Environmental Management Programme report in terms of the National Environmental Management Act (Act 107 of 1998) (NEMA), it cannot be concluded that the said activities will not result in unacceptable pollution, ecological degradation or damage to the environment.

In terms of section 16(3)(b) of the EIA Regulations, 2014, any report submitted as part of an application must be prepared in a format that may be determined by the Competent Authority and in terms of section 17 (1) (c) the competent Authority must check whether the application has taken into account any minimum requirements applicable or instructions or guidance provided by the competent authority to the submission of applications.

It is therefore an instruction that the prescribed reports required in respect of applications for an environmental authorisation for listed activities triggered by an application for a right or a permit are submitted in the exact format of, and provide all the information required in terms of, this template. Furthermore, please be advised that failure to submit the information required in the format provided in this template will be regarded as a failure to meet the requirements of the Regulation and will lead to the Environmental Authorisation being refused.

It is furthermore an instruction that the Environmental Assessment Practitioner must process and interpret his/her research and analysis and use the findings thereof to compile the information required herein. (Unprocessed supporting information may be attached as appendices). The EAP must ensure that the information required is placed correctly in the relevant sections of the Report, in the order, and under the provided headings as set out below, and ensure that the report is not cluttered with un-interpreted information and that it unambiguously represents the interpretation of the applicant.

OBJECTIVE OF THE ENVIRONMENTAL IMPACT ASSESSMENT PROCESS

The objective of the environmental impact assessment process is to, through a consultative process: -

- determine the policy and legislative context within which the activity is located and document how the proposed activity complies with and responds to the policy and legislative context;
- describe the need and desirability of the proposed activity, including the need and desirability of the activity in the context of the preferred location;
- identify the location of the development footprint within the preferred site based on an impact and risk assessment process inclusive of cumulative impacts and a ranking process of all the identified development footprint alternatives focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects of the environment;
- determine the: -
  - nature, significance, consequence, extent, duration and probability of the impacts occurring to inform identified preferred alternatives; and
  - degree to which these impacts: -
  - can be reversed;
  - may cause irreplaceable loss of resources, and
  - can be avoided, managed or mitigated.
- identify the most ideal location for the activity within the preferred site based on the lowest level of environmental sensitivity identified during the assessment;
- identify, assess, and rank the impacts the activity will impose on the preferred location through the life of the activity;
- identify suitable measures to manage, avoid or mitigate identified impacts; and
- identify residual risks that need to be managed and monitored.

EXECUTIVE SUMMARY

Introduction

The Applicant for the proposed Project, Dagsoom Coal Mining (Pty) Ltd (Dagsoom) was the holder of a Prospecting Right (reference number MP 30/5/1/1/2/12846 PR) for the proposed Twyfelaar Coal Mine. The proposed project is located near Sheepmoor within the Msukaligwa Local Municipality, situated in the Highveld sub-region of the Gert Sibande District Municipality in the Mpumalanga Province. The Prospecting Right expired on 05 May 2019. Dagsoom submitted applications for Environmental Authorisation in terms of the National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA) and a Mining Right Application in terms of the Mineral and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002) (MPRDA) on 30 April 2019.

This application triggers the following:

- An Integrated Environmental Authorisation Application, a Scoping and Environmental Impact Assessment (S&EIA) process as promulgated under the National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA),
- The National Environmental Management: Waste Act, 2008 (Act No. 56 of 2008) (NEM:WA);
- A Water Use Licence Application (WULA) and associated Integrated Water and Waste Management Plan (IWWMP) in terms of the National Water Act, 1998 (Act No. 36 of 1998) (NWA); and
- A Mining Right in terms of the MPRDA.

The Mining Right application area includes Portions 1, 2, 5, 7, 8, 9, and the Remaining Extent of the Farm Twyfelaar 298IT and the Remaining Extent (RE)of the Farm Klipfontein 283IT. The application was received by the DMR on 30 April 2019 (reference number: MP 30/5/1/2/2/10236 MR). For this application, however; Dagsoom only intends to extract coal (including torbanite) and undertake the associated mining activities on Portion 2 of the Farm Twyfelaar 298IT.

The Mine Works Programme (which was submitted with the Mining Right Application) anticipated the establishment of three mining sections within the Mining Right Boundary, as defined below:

- Northern section known as Block A in this report, located on Portion 2 of the farm Twyfelaar 298IT (the Project),
- Southern section on the Remaining Extent of the farm Twyfelaar 298IT (now *excluded* from this application), and
- Eastern/Klipfontein section on the farm Klipfontein 283IT (now *excluded* from this application).

Dagsoom intends to extract coal and undertake the associated mining activities on the Northern Section (Portion 2 of the Farm Twyfelaar 298IT) in the period 2022 until 2026, and thereafter mining is planned to commence on the Southern Section and Eastern/Klipfontein Section from 2026

During the Scoping Phase of this Project, all three mining sections were included in the assessment as per the Mine Works Programme. The mine schedule contemplated in the Mining Right Application was based on current knowledge of the coal resources, coal markets and pricing.

The potential effects of pricing and markets on future mining layouts and mining methods for the Southern Section and Eastern/Klipfontein sections (that will only commence mining in 2026), have resulted in Dagsoom preparing this EIA/EMPr for Block A only (the Northern section) due to the near-term nature of these activities.

Due to the possible amendments that may be required in the future for the Southern and Eastern/Klipfontein sections, the mining activities contemplated for these sections will be subject to possible future amendments to the mining work programme and environmental authorization that will be prepared at a future date (in terms of the provisions of the relevant acts and regulations) to procure the necessary environmental authorisation for the activities contemplated for these two sections.

Project Applicant

The details of the Project Applicant are included in the table below.

Company name:	Dagsoom Coal Mining (Pty) Ltd
Contact person:	Hilton Philpot
Physical address:	17 Fleming Street, Mill Hill, Bryanston, 2060
Telephone:	-
Cell phone:	0824538007
Email:	hilton@pitsa.co.za

Project Overview

The proposed Project is a "greenfields" Project, meaning there is currently no mining activity on the proposed site. The proposed site is situated on the eastern escarpment of the Mpumalanga Highveld coalfield. Dagsoom proposes to extract the coal through underground mining and access it through an adit. The Run of Mine (RoM) coal will be conveyed from the mine adit to the wash plant. Numerous wetlands and hillside seepage areas were identified within the Mining Right boundary. The proposed mine section at Block A will therefore be underground mining, with all plant infrastructure around the mine access area.

The proposed infrastructure required includes the following:

- Underground Mine accessed by an adit;

- Access and haulage roads;
- Ventilations fans;
- Wash plant;
- Pollution control dams;
- Raw water pump station and process water pump station;
- Raw water pipeline and process water pipeline;
- Electricity supply;
- Potable water treatment plant and associated tanks;
- Sewage treatment plant;
- Reverse Osmosis plant;
- Change houses;
- Offices and ablution facilities;
- Workshops and cable workshops;
- Refuel bays;
- Weighbridges and weighbridge control rooms; and
- Access control offices.

The position for the adit is selected based on the most appropriate position for a mine access, together with the associated surface infrastructure positioned outside the identified wetlands (based on information available at that time), but with consideration on the most practical placement based on the coal seam, mine layout, ventilation considerations, terrace for product handling and the access road from the main road.

At the time of the Specialist Studies being undertaken, the coal reserves were to be mined with continuous miners, however, it has since been established that conventional drill-and-blast may be a more effective method to extract coal. Block A will be mined at a rate of about 480 ktpa kilo tonnes per annum (ktpa) or 40ktpm, which is the industry benchmark due to the low seam height to be mined.

The total maximum production for this mine is planned to be 480 ktpa or slightly higher during stooping operations. The operating cost of the mine is also directly in relation to the production rate. This Life of Mine schedule allows a life of mine of five years for Block A.

Purpose of this Report

The purpose of an EIA process is to ensure that the potential environmental and social impacts associated with the construction, operation and closure/ rehabilitation of a project are identified, assessed and appropriately managed. There are two primary phases of an EIA process, namely the Scoping Phase and the Impact Assessment Phase. Identification of potential impacts occurs during the Scoping Phase, whilst the assessment and mitigation of those impacts occurs during the Impact Assessment Phase. The impact assessment and mitigation management are presented in this Environmental Impact Assessment and Environmental Management Plan report (EIA/EMPr). Various specialist studies were undertaken during the Project evaluation to inform the EIA/EMPr; these include:

- Aquatic Ecology Assessment;
- Fauna and Flora Assessment;
- Wetland Assessment;
- Groundwater Assessment;
- Surface water Assessment;
- Heritage Assessment;
- Social Assessment;
- Soils, Land Use and Land Capability Assessment;
- Blasting and Vibration Assessment;
- Air Quality Assessment;
- Noise Assessment;
- Traffic Assessment and
- Rehabilitation and Closure Assessment.

A summary of the baseline environment is presented in Section 10 (Part A). Various environmental monitoring plans are included in Section 8 (Part B) of this report and should be implemented to measure compliance, determine if mitigation measures are effective and determine trends over the life of the project.

Environmental Consultants

Contact details for the independent EAP are provided in the table below:

Company name:	Digby Wells Environmental
Contact person:	Ms. Xan Taylor
Physical address:	Digby Wells House, Turnberry Office Park, 48 Grosvenor Road, Bryanston, 2191, South Africa.
Telephone:	011 789 9495
Cell phone:	011 069 6801
Email:	xanthe.taylor@digbywells.com

Approach and Methodology for the Public Participation Process

A Public Participation Process (PPP) was initiated during the Scoping Phase, which is central to the investigation of environmental and social impacts, as it is important that stakeholders who are affected by the project are given an opportunity to identify concerns and to ensure that local knowledge, needs and values are understood and taken into consideration as part of the impact assessment process. The comments from the stakeholders are included in the Comment and Response Report.

The draft EIA/EMPr has been submitted to the public for their input and comments for a period of 30 days. The commenting period is from **05 November 2019** and ends on **04 December 2019**. The draft EIA/EMPr is available for review at the locations listed below:

- Sheepmoor Police Station (SAPS); and
- Digby Wells' website.

Public meetings are planned to be held during this commenting period to present the draft EIA/EMPr and obtain comments from the Interested and Affected Parties (I&APs). The draft EIA/EMPr will be updated with the comments received from the I&APs prior to submission of the Final EIA/EMPr to the DMR for consideration. Once the DMR has made a decision this will be communicated to all the registered I&APs.

Environmental Impact Summary

Although the baseline environment was assessed across the full Mining Right boundary, the impact assessment focused on Portion 2 of the Farm Twyfelaar 298IT where mining activities will be taking place in relation to the application process.

The impacts to the biophysical environment will be subject to mostly negative environmental impacts. The site is located in the second most diverse biome in the country, supporting a vast range of flora and fauna. The Project Area, Block A, is characterised by 12 wetland systems. The bench wetlands and the hillslope seep wetlands associated with the 'koppie' (Block A) and other hillslopes situated on and directly below the ridges of most of the higher lying areas were found to be in pristine or near-pristine condition due to the reduced suitability of these areas (steep slopes and limited access) for agropastoral activities and other anthropogenic disturbances. The 'koppie' wetlands are fed by a shallow aquifer perched within the hill of Block A. The anticipated impacts to both groundwater and wetlands can be mitigated, however, the shallow aquifer cannot be affected by mining activities as this will cut off supply to the surrounding wetlands. The main source of water supply in and around the proposed mining area are streams and groundwater (which is abstracted by use of community hand pumps) supplemented by a number of springs. Water is mainly used for domestic use and livestock watering. Block A is also located in the Eastern Highveld Grassland Biome which is listed as Vulnerable on the National List of Threatened Ecosystems. The ecology of the site is highly sensitive to mining and the recommendation that the majority of infrastructure (ie, not associated with the access point) be further investigated to move to less sensitive areas on Portions 1, 2 and 5 of the Farm Twyfelaar 298IT.

In terms of air quality, noise and blasting, these impacts were found to be mostly negligible and no blasting impacts are expected to be felt by households as no residential dwellings are within close enough proximity to the proposed Block A operations. The identified heritage resources within the Mining Right area are also unlikely to be affected by blasting. No graves have been identified in the immediate vicinity of Block A, but three culturally significant ruins were identified which need to be protected.

The majority of the positive impacts are associated with the socio-economic impacts as a result of the Project proceeding. Should the Mining Right and Environmental Authorisation be granted, surrounding communities will benefit from the community upliftment project proposed in the Social and Labour Plan, employment opportunities for the Life of Mine, and positive growth contributions to the Gross Domestic Product of the region.

Alternatives Considered

The following alternatives were considered in this EIA/EMP:

- Process alternatives;
- Design and layout alternatives;
- Mining method alternative;
- Haul Road routing alternative; and
- The ‘No-Go” alternative.

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Part A: Scope of Assessment and Environmental Impact Assessment Report

1 Introduction

Dagsoom Coal Mining (Pty) Ltd (hereafter Dagsoom) applied for a Mining Right in terms of the Mineral and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002) (MPRDA) to mine coal (and torbanite). The Mining Right boundary includes Portions 1, 2, 5, 7, 8, 9 and the Remaining Extent (RE) of the Farm Twyfelaar 298IT and the Remaining Extent (RE) of the Farm Klipfontein 283IT and will be known as the Twyfelaar Coal Mine. For the purpose of this application, initial mining activities will only take place on Portions 2 of the Farm Twyfelaar 298IT and most of the surface infrastructure will be limited to this same farm portion. The application processes requiring authorisation or licencing for mining to proceed include:

- An Integrated Environmental Authorisation Application, a Scoping and Environmental Impact Assessment (S&EIA) process as promulgated under the National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA),
- The National Environmental Management: Waste Act, 2008 (Act No. 56 of 2008) (NEM:WA);
- A Water Use Licence Application (WULA) and associated Integrated Water and Waste Management Plan (IWWMP) in terms of the National Water Act, 1998 (Act No. 36 of 1998) (NWA); and
- A Mining Right in terms of the MPRDA.

The resource location is approximately 40 km south-east of Ermelo, close to the N2 in the direction of Piet Retief. The project area is situated on the eastern escarpment of the Mpumalanga Highveld in the Ermelo Coal Field.

The coal will be accessed through an adit (an entrance to the underground mine) from the mountain-side associated with Block A (refer to Figure 5-2). The surface topography is rather mountainous, with plateaus and valleys between mountain ridges in typical escarpment topography. The surface is predominantly used for livestock grazing, as well as commercial and subsistence farming activities. The majority of the surface rights to areas where mining activities are likely to take place are owned by the Government of the Republic of South Africa.

2 Item 3: Project Applicant

Dagsoom is the proponent in this application. The details of the applicant are presented in Table 2-1.

Table 2-1: Contact details of the EAP

Name of Applicant:	Dagsoom Coal Mining (Pty) Ltd
Contact person:	Hilton Philpot
Physical address:	17 Fleming Street, Mill Hill, Bryanston, 2060
Postal address:	P O Box 1222, Cramerview, 2060

Postal code:	2060	**Cellphone:**	0824538007
Telephone:	-	**Fax:**	-
Email:	hilton@pitsa.co.za		

2.1 Item 3(a)(i): Details of the EAP

Digby Wells Environmental (hereafter Digby Wells) has been appointed by Dagsoom as the Environmental Assessment Practitioner (EAP) to manage the application processes. The details of the EAP are contained in Table 2-2 and the Curriculum Vitae of the EAP is attached in Appendix A.

Table 2-2: Contact Details of the EAP

Name of Practitioner:	Xan Taylor
Telephone:	011 789 9495
Fax:	011 789 9498
Email:	Xanthe.Taylor@digbywells.com

2.2 Item 3(a)(ii): Expertise of the EAP

This section provides details regarding the EAP's qualifications and experience.

2.2.1 The Qualifications of the EAP

Ms Taylor holds the following degrees/ diplomas:

- BA Honours Environmental Management, UNISA, 2013
- BA English and Psychology, UNISA, 2009

2.2.2 Summary of the EAP's Past Experience

Xan Taylor started working in the industry whilst completing her Honours degree, in 2012. Xan joined Digby Wells Environmental in 2015 and has almost eight years' experience. The majority of Xan's experience is in the mining sector relating to applications governed by NEMA for both the 2010 and 2014 Regulations (as amended) thereunder, the MPRDA, and the NWA, as well as international legislation, International Finance Corporation Performance Standards and World Bank Guidelines.

Her experience comprises managing integrated mining applications: compiling application forms, Basic Assessment reports, Scoping reports, Environmental Impact Assessment reports, Environmental Management Programmes, international Environmental and Social Impact Assessments, NEMA Regulation 29 and Regulation 31 Amendment reports, Section 102 Amendment reports, exemption applications, Appeals processes, and auditing.

3 Item 3(b): Description of the Property

Table 3-1 contains the details of the farm portions included where the mining activities will take place, the municipal district and nearest town to the site.

Table 3-1: Property Description

Farm Name:	Portion 2 of the Farm Twyfelaar 298 IT is where the bulk of the mining activities will take place. (The Mining Right boundary includes: Portions 1, 2, 5, 7, 8, and 9 and the Remaining Extent (RE) of the Farm Twyfelaar 298IT and the Remaining Extent (RE), of the Farm Klipfontein 283IT)
Application Area (Ha):	Approximately 2,438.7 ha
Magisterial District:	Gert Sibande District Municipality
Distance and direction from nearest town:	Approximately 8 km west of Sheepmoor town
21 digit Surveyor General Code for each farm portion:	T0IT00000000029800002

4 Item 3(c) of Appendix 3: Locality Map

The Locality Map is shown in Figure 5-1 below and attached as Appendix B.

5 Item 3(d) of Appendix 3: Description of the Scope of the Proposed Overall Activity

The preliminary infrastructure layout plan is shown in Figure 5-2 below and attached in Appendix B.

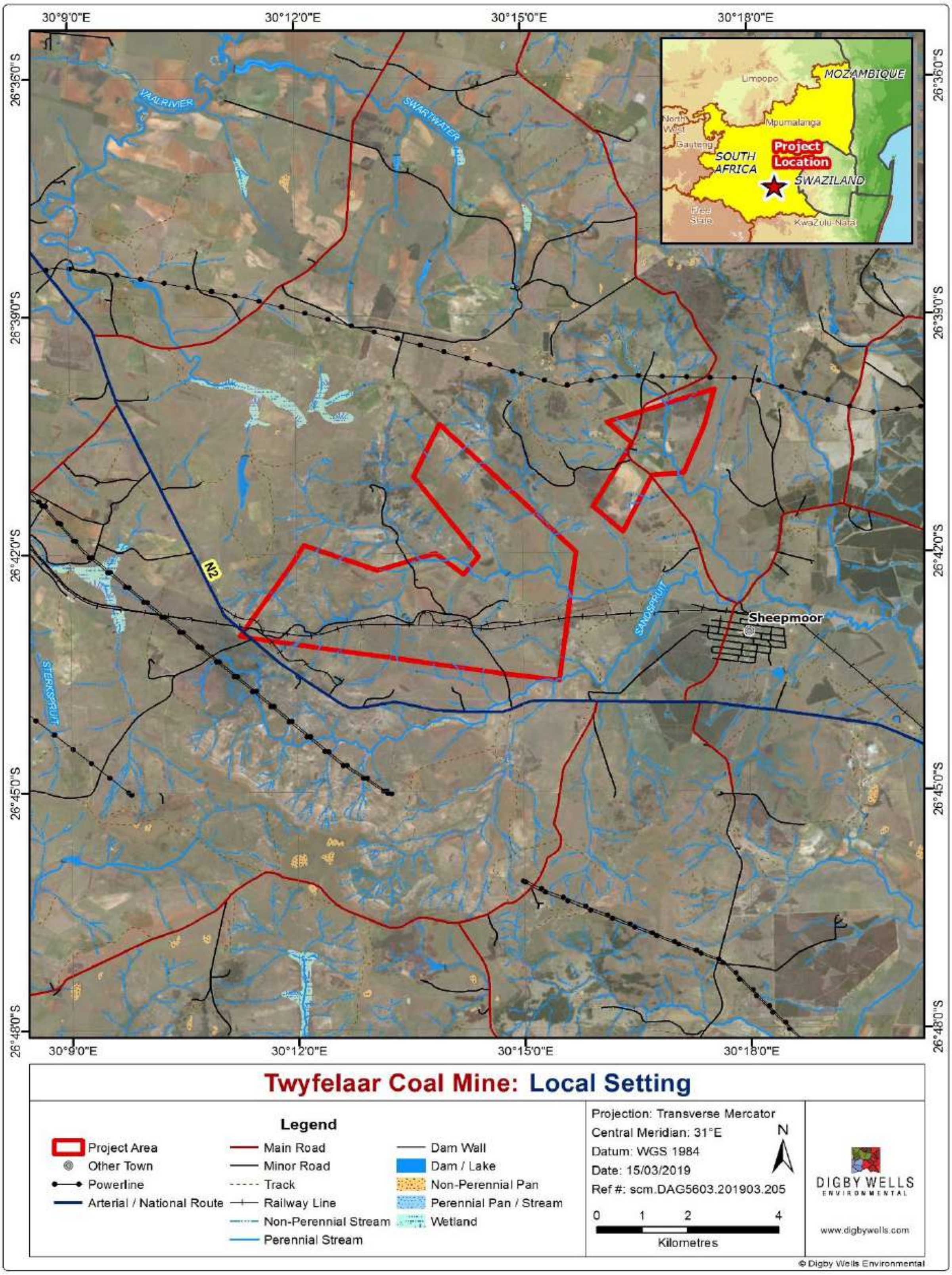

Figure 5-1: Local Setting of the Proposed Twyfelaar Coal Mine

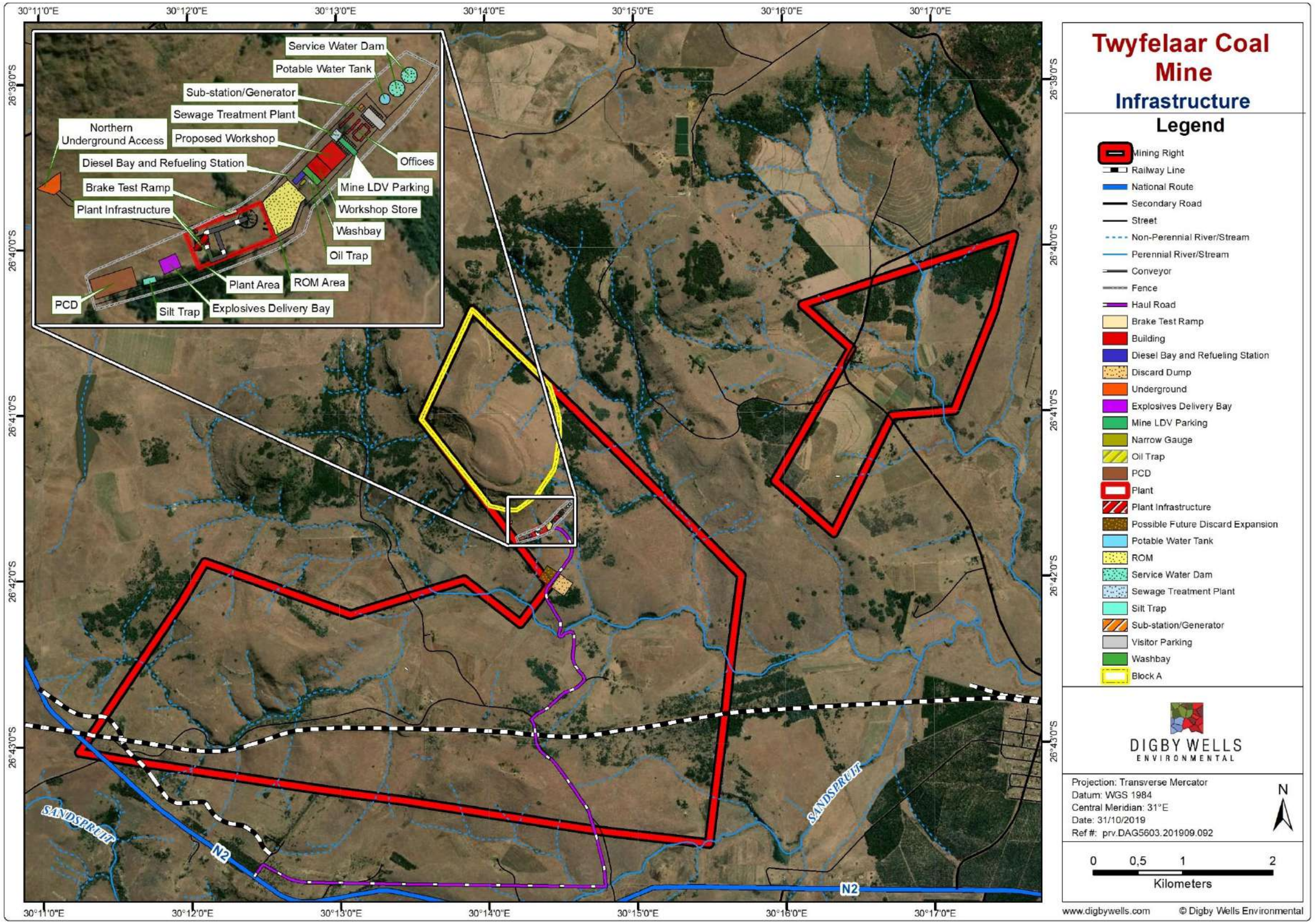

Figure 5-2: Preliminary Infrastructure Layout Map

5.1 Item 3(d)(i): Listed and Specified Activities

This section details the proposed project activities proposed to be undertaken on site, as well as the Listed Activities in terms of the NEMA EIA Regulations (2014, as amended). Table 5-1 details the project activities per phase (Construction, Operational and Decommissioning Phases), and Table 5-2 provides the identified Listed Activities as provided by the NEMA EIA Regulations, 2014 (as amended). The proposed infrastructure required includes the following:

- Underground Mine accessed by adit;
- Access and haulage roads;
- Ventilation fan;
- Wash plant;
- Pollution control dam (PCDs);
- Raw water pump station and process water pump station;
- Raw water pipeline and process water pipeline;
- Electricity supply;
- Potable water treatment plant and associated tanks;
- Sewage treatment plant;
- Reverse Osmosis plant;
- Change houses;
- Offices and ablution facilities;
- Workshops and cable workshops;
- Refuel bays;
- Weighbridges and weighbridge control rooms; and
- Access control offices.

Table 5-1: Project Activities per Phase

Project Phase	Project Activity
Construction Phase	■ Site/vegetation clearance; ■ Access and haul road construction; ■ Infrastructure construction; ■ Development of a box cut; ■ Power line construction; ■ Diesel storage and explosives magazine; and ■ Topsoil stockpiling.

Project Phase	Project Activity
Operational Phase	■ Removal of rock (blasting); ■ Stockpile (rock dumps, soils, ROM, discard dump) establishment and operation; ■ Diesel storage and explosives magazine; ■ Operation of the underground workings; ■ Operating the wash plant; ■ Operating sewage treatment plant; ■ Water use and storage on-site – during the operation water will be required for various domestic and industrial uses. Dams will be constructed that capture water from the mining area which will be stored and used accordingly; ■ Storage, handling and treatment of hazardous products (including fuel, explosives and oil) and waste; and ■ Maintenance activities – through the operations maintenance will need to be undertaken to ensure that all infrastructure in operating optimally and does not pose a threat to human or environmental health. Maintenance will include haul roads, pipelines, processing plant, machinery, water and stormwater management infrastructure, stockpile areas.
Decommissioning Phase	■ Demolition and removal of infrastructure – once mining activities have been concluded infrastructure will be demolished in preparation of the final land rehabilitation; ■ Rehabilitation – rehabilitation mainly consists of spreading of the preserved subsoil and topsoil, profiling of the land and re-vegetation; and ■ Post-closure monitoring and rehabilitation.

Table 5-2: Listed Activities in terms of the NEMA

Name of Activity	Areal extent of the activity	Listed Activity	Applicable Listing Notice	Waste Management Authorisation
Listing Notice 1				
Site/vegetation clearance *The clearance of an area of 1 hectare or more, but less than 20 hectares of indigenous vegetation, except where such clearance of indigenous vegetation is required for-* *(i) the undertaking of a linear activity; or* *(ii) maintenance purposes undertaken in accordance with a maintenance management plan.*	Approximately 20 ha	X- 27	GN R983, under NEMA	-
All infrastructure including ventilation fans, change houses, offices, ablutions, workshops, cable workshop, weighbridge, weighbridge control room and access control office. *The clearance of an area of 1 hectare or more, but less than 20 hectares of indigenous vegetation, except where such clearance of indigenous vegetation is required for-* *(i) the undertaking of a linear activity; or* *(ii) maintenance purposes undertaken in accordance with a maintenance management plan*	Approximately 20 ha	X-27	GN R983 under NEMA	-

Name of Activity	Areal extent of the activity	Listed Activity	Applicable Listing Notice	Waste Management Authorisation
Construction of access and haulage road *The development of a road-* *(i) for which an environmental authorisation was obtained for the route determination in terms of activity 5 in Government Notice 387 of 2006 or activity 18 in Government Notice 545 of 2010; or* *(ii) with a reserve wider than 13,5 meters, or where no reserve exists where the road is wider than 8 metres;* *but excluding a road-* *(a) which is identified and included in activity 27 in Listing Notice 2 of 2014;* *(b) where the entire road falls within an urban area; or* *(c) which is 1 kilometre or shorter.*	The construction of an access and haul road with maximum width of 9.6 m and approximately 6 km long (0.54 ha)	X-24 *(ii)*	GN R983, under NEMA	-
Pollution control dam *The development of facilities or infrastructure for the off-stream storage of water, including dams and reservoirs, with a combined capacity of 50,000 cubic metres or more, unless such storage falls within the ambit of activity 16 in Listing Notice 2 of 2014.*	Three PCDs totalling about 1.5 ha	X- 13	GN R 983 under NEMA	-
Raw water pipeline	Approximately 1.49 km long and 6 cm in diameter	X-9 (i) and /or (ii)	GN R983 under NEMA	-

Name of Activity	Areal extent of the activity	Listed Activity	Applicable Listing Notice	Waste Management Authorisation
The development of infrastructure exceeding 1000 metres in length for the bulk transportation of water or storm water- *(i) with an internal diameter of 0,36 metres or more; or* *(ii) with a peak throughput of 120 litres per second or more;* *excluding where-* *(a) such infrastructure is for bulk transportation of water or storm water or storm water drainage inside a road reserve; or* *(b) where such development will occur within an urban area.*				
Process water *The development and related operation of infrastructure exceeding 1 000 metres in length for the bulk transportation of sewage, effluent, process water, waste water, return water, industrial discharge or slimes-* *(i) with an internal diameter of 0,36 metres or more; or* *(ii) with a peak throughput of 120 litres per second or more;* *excluding where-*	Approximately 2 km	X-10 (i) and or (ii)	GN R 983 under NEMA	-

Name of Activity	Areal extent of the activity	Listed Activity	Applicable Listing Notice	Waste Management Authorisation
(a) such infrastructure is for bulk transportation of water or storm water or storm water drainage inside a road reserve; or *(b) where such development will occur within an urban area.*				
Operating sewage treatment plant *The development and related operation of infrastructure exceeding 1 000 metres in length for the bulk transportation of sewage, effluent, process water, waste water, return water, industrial discharge or slimes-* *(i) with an internal diameter of 0,36 metres or more; or* *(ii) with a peak throughput of 120 litres per second or more;* *excluding where-* *(a) such infrastructure is for the bulk transportation of sewage, effluent, process water, waste water, return water, industrial discharge or slimes inside a road reserve or railway line reserve; or* *(b) where such development will occur within an urban area.*	Approximately 1 ha	X-10	GN R 983	GN R 921 under NEM: WA Category B 4 (10)
Power line construction	22kV line, approximately 2.3 km long	X- 11	GN R983, under NEMA	-

Name of Activity	Areal extent of the activity	Listed Activity	Applicable Listing Notice	Waste Management Authorisation
The development of facilities or infrastructure for the transmission and distribution of electricity- *(i) outside urban areas or industrial complexes with a capacity of more than 33 but less than 275 kilovolts; or* *(ii) inside urban areas or industrial complexes with a capacity of 275 kilovolts or more*				
Listing Notice 2				
Site/vegetation clearance *The clearance of an area of 20 hectares or more of indigenous vegetation, excluding where such clearance of indigenous vegetation is required for-* *(i) the undertaking of a linear activity; or* *(ii) maintenance purposes undertaken in accordance with a maintenance management plan*	▪ 5.7 ha of habitat representing high ecological sensitivity ▪ .1.9 ha of remaining habitat of low ecological sensitivity.	X-15	GN 984, under NEMA	-
Mining of coal by underground mining *Any activity including the operation of that activity which requires a mining right as contemplated in section 22 of the Mineral and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002), including-* *(a) associated infrastructure, structures and earthworks directly related to the extraction of a mineral resource; or*	210 ha	X- 17	GN R 984 under NEMA	-

Name of Activity	Areal extent of the activity	Listed Activity	Applicable Listing Notice	Waste Management Authorisation
(b) the primary processing of a mineral resource including winning, extraction, classifying, concentrating, crushing, screening or washing.				
Infrastructure construction *Any activity including the operation of that activity which requires a mining right as contemplated in section 22 of the Mineral and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002), including-* *(a) associated infrastructure, structures and earthworks directly related to the extraction of a mineral resource; or* *(b) the primary processing of a mineral resource including winning, extraction, classifying, concentrating, crushing, screening or washing;* *but excluding the secondary processing of a mineral resource, including the smelting, beneficiation, reduction, refining, calcining or gasification of the mineral resource in which case activity 6 in this Notice applies.*	Infrastructure approximately 20 ha	X- 17	GN R 984, under NEMA	-
Diesel storage and explosive magazine *The development of facilities or infrastructure, for the storage, or storage and handling of a*	Approximately 1 ha	X- 4	GN R 984 under NEMA	GN R 921 under NEM:WA Category B 4 (1) & Category B 4 (10)

Name of Activity	Areal extent of the activity	Listed Activity	Applicable Listing Notice	Waste Management Authorisation
dangerous good, where such storage occurs in containers with a combined capacity of more than 500 cubic metres.				
Water Use Licence *The development of facilities or infrastructure for any process or activity which requires a permit or licence in terms of national or provincial legislation governing the generation or release of emissions, pollution or effluent*	PCD: 0.3 ha	X- 6	GN R 984 under NEMA	GN R 921 under NEM:WA Category B 4 (11)
Sewage treatment plant *The development and related operation of facilities or infrastructure for the treatment of effluent, wastewater or sewage with a daily throughput capacity of 15 000 cubic metres or more.*	Approximately 1 ha	X-25	GN R 984 under NEMA	
Waste Activities				
Diesel storage and explosive magazine *The storage of hazardous waste in lagoons*	Approximately 1 ha	Category B 4 (1)	GN R 921 under NEM: WA	-
Refuel bays *The storage of hazardous waste in lagoons excluding storage of effluent, wastewater or sewage.*	Approximately 1 ha	Category B 4(1)	GN R 921 under NEM: WA	-
Sewage treatment plant, pollution control dam	Approximately 2 ha	Category B 4 (10)	GN R 921 under NEM: WA	-

Name of Activity	Areal extent of the activity	Listed Activity	Applicable Listing Notice	Waste Management Authorisation
The construction of a facility for a waste management activity listed in Category B of this Schedule				
Stockpiling (rock dumps) *The establishment or reclamation of a residue stockpile or residue deposit resulting from activities which require a mining right, exploration right or production right in terms of the Mineral and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002).*	Approximately 3 ha	Category B 4 (11)	GN R 921 under NEM: WA	-
Rock removal (blasting), Stockpiling (rock dumps, soils, ROM, discard dump, pipelines) *Mining, exploration or production operation, resulting in the development of residue stockpiles and residue deposits"* *Prospecting, mining, exploration or production operation, resulting in development of residue stockpiles and residue deposits. The management and control of these wastes must take place in accordance with the regulations for management and control of residue deposits and residue stockpiles or an integrated environmental authorization as provided for in terms of NEMA.*	Approximately 6 ha	Category B; Listing 7, 10, 11	GN R 921 under NEM: WA	-

5.2 Item 3(d)(ii): Description of the Activities to be Undertaken

The coal resource outcrops or sub-outcrops (comes close to surface) within several areas of the Mining Right area being applied for. Since the Scoping Phase of the Project, the mining areas subject to Environmental Authorisation has been reduced from three mining areas to one mining area, referred to as Block A (refer to Figure 5-2 above).

The two additional mining areas contemplated in the Mine Works Programme will be subjected to further environmental authorisation at a later stage of the mine's life.

The mine will therefore consist of one underground section, Block A, with infrastructure around the mine access area on the northern side of the Project Area on the Farm Twyfelaar 298IT (Portion 2).

The C- seam and particularly the C-Lower seam, is the only seam that occurs at mineable thickness over the Block A area. There is a sandstone and shale parting of more than 3 m that separates the C-Upper and C-Lower seams and no opportunity exists for these coal seams to be mined together as per the case at other coal mines in the area. No faults or dykes were discovered during the exploration phase.

5.2.1 Reserves

The Twyfelaar Coal Project Northern Section comprises a coal inventory of some 4.5 Mt. Planned extraction of which some 2.5Mt is planned for extraction.

Approximately 12% of the Mineable tonnes *in-situ* (MTIS) is lost due to layout losses which is primarily due to barrier pillars left between mining panels and the inability to mine up to the exact border of the pre-defined resource. Another 5% will be left behind during the mining process. The pillar sizes are determined based on the depth of cover, seam height and road width and the assumption was made that 60% of the pillars left behind will be mined during the stooping phase which gives more than 80% total extraction of the resource within the panels.

5.2.2 Resource Access

The position for the mine access points has been selected based on the most appropriate position for a mine access, together with the entire associated surface infrastructure positioned outside the wetlands, but with a practical view on the seam access, mine layout, ventilation considerations, terrace for product handling and access road from an unnamed tar road.

The resource will be accessed through a boxcut adit. No detailed geotechnical analysis has been done on the strata formation stability where the boxcuts are planned and a typical safe excavation is planned for the purpose of this exercise.

Detailed designs will also reveal if the boxcuts must access the seam at a dip or if the floor of the boxcut will be an extension of the coal floor of the C-Lower seam. The current design (Portion 2 of the farm Twyfelaar) accesses the seam at seven degrees which allows for the smallest and lowest cost excavation. The resource will be accessed with at least three roads from the boxcut high wall; one road for men and material, one for the RoM conveyor and one the return airway which will be connected to the ventilation fans on the side "high wall" of the boxcut.

5.2.3 Production and Scheduling

Bord and pillar mining with continuous miners was the preferred mining option for this operation at the time of the specialist reports being written, and therefore the majority of the specialist reports have been assessed based on this method of mining. It has since been established that conventional drill and blast mining may be more feasible. The Blast Impact Assessment has considered drill-and-blasting and the remainder of the specialist reports will consider this change in mining for the Final EIA. *The Groundwater Report has not modelled for nitrate associated with explosives, and the Groundwater and Wetland Specialists need to consider the impacts potential rock fracturing will have on the perched aquifer, based on the outcome of the Blasting Report.*

Each production section will be mined at a rate of about 240 kilo-tonnes per annum (ktpa) or 20 ktpm, which is the industry benchmark due to the low seam height to be mined. Stooping production rates may increase up to 30 ktpm due to less support requirements.

The total production for this mine is planned to be 480 ktpa or slightly higher during stooping operations with two continuous miner sections.

The stooping operations will be at 50 ktpm due to less support requirements and because the geological challenges would already be overcome during the development phase. This schedule allows a Life of Mine (LoM) for Block A (Northern Section) of about 5-6 years (including ramp up)

6 Item 3(e): Policy and Legislative Context

This section aims to provide a description of the policy and legislative context within which the project is being proposed. This section has been divided into national, provincial and policies, plans, guidelines and development planning frameworks and tools. Table 6-1 provides a description of the national legislation and guidelines that is considered applicable to the Project and its activities.

Table 6-1: Policy and Legislative Context

Applicable legislation and guidelines used to compile the report	Reference where applied
<u>The Constitution of the Republic of South Africa, 1996</u> Under Section 24 of the Constitution of the Republic of South Africa, 1996 (the Constitution) it is clearly stated that: *Everyone has the right to* *(a) an environment that is not harmful to their health or well-being; and* *(b) to have the environment protected, for the benefit of present and future generations, through reasonable legislative and other measures that -* *(i) Prevent pollution and ecological degradation;* *(ii) Promote conservation; and* *(iii) Secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development.*	Dagsoom is undertaking an EIA process to identify and determine the potential impacts associated with the Project. Mitigation measures recommended will aim to ensure that the potential impacts are managed to acceptable levels to support the rights as enshrined in the Constitution.
<u>National Environmental Management Act, 1998 (Act No 107 of 1998) and EIA Regulations (as amended in 2017)</u> The Environmental Management Act, 1998 (Act No 107 of 1998) (NEMA), as amended was set in place in accordance with Section 24 of the Constitution. Certain environmental principles under NEMA have to be adhered to, to inform decision making for issues affecting the environment. Section 24 (1)(a) and (b) of NEMA state that: *The potential impact on the environment and socio-economic conditions of activities that require authorisation or permission by law and which may significantly affect the environment, must be considered, investigated and assessed prior to their implementation and reported to the organ of state charged by law with authorizing, permitting, or otherwise allowing the implementation of an activity.*	Activities associated with the proposed mine are identified as Listed Activities in the Listing Notices (as amended) and therefore require environmental authorisation prior to being undertaken. This EIA/EMPr is be informed by the requirements of the NEMA and Regulations thereunder.

Applicable legislation and guidelines used to compile the report	Reference where applied
The EIA Regulation, 2014 was published under GN R 982 on 4 December 2014 (EIA Regulations) and came into operation on 08 December 2014. Together with the EIA Regulations, the Minister also published GN R 983 (Listing Notice No. 1), GN 984 (Listing Notice No. 2) and GN R 985 (Listing Notice No. 3) in terms of Sections 24(2) and 24D of the NEMA, as amended. The EIA Regulations have been made applicable to prospecting and mining activities.	
Mineral and Petroleum Resource Development Act. 2002 (Act No. 28 of 2002) The MPRDA sets out the requirements relating to the development of the nation's mineral and petroleum resources. It also aims to ensure the promotion of economic and social development through exploration and mining related activities. The MPRDA requires that mining companies assess the socio-economic impacts of their activities from start to closure and beyond. Companies must develop and implement a comprehensive Social and Labour Plan (SLP) to promote socio-economic development in their host communities and to prevent or lessen negative social impacts.	The Applicant has applied for a Mining Right on various portions the Farm Twyfelaar 298IT and the Farm Klipspruit 283IT near Ermelo. The EIA process is undertaken to meet the requirements of the MPRDA read with the EIA Regulations, 2014 (as amended). Financial Provisioning and Closure Costs are included herein, and the report is appended hereto as Appendix P.
National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008) On 29 November 2013, the list of waste management activities published under GN R718 of 3 July 2009 (GN R718) was repealed and replaced with a new list of waste management activities under GN R921 of 29 November 2013. Included in the new list are activities listed under Category A, B and C. These activities include inter alia the following: Category A describes waste management activities requiring a Basic Assessment process to be carried out in accordance with the EIA Regulations supporting an application for a waste management licence; Category B describes waste management activities requiring an Environmental Impact Assessment process to be conducted in accordance with the EIA Regulations supporting a waste management licence application; and	A Waste Management Licence (WML) has been applied for due to the nature of mining activities.

<table>
<tr><th>Applicable legislation and guidelines used to compile the report</th><th>Reference where applied</th></tr>
<tr><td><u>Category C</u> describes waste management activities that do not require a WML but these activities will have to comply with the prescribed requirements and standards as prescribed by the Minister, which includes the Norms and Standards for Storage of Waste, 2013. These activities include the storage of general waste at a facility with a capacity to store in excess of 100 m^3 and storage of hazardous waste in excess of 80 m^3.

The Waste Classification and Management Regulations published under GN R 634 of November 2013 require that all wastes be classified according to SANS10234 and managed according to its classification.</td><td></td></tr>
<tr><td><u>National Water Act, 1998 (Act No. 36 of 1998) (NWA)</u>

The NWA provides for the sustainable and equitable use and protection of water resources. It is founded on the principle that the National Government has overall responsibility for and authority over water resource management, including the equitable allocation and beneficial use of water in the public interest, and that a person can only be entitled to use water if the use is permissible under the NWA.

GN R 704 was published in June 1999 and aims to regulate the use of water for mining and related activities for the protection of water resources and states the following:
▪ Regulation 4: No residue deposit, reservoir or dam may be located within the 1:100 year flood line, or less than a horizontal distance of 100 m from the nearest watercourse. Furthermore, person(s) may not dispose of any substance that may cause water pollution;
▪ Regulation 5: No person(s) may use substances for the construction of a dam or impoundment if that substance will cause water pollution;
▪ Regulation 6 is concerned with the capacity requirements of clean and dirty water systems, and
▪ Regulation 7 details the requirements necessary for the protection of water resources.</td><td>An IWULA and an associated IWWMP are required in terms of Section 21 of the NWA for the Project. The water uses under Section 21 of the NWA which may be relevant to this Project are listed below:
▪ S21(a) – Taking water from a water resource;
▪ S21(b) – Storing water;
▪ S21(c) – Impeding or diverting the flow of water in a watercourse;
▪ S21(i) – Altering the bed, banks, course or characteristics of a watercourse;
▪ S21(j) removing, discharging or disposing of water found underground if it is necessary for the efficient continuation of an activity or for the safety of people; and
▪ S21(g) – Disposing of waste in a manner which may detrimentally impact on a water resource.</td></tr>
</table>

Applicable legislation and guidelines used to compile the report	Reference where applied
DWS[1] Best Practice Guideline – G1: Storm Water Management Plan (SWMP) These are guidelines provided by the DWS for the development of a SWMP. The following will be undertaken to develop the conceptual SWMP: ▪ Delineate the clean and dirty area contributing to runoff (based on the final layout plans) and site-specific hydrological assessments to determine volumes that require to be handled. The SWMP should ensure that temporary drainage installations should be designed, constructed, and maintained for recurrence periods of at least a 25-year, 24-hour event, while permanent drainage installations should be designed for a 50-year, 24-hour recurrence period; and ▪ Site specific assessments to establish the appropriate mitigation measures and surface water monitoring programme.	All water management infrastructure must be designed for a 1:100 year, 24 hour rainfall event.
DWS Best Practice Guideline – G4: Impact Prediction The impacts of mine activities on the groundwater environment must be assessed as part of the MRA, as well as for the IWULA. The baseline conditions must be assessed to define the current aquifer systems, groundwater use and groundwater conditions before mine commencement and to determine the extent of possible future impacts on the groundwater resources.	An IWULA and an associated IWWMP are required in terms of Section 21 of the NWA. The EIA as part of the MRA will assess potential impacts on groundwater resources as a result of the Project.
National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004) (NEM:BA) The NEM:BA regulates the management and conservation of the biodiversity of South Africa within the framework provided under NEMA. This Act also regulates the protection of species and ecosystems that require national protection and also takes into account the management	A Fauna and Flora Impact Assessment is appended hereto as Appendix E.

[1] Previously the Department of Water Affairs (DWA)

Applicable legislation and guidelines used to compile the report	Reference where applied
of alien and invasive species. The following regulations which have been promulgated in terms of the NEM:BA are also of relevance: ▪ Alien and Invasive Species Lists, 2014 published (GN R.599 in GG 37886 of 1 August 2014); ▪ National Environmental Management: Biodiversity Act, 2004: Threatened and Protected Species Regulations; and ▪ National list of Ecosystems Threatened and in need of Protection under Section 52(1) (a) of the Biodiversity Act (GG 34809, GN R.1002, 9 December 2011).	
National Environmental Management: Air Quality Act, 2004 (Act No. 39 of 2004) The prevailing legislation in the Republic of South Africa with regards to the Air Quality field is the National Environment Management: Air Quality Act, 2004 (Act No. 39 of 2004) (NEM: AQA). According to the Act, the DEA, the provincial environmental departments and local authorities (district and local municipalities) are separately and jointly responsible for the implementation and enforcement of various aspects of NEM: AQA. A fundamental aspect of the new approach to the air quality regulation, as reflected in the NEM: AQA is the establishment of National Ambient Air Quality Standards (NAAQS). These standards provide the goals for air quality management plans and also provide the benchmark by which the effectiveness of these management plans is measured. The NEM: AQA provides for the identification of priority pollutants and the setting of ambient standards with respect to these pollutants.	An Air Quality Impact Assessment has been summarised in this EIA/EMPr and is appended hereto as Appendix L.
National Dust Control Regulation 2013 The Minister of Water and Environmental Affairs, released on the 01 November 2013 the National Dust Control Regulation, in terms of Section 53, read with Section 32 of the National Environmental Management: Air Quality Act, 2004 (Act No. 39 of 2004)(NEM:AQA). In the published National Dust Control Regulations, terms like target, action and alert thresholds were	An Air Quality Impact Assessment has been summarised in this EIA/EMPr and is appended hereto as Appendix L.

Applicable legislation and guidelines used to compile the report	Reference where applied
omitted. Another notable observation was the reduction of the permissible frequency of exceedance from three to two incidences within a year. The standard actually adopted a more stringent approach than previously and would require dedicated mitigation plans now that it is in force.	
<u>National Noise Control Regulations, R.154 of 1992 (the Noise Regulations) promulgated in terms of Section 25 of the Environmental Conservation Act, 1989 (Act 73 of 1989)</u> The National Noise-Control Regulations (GN R154 in Government Gazette No. 13717 dated 10 January 1992) (NCRs) form part of the Environmental Conservation Act and these Regulations apply to external noise. The NCRs differentiates between Disturbing Noise levels (which is objective and scientifically measurable which are generally compared to existing ambient noise level) and Noise Nuisance (which is a subjective measure and is defined as noise that "*disturbs or impairs or may disturb or impair the convenience or peace of any person*"). Local Authorities use Controlled Areas to identify areas with high noise levels. Restrictions have been set out for development that occurs in these Controlled Areas. These regulations make provision for guidelines pertaining to noise control and measurements. The regulations make reference to the use of the South African National Standards 10103:2008 (SANS) guidelines for the Measurement and Rating of Environmental Noise with Respect to Land Use, Health, and Annoyance and to Speech Communication. As such, a Noise Impact Assessment in accordance with the NCRs must be undertaken for submission to determine the potential disturbing and nuisance noise levels associated with a particular development.	A Noise Impact Assessment has been summarised in this EIA/EMPr and the report is appended hereto as Appendix M.
<u>The National Heritage Resources Act, 1999 (Act No. 25 of 1999) (NHRA)</u> The National Heritage Resources Act, 1999 (Act No. 25 of 1999) (NHRA) is the overarching legislation that protects and regulates the management of heritage resources in South Africa.	For the Scoping Phase, a Notice of Intent to Develop (NID) was submitted to SAHRA. A Heritage Impact Assessment has been undertaken and included as Appendix J.

Applicable legislation and guidelines used to compile the report	Reference where applied
The Act requires that Heritage Resources Agency's in this case the South African Heritage Resources Agency (SAHRA) and Provincial Heritage Resources Authority of Gauteng (PHRA-G), be notified as early as possible of any developments that may exceed certain minimum thresholds. This act is enforced through the National Heritage Regulations GN R 548 (2000).	
GN R 1147 (Financial Provisioning Regulations), 2015 The Financial Provisioning Regulations prescribe methods for determining the quantum of financial provision for rehabilitation and mechanisms for providing for it. Section 41 (1) of the MPRDA has been repealed and Section 24P of the NEMA, as amended, which provides that the holder of a mining right must make financial provision for rehabilitation of negative environmental impacts. The financial provision must guarantee the availability of sufficient funds.	The Financial Provisioning Regulations are applicable to rehabilitation and closure plans as they prescribe the minimum content of an annual rehabilitation plan and the minimum content of a final rehabilitation, decommissioning and mine closure plan. The Closure and Rehabilitation Report is attached as Appendix P and summarised in this EIA/EMPr.
GN R 527 (MPRDA Regulations), 2004 Regulation 527 (GN R. 527) specifies that the EMP must include environmental objectives and specific goals for mine closure. The applicant for a mining right must make prescribed financial provision for the rehabilitation or management of negative environmental impacts, which must be reviewed annually. R527 provides specific principles for mine closure including safety and health, residual and latent environmental impacts etc.	The EMP is provided in Part B, Sections 5 and 6 of this report.

7 Item 3(f): Need and Desirability of the Proposed Activities

There is a national requirement for coal to meet the demand for electricity supply. This proposed Project will supply coal to the local markets, thereby assisting with the alleviation of the shortage of supply. The National Development Framework includes, in summary, the need to produce energy to support industry at competitive prices. Furthermore, the proposed Project will contribute to the local economy through job creation and procurement. Increased employment will lead to increased expenditure, tax base and royalties.

The Gert Sibande Municipality and Wards influenced by this project, experience unemployment rates between 18% and 43%, respectively and the Project could assist in alleviating some of these unemployment rates. The Social and Labour Plan (SLP) stipulates that the Applicant should firstly employ people from the directly affected wards. The Applicant will also provide skills development to employees thereby advancing the future employability of these individuals. The SLP further identifies community development projects from which the surrounding communities will benefit as a result of the project.

As stated in the MPRDA, the Government’s objective is to maximise the benefit of the nation’s mineral resources for the benefit of all South Africans. By establishing a new mining operation, this objective can be accomplished, particularly through job creation.

From an environmental perspective, the Applicant is willing to pursue underground mining on a shallow coal reserve in an effort to reduce the environmental impact of open pit mining, due to the environmental sensitivity on the site.

8 Item 3(g): Motivation for the Preferred Development Footprint within the Approved Site including a Full Description of the Process followed to reach the Proposed Development Footprint within the Approved Site

The location of the Project has been decided by the location of the identified coal seams. The layout of the surface infrastructure was considered in the specialist studies which will advise proposed changes to the layout to avoid or minimise certain impacts. The mine layout will need to be amended to minimise the impacts to wetlands and the Eastern Highveld Grassland by reducing the overall layout to a more condensed area, as the impact assessment was based on the preliminary layout.

8.1 Item 3(g)(i): Details of the development footprint alternatives considered

A project alternative is defined as a possible course of action, in place of another, that would meet the same purpose and need (DEAT, 2004).

In an EIA process, project alternatives serve to determine the most effective way of meeting the objectives of that project. This is generally done through either enhancing the benefits of an activity and/or mitigating the negative impacts and risks of an activity.

According to the Department of Environmental Affairs (DEA) Criteria for Determining Alternatives in EIA Guideline (2004), there are various types or categories of alternatives, including:

- Location alternative – alternative project sites in the same geographic area;
- Process/design alternative – alternative process/design/equipment;
- Activity alternative – consideration of different means to achieve the same project objective;
- Routing alternative – consideration of different routes for linear infrastructure;
- Site layout alternative – consideration of the different options to place project infrastructure; and
- No-go alternative – the proposed project/activity does not proceed, implying that the current situation or status quo remains.

8.1.1 Process Alternatives

Scopion Mineral Processing (2014) Processing Report for the Dagsoom Coal Project, South Africa, C0085-00-REP-001 considered the Run of Mine volume alternatives discussed below. Although these alternatives have therefore been considered in detail, the Air Quality and Noise reports required this information for the respective impact assessments.

8.1.1.1 Option 1

This option involves mining, stockpiling, hauling and selling ROM material to a local customer. A 100% yield is assumed as no processing follows the mining operations. The ROM product is hauled by road to the customer at a rate of 408 000 tpa. This option will likely encompass drilling and blasting operations. A ROM stockpile is required, as well as a product load-out facility.

8.1.1.2 Option 2

This option involves mining, stockpiling, crushing and selling to a local customer, possibly Eskom. .A 100% yield is assumed, and the ROM product is hauled to the customer at a rate of 408 000 tpa. A ROM stockpile is required, followed by a crushing and screening plant, as well as a product loadout facility.

8.1.1.3 Option 3

This option involves mining, stockpiling, crushing, screening, washing and selling an upgraded product for the export market. An 80% theoretical yield is assumed. Therefore, the production rate is 287 232 tpa of export quality coal. The ROM product is hauled to a train load-out station, from where the coal is transported to the Richards Bay Coal Terminal (RBCT) via the RBCT railway line. A Run of Mine (ROM) stockpile is required, followed by a crushing and screening plant, a dense medium separation (DMS) plant, fine tailings and coarse discard facilities, as well as a product load-out facility.

8.1.2 Design and Layout of the Project

In the pre-feasibility stage of the Project, the Applicant determined that the coal seam is sufficiently deep enough under surface to implement underground mining at Block A. The Applicant was aware of wetlands on site which assisted in informing the decision to implement underground mining as opposed to surface mining. Furthermore, the Fauna and Flora study has confirmed that the area of Block A and surrounds is characterised by Eastern Highveld Grassland and therefore also unsuited to surface mining.

The placement of infrastructure will need to be reconsidered to avoid the ecologically highly sensitive areas. Certain critical infrastructure including but not limited to the adit, ROM pad and conveyor cannot be moved and will be considered in an ecological off-set report (off-set being the only viable option to mitigate against the loss of grasslands on site). The remaining infrastructure which is not critical for the access area must be replaced within the least sensitive delineated areas. With reference to the composite map shown in Figure 3-1 (Part B), there is an area of significantly lower sensitivity south of the discard dump, amongst others, which can be considered for the remainder of the required mining infrastructure.

A Biodiversity off set report must be compiled in which the offset requirements and receiving area is identified, at this stage the removal of all AIP tree species, and returning these areas to natural grasslands within the project are can be considered. The ecosystem processes patterns and services will possibly be enhanced with the removal of the AIP infestations from sensitive ecosystems such as wetlands, riparian areas all of which fall within the Critical Biodiversity Areas (CBA's) present on site, and will increase the CBA percentage as defined by the Mpumalanga Conservation plan.

8.1.3 Mining Method Alternatives

Mining method alternative is twofold; the first being the method of using continuous miners versus drilling and blasting, and the second consideration is that of subsidence which must be investigated further, as shallow mining will present a very high risk of subsidence.

8.1.3.1 Continuous Miner versus Drilling and Blasting

Dagsoom proposes to implement conventional drilling and blasting as the preferred mining alternative, however, the initial preferred alternative was to use continuous miners. Based on the initial scope of work, the specialist reports considered continuous mining and will need to consider the implications of implementing drill and blast, based on the outcome of the blasting study. Conservatively, the concerns regarding blasting underground relate to rock fracturing which could impact the shallow aquifer, impacting the pristine bench and hillslope seep wetlands which rely on this water supply, therefore creating a cumulative impact for groundwater, surface water, wetlands and aquatic ecology. Further to this, the nitrate plume associated with blast materials has not been considered but has conservatively assumed to extend as far as the sulphate plume, but nitrate does dissolve more easily and may therefore not extend as far as sulphate plume.

The findings of the blasting report which has considered the proposed drill and blast method had focused on surrounding infrastructure on the surface which was considered to have a minimal impact. However, the blasting report did not consider geological impacts underground as a result of blasting and therefore no clear determination of whether the drill and blast alternative can be implemented in a way that would not exceed the impacts of continuous mining. This will be considered further by the specialist team and submitted in the final version of the EIA/EMP.

8.1.3.2 Subsidence Considerations for Underground Mining

The shallower the coal is the higher the risk of roof or pillar collapse and subsidence occurring. Subsidence with or without cracks may occur, and the size of cracks determine the impact on the hydrology, geohydrology and ecological sensitivity of the area. Subsidence must be avoided.

Subsidence has partially been considered in the *Twyfelaar Conceptual Mining Study Report*, compiled by ECMA Consulting (Pty) Ltd (hereafter ECMA), dated September 2014. The following extract is taken directly from this report:

> *"The safety factor (1.8 - 2) applied in the mine layout and design is sufficient to allow a stable roof, but with the vision in mind to do stooping (extraction of pillars) to fully utilise the coal resource. The C-lower seam varies between 30m (to be confirmed for geotechnical stability) and 215m in depth, primarily due to the topography and has an average seam thickness of just over 1.5m.*
>
> *Coal cutting is carried out by a continuous miner (CM), which cuts out portions of the seam (bords) and systematically leaves standing ground (pillars) for support. Coal is loaded from the CM into shuttle cars, which dump the coal onto a feeder breaker which sizes the coal to less than 300mm for conveyance to surface. It is the most commonly practiced method of coal mining in South Africa and in most coal mines worldwide. The method can successfully handle very minor faulting and dolerite intrusions, although these do have a negative impact on productivity. A drill and blast team have to mine through structures that cannot be cut by a continuous miner. (no structures are identified to date and no drill and blast team is currently allowed for)*
>
> *The system described above is used for this study, but a mining method with a different pillar configuration where the continuous miner is followed with a continuous conveyor is currently used at one mine in South Africa and it proves to be much more productive than the CM and shuttle car combination. This must be investigated and considered in the final feasibility study before mining commences.*

The resource recovery factor of this method diminishes with depth as larger pillars are required at depth, thereby lowering the extraction factor. Pillar extraction will be done in retreat after primary mining is done. There are various versions of pillar extraction which differ in the extent to which individual pillars are extracted, as well as the pattern/sequence of pillar extraction. With total extraction methods, goafing (collapse of roof) will occur with the associated fracturing of the roof strata and possible surface subsidence. With partial pillar extraction methods (such as checker bording), a sufficient number of pillars are left intact to avoid goafing and surface subsidence. The safe assumption is made that 60% of the coal in the pillars is extracted during stooping activities at this project" (pg 21 - 22, ECMA, 2014).

As recommended in the ECMA report (2014), further detailed geotechnical work is required to finalise pillar designs prior to mining to avoid subsidence.

8.1.4 Routing Alternatives

Four routing alternatives were considered (as shown in Figure 8-1) in the pre-feasibility phase of the Project and the Traffic Impact Assessment, based on these alternatives, determined the preferred routing option for the proposed haul road to follow. The preferred route was determined to be Road C, which considered the existing road network, proximity to residences, public transport services and future road planning. The impacts associated with the preferred haul road are discussed in Section 11 of Part A.

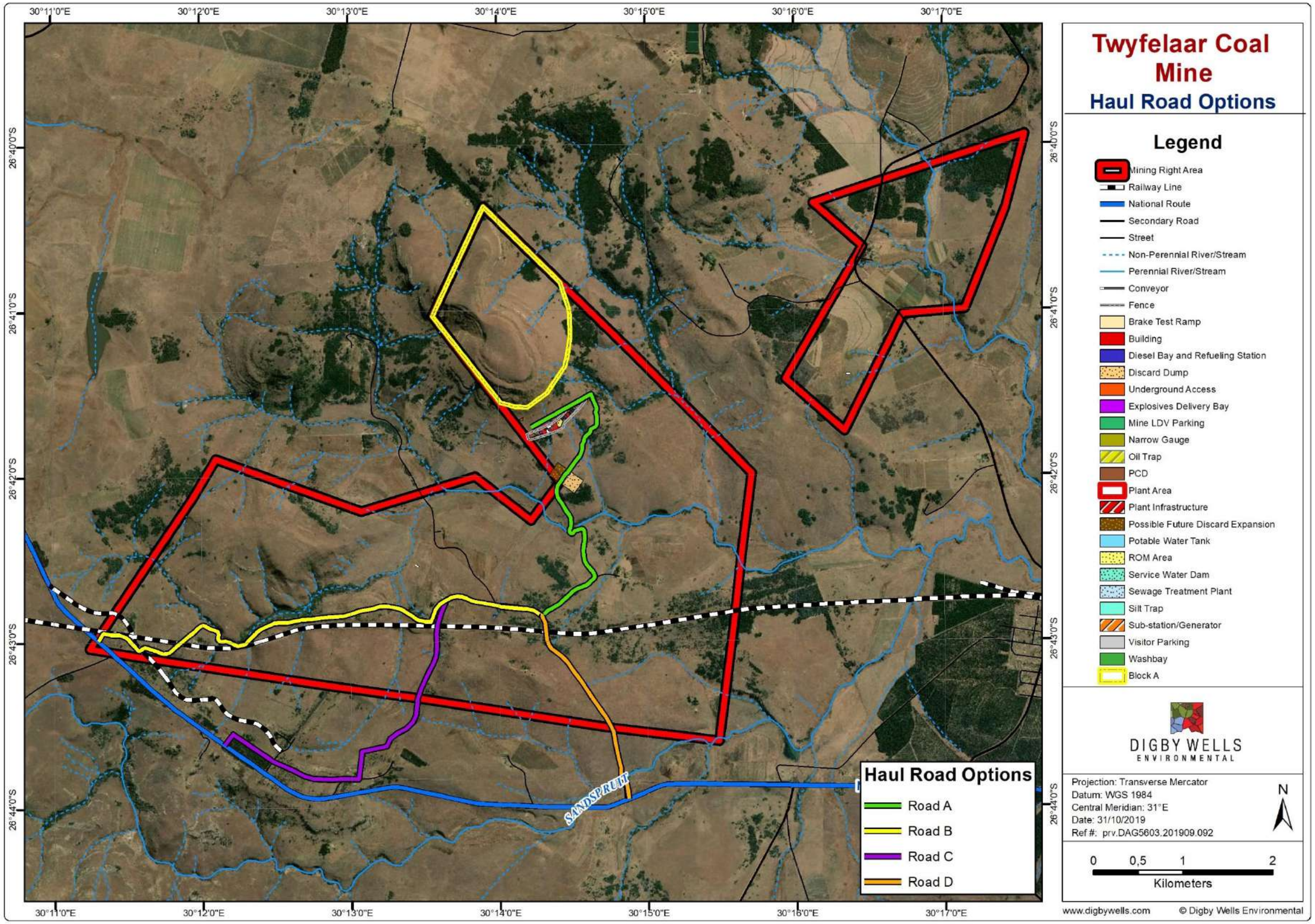

Figure 8-1: Proposed Haul Road Routing Alternatives

8.1.5 The No-Go Alternative

The No-Go Alternative considers the option of the Project not proceeding and maintaining the status quo. The current land use of predominantly cattle and subsistence farming will persist, and the identified negative environmental impacts will also be avoided. However, the positive impacts associated with the Project, pertaining to socio-economic benefits such as employment, as well as the proposed community upliftment projects associated with the Social and Labour Plan, will not be realised.

9 Item 3(g)(ii): Details of the Public Participation Process followed

The Public Participation Process (PPP) was developed to ensure compliance with environmental regulatory requirements and to provide I&APs with an opportunity to evaluate the proposed project. During this process stakeholders are able to provide inputs and to receive feedback from the environmental specialists and/or proponent.

9.1 Stakeholder Identification

During the Scoping Phase, the following methods were used to develop a stakeholder database which was utilised to ensure a proper representation of stakeholders interested in or affected by the proposed Project. This included the following:

- Stakeholders (including Government Departments, landowners, land occupiers, communities, Non-Governmental Organisations, agricultural organisations, Parastatals and businesses) have and will continue to be identified and captured in a stakeholder database;
- Windeed and desktop searches were conducted in and around the project area to verify land ownership and obtain contact details;
- Responses were received from newspaper advertisements and site notices;
- Responses were received from distribution of the Background Information Document (BID) and notification letter;
- Telephonic and one-on-one consultations with landowners and land occupiers were done to identify additional I&APs;
- The environmental Scoping Report and associated documentation was made available for public comment for a period of 30 days, from 09 May to 07 June 2019;
- A Focus Group Meeting with the directly affected land occupiers and a Public Meeting were held on 03 June 2019; and
- Suggestions, concerns raised during the public meetings and comment period have been recorded and responded to in Table 9-3 below and included in the Public Participation Report attached in Appendix C.

A stakeholder database was compiled and updated throughout the PPP with new stakeholders (refer to Appendix C). The directly affected landowners for the proposed Project are presented in Table 9-1 below.

Table 9-1: Directly Affected Landowners

Farm and Portions	Landowners
Remaining Extent of the farm Twyfelaar 298	Bambanani Sakhisizwe Communal Property Association
Portion 1,2,and 5 of the farm Twyfelaar 298	National Government of Republic of South Africa
Portion 7 of the farm Twyfelaar 298	Mphethi Maachuene Josephine
Portion 8 and 9 of the farm Twyfelaar 298	Transnet Limited
Remaining Extent of the farm Klipfontein 289IT	Nicolaas Wilhelmus Jacobus Vorster

9.2 Consultation with Stakeholders during the Scoping Phase

A notification letter and Short Message Service (SMS) were sent out to the stakeholders and telephonic discussions were also undertaken throughout the Scoping phase to inform I&APs about the meetings to be held and to obtain comments. These three methods were employed to ensure that the stakeholders do attend the meetings to allow for an opportunity to raise comments in relation to the project.

The purpose of the stakeholder meetings was to disseminate detailed project information to the I&APs. During the engagement the various stages of the EIA process and the PPP were explained as well as the related legislated timeframes. Having various stakeholder meetings (i.e. public and focus group meetings) was largely motivated by requests from stakeholders and their need to have discussions around specific requirements and concerns, for example employment, social development and land acquisition. Translation into the appropriate language(s) was available at the various stakeholder meetings.

Comments raised by the stakeholders were captured in the Comments and Response Report (CRR) (see Appendix C). The comments received during the Scoping phase were closely looked at and addressed, where applicable, by the project team to ensure the scope for the specialist studies undertaken during the Impact Assessment Phase were clearly defined. Responses have been included in the CRR and were incorporated into this report (see Appendix C). The PowerPoint presentations utilised as part of the various stakeholder meetings are appended hereto as Appendix C.

9.2.1 Public Meeting

A public meeting was held on 03 June 2019 for all I&APs who are affected or interested on the proposed project. The purpose of the meeting was to disseminate detailed information about the proposed project, address comments already raised by the community representatives where possible, and to obtain further comments. The meeting was held at Sheepmoor Community Hall, consequently the attendees were from the same vicinity.

9.2.2 Focus Group Meeting

A focus group meeting was held at the Twyfelaar 289IT Portion 0 on the same day, 03 June 2019. This meeting was specifically dedicated to the directly affected landowners and land occupiers on Twyfelaar. A formal presentation was conducted by the EAP, maps that showed the project area was distributed amongst every individual who attended the meeting.

Table 9-2: Public Participation Scoping Phase Activities

Activity	Details	Reference in Report
Identification of stakeholders	Stakeholder database which represent various sectors of society, including directly affected and adjacent landowners, in and around the proposed project area.	**Appendix B4** Stakeholder database
Distribution of announcement letter and BID	BID, announcement letter with Registration and Comment Form was emailed and posted to stakeholders on Thursday, **15 May 2019**.	**Appendix B4** Public Participation Materials
Placing of newspaper advertisement	An English advert was placed in the Highveld newspaper on Tuesday, **14 May 2019**.	**Appendix C1** Public Participation Materials
Putting up of site notices	English site notices were put up at the proposed project site and other public places around the proposed site on **9 and 15 May 2019:** ▪ Entrance to the community farm boundary (Vodacom Tower); ▪ Entrance to the Sheepmoor Police Station; ▪ Farm entrance into the community; ▪ Close to the railway station; ▪ On a fence close to the community of Bambanani; ▪ On a fence close to the proposed project; ▪ At the post office gate south of the project area; and ▪ At the Sheepmoor clinic entrance.	**Appendix C 2** Public Participation Materials

Activity	Details	Reference in Report
Announcement of Draft Scoping Report	The announcement of the availability of the Draft Scoping Report was emailed and sms's were sent to stakeholders together with the formal project announcement. Copies of the Scoping Report are available at: ▪ Sheepmoor Police Station: 114 Part Street, Sheepmoor, 2350; and ▪ www.digbywells.com (under public documents for DAG5603). An SMS was also sent to stakeholders announcing availability of the Scoping Report. The commenting period for the project was: *(30-day comment period for the Scoping Report: 09 May 2019 until 7 June 2019).*	**Appendix B 3** Progress Materials
Meetings with stakeholders	A focus group meeting was held on the **Monday, 03 June 2019** from 10h:30 - 11h:30 at the farm Twyfelaar 289 IT Portion 0 (26°40'41.00"S; 30°16'25.68"E) A public meeting was held on the **Monday, 03 June 2019** from 12:30 - 14:30 at the Sheepmoor Community Hall.	**Appendix D 3** Progress Materials **Appendix D 5** Comment and Response Report
Announcement of the Final Scoping Report	A notification for availability of the Final Scoping Report was emailed and posted to stakeholders on 14 June 2019. Copies of the Final Scoping Report was available at: ▪ Sheepmoor Police Station; ▪ At www.digbywells.com under Public Documents.	**Appendix B 3** Progress Materials
Obtaining comments from stakeholders	Comments, issues of concern and suggestions received from stakeholders are captured in the CRR.	**Appendix B6** Comment and Response Report

9.3 Item 3(g)(iii): Summary of Issues Raised by I&APs

The CRR has been compiled capturing all stakeholder comments obtained during the Scoping Phase public comment period. The CRR is contained in Table 9-3.

Table 9-3: Comments and Response Received During Scoping Phase

Contributor	Organisation / Community	Date	Method	Comment Raised	Response
Mr Desmond Maake	Director: Planning and Economic Development	14 May 19	Email- Comment Form	The project might have a significant impact on the demographics, provision of infrastructure (houses, water, roads etc)	At present, no resettlement of households is required for this project but the SLP does include provision of boreholes to provide water to communities directly affected by the project.
				[The Project] Might have a positive impact on the economy and increase employment opportunities. The project might also have some social ills associated with it.	The proposed Project will provide new employment opportunities to the area which will increase expenditure on a local scale thereby benefitting the local economy. The Socio-economic Impact Assessment (SIA) has provided mitigation measures to assist in preventing an influx of seekers. Furthermore, the SIA provides mitigation in the form of a skills survey to ensure employment opportunities are provided to members of communities within a 50 km radius of the site.
				Proper planning for provision of infrastructure.	The Traffic Impact Assessment report attached hereto in Appendix N, has determined the preferred haul route, in consultation with surrounding affected landowners and land occupiers. Where intersection and road upgrades are required for the haul road, these have also been identified and the Applicant has been accordingly advised.
Zanele Masina	Sheepmoor community member	15 May 19	Email	Good Evening Nondumiso I am Zanele Masina would like to register as I&AP for the proposed Dagsoom coal mine. I would like to receive the application documents, for review and comments. Looking forward to hearing from you. Kind Regards	Dear Zanele, Thank you for your email. Please find attached the information as requested. Feel free to contact us should you require any information. Kind regards,
Gibson Wenzel	Chairperson (Ward Eleven Business Forum)	15 May 19	Email	Evening Nondumiso, I will like to register as an Affected Party to this proposal.	Good day, Please provide project code for the project you refer too.
		16 May 19		[Response to previous email providing project reference number] Project number (DAG5603)	Good day, Thank you for your email, Please find attached documents for your attention. Kindly complete the comment form and send back to us. Feel free to contact us should you require any information. Kind regards,

Contributor	Organisation / Community	Date	Method	Comment Raised	Response
Piet Langenhoven	Landowner- Windhoek part 1, IT 291	22 May 19	Email	Project DAG5603 refers: Can you please send me a high resolution map of the proposed mining area. From the information supplied as part of the public participation process, it seems as if our farm – Windhoek part 1, IT 291 to be directly adjacent the proposed mine. We wish to determine exactly where the boundaries of the proposed mine will be and how it will influence our property. Regards On behalf of TallyProps 7 (Pty) Ltd – Reg no 2001/004631/07 Holding company for Windhoek part 1, IT 291	Good day, Please find the land tenure map which is the highest resolution we have and can send via email. Kindly let us know if this is visible enough for you? Kind regards,
Gibson Wenzel	Chairperson - Ward Eleven Business Forum	22 May 19	Email via Comment Form	[The Project] Positively [impact] local business, SMME's, tenderpreneurship and co-operatives will be boosted. Growth through various opportunities	Thank you for participating in the Project and providing comments.
				Economically business will balloon, more local people will have work, depreciation of crime which will lead to a safer society, more skills development to local people and a developed community through the SLP.	
				Transparency through all processes must be practiced constantly. A continuous engagement of all stakeholders and the community involved through all processes.	Stakeholder engagement is welcome at any time throughout the Environmental Authorisation Process. All comments received beyond the Scoping Phase (public comment period 07 May to 07 June 2019) will be captured and responded to in the EIA Phase.
				If mining rights granted by DMR I reckon people must be trained prior the commencement of the project especially in the not-so-critical skills. Co-operatives to be trained to cater for things such as alien plant species eradication and water pollution in nearby streams.	Thank you for your comment. This suggestion is valid and will be considered by the Applicant. The SLP that accompanies the mining right application has provision for training prior to the project commencement especially in respect of portable skills. The SLP also caters for agricultural cooperative and as you note should include alien species control.
Yuza Chabalala	Transnet -Risk Consultant	22 May 19	Email	Good day, Please advise on this matter. I just received this invitation. Kind Regards	Good day, Thank you for your email. You have been registered. Please find attached more documents on the project in case you have not received it. Feel free to contact us should you require any information. Kind regards,
				Greetings I acknowledge receipt of your invite to participate in the public meeting for the project; please register my name as the representative for Transnet Freight Rail (Ermelo Depot).	

Contributor	Organisation / Community	Date	Method	Comment Raised	Response
		23 May 19		Good morning May you please provide me with the Draft Scoping Report for the project; I see in the map that TFR will be highly impacted based on the facts that the project is in the proximity of the rail line and we are in the business of transporting coal in the region to the port in Richards Bay. A hard copy/CD may be sent to my attention at Area Manager Building, Transnet Freight Rail, Armersfoort Road, Ermelo, 2350.	Good day, Thank you for your email, Do you wish we send both a hard copy and a CD? Kind regards,
				Good day Any or both is welcome or even an you email the document; Regards	Good day, Please find attached the document as requested. Kindly acknowledge receipt as one needs to be sure you have received it. Kind regards,
Yuza Chabalala	Transnet -Risk Consultant	31 May 19	Email	Please be aware that Transnet does have rail and pipelines throughout the Free State and KwaZulu Natal and that both Transnet land and pipelines may be affected by your proposed prospecting/mining rights which you are applying for.	The Applicant is aware of the Transnet railway line which traverses the southern area of the proposed Mining Right boundary. Please refer to Appendix B of this Report where the railway line has been included in the appropriate plans. Dagsoom has been in contact with Transnet to discuss this matter but the appropriate contact person at Transnet was confirmed at the Scoping Phase Public Meeting held on 03 June 2019. Further communication with the Applicant and Transnet will be arranged.
				We therefore wish to draw your attention to Section 48 (1) of the Minerals and Petroleum Resources Development Act, 2002 which stipulates as follows: “48. (1) Subject to section 20 of the National Parks Act, 1976 (Act No. 57 of 1976), and subsection (2), no reconnaissance permission, prospecting right, mining right or mining permit may be issued in respect of— (a) land comprising a residential area; (b) any public road, railway or cemetery; (c) any land being used for public or government purposes or reserved in terms of any other law; or (d) areas identified by the Minister by notice in the Gazette in terms of section 49.” Please note that under no circumstances will or do Transnet SOC Limited permit, grant permission or consent to any prospecting or mining activities on its properties. As far as the adjacent properties to the railway line is concerned, your attention is drawn to Regulation 17 (6) (a) of the Mine Health and Safety Act, 1996 which determines that no mining operations may be carried out under or within a horizontal distance of 100 meters from buildings, roads, railways, reserves etcetera.	Thank you for your comment. The appropriate buffer from the Transnet railway line will be applied to avoid damage to the line and Transnet property. We wish to confirm that no prospecting has taken place on Transnet Properties and we take cognisance of the various acts and regulations and will comply therewith. As per the MPRDA, the Applicant will consult in detail with Transnet. Although the planned mining area includes the Transnet portions of the farm Twyfelaar, the applicant will seek to exclude and excise these portions going forward, prior to the DMR granting the mining right.

Contributor	Organisation / Community	Date	Method	Comment Raised	Response
Ennock Khumalo	Phakamani Community	03 Jun 19	Public Meeting	There are agricultural activities, farms and livestock in the community of Phakamani. Where are our livestock going to drink water if you pollute water sources? Please provide us with an alternative water source, before the mine starts.	**EAP:** A conceptual storm-water management plan has been developed and can be referenced in section 8 of the Surface Water Impact Assessment Report in Appendix H. Furthermore, the Groundwater Impact Assessment (Appendix I) and Surface Water Impact Assessment provide the appropriate monitoring points for both groundwater and surface water bodies, which Dagsoom will need to monitor regularly to ensure the mining operation is not polluting surrounding areas. A summary of the monitoring plans can be seen in Part B, section 8.1 of this report. If monitoring results prove a reduction in water quality, or if a surrounding land user experiences a reduction in borehole levels, Dagsoom will need to take corrective action to address this.
Scelo Nkosi	Phakamani Community	03 Jun 19	Public Meeting	There are family graves on Twyfelaar farm. Are they going to be removed? If yes, where are they going to be relocated?	No graves were found in the vicinity of Block A (the proposed mining area). The blasting report has also concluded that affects to surface infrastructure as a result of blasting underground are highly unlikely.
Sandile Sibande	Marvistaad Community	03 Jun 19	Public Meeting	Have you considered skills development programmes for the affected parties, because most mines hire people from outside our area due to lack of skills? How will skill development programme happen?	**Applicant**: The plan is to empower the community members with skills which is covered in the SLP and is currently approved. Approximately 230 people may be employed, and half of these are contractors. The rest will be offered things such as learnerships which forms part of skill development, as well as Adult Basic Education Training (ABET) training will also take place. Confirmation of a budget for these programmes is already in place. The mine will also comply with Employment Equity Act, 1998 (Act No.55 of 1998) to implement these programmes. A human resource department will be developed, and this will comprise of representation from the community.
Martha Mtshali	Phakamani Community	03 Jun 19	Public Meeting	Are we not going to be affected by blasting?	The Blast Impact Assessment (Appendix K) has indicated that it is highly unlikely that any infrastructure surrounding Block A will be affected by blasting. There is a possibility that vibrations may be felt but these vibrations will not affect any structures in the vicinity of Block A as all identified structures fall outside the zone of influence.
Mthobisi Ntuli	Marvistaad Community	03 Jun 19	Public Meeting	Can the mine build a school or clinic, as part of giving back to the community?	This comment has been noted and will be considered by the Applicant.
Nicholas Masina	Bambanani Trust	03 Jun 19	Public Meeting	I am the owner of the farm Twyfelaar 301. What is going to happen to me before the mine starts?	The mining right application does not consider any mining on the property held by the Bambani Trust. The Bamabani Trust area is outside of the mining area.

Contributor	Organisation / Community	Date	Method	Comment Raised	Response
Simon Nkosi	Phakamani Community	03 Jun 19	Focus Group Meeting	I am just underneath where the mine is proposed, how am I going to be affected?	The Blast Impact Assessment (Appendix K) has indicated that it is highly unlikely that any infrastructure surrounding Block A will be affected by blasting. There is a possibility that vibrations may be felt but these vibrations will not affect any structures in the vicinity of Block A as all identified structures fall outside the zone of influence.
Jacob Ndinisa	Bambanani-Sakhisizwe CPA	03 Jun 19	Focus Group Meeting	Why is the [Scoping] report placed in Sheepmoor? The report needs to be delivered to us as affected parties. How will you feel if only the interested parties are commenting on your reports? The map provided to us is not for the directly affected parties, instead it shows other places. Why didn't you get the actual percentage of people who are not working from us, not from the municipality?	Thank you for your comment. This will assist us going into the EIA Phase. We will have a copy of the EIA report available on the farm agreed to for all to read and provide comments. According to the map on the site notices we are required by law to show a map that will show the affected farm portions as well as surrounding areas. This allows those communities surrounding the project area to be able to understand and locate where the project site is located. The actual percentage of those not working is taken from StatsSA 2011; however, a Social Impact Assessment will be undertaken to understand how many people within this community are not working and this will be reflected in that report
The whole community	Phakamani Community	03 Jun 19	Focus Group Meeting	We request that the next report be placed at Welcome Ndinisa's house.	It was agreed in the meeting that a copy of the EIA Report will be placed at Mr Ndinisa's house.
Scelo Nkosi	Phakamani Community	03 Jun 19	Focus Group Meeting	Please only focus on our community, and do not prioritise the Sheepmoor community. We do not have electricity and water. We need to take control over the project, and we expect each and every household be provided with employment. Why is Sheepmoor important in this project? Do you think Sheepmoor people are smarter than us? Why involve them?	**Stakeholder Engagement Specialist:** The consultation process being followed is governed by the NEMA and Digby Wells is required to consult with directly and indirectly affected people and communities. All actions related to the application of a Mining Right and application for environmental authorisation are in accordance with the with the Constitution of South Africa, the NEMA and MPRDA. The contents and placement of all advertisements associated with this project have been in accordance with the NEMA Regulations. As far as employment opportunities are concerned, the mine will only be able to employ people with the relevant skills and training will be provided in certain instances to up-skill certain potential employees. The proposed community projects proposed in the SLP may also provide employment to those who cannot be employed by the mine. These included environmental, agricultural and education programmes.
Scelo Nkosi	Phakamani Community	03 Jun 19	Focus Group Meeting	You should have had one meeting with Sheepmoor people and us, they should come here.	The purpose of the Focus Group Meeting is to consult the directly affected communities as the needs and expectations of directly affected communities/people often differ to those who are indirectly affected. Digby Wells will consider a combined meeting during the EIA Phase, should a suitable venue on site be made available.
Zanele Masina	Community Member	03 Jun 19	Public Meeting	Groundwater contamination: We have had lot of issues from other mines that pollute our water. What will be the mitigation measures in place? We need a current environmental baseline	The current environmental baseline was contained in the Scoping Report. The Groundwater Impact Assessment found the impacts to groundwater to be negligible overall. The Groundwater report is attached in Appendix I.
Bongani Jiyane	Ward Councillor	03 Jun 19	Public Meeting	The SLP has been approved	Noted.

Contributor	Organisation / Community	Date	Method	Comment Raised	Response
Mandla Zulu	ANC	03 Jun 19	Public Meeting	We need to have the SLP presented to us and it must clearly define "Local" in respect of the community and the surrounding towns. How will the community benefit from the project? We need to be consulted with all the stages of the project and all our comments should be included on the CRR.	Your comment is noted. The SLP will be presented to the community and the extent to what is considered “local” will be defined. This will clarify the extent to which the proposed project will benefit the respective communities.
				Agrees with Zanele, that there will be negative impacts in groundwater.	The Groundwater Impact Assessment found the impacts to groundwater to be negligible overall. The Groundwater report is attached in Appendix I.
				You need to form a tripod between the community, DMR and the Applicant	Thank you for your comment.
Yuza Chabalala	Transnet -Risk Consultant	03 Jun 19	Public Meeting	Please ensure to include in detail all the impacts associated with the proposed project and mitigation measures in place, on the report.	Refer to section 11 in Part A of this report for a consolidation of the impacts assessed by the various specialists. Each specialist impact assessment report has been appended to this report.
Piet Langenhoven	Farm-Owner	03 Jun 19	Public Meeting	Will there be a subsidence risk?	The rock engineering studies have been undertaken to inform the requirement for support and extraction. The mine planning will take this into account specifically to avoid subsidence.
Zanele Masina	Community Member	03 Jun 19	Public Meeting	People from outside will be employed to construct an access road, as most community members are unskilled; and this will cause issues, for example, language barriers and health issues. How will this be resolved?	The Socio-economic impact assessment has provided mitigations to reduce the negative social impacts associated with this Project which include a skills survey of the surrounding communities, skills development in the communities and a stakeholder engagement plan to continuously engage with the community. However, construction of a road will be undertaken by the required professionals but a recommendation to involve local communities in this Project can be arranged by the Applicant and the contractors assigned to construct the haul road.
				A Traffic Impact assessment should be considered.	The Traffic Impact Assessment is attached in Appendix N.
				The proposed project area is surrounded by mud houses, therefore; Blasting Impact Assessment is required.	The Blast Impact Assessment is attached in Appendix K.
				Wetlands. How are you going to mitigate the impacts associated with the proposed project? Please do all assessments in a correct manner, otherwise we will shut down the mine.	The Wetland Impact Assessment is attached in Appendix F.
				SLP: Before the mine resumes, a consultation with the affected community is required to find out the skills already in place. Do not consult with the municipality	Dagsoom has consulted with the communities regarding the proposed SLP projects.
				The mine should remove the cores drilled during prospecting. It is a problem in this area that prospectors leave the drilled cores on the surface if the core doesn’t contain a coal sample.	Noted.
				Stoping is not advised as this requires the walls to be removed which compromises ground stability and will lead to subsidence.	Comment is noted. The rock engineering studies will determine the potential to stoop to avoid subsidence.

Contributor	Organisation / Community	Date	Method	Comment Raised	Response
Scelo Patrick Nhlabathi	Phakamani Community	03 Jun 19	Public Meeting	How will you consult my family to discuss the grave issue, they do not have any contact details?	The location of the family graves has been requested from the I&AP and will be provided to the Heritage Specialist to inspect during the EIA Phase. Currently, no graves will be impacted by mining at Block A.
Mandla Zulu	ANC	03 Jun 19	Public Meeting	The Mining Charter states that the mine should contribute 18% of its shares to the community and 12% of its shares to the workers.	**Applicant**: This issue will be discussed after the mine has obtained a Mining Right, probably in two years' time. Five per cent will be contributed to the community and 5% to the mine workers as per the mining charter.
Bongani Jiyane	Ward Councillor	03 Jun 19	Public Meeting	The whole of Ward 11 should benefit from the proposed project.	Comment is noted. The Applicant is aware that the Sheepmoor Community will be affected by the proposed Project. The Applicant will engage with the directly affected community and the Sheepmoor Community and develop a plan to fairly address both of their needs and aspirations.
Bheki Maseko	Community Member	03 Jun 19	Public Meeting	It is not only the directly affected parties who will be affected by the proposed project, even our community [Sheepmoor] is. You need to start upskilling the community now, so that we benefit as well.	
Mandla Zulu	ANC	03 Jun 19	Public Meeting	The Mine Community Development (MCD) goes hand-in-glove with the SLP. You cannot obtain the MR without these two.	That is correct.
Mandla Thela	Community Member	03 Jun 19	Public Meeting	Who will benefit? directly or indirectly? Is it only the farmers that will benefit?	Dagsoom, in accordance with its SLP, will develop the details of its Human Resource Development programmes and Mine Community Development Projects going forward. Budgets and high-level plans have been developed to address this. Where it can, and cognisant of the respective Act and regulations and in line with its SLP, Dagsoom will seek to employ certain staff from the local community. If the required skills cannot be gained from the immediate community, Dagsoom must advertise to surrounding communities. Additionally, as part of Dagsoom's SLP requirements, the Applicant will develop various skills development initiatives, which will serve beneficiaries in improving qualifications for job seekers.
Braam Moodie	Landowner	11 June 19	Email – Comment Form and Written Comment	Planned coal extraction is 20kton per month or 670tons per day assuming a 30-day month. Assuming a coal lorry with trailer can carry 60 tons of coal per load, it means and additional 11 lorries will use the N2 to transport the coal. Although this will not represent a large traffic volume on the N2, it will make a difference to the traffic flow as there are a number of up hills from Twyfelaar in the direction of Ermelo. This will cause unwanted traffic congestions-especially over weekends. If coal transport is only limited to weekdays, the expected lorry loads will increase to 15 or 16 per day. This traffic volume is due to double once stoping commences.	These issues have been considered in the Traffic Impact Assessment, attached in Appendix N.
				There is a water pipeline running close to the proposed washing plant (+/- 4 km away) This pipeline supplies high quality water to Eskom power plants on the Highveld from the Heyshope and Jericho dams. The pipeline is owned by Department of Water Affairs, but the construction of the pipeline was originally paid for by	Currently, the water source for the proposed mine will either be supplied by the municipality or from a dam located on the Twyfelaar.

Contributor	Organisation / Community	Date	Method	Comment Raised	Response
				Eskom. The maintenance of the pipeline is also done by Eskom through their subsidiaries. Therefore, Eskom is in control of the water running through that pipeline. If Eskom does not want to share some of the water from the pipeline with the proposed mine, water will have to be sourced from local sources. This will reduce the run-off to the wetland below the proposed mine. It will also reduce the water available to the community of Sheepmoor - especially as drinking water for their cattle	The pipeline identified would have been affected by the Eastern Mining area which has now been excluded from the application. The only mining activities taking place will happen at Block A (refer to Figure 5-2).
				Storing tailings from a coal washing plant above ground creates a huge dust problem. In winter, the wind direction is mostly from west directly to the east. This will mean the community of Sheepmoor will be directly in the path of the dust cloud from the tailings heap. Being only 6 km away from the proposed tailings heap, the community will suffer the full effect of the coal dust generated during winter. This will have severe effects on people's health and their quality of life. No washing will ever be white again in the path of such a dust cloud. Dust in people's eyes, homes and the like will be a complete irritation It is required that such a tailings heap be covered with topsoil and planted with indigenous plants to reduce the dust generated. This might only happen at the end of the project life. During the project operation it is not practical to cover the tailings heap with topsoil as is evident from a number of similar operations on the Highveld. During this time, the community of Sheepmoor will suffer as a result of the dust	Exposed stockpiles and dumps will be subject to dust control through appropriate measures (i.e., suppressants and wetting). The spread of fine particulates and gases that can affect health have been modelled to determine their reach. Refer to the Air Quality Impact Assessment report in Appendix L.
				In the proposal for the mine it is stated that a reverse osmosis plant will be build, presumably to treat the waste water from the washing facility and the acid water seepage. Reverse osmosis plants does produce very high quality water for re-use but it also concentrates all the unwanted salts in a brine. In the documentation supplied to date no mention has been made of how the brine will be disposed of. The brine cannot be stored or disposed of onsite - be it in special dams (even lined dams does leak) or in the mined-out areas. This brine will seep into the water sources and contaminate it. An acceptable disposal plan for the brine needs to be presented to the community.	Brine must be collected by a third-party registered waste management facility. Storage of brine will also require a Water Use Licence in terms of Section 21 (g) of the NWA prior to storage being permitted.
				How will water run-off from the mines and contaminated water be controlled and ensured that that acid water or contaminated water does not end up in the wetland below the mining operations or impact agriculture? In the proposal it is stated that a pollution	The conceptual Stormwater Management Plan is contained in section 8 of the Surface Water Impact Assessment report in Appendix H.

Contributor	Organisation / Community	Date	Method	Comment Raised	Response
				control dam and a reverse osmosis dam will be constructed. What will the design and operating capacity of the reverse osmosis plant be? At the very least the operating capacity should be able to handle all water produced by the mining operations as well as all run-off and seepage from the mines. The concern is that rainstorms in the area can dump 100 millimetres or more of rain in an hour. The pollution control dam must be constructed to withstand such a rainstorm. The frequent rain storms in the area is not an opportunity to dump the contents of the pollution control dam into the stream. This is the practice of unscrupulous operators who use the dilution effect of the rainwater to drain their pollution control dams. The expectation is that all water in the pollution control dams must pass through the reverse osmosis plant and the brine disposed of responsibly.	
				Once mining operations have been terminated, seepage of acid water will still continue. As a standard, a trust must be created to pay for land rehabilitation and pollution control once the mining operation has stopped. The names of trustees to this trust must be published and the trustees must comprise of knowledgeable and competent people to carry out this responsibility on behalf of the next generation.	As per the requirement of the Regulations Pertaining to the Financial Provision for Prospecting, Exploration, Mining or Production Operations (Government Notice No 1147), published on 20 November 2015, under the NEMA, Dagsoom must secure the calculated amount for closure and rehabilitation activities. The Closure and Rehabilitation Report is attached in Appendix P.
				Once the mining project starts, there will be an expectation that the mining company will contribute to fire prevention and fire control in the area and specifically on Twyfelaar. This will include making fire breaks, having functional equipment and people available to do fire control. Also, to support the local fire prevention organisation in terms of preventative and contingency plans.	A Standard Operating Procedure will be developed by Dagsoom specifically for fire control and management on site. These comments are noted, and the Applicant will contribute to fire prevention and control in the area.
				There is water pipeline running close to the proposed washing plant (+/- 4 km away) This pipeline supplies high quality water to Eskom power plants on the Highveld from the Heyshope I Jericho dams. Should Eskom agree to share some of the water with the proposed washing plant, the water can either be sourced from the high pressure end of the Kliphoek pumping station situated at -26.675695, 30.273264. As an alternative water can be gravity fed from the Onverwacht storage dams at -26.655848, 30.255690. In such a case the shortest route for the pipeline will run across our properties Windhoek IT 291 Part 1 and Part 8 No permission has been given for the construction of such a pipeline through our property.	To date, water supply from the pipeline has not been considered for this application. Should water be made available from this source, any mining-related infrastructure that traverses an adjacent or privately-owned farm will be subject to the appropriate permissions and approvals prior to construction and use of such infrastructure taking place.

Contributor	Organisation / Community	Date	Method	Comment Raised	Response
				At the public participation meeting of 3 June 2019 at Sheepmoor, it was stated by the representative from Dagsoom that subduction [subsidence] of this section will not occur once mining is completed. As we do not agree with this statement, we would want to see the detailed rock mechanics study supporting this statement. The concerns associated with subduction is this area are as follows: Subduction will cause light tremors. These tremors can result in rock falls from the escarpment down on to the valleys below. Our land (Windhoek IT 291 part 1) borders directly on the escarpment cliffs. There are no houses or built structures threatened by these rock falls. But these slopes up to the escarpment cliffs are used for cattle grazing and also cultivation of wood. A rock fall can injure or kill a herd of cattle as well as damage a forested area.	Rock engineering studies have been undertaken from borehole cores and the basis of the underground mine extraction plan is based on this work. The mining studies are based on current best practise to avoid goafing and surface subsidence. The Applicant intends to bolster this work with additional geotechnical studies prior to commencing with mining. This is planned work and these studies will also assess the conditions of the adit and boxcut locations. The Applicant will provide information from the study.
				The cliffs, associated scenery, plant growth, waters flows are an asset to the landowners. This area is frequently used for hiking, picnic and may find a future commercial application through tourism. If there is any possibility of tremors causing rock falls, it will prevent any human movement in this area. The opportunity for landowners to hike this area and for future commercial development will be sterilised for several decades once mining commences in the area Twyfelaar 298 part 2.	If this Project is approved, no access within the Block A mining area can be permitted for health and safety reasons.
				Tremors and subduction can also affect the underground flow and quality of water. In the scoping report (paragraph 9.4.4.1) it is stated the rock formations in the area is not known for large scale development of aquifers. Aquifers that occur in the area can therefore be classified as minor, but of high importance.	During steady state production, the groundwater inflows will likely be in the range of ~50 to ~80 m^3/d which are regarded as relatively low. This is due to the fact that mining at Block A is taking place at great depth below ground level, as the mine void is present below a significant hill capped by a dolerite sill. Therefore, the aquifer unit in which the mining will take place is expected to be low fractured rock. The anticipated groundwater abstraction volumes are not expected to significantly impact on the local groundwater availability.

Contributor	Organisation / Community	Date	Method	Comment Raised	Response
				On our land we have a borehole (- 26.66925, 30.246587) which is the sole drinking water source to the homestead on the farm. There are also a number of fountains on the farm which have the capacity to supply water to 300 head of cattle throughout the year. For this reason, there is no water buckets for cattle on the farm. All drinking requirements are supplied from these fountains. The concern is that the drinking water supply (both in terms of volume and quality) to the homestead and drink water supply to cattle will be affected by tremors or subduction. For this reason, we request that the volume flow and quality of water from the fountains be measured to set a baseline and once mining operations start, be continuously monitored and the results be supplied to us as land owners.	During steady state production, the groundwater inflows will likely be in the range of ~50 to ~80 m^3/d which are regarded as relatively low. This is due to the fact that mining at Block A is taking place at great depth below ground level, as the mine void is present below a significant hill capped by a dolerite sill. Therefore, the aquifer unit in which the mining will take place is expected to be low fractured rock. The anticipated groundwater abstraction volumes are not expected to significantly impact on the local groundwater availability.
				Cracks in the substrate above the mining area at Twyfelaar IT 298 part 2 will cause seepage into the mined cavities. This will lead to seepage of acid water from the mined cavity to the outside mountain side. The acid water running down the mountain side will destroy all plant growth and in effect turn it into a desert - destroying grazing capacity.	The contaminant migration as calculated for the proposed mine takes into account recharge into the underground mine, and shows the contaminant plume extent is mostly confined to the mine area and surroundings due. This is related to the relatively low recharge to the substrate above the mining area, which are capped by a dolerite sill. Within the area of the expected plume extent, groundwater levels are approximately 10m below ground level and therefore this plume will not directly impact on the agricultural potential of the overlying land.
				The flora study reported in in the scoping report (paragraph 9.4.7) is a general study listing the vegetation types in the area surrounding the mine. The study does not consider the microenvironments that occur in the number of caves along the escarpment cliffs On Twyfelaar 298 part 2 there is a cave within microenvironment containing unique plants. These plants are watered by run-off from the escarpment. Should there be cracks in the substrata above the mined area, this run-off will disappear and as a result these microenvironments will be destroyed	As Dagsoom is proposing underground mining, it is more pertinent to assess the vegetation units which will be disturbed on the surface due to infrastructure development and in the areas where the box cut will be established at Block A.
				These roads have not been in use for a decade or more and have fallen into disrepair. The roads are therefore not available for use by the project to establish a mine, the mining activities or any personnel or equipment involved in these activities.	These issues have been considered in the Traffic Impact Assessment, attached in Appendix N.

Contributor	Organisation / Community	Date	Method	Comment Raised	Response
				Measures must be taken to prohibit movement of people from the mining operations to neighbouring areas, especially by foot. The current locals have certain ways and routes as to how they move. These routes have been well established. When additional people come to settle in the area because of the mining operations there is opportunity to explore the area and to visit the locals. This is to be done only via accepted routes. Fences, barricades and other measures must be put in place to prevent a haphazard movement of people If these controls are not in place, it will expose the landowners to higher risks of crime (property theft, livestock theft), illegal hunting, lighting of veld fires through deliberate or inconsiderate action and damage of existing fences.	Your concerns are noted. Access control to the mine will be implemented, however, Dagsoom cannot reasonably monitor the movement of mine employees beyond the mining operation. It is the onus of the mine to educate employees on illegal hunting activities, building of fires, and awareness of surrounding farms where access is not granted. The Applicant proposes that it will work together with the surrounding farms to establish protocols and measures to minimise or prohibit access where necessary.
				In the Scoping Report under paragraph 9.4.7 - Fauna and Flora, the details for fauna and flora have been mixed up. Under the heading of Fauna, paragraph 9.4.7.1 the report describes vegetation and under the heading of Flora, paragraph 9.4.7.2 the report describes mammals, birds and the like. The listing of potentially occurring mammals (Table 9-7) is not complete. As examples it does not list the following animals: Bush pig (Potamochoerus larvatus). It is acknowledged that this is a problem animal and should be of no concern to the proposed mine development. Civet cat (Civettictis civetta). We have found dropping of civets on our land. The droppings being very distinct containing the shells of centipedes. Civets are not found in arid regions but in proximity to water. Otters. There are frequent fresh signs of otters on our land. This includes tracks as well as droppings. The droppings being distinctive in containing crab shells. The otters are dependent on the water streams from the fountains on the farm. The lists therefore need to be updated.	Thank you for noting this discrepancy. This has been rectified in the Final Scoping Report. The Fauna and Flora specialist will conduct a three-day site visit which includes various methods to identify faunal species which have been on site. The information provided has been passed onto the Specialist for consideration in the Fauna and Flora Impact Assessment attached in Appendix E. An alien species monitoring programme will also form part of this report.
				In the Scoping Report Figure 9-8 the streams on Windhoek IT 291 part 1 and other indirectly affected areas are shown as non-perennial. **This is incorrect**. These streams are fed by a number of permanent fountains throughout the year resulting in a permanent water flow.	Thank you for this information. This will be considered by both the Fauna Specialist and Surface Water specialists and included in the respective specialist impact assessment reports.

Contributor	Organisation / Community	Date	Method	Comment Raised	Response
				This allows animals such as otters to frequent the area throughout the year. Stream volumes do fall during winter times, but these flows have never stopped in the 12 years that we have owned the farm. For this reason the issue of fountains was raised under the heading **Effects and impacts of the proposed mine.** Also was the threat raised that subduction of the mined area and associated tremors could result in these fountains being shut off. It is also the reason why we request that the study supporting paragraph 9.4.7 - Fauna and Flora in the Scoping Report be redone with specific emphasis to life sensitive to the availability of water, especially unpolluted water.	
				Take note that Mr VJ Sivengo, stays on the edge of the Klipfontein IT 283 area. Mr Sivengo's house is situated at -26.683066, 30.269982. We request that he is to be treated as a directly affected party.	Thank you for the information provided. Digby Wells will be in contact to gain Mr Sivengo's contact details to be added to the I&AP database.
				Water problems + pollution. Fountain and water streams/ flow disappear Quality of animal feed + natural pasture Security mine workers crossing farm to site. Dust and air pollution on road transporting coal.	During steady state production, the groundwater inflows will likely be in the range of ~50 to ~80 m^3/d which are regarded as relatively low. This is due to the fact that mining at Block A is taking place at great depth below ground level, as the mine void is present below a significant hill capped by a dolerite sill. Therefore, the aquifer unit in which the mining will take place is expected to be low fractured rock. The anticipated groundwater abstraction volumes are not expected to significantly impact on the local groundwater availability.
				Security, Human + animal health (pollution) Water shortage + pollution Natural grass distasteful + unhealthy for grazing	
				By establishing a security fence alongside border Windhoek its west of Roodewal road. Testing all water quality + boreholes Grazing area on portion 3 and 5 next to site has a fountain 200m from site which is depended on fountain.	
				Livestock (Cattle farming) Agronomy mealies + beans	
				Our house (residence) is 50m from Roodewal road where transportation of coal will take place. The dust and health risk will be unbearable. The buildings and living area will not be secure against the dust and noise	Recommendations pertaining to the haul road and required updates have been included in the Traffic Impact Assessment, attached in Appendix N. Further to this, mitigation measures to alleviate the effects of dust from the haul road have been included in the Air Quality Impact Assessment (Appendix L) and included in the EMP which Dagsoom must adhere to for operation. Further to this, the EMP will be audited and a grievance mechanism to lodge complaints with the mine will also be available should you experience any issues.
				All of these impacts could be avoided by not going ahead with proposed Dagsoom coal mining project	Your objection the proposed Project is noted.

Contributor	Organisation / Community	Date	Method	Comment Raised	Response
				The Sheepmoor area is a prime agriculture area, with various wetlands and is a catchment area for water running to Jericho and Morgenstond dam	Based on the Groundwater Impact Assessment and the underlying geology of Block A, the impact to wetlands is not anticipated to be severe, unless subsidence occurs. All reports related to water impacts and usage in relation to the proposed project will be provided to the Department of Water and Sanitation for adjudication.
				Good afternoon It has come under our attention that an application for authorisation for a Mining Right for the applicant Dagsoom Coal Mining (Pty) Ltd under DMR Reference Number: MP30/5/1/2/2/10236MR (your reference DAG5603) has been lodged with the relevant Department and is currently already in Scoping Phase. It is our understanding that your company Digby Wells Environmental has been appointed as the Environmental Assessment Practitioner (EAP) for this project and we would therefore like to request proof of consultation with ourselves as occupiers/owners of the land adjacent to the site (and therefore directly interested and affected) where the activity is or is to be undertaken in terms of the legislation provided below; NEMA: EIA Regulations of 2014 (GNR 326)	Proof of consultation was emailed on 12 June 2019.
				Public Participation Process (1) This regulation only applies in instances where adherence to the provisions of this regulation is specifically required. 2) The person conducting a public participation process must take into account any relevant guidelines applicable to public participation as contemplated in section 24J of the Act and must give notice to all potential interested and affected parties of an application or proposed application which is subjected to public participation by- (a) fixing a notice board at a place conspicuous to and accessible by the public at the boundary, on the fence or along the corridor of- {i) the site where the activity to which the application or proposed application relates is or is to be undertaken; and (ii) any alternative site	Please refer to the Public Participation Report appended to this report in Appendix C. This report provides all public announcement materials disseminated to date. Due to the protection of personal information, a list of consulted parties may not be provided. A written response was provided to Mr Moodie on 12 June 2019.
				(b) giving written notice, in any of the manners provided for in section 470 of the Act, to- (i) the occupiers of the site and, if the proponent or applicant is not the owner or person in control of the site on which the activity is to be undertaken, the owner or person in control of the site where the activity is or is to be undertaken and to any alternative site where the activity is to be undertaken; (ii) owners, persons in control of, and occupiers of land adjacent to	

Contributor	Organisation / Community	Date	Method	Comment Raised	Response
				the site where the activity is or is to be undertaken and to anv alternative site where the activity is to be undertaken; (iii) the municipal councillor of the ward in which the site and alternative site is situated and any organisation of ratepayers that represent the community in the area; (iv) the municipality which has jurisdiction in the area; (v) any organ of state having jurisdiction in respect of any aspect of the activity; and (vi) any other party as required by the competent authority; (c) placing an advertisement in- Kindly send us all proof of consultation/written notice within 24 hours to avoid further unnecessary legal action to be taken which would not be in the beneficial interests of both parties.	

10 Item 3(g)(iv): The Environmental Attributes associated with the Development Footprint Alternatives

This section provides a summary of the baseline environment affected by the proposed project activity, type of current land uses, environmental features, and current land use, based on the infield observations and assessments undertaken by the relevant specialists.

A number of specialist studies have been undertaken during the EIA phase of the proposed Project, the reports are appended in their respective appendices in Table 10-1 below:

Table 10-1: Specialist Reports and Associated Appendices

Specialist Study	Appendix
Soils, Land Capability and Land Use Assessment	Appendix D
Fauna and Flora Assessment	Appendix E
Wetland Assessment	Appendix F
Aquatic Ecology Assessment	Appendix G
Surface water Assessment	Appendix H
Groundwater Assessment	Appendix I
Heritage Assessment	Appendix J
Blasting Assessment	Appendix K
Air Quality Assessment	Appendix L
Noise Assessment	Appendix M
Traffic Assessment	Appendix N
Socio-economic Assessment	Appendix O
Rehabilitation and Closure Assessment	Appendix P

The sections below provide the baseline bio-physical and socio-economic environmental conditions currently present on the Project site. The information provided in this section has been obtained from the abovementioned specialist reports.

10.1 Regional Climate

The area typically experiences warm summer temperatures, whilst winters are generally cold with a high incidence of frost (Mucina & Rutherford, 2012). Frost is fairly common during the cold winter months of June to August, commonly associated with early morning mist. The climate of the study area is similar to that of the close by town of Ermelo. Sheepmoor receives an average of 75 mm of rain a year, with most rainfall occurring during summertime. The study area is situated within the Cold Interior Climatic Zone of the country. The average daily maximum temperature in January (the hottest month) is 25ºC, and in July (the coldest month) is 16 ºC. Due to its position near the escarpment, the area is somewhat windier than is typical for the South-Eastern Mpumalanga Highveld, although the majority of winds are still light and their direction is controlled by topography (Msukaligwa LM Spatial Development Framework, 2010). Refer to Figure 10-1 for average temperatures and proposed precipitation.

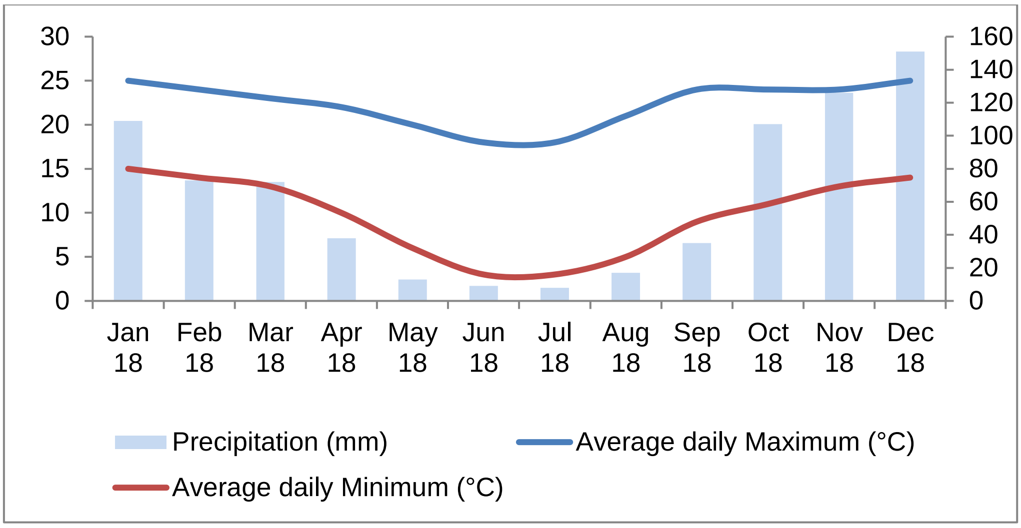

Figure 10-1: Average temperatures and precipitation for the proposed Project (Ermelo Weather Station)

10.2 Topography

The topography is that of slight to moderately undulating plains, with some low hills and pan depressions scattered throughout the landscape. Altitude typically varies from 1,500 m to 1800 m as depicted in Figure 10-2. Drainage occurs in the North easterly direction. Non-perennial drainage lines are located to the East and West. The majority of the project area has steep slopes with the higher-lying areas have steeper slopes of between 10° and 45°, whereas low lying areas have gentle slopes that range from 0° and 10°.

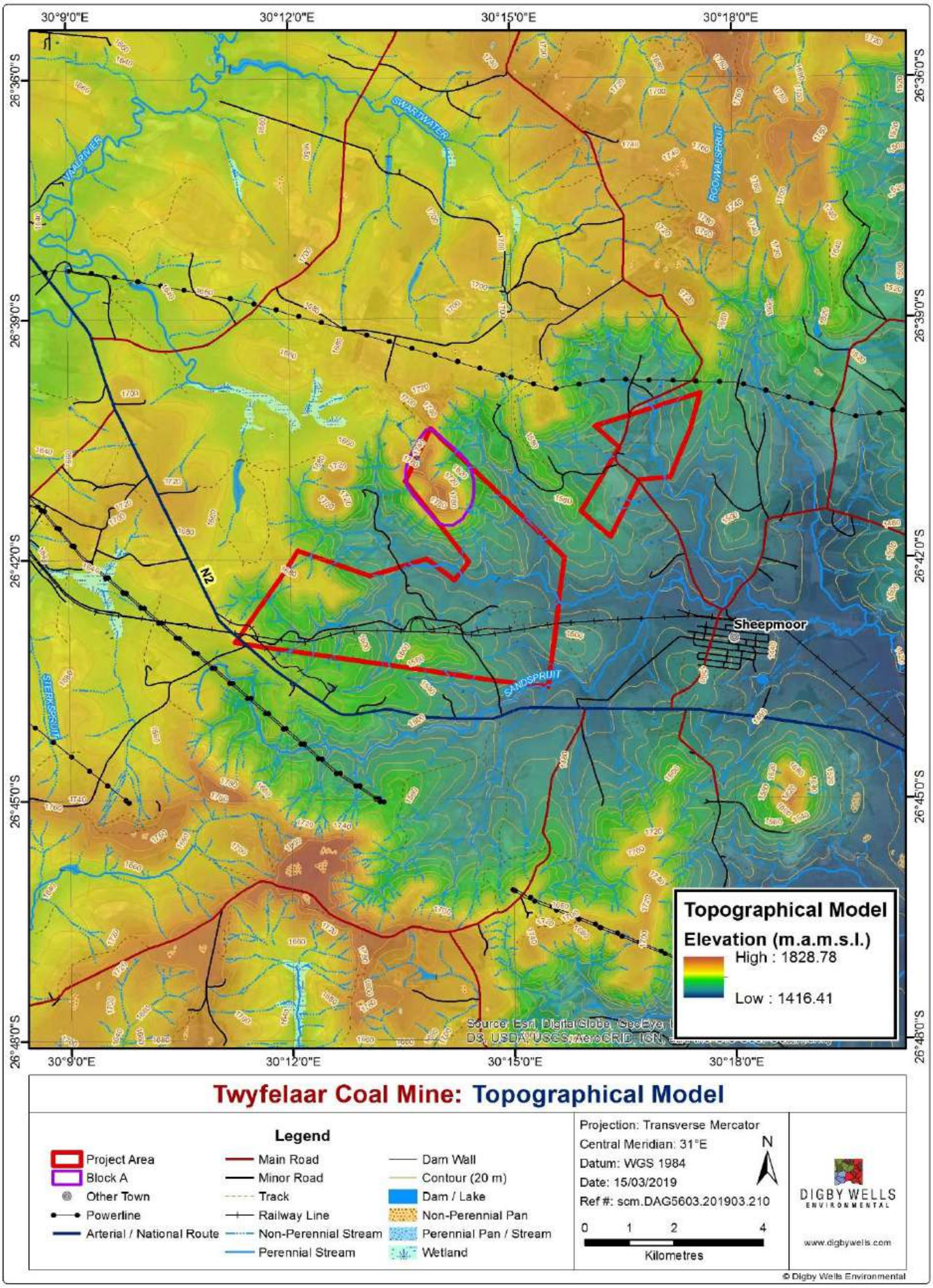

Figure 10-2: Topography of the Twyfelaar Project Area

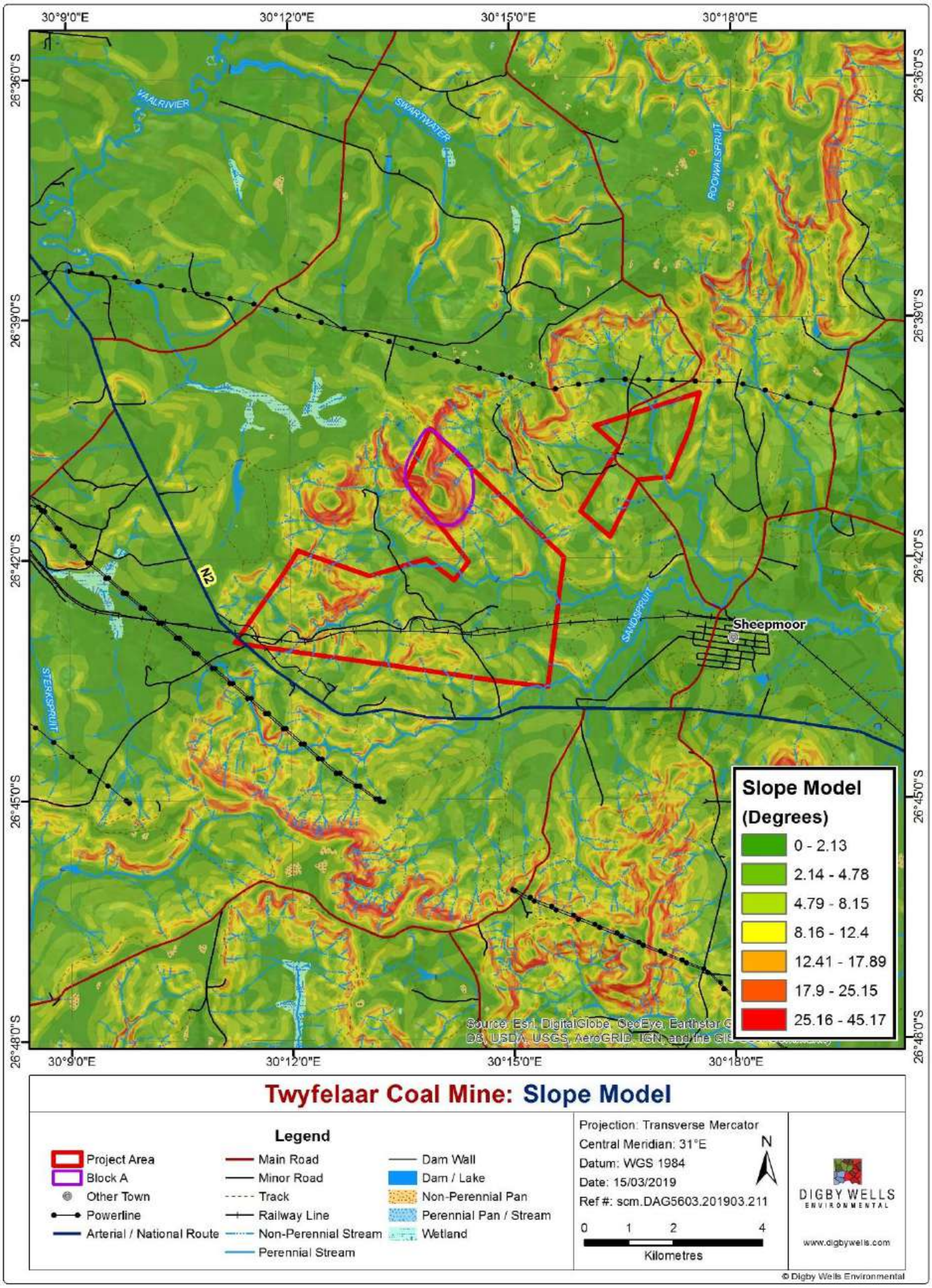

Figure 10-3: Slope Aspect for the Proposed Project Area

10.3 Geology

The proposed Twyfelaar Coal Mining Project is in the eastern escarpment of the Mpumalanga Highveld in the Ermelo coalfield. The geology of the project area is dominated by the Madzaringwe Formation of the Karoo Supergroup and Karoo Dolerite Suite, as depicted in Figure 10-4. These are comprised of mudstone, shale and siltstone.

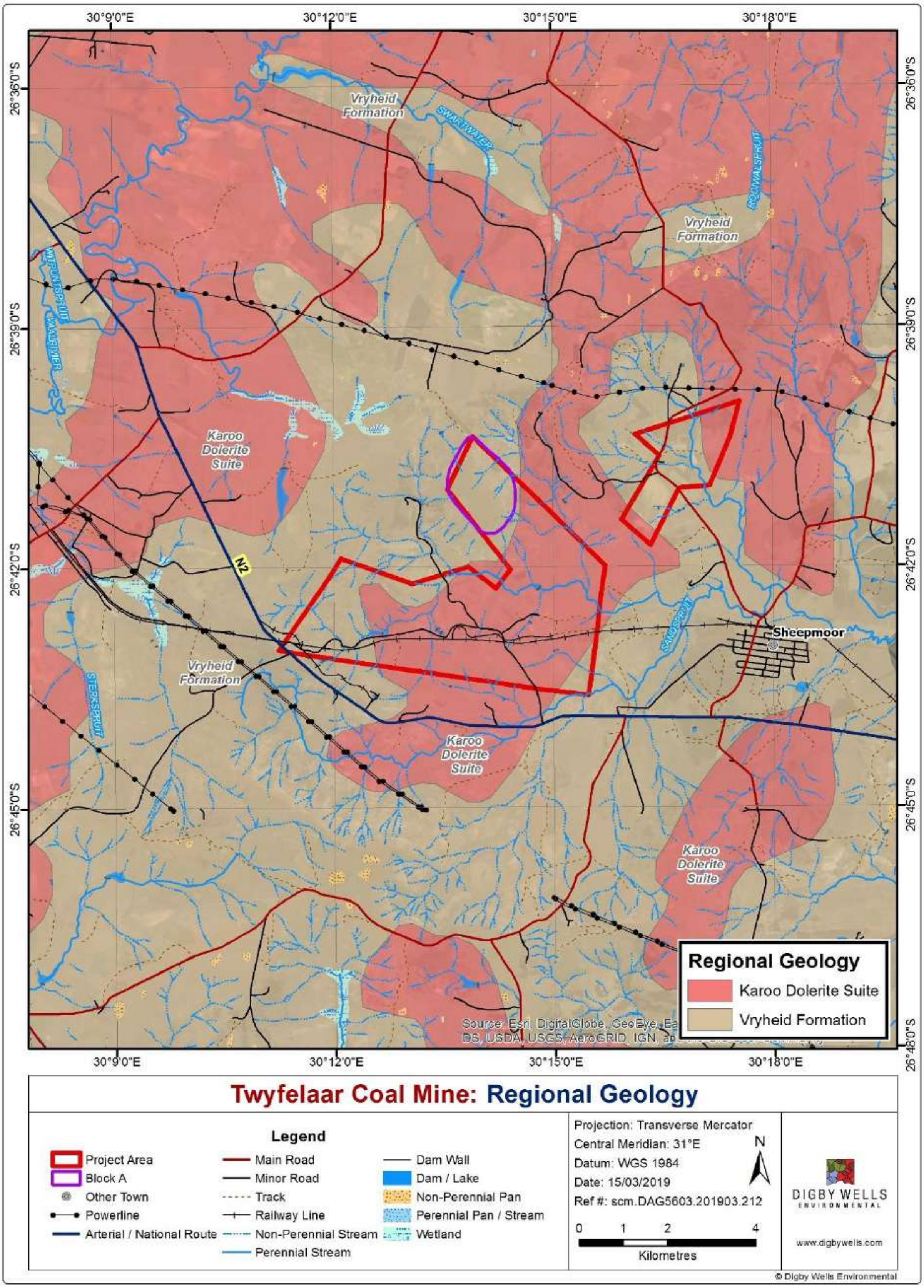

Figure 10-4: Regional Geology

10.4 Soil, Land Use and Land Capability

The Soil, Land Use and Land Capability Assessment was undertaken during the EIA Phase is appended to this report as Appendix D. A site visit was undertaken on the 22nd of August 2019, during the surveys, soil sampling and land use assessments were also performed.

10.4.1 Land Types

A total of three Land Type units occur within the Project Area, namely: Fa162 (Shallow soils, no lime); Bb35 (Yellow, highly weathered structureless soils with plinthic subsoils) and Ba51 (red, highly weathered structureless soils with plinthic subsoils). Table 10-2 gives a brief description of the dominant Land Types within the Project Area.

Table 10-2: Dominant Land Types in the Project Area

Land Type	Description
Fa162	Shallow soils such as the Mispah and Glenrosa forms predominate with little to no lime in the landscape.
Bb35	Red and yellow structureless soils with low to medium base status due to leaching. This land type has plinthic subsoils which are characterized by iron oxides in the form of mottles and concretions. Plinthic soils are usually indicative of a fluctuating water table. Red soils comprise less than 33% of the land type. Soil forms that are found within this land type include Glenrosa, Mispah, Clovelly, Avalon, Cartref, Longlands, Wasbank, Huuton, Griffin and Katspruit.
Ba51	Red and yellow structureless soils with low to medium base status due to leaching. This land type has plinthic subsoils which are characterized by iron oxides in the form of mottles and concretions. Plinthic soils are usually indicative of a fluctuating water table. Red soils comprise more than 33% of the land type. Soil forms that are found within this land type include Hutton, Mispah, Glenrosa, Avalon, longlands, Swartland, Griffin, Shortlands, Glencoe, Kroonstad, Bonheim, Katspruit, Willowbrook and Dundee.

10.4.2 Land Use

The Project Area is dominantly Greenfields. Other land uses identified in the area include cultivated land, forestry plantations animal grazing and settlement or built-up area. These are visually depicted in Figure 10-6.

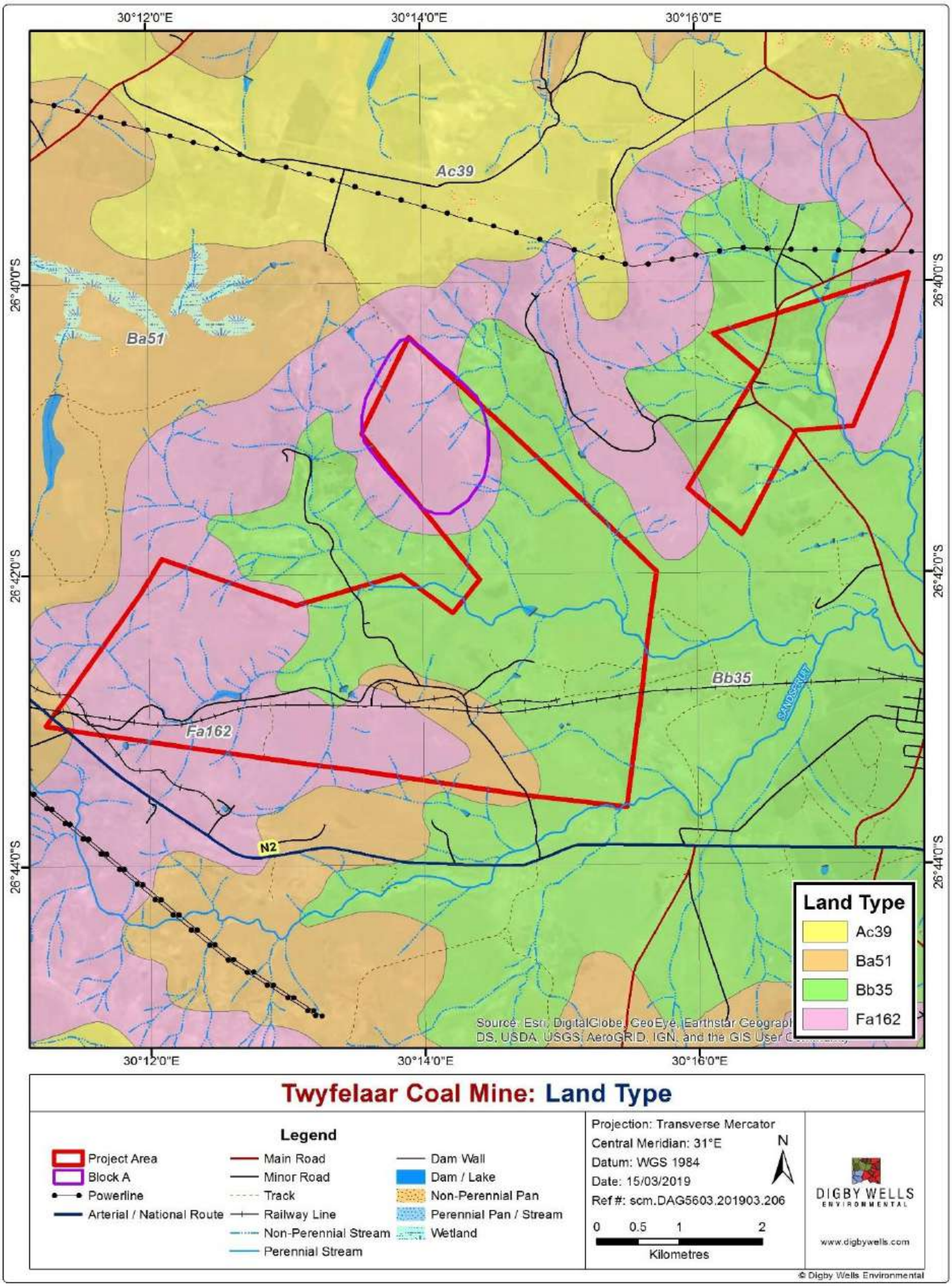

Figure 10-5: Land Type Map of the Project Area

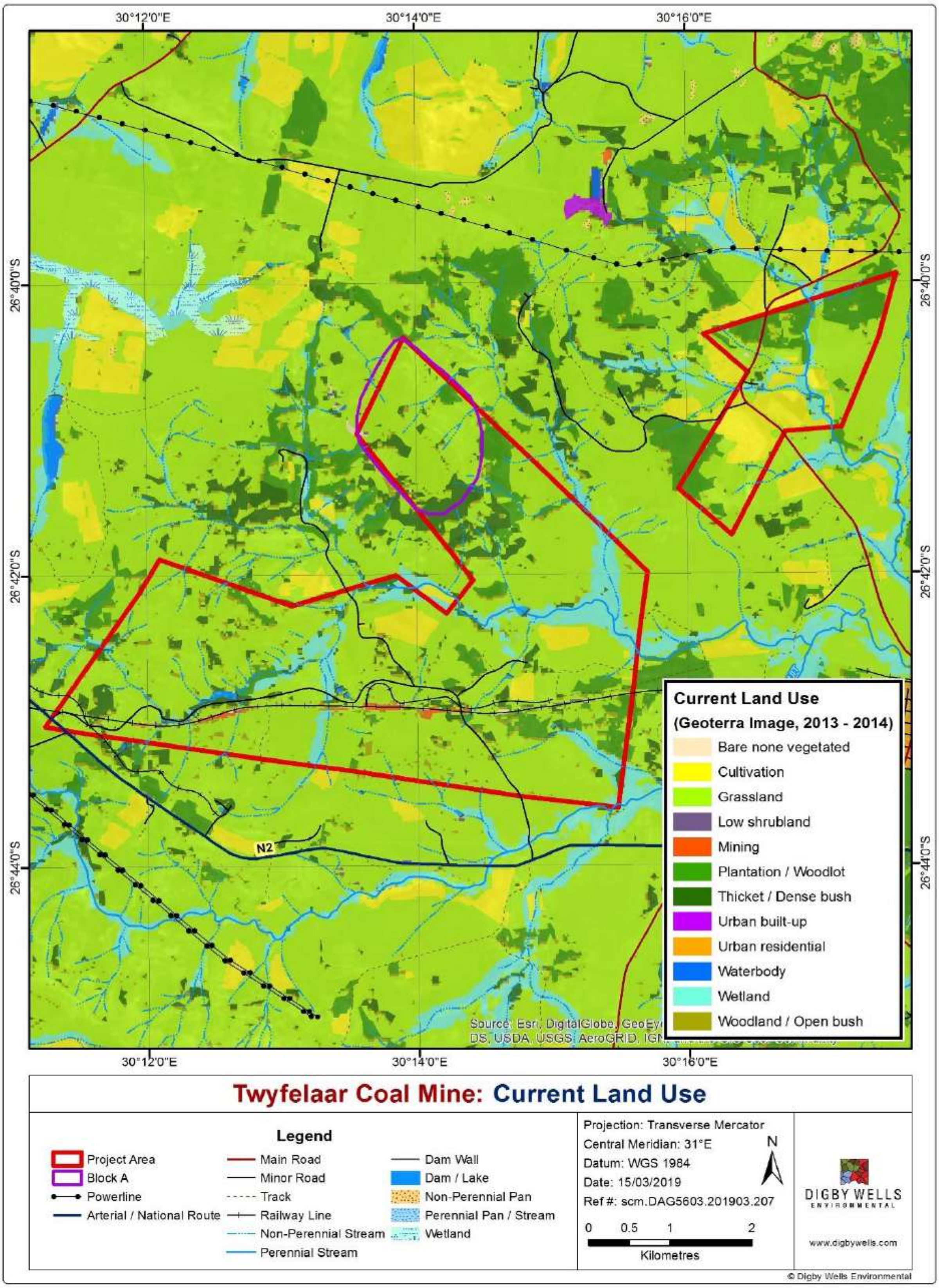

Figure 10-6: Land Use Map for the Project Area (Geoterraimage, 2014)

10.4.3 Soil Chemical and Physical Characteristics

The results of soil analysis are presented in Table 10-4 and as a basis for interpreting this data, local soil fertility guidelines are presented in Table 10-3.

Table 10-3: Soil Fertility Guidelines (Fertilizer Association of South Africa, 2016)

Guidelines (mg per kg)		
Macro Nutrient	**Low**	**High**
Phosphorus (P)	<5	>35
Potassium (K)	<40	>250
Sodium (Na)	<50	>200
Calcium (Ca)	<200	>3000
Magnesium (Mg)	<50	>300

In general, soil organic carbon provides an indication of organic matter content in a soil. The levels above 2% to 3% are considered moderate to high (du Preez, Mnkeni, & van Huyssteen, 2010). An external nutrient input source, such as crop residues, will be required where deficiency pf organic matter occurs, especially during the rehabilitation phase pf the mining project so that revegetation can be successfully implemented.

Table 10-4: Soil Physico-Chemical Properties

Soil ID	Soil form	pH	SAR	P (Bray1)	Na	K	Ca	Mg	B	Mo	Al	Fe	S	OC	Clay	Silt	Sand	Texture
				mg/kg										%				
DAG01A	Glenrosa	4.82	1.04	1	296.5	406	2297	2314	176.4	<16	72208	115312	33.48	2.5	32	17.04	50.96	Sandy Clay Loam
DAG02	Clovelly	3.9	0.71	1.46	106.	2636	284.	854.	70.7	0	2827	20610	40.44	2.1	20	6.08	73.9	Sandy Loam
DAG03	Glencoe	4.3	0.62	1.69	98.7	782.	832.	655.	120.	<1	3242	24960	38.59	1.3	20	8.24	71.7	Sandy Loam
DAG04	Cartref	3.9	0.63	1	81.8	97.3	596.	414.	<80	<1	1519	46500	29.85	2.5	12	27.0	60.9	Sandy Loam
DAG06	Bonheim	5.5	0.59	1.29	225.	769.	3998	4185	104.	<1	7721	64384	25.70	3.6	20	59.8	20.1	Silty loam
DAG07	Clovelly	3.9	0.38	2.24	**39.9**	449.	207.	371.	<80	<1	4231	18240	40.38	1.6	20	6.64	73.3	Sandy Loam
DAG08	Clovelly	5.2	1.91	1	844	327.	3818	6574	<80	<1	3552	52592	20.65	1.6	12	12.6	75.3	Sandy Loam
DAG09	Clovelly	4.0	65	1.26	93.4	905.	446.	667.	<80	<1	4920	19360	40.70	1.6	24	10.6	65.4	Sandy Clay

*Note: Highlighted cells indicate exceedance of guidelines for optimum agricultural potential

10.4.4 Soil Classification

Twelve different soil forms were identified within the surveyed area, and the distribution of the identified soil forms at the Project Area is presented in Table 10-5 and Figure 10-7.

Table 10-5: Identified Soil Forms within the Project Area

Soil Forms	Area Surveyed (km^2)	% Surveyed Area
Glenrosa	2.94	12
Clovelly	13.04	51
Mispah	7.99	31
Swartlands	0.26	1
Rock	0.25	1
Katspruit	1.04	4

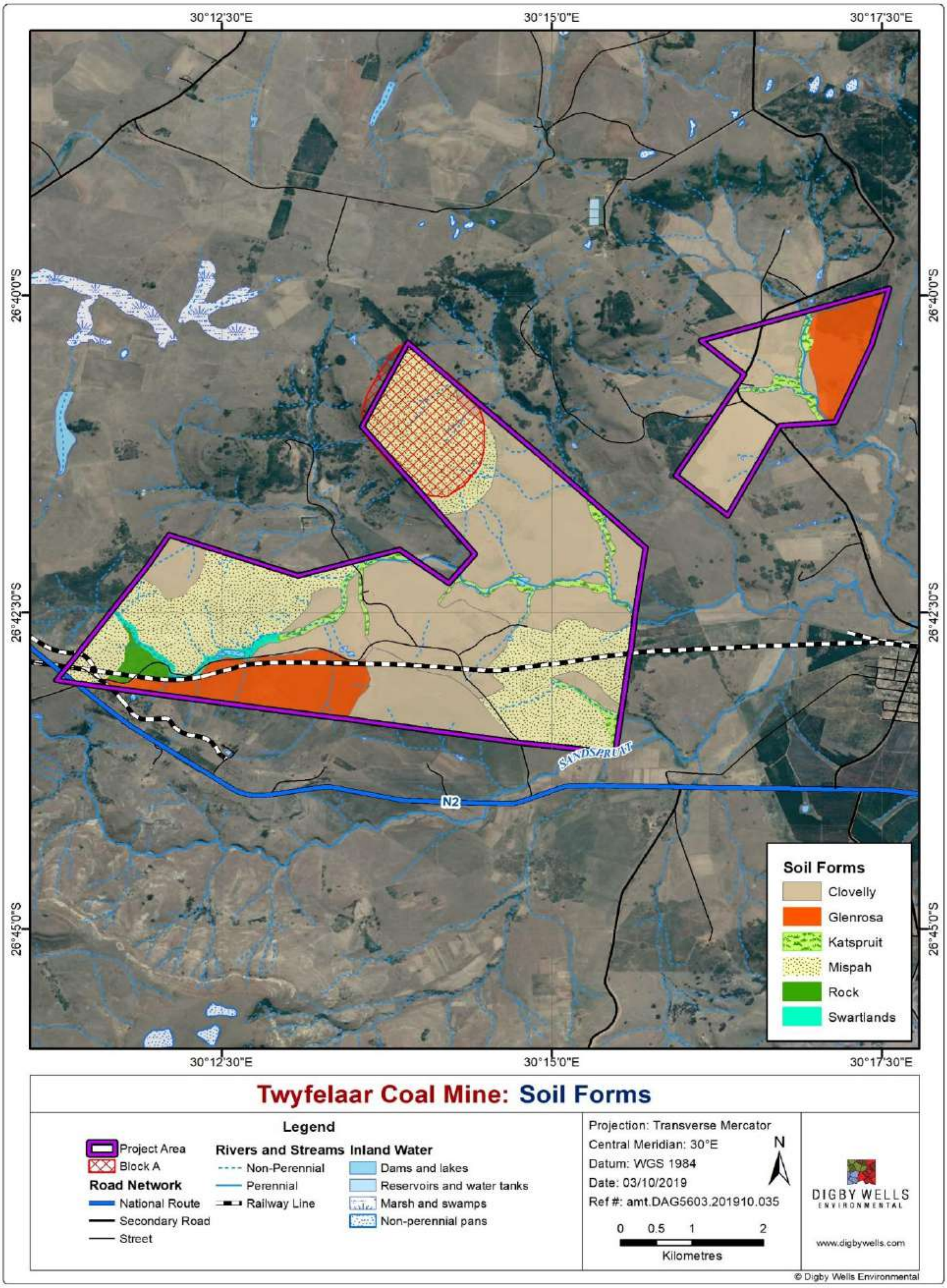

Figure 10-7: Soil Forms Distribution Map for the Project Area

10.4.5 Land Capability and Agricultural Potential

Land capability classes were determined and assigned to the Project Area, based on the soil form distribution on the project site. The site was classified into four different classes as shown in Table 10-6 and Figure 10-8.

Table 10-6: Land Capability within the Project Area

Class	% Surveyed Area	Soil Form	Increased Intensity of Use									Land Capability Groups
II	51	Clovelly	W	F	LG	MG	IG	LC	MC	IC	-	Arable land
VII	48	Glenrosa, Mispah, Swartlands, Katspruit,	W	F	LG	-	-	-	-	-	-	Wildlife
VIII	1	Rock	W	-	-	-	-	-	-	-	-	

W - Wildlife
F - Forestry
LG- Light grazing
MG - Moderate grazing
IG - Intensive grazing
LC - Light cultivation
MC - Moderate cultivation
IC - Intensive cultivation
VIC - Very intensive cultivation

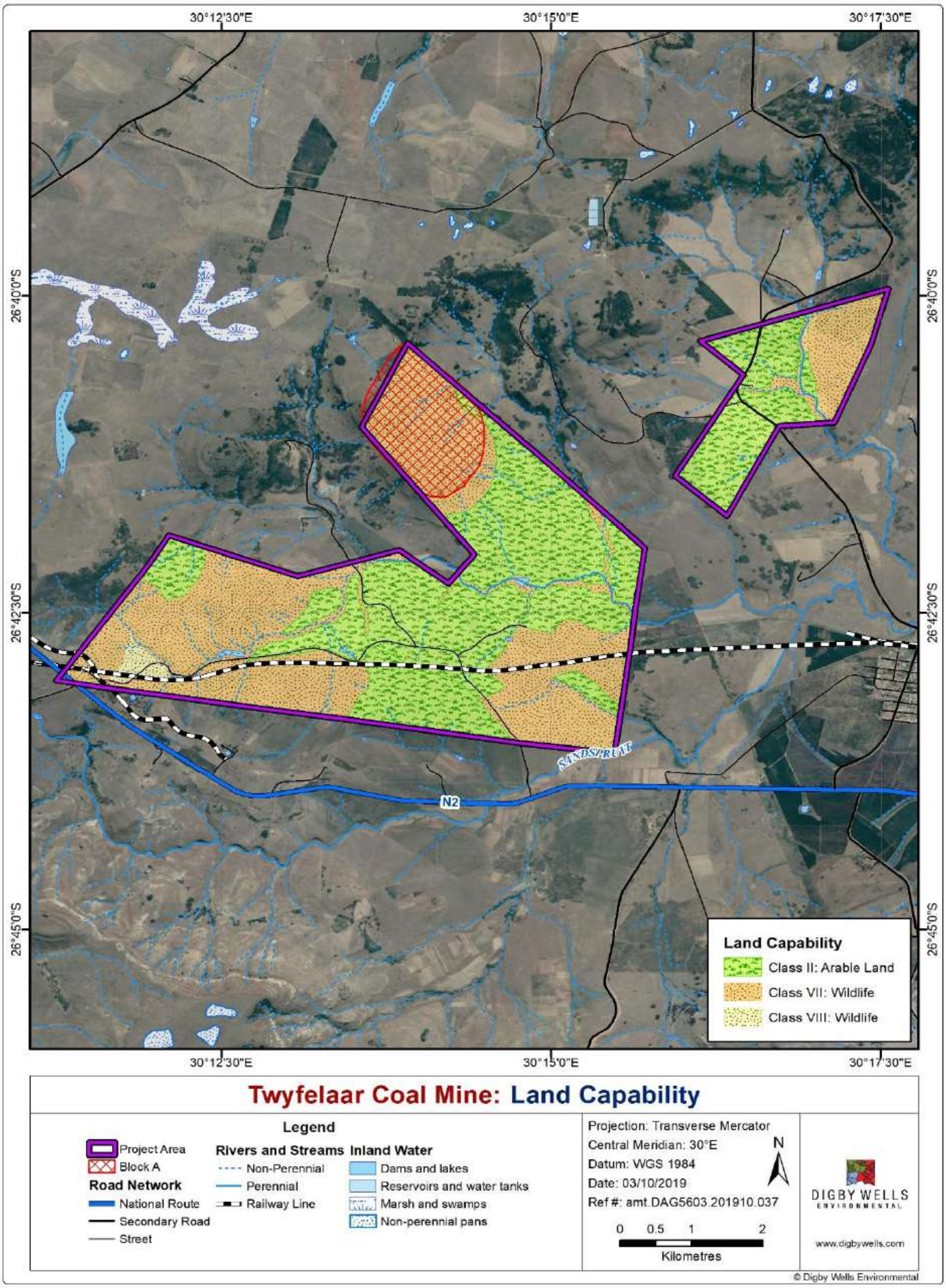

Figure 10-8: Land Capability Map for the Project Area

10.4.6 Land Suitability

Soil agricultural potential or suitability mapping was determined by considering the soil forms, land capability classes, soil chemistry results, the hydrology of the site and the current land use are presented in Table 10-7 and Figure 10-9.

Table 10-7: Land Suitability Classification within the Project Area

Class	% Surveyed Area	Soil Forms	Definition	Conservation Need	Agricultural Potential/ Use-Suitability
II	51	Clovelly	▪ Slight limitations ▪ High arable potential ▪ Low erosion hazard	Adequate run-off control	Annual cropping with special tillage or ley
V	4	Katspruit	▪ Watercourse and land with wetness limitations	Protection and control of water table	Improved pastures or Wildlife
VII	45	Glenrosa, Mispah & Swartlands	▪ Very severe limitations ▪ Suitable only for natural vegetation	Adequate management for natural vegetation.	Natural veld grazing and afforestation
VIII	1	Rock	▪ Extremely severe limitations ▪ Not suitable for grazing or afforestation	Total protection from agriculture.	Wildlife

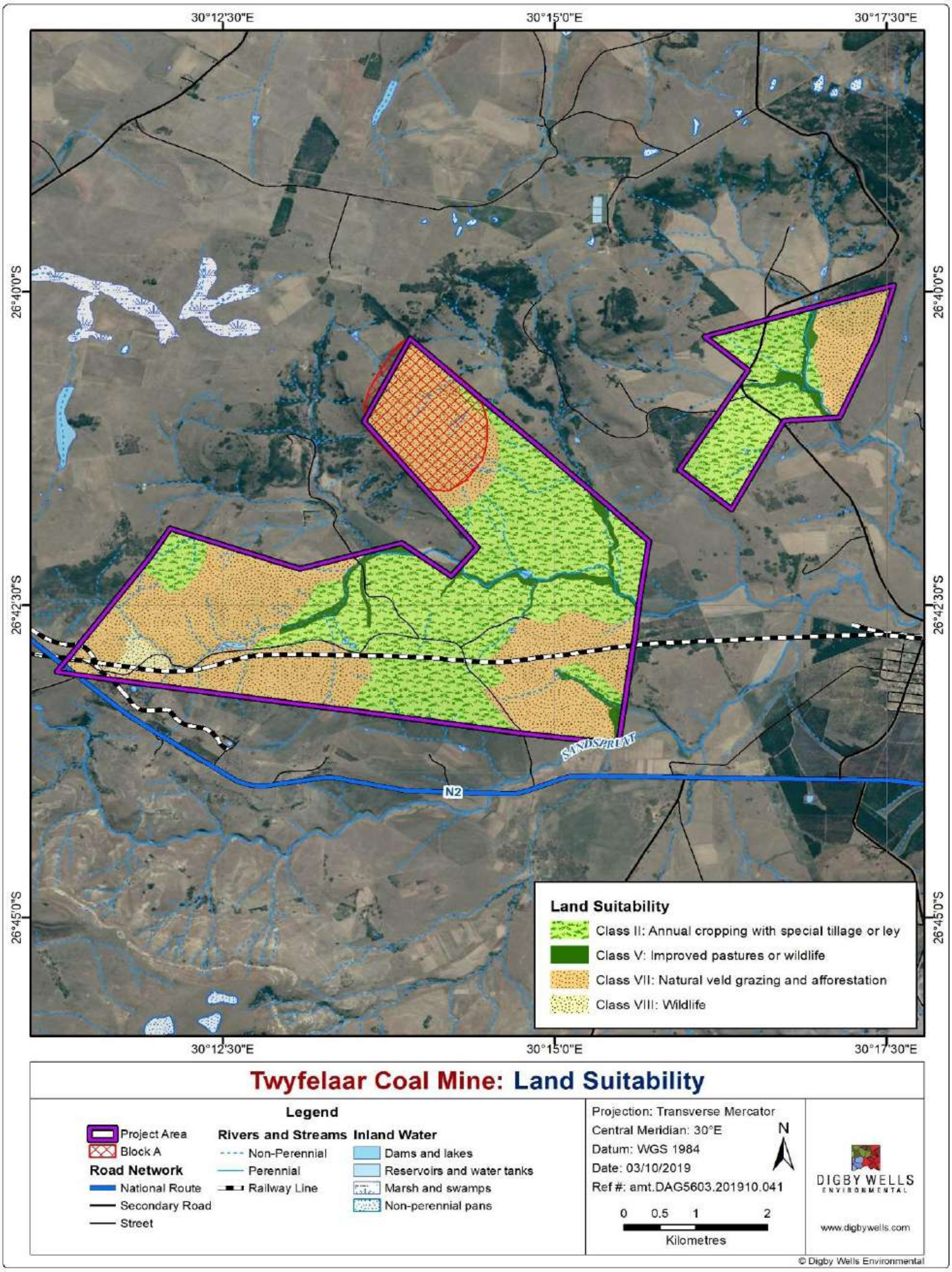

Figure 10-9: Land Suitability Map for the Project Area

10.5 Flora

The Fauna and Flora Assessment baseline has been compiled based on the infield assessment undertaken during the EIA phase and is appended to this report as Appendix E.

The Dagsoom project area is situated in the transition zone between the Wakkerstroom Montane Grassland and Eastern Highveld Grassland vegetation types. A species composition that is representative of the transition zone between these two vegetation types were encountered. Impacts to the natural vegetation currently counts livestock use and cultivation. As aforementioned, the site is located in the second most diverse biome in the country, supporting a vast range of flora and fauna. The implementation of strict mitigation measures if of considerable importance, specifically from a biodiversity perspective and should be implemented in a sustainable and responsible way.

The site has been classified into six primary land management units, namely: agricultural areas, alien bushclumps, secondary grassland, primary grassland, rocky outcrops, and riparian areas. The agricultural areas are associated with the dominant land use in the area did not harbour any natural vegetation. Vegetation cover is sparse and includes alien plant species such as: *Cirsium vulgare* (Scotch Thistle) and *Solanum sisymbriifolium* (Dense-thorned Bitter Apple).

Floral diversity in the Primary Grassland was regarded as expected in comparison with the expected species. Alien invasive tree species were found to dominate many landscapes, including riparian, wetlands and primary and secondary grassland.

Few flora Species of Special Concern (SSC) were recorded on site and this is most likely attributable to disturbance related to agriculture. The vegetation types and related sensitivity are provided in Table 10-8 and the depicted in Figure 10-10.

Table 10-8: Vegetation Types and Sensitivity

Classification	Sensitivity	Area - Hectares	Percentage of Mining Infrastructure Footprint Covered
Rocky Outcrop	High	165.36	5.7409
AIP	Low	342.15	6.2757
Secondary Grassland/Wetland	High	662.1	0.3195
Primary Grassland	High	1058.1	87.6640
TOTAL		**2227.71**	**100.0**

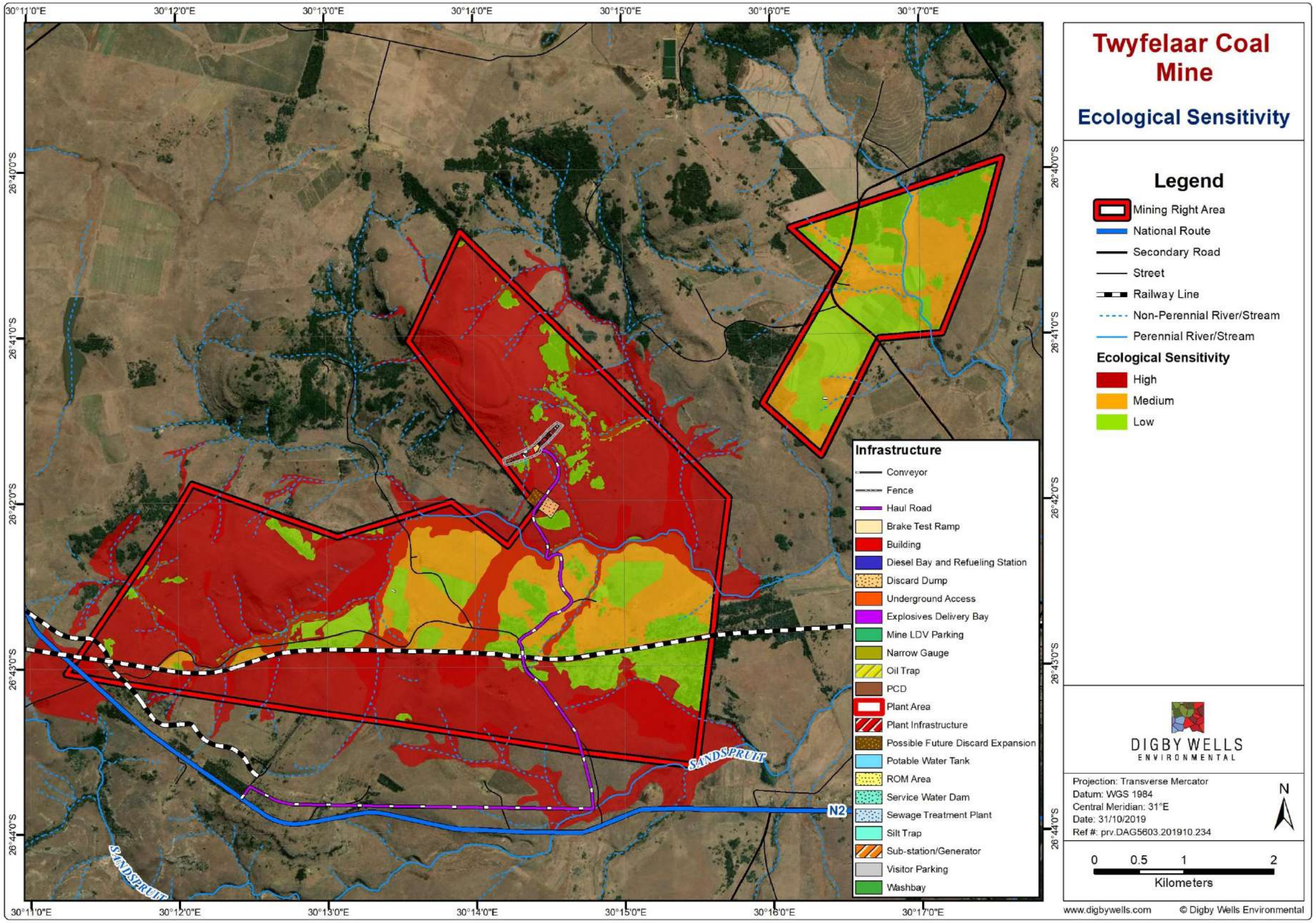

Figure 10-10: Ecological Sensitivity and Infrastructure

10.5.1.1 Vegetation Communities

In this section the vegetation communities identified during the field work component of the study is discussed in the Table 10-9 below and characteristic features of these are highlighted.

Table 10-9: Identified Vegetation Communities

Vegetation Communities	Characteristic Features
Rocky Outcrops	Rocky outcrops/Ridges are a sensitive landscape as determined by the Mpumalanga Tourism and Parks Agency (MTPA), as per the minimum requirements set forth by Parks Board. These outcrops provide habitat plant for both plants and animal species that are nit impacted on by agricultural activities. Observed plants including woody plants: Blue Bush (*Diospyros lycoides)* and an understorey layer comprised of grasses: mostly *Hyparrhenia hirta* (Common Thatching Grass), *Themeda triandra* (Red Grass) and *Cymbopogon excavatus* (Common Turpentine Grass).
Riparian areas	The wetland/riparian vegetation type is composed of typical riparian plant species which are adapted to permanent or perennial saturation. This includes Schoenoplectus and Cyperus species as well as a number of wet grasses, such as Cotton Wool Grass (*Imperata cylindrica*), Rye Grass (*Lolium perenne*), Rescue Grass (*Bromus catharticus*) and Swamp Couch Grass (*Cynodon dactylon*).
Agricultural Fields	The agricultural fields are comprised of Maize (*Zea mays*). These areas have been colonised by problem plants on the periphery such as Common Black Jack (*Bidens pilosa*) and Flax-leaf fleabane (*Conyza bonariensis*).
Primary Grassland	The grassland unit was identified as the original or primary vegetation type in the area (Figure 10-10) and covered an area of 1 058ha. The grass layer was largely dominated by Gum Grass (*Eragrostis gummiflua)*, Weeping Love grass (*E. curvula*), Common Thatch grass (*Hyparrhenia hirta*), Red Grass, (*Themeda triandra*) the few forbs present were, False gerberea (*Haplocarpha scaposa*), Vaal River Lilly (*Crinum bulbispermum),* and Star Flower (*Hypoxis hemerocallidea*). Few alien invasive plant species were encountered however Bankrupt Bush (*Seriphium plumosum*) was recorded.
Secondary Grassland	The secondary grassland vegetation type is composed of original grassland vegetation, which has been largely impacted on/transformed previously by agricultural activities (specifically grazing). The grass layer is dominated by Weeping Love Grass (*Eragrostis curvula)* and Tough Love Grass (*Eragrostis plana)*. Forbs present include *Pelargonium luridium* and possibly *Monopsis decipiens*. Alien and invasive vegetation includes White Flower Mexican Poppy (*Argemone ochroleuca),* Yellow Nut Sedge *(Cyperus esculentus),* and Sticky Nightshade *(Solanum sisimbriifolium).* No Red Data/protected flora species were recorded in this vegetation type.

Vegetation Communities	Characteristic Features
Exotic Tree Stands	Stands of Exotic Trees including Red River Gum (*Eucalyptus camaldulensis)* and Black Wattle (*Acacia mearnsii*) are found within the study area. The Black Wattle infestation was evident in the riparian areas and the mountainous rocky areas. The Eucalyptus tree stands are believed to have been historically planted to provide timber or screening for the farmhouses. This is regarded to be a highly disturbed vegetation community. Little vegetation is supported below the tree canopy. No Red Data protected, or medicinal species were recorded in this community and the probability of occurrence of such species is considered low. The conservation importance of these areas is therefore considered low.

10.5.1.2 Alien Plant Invasion

Alien plant species invasion is significant on site with alien bushclumps of woody species covering an area of 341.1ha. Species of such as *Acacia mearnsii* (Black Wattle) and *Eucalyptus* spp. out-complete native species, forming dense mono-specific stands. This reduces the area available for potential plant Species of Special Concern (SSC), as well as land for grazing by domestic and wild animals.

Certain species have different alien invasive categories for different provinces in South Africa. Table 10-10 lists the alien plant species that were recorded on the Twyfelaar Project area, including invasive categories for those species that have been recognised as invasive.

Table 10-10: Alien plant species recorded on site

Family	Species Name	Common Name	Status	NEMBA
Asteraceae	*Bidens pilosa*	Common Blackjack	Alien Invasive	-
Asteraceae	*Cirsium vulgare*	Scotch thistle	Alien Invasive	1b
Asteraceae	*Hypochaeris radicata*	Hairy wild lettuce	Alien Invasive/Edible	-
Asteraceae	*Senecia madagascariensis*	Canary Weed	Weed	-
Asteraceae	*Seriphium plumosum*	Bankrupt Bush	Weed	-
Brassicaceae	*Lepidium africanum*	Pepperweed	Weed	-
Cactaceae	*Opuntia ficus-indica*	Sweet Prickly Pear	Alien Invasive	1b
Fabaceae	*Acacia mearnsii*	Black Wattle	Alien Invasive	2
Myrtaceae	*Eucalyptus camaldulensis*	Red River Gum	Alien Invasive	1b
Pinaceae	*Pinus radiata*	Radiata Pine	Alien invader	1b

Family	Species Name	Common Name	Status	NEMBA
Poaceae	*Arundo donax*	Spanish Reed	Alien	1b
Poaceae	*Pennisetum clandestinum*	Kikuyu Grass	Exotic	-
Solanaceae	*Solanum sisymbriifolium*	Wild Tomato	Alien Invasive	1b
	Tagetes minuta	Tall Khaki Weed	Alien Invasive	-

10.6 Fauna

The Fauna and Flora Assessment baseline has been compiled based on the infield assessment undertaken during the EIA phase and is appended to this report as Appendix E.

Fauna occurring on site include assemblages within terrestrial and wetland ecosystems, these include mammals, birds, reptiles, amphibians and invertebrates. The project area is mostly dominated by grassland habitat that remains intact and showed a marked reduction in plant diversity from the former reference state.

10.6.1.1 Mammals

The mammal survey was conducted concurrently with the flora and vegetation survey. The visual sightings and ecological inductions were used to identify the mammal inhabitants of the study area, this includes scats, tracks and nesting sites such as burrows and dens. Scats found were collected (if required), photographed on scale and along with any tracks found, were also identified. For identification purposes a field guide, Smithers Mammals of Southern Africa (2000), was used. All mammal species recorded are included in this report as Appendix E.

10.6.1.2 Avifauna

The habitat of the proposed mining and surrounding area generally includes mesic Highveld grassland dominated by agriculture (Maize production and grazing). A total of 51 bird species were observed during the surveys, these species are listed in Appendix E.

The Secretary Bird (VU) (*Sagittarius serpentarius*) and a pair of Southern Bald Ibis (VU) (*Geronticus calvus*) were also observed and recorded in the study area, refer to Figure 10-11. Both these SSC are threatened because of habitat destruction in grasslands, caused by mainly agriculture.

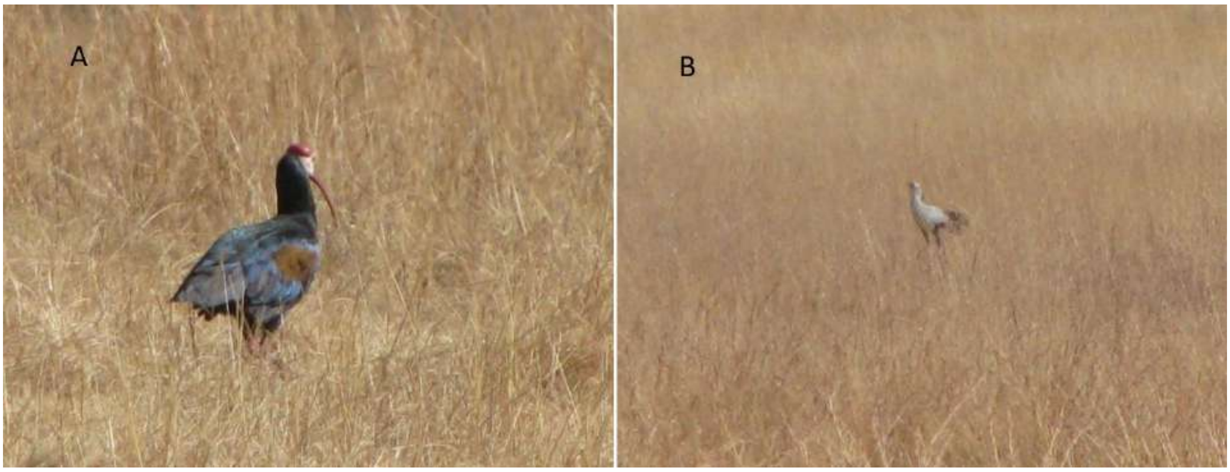

Figure 10-11: Avifauna SSC recorded, A. Southern Bald Ibis (VU) (*Geronticus calvus*), B. Secretary Bird (VU) (*Sagittarius serpentarius*)

10.6.1.3 Reptiles

The reptile population in the area is expected to be representative of the vegetation and habitat types present. Through interviews with land owners, it was determined that the Brown House Snake (*Lamprophis capensis*), Mole Snake (*Pseudaspia cana)* Figure 10-12, Rhombic Night Adder (*Causus rhombeatus*), and the Mozambique Spitting Cobra (*Naja mossambica*) are present.

Figure 10-12: Mole Snake (*Pseudaspia cana)* (light and dark morphs)

10.6.1.4 Amphibians

A list of 10 frog species expected to occur within the study area is presented in Appendix E. The presence of suitable habitat within the study area provides refuge to a number of different species of amphibians however no frog species were identified within the Dagsoom study area during the field survey. This is a limitation that is presented in the dry season, when most frogs aestivate in a variety of areas including under logs and rocks, streambanks and inside termitaria. No amphibian SSC were recorded, and none are expected according to historic records obtained from Fitzpatrick Institute (2019).

10.6.1.5 Invertebrates

According to local literature and with reference to the existing vegetation, it is expected that members of the Orthoptera (grasshoppers, locusts and crickets), Hemiptera (bugs, cicadas, and leaf hoppers), Lepidoptera (butterflies and moths), Coleoptera (beetles), Hymenoptera (wasps and ants) and flies (Diptera) (Picker, *et al.,* 2002) would be present on site. Five butterflies were recorded on site and are tabulated below.

No invertebrate SSC were observed on the Twyfelaar project area during the site visits in August 2019.

Table 10-11: Recorded list of butterfly species on the Twyfelaar project area

Species Name	Common Name	Status
Junonia octavia	Gaudy Commodore	LC
Junonia hierta	Yellow pansy	LC
Junonia orithya madagascariensis	Eyed pansy	LC
Catopsilia florella	African migrant	LC
Belenois aurota	Brown Veined White	LC

10.7 Wetlands

The Wetland Impact Assessment undertaken during the EIA Phase is appended to this report as Appendix FAppendix G. A site visit was undertaken in September 2019, during the dry season.

10.7.1 Wetland ecological health assessment (WET-Health)

According to Macfarlane, Kotze, & Ellery (2009), the health of a wetland can be defined as a measure of the deviation of wetland structure and function from the wetland's natural reference condition. A level 1 WET-Health assessment was done on the wetlands in accordance with the method described by Kotze *et al.* (2007) to determine the integrity (health) of the wetland. A Present Ecological State (PES) analysis was conducted to establish baseline integrity (health) for the wetland. The health assessment attempts to evaluate the hydrological, geomorphological and vegetation health in three separate modules to attempt to estimate similarity to or deviation from natural conditions.

Central to WET-Health is the characterisation of HGM units, which have been defined based on geomorphic setting (e.g. hillslope or valley-bottom; whether drainage is open or closed), water source (surface-water dominated, or sub-surface water dominated) and pattern of water flow through the wetland unit (diffusely or channelled) as described above.

The system of classification focuses on the hydro-geomorphic setting of wetlands which incorporates geomorphology; water movement into, through and out of the wetland; and landscape or topographic setting. Once wetlands have been identified, they are categorised into Hydro-geomorphic (HGM) units as shown in Table 10-12: Description of the various HGM units for wetland classification

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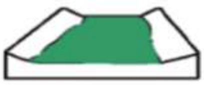
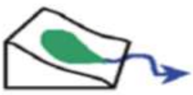
Table 10-12: Description of the various HGM units for wetland classification

Hydromorphic wetland type	Diagram	Description
Floodplain		Valley bottom areas with a well-defined stream channel, gently sloped and characterised by floodplain features such as oxbow depression and natural levees and the alluvial (by water) transport and deposition of sediment , usually leading to a net accumulation of sediment. Water inputs from main channel (when channel banks overspill) and from adjacent slopes.
Valley bottom with a channel		Valley bottom areas with a well-defined stream channel but lacking characteristic floodplain features. May be gently sloped and characterized by the net accumulation of alluvial deposits or may have steeper slopes and be characterised by the net loss of sediment. Water inputs from the main channel (when channel banks overspill) and from adjacent slopes.
Valley bottom without a channel		Valley bottom areas with no clearly defined stream channel, usually gently sloped and characterised by alluvial sediment deposition, generally leading to a net accumulation of sediment. Water inputs mainly from the channel entering the wetland and also from adjacent slopes.
Hillslope seepage linked to a stream channel		Slopes on hillsides, which are characterised by colluvial (transported by gravity) movement of materials. Water inputs are mainly from sub-surface flow and outflow is usually via a well-defined stream channel connecting the area directly to a stream channel.
Isolated hillslope seepage		Slopes on hillsides that are characterised by colluvial transport (transported by gravity) movement of materials. Water inputs are from sub-surface flow and outflow either very limited or through diffuse sub-surface flow but with no direct link to a surface water channel.
Pan/Depression		A basin-shaped area with a closed elevation contour that allows for the accumulation of surface water (i.e. It is inward draining). It may also receive subsurface water. An outlet is usually absent and so this type of wetland is usually isolated from the stream network.

The proposed project area and its associated 500 m zone of regulation comprised of the various wetlands and their associated (HGM) units:

- WET1 comprised of five HGM units: three hillslope seep wetlands and two unchanneled valley bottom wetlands;
- WET2 was comprised of eight HGM units: Five hillslope seep wetlands, one unchanneled valley bottom wetland and one channeled valley bottom;
- WET3 was comprised of two HGM units: A channeled valley bottom system and a large hillslope seep wetland;
- WET4 comprised of a hillslope seep and a narrow riparian channel further downslope, which then flowed into a larger river system further downstream;
- WET5 was comprised of one ephemeral drainage line, bench wetlands (more specifically ‘shelves’), hillslope seeps, three channeled valley bottom HGM units and a narrow riparian channel further downslope, which then flowed into a larger river system further downstream;
- WET6 comprised of one hillslope seep, which was regarded as hydrologically connected to the larger river system further downgradient;
- WET7 was a hillslope seep;
- WET8 was predominantly comprised of a large channeled valley bottom wetland system, to which 3 benches, 40 hillslope seeps, 13 smaller channeled valley bottom wetlands, and 14 unchanneled valley bottom wetlands were hydraulically connected;
- WET9 was predominantly comprised of a large channeled valley bottom wetland system, to which seven hillslope seeps, one smaller channeled valley bottom wetland, and three unchanneled valley bottom wetlands were hydraulically connected;
- WET10 was comprised of three hillslope seeps hydraulically connected to a channeled valley bottom HGM unit;
- WET11 was comprised of a hillslope seep hydraulically connected to a channeled valley bottom HGM unit; and
- WET12 was comprised of an unchanneled valley bottom wetland, which was hydraulically fed by four hillslope seepage wetlands.

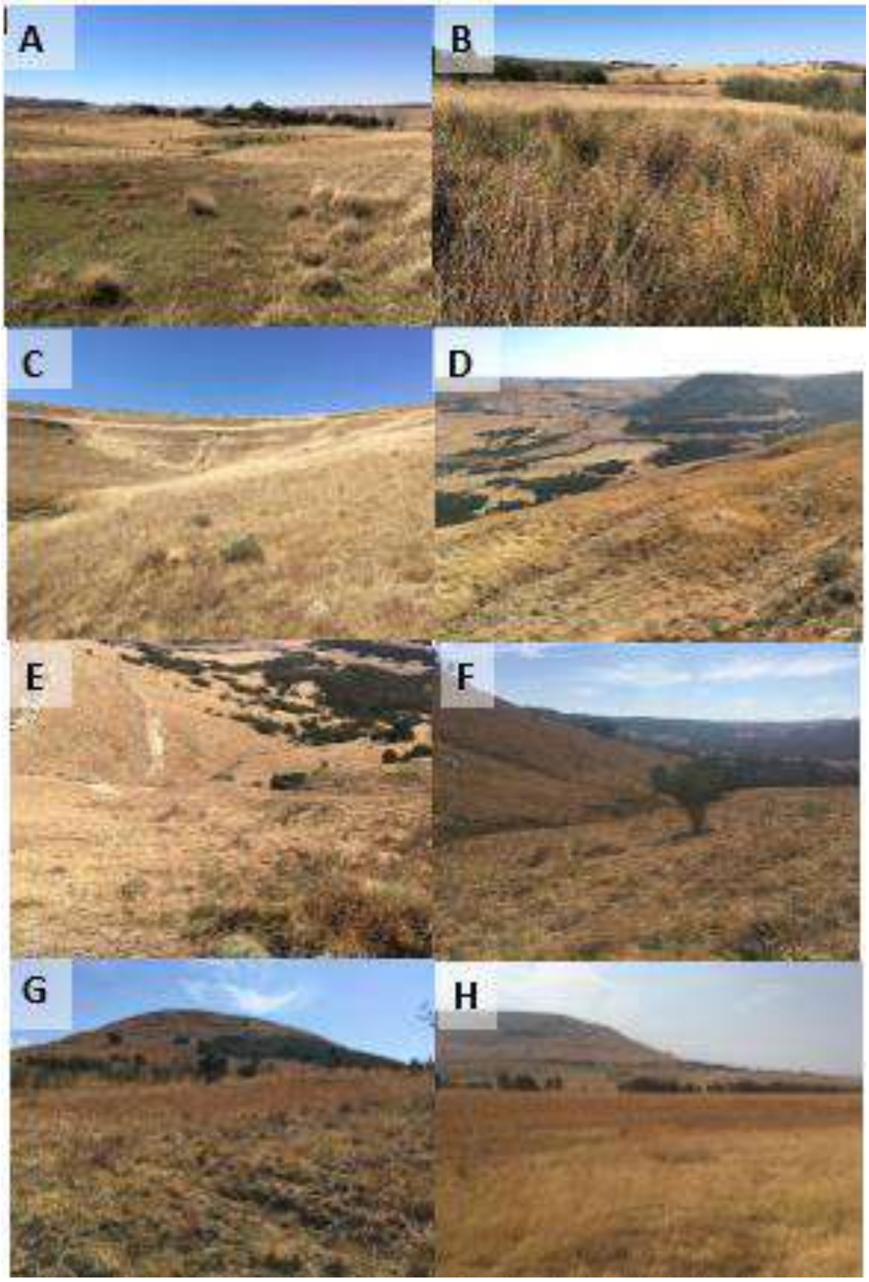


Figure 10-13: A: WET1 – Valley bottom; B: WET2 – Hillslope seep; C: WET3 – Hillslope seep; D: Benches; E: Hillslope seep on western slopes of the koppie; F: Channelled valley bottom showing *Acacia mearnsii* encroachment on the footslopes of the koppie; G: Hillsope seep; H: WET8 – Valley bottom

Table 10-13 indicates the wetlands and the extent of their various HGM types within the proposed project area. Figure 10-14 indicates the location of the wetlands and their various HGM units.

Table 10-13: Wetlands and their various HGM units within the proposed project area and within the 500 m zone of regulation

Wetland	HGM unit	Area (Ha)	Wetland	HGM unit	Area (Ha)
WET1	Unchanneled valley bottom 1-2	15.78	WET7	Hillslope seep	1.7
	Hillslope seeps 1-3	14.75	WET8	Benches 1-3	6.89
WET2	Channeled valley bottom	57.51		Hillslope seeps 1-40	391.36
	Unchanneled valley bottom	5.31		Channeled valley bottoms 1-14	500.00
	Hillslope seeps 1-6	25.74		Unchanneled valley bottom 1-14	211.27
	Riparian	0.34		Riparian	33.63
WET3	Hillslope seep	30.40	WET9	Hillslope seeps 1-7	30.14
	Channeled valley bottom	2.3		Channeled valley bottoms 1-2	89.93
WET4	Hillslope seep	0.61		Unchanneled valley bottoms 1-3	10.49
	Riparian	0.61	WET10	Hillslope seeps 1-3	3.24
WET5	Hillslope seeps 1-8	8.06		Channeled valley bottom	1.19
	Benches 1-6	6.80	WET11	Hillslope seep	7.19

	Channeled valley bottom	3.33		Channeled valley bottom	6.12
	Riparian	0.94	WET12	Hillslope seeps 1-4	14.32
WET6	Hillslope seep	0.51		Unchanneled valley bottoms 1-2	13.76
TOTAL WETLANDS				**1158.36 ha**	

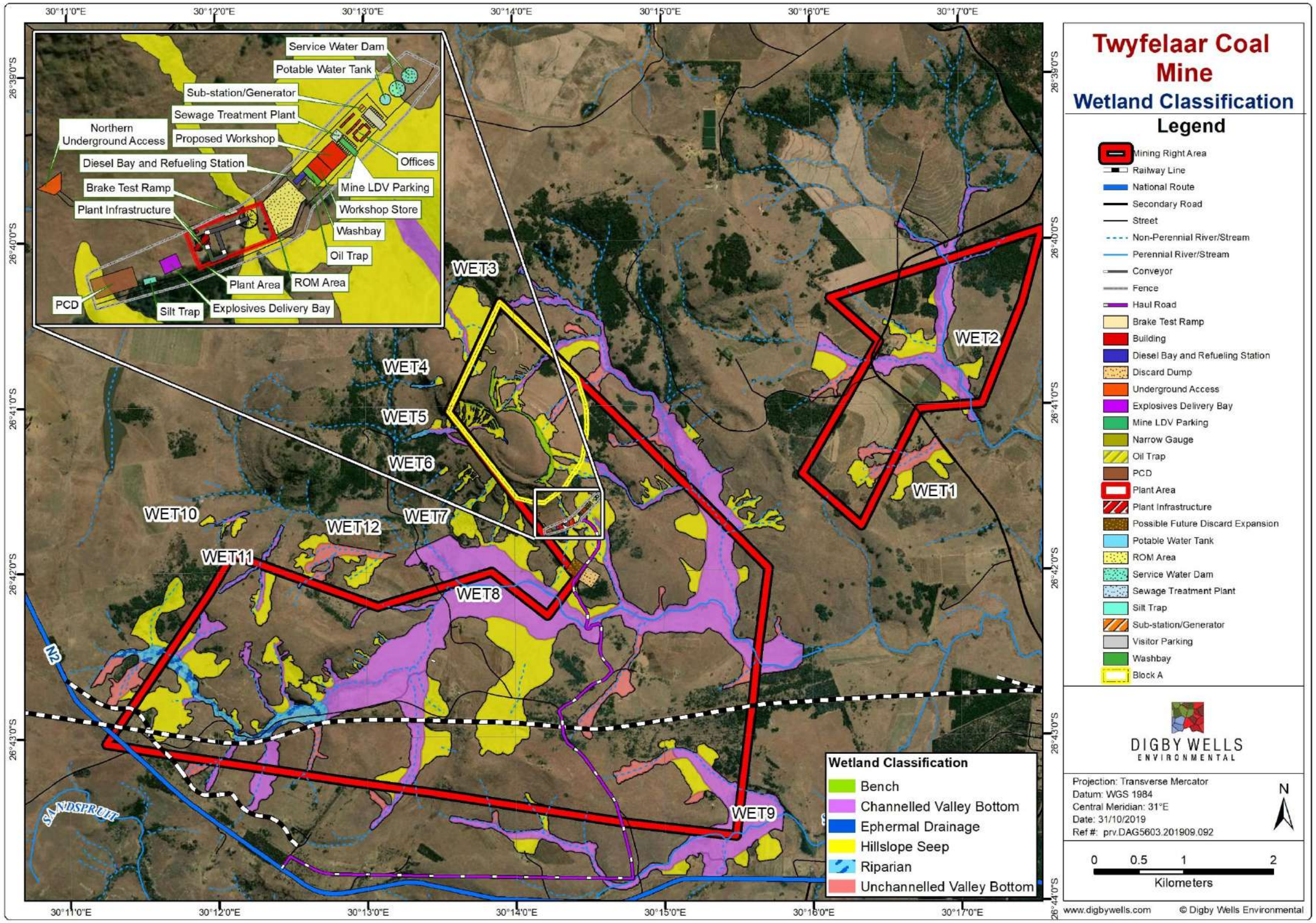


Figure 10-14: Wetland delineation

10.7.1 Terrain indicator and hydrology

The terrain unit indicator was used extensively in the identification of wetlands and their various HGM units. Topographical maps, and both two- and five-meter contours in the preliminary identification of wetland areas were utilised. Further to this, the underlying geology of the area was investigated so as to gain a greater understanding of the potential movement of subsurface water and potential areas of daylighting. The geology of the study area was comprised largely of dolerite, sandstone and shale, with isolated areas of alluvium (Digby Wells, 2019b). The 'koppie' situated in the north western portion of the study area consists largely of sandstone and shale, with an overlaying sill of dolerite, where daylighting moisture and the origin of many of the hillslope seeps associated with WET3, WET4, WET5, WET6, WET7 and WET8 were observed.

10.7.2 Vegetation indicator

Vegetation structures of the various wetlands and their respective HGM units were relatively variable, being largely dependent on slope as well as the level of anthropogenic impact or disturbance at each point.

NB: It is important to note that the assessment was carried out at the end of the dry season and as such, many species were unidentifiable due to the absence of identifying features such as inflorescences. Thus, the species described as dominant in the sections below, are those representative of a dry season survey. Other dominant species, which may only be identified in the appropriate flowering season, are likely to have been overlooked.

- WET1:

  Isolated stands of *Acacia mearnsii* and *Eucalyptus cinerea* were observed along the wetland boundaries. *Stoebe vulgaris*, *Eragrostis gummiflua* and *Hyparrhenia tamba* were the dominant species observed in the temporary zones of the two unchanneled valley bottom wetlands, while *Juncus effusus* was observed in the impoundments and *Sporobolus* sp. and *H. tamba* were observed in the permanent zones. The vegetation structure of the hillslope seep wetlands included species such as *E. gummiflua, Paspalum* sp.*[2], *Andropogon eucomis, Cynodon dactylon* and *Setaria* sp.

- WET2:

  The eastern portion of the channeled valley bottom system was dominated by A. mearnsii, which is likely to have aggravated the channelization observed in the system at the time of the assessment. Other species identified included *Bidens pilosa, Cosmos bipinnatus, Typha capensis, Datura ferox, S. vulgaris* and *Verbena bonariensis. H. tamba* was observed in the temporary zone. A large impoundment was observed in the middle portion of the channeled valley bottom. Species at this point included *J. effuses, B. pilosa, T.*

[2] *indicates exotic species

capensis, Phragmites australis, Populus sp. and *A. mearnsii.* To the north, the system is once again dominated by *A. mearnsii*. Large portions of the hillslope seepage wetlands had been cleared for crop farming, however, species observed included *E. gummiflua, Setaria* sp*., H. tamba* and *J. effuses.*

- WET3:

The hillslope seep was dominated by *H. tamba*. Other species observed included *J. effuses, Cyperus* sp., aloes and ferns. Isolated patches of *Themeda triandra* were observed and *S. vulgaris* was observed towards the edges of the temporary zone. The channelled valley bottom was dominated by *A. mearnsii*.

- WET4, WET5, WET6 and WET7:

The vegetation structure of WET4 was regarded as natural with no alien invasive species observed. The bench wetlands associated with WET5 were dominated by *H. tamba*, while the hillslope seeps associated with WET5, WET6 and WET7 were dominated by *H. tamba, Imperata cylindrica, Sporobolus* sp. and *T. triandra*. *A. mearnsii* dominated the channelled valley bottom and the riparian zone of WET5, limiting biodiversity and resulting in alterations to the natural vegetation structures at these points.

- WET8:

As with WET5, the bench wetlands associated with WET8 were dominated by *H. tamba*, while the hillslope seeps associated were dominated by *H. tamba, Imperata cylindrica, Sporobolus* sp. and *T. triandra*. Aloes were also observed in the hillslope seep zones. *A. mearnsii* dominated the channeled valley bottoms on the foothills of the koppie with special mention of the large channeled valley bottom wetland to the east of the koppie. Dense stands of *A. mearnsii* has resulted in a complete loss of wetland integrity at this point. Resulting in loss of water and carbon retention, limiting biodiversity, and resulting in alterations to the natural vegetation structures at these points. The southern and western portions of the large channelled valley bottom are more natural, with species such as *E. gummiflua, Agrostis lachnantha, H. tamba, I. cylindrica, Andropogon eucomis* and *Sporobolus* sp. Isolated stands of *V. bonariensis* were also observed. Large portions of hillslope seeps and the unchanneled valley bottoms had been cleared for agricultural purposes.

- WET9:

The majority of this area had been burned at the time of the assessment and the only species identified were *A. mearnsii* along the wetland boundary and *H. tamba.*

- WET10 and WET11:

Species observed in the hillslope seeps included *T. triandra, I. cylindrica* and *H. tamba.* A number of additional species were present; however, these were unidentifiable due to the lack of inflorescences. Isolated stands of *A. mearnsii* were also observed.

- WET12:

This wetland was largely impacted by *A. mearnsii* and the effects of erosion and vegetation was absent in many areas.

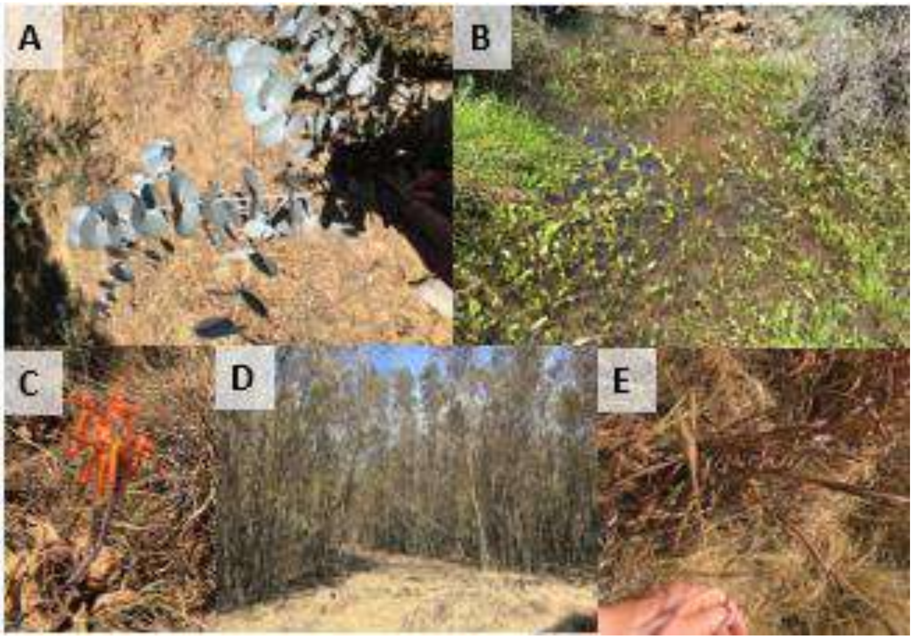


Figure 10-15: A: *Eucalyptus cinerea;* B: *Limosella* sp.; C: *Aloe* sp.; D: Dense encroachment of *A. mearnsii;* E: *Andropogon appendiculatus*

10.7.3 Soil indicator

The soils dominating the project area were identified as Mispah, Glenrosa, Clovelly and Swartland (Soils, Land Use and Land Capability, Digby Wells, 2019a).

The Swartland soils were largely identified within the riparian zone associated with WET8, and were not regarded as wetland indicator soils at the time of the assessment. These soils are comprised of an orthic topsoil horizon, followed by a pedocutanic subsoil, overlaying a lithic horizon (ARC-Institute for soil, 2018). Pedocutanic soils are highly structured and were regarded as unlikely to facilitate free drainage of water.

The Katspruit soils were observed to be dominant within the large channelled valley bottom wetland also associated with WET8 as well as with the channelled valley bottom wetland associated with WET2. Katspruit soil types are comprised of an orthic topsoil horizon and a gley subsoil horizon (ARC-Institute for soil, 2018). These soils are generally subjected to long durations of saturation with stagnant and reduced water, and are generally indicative of the permanent zones in wetlands

The Glenrosa soil types were largely associated with the south-western hillslope seepage wetlands associated with WET8. These soils are comprised of an orthic topsoil horizon, with a lithic subsoil horizon which tends to become gleyed when soils are frequently wetted (ARC-Institute for soil, 2018).

The Mispah soils were associated with WET3, WET4, WET5, WET6, WET7, WET9, WET11 and WET12. These soils form part of the orthic topsoil horizon overlaying a hard rock horizon (ARC-Institute for soil, 2018) and are generally regarded as shallow. These soils were thus more likely to be associated with the hillslope seep wetlands observed where the subsurface low of water would be likely to occur.

WET10 as well as large portions of WET8 were associated with Clovelly soils where wetland indicators (i.e. mottling) were situated close to the surface. This soil type consists of an orthic topsoil horizon overlaying yellow-brown apedal and lithic subsoils (ARC-Institute for soil, 2018).

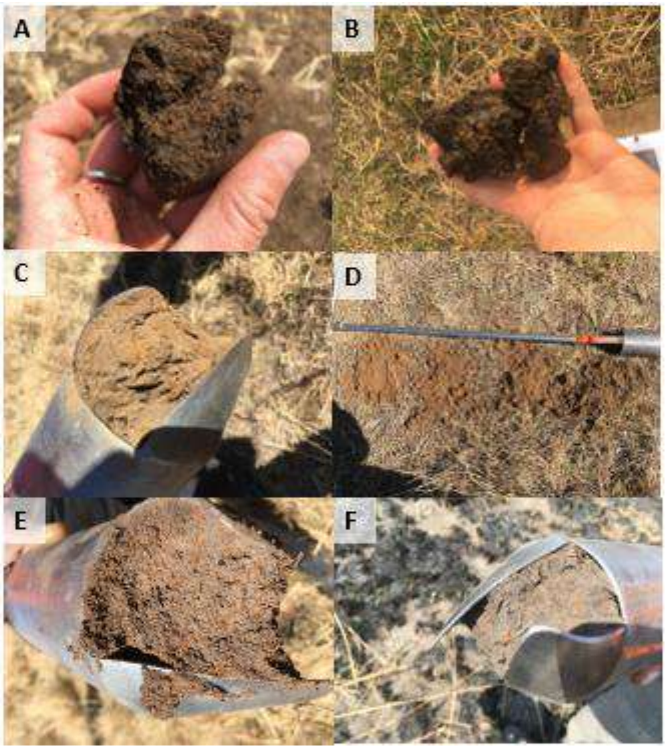


Figure 10-16: A and B: Structured soils; C, E and F: Mottling; D: Example of the soil profile in the hillslope seepage wetlands

10.7.4 Wetland Health and Integrity (WET-Health)

The health and ecological integrity of each of the wetlands and their respective HGM units were assessed at the time of the field assessment and the results are discussed briefly:

- WET1:

The HGM units associated with WET1 have been heavily impacted as a result of agropastoral activities. Impacts include impoundments along the unchanneled valley bottom wetlands, which has resulted in alterations to the faunal and floral structures, loss of flow connectivity, gully formation and erosion. The unchanneled valley bottom wetlands and the hillslope seep wetlands have been severely impacted due to use of the wetland areas for grazing activities and large portions of the seeps have been cleared for agricultural crops, with special mention of HS2 and HS3.

The HGM units associated with WET1 were all categorized as *moderately modified* (ecological category C).

- WET2:

The HGM units associated with WET2 have been largely impacted as a result of agropastoral activities. Large areas have been affected by severe encroachment of *A. mearnsii* (Black Wattle), with special mention of the channeled valley bottom system. This has resulted in alterations to the soil characteristics (i.e. loss of carbon) and alterations to the vegetation characteristics, which should generally be comprised of natural grasslands (see section 10.7.1). Further to this, the construction of impoundments along the channeled valley bottom have resulted in changes to the natural water flow and distribution, alterations to the natural water tables, erosion and gulley formation.

The hillslope seeps and the unchanneled valley bottom associated with WET2 were categorized as *moderately modified* (ecological category C), while the channeled valley bottom was categorized as *largely modified* (ecological category D).

- WET3:

The middle portion of the channeled valley bottom has been severely impacted by *A. mearnsii*. The northern portion of the hillslope seep on the footslopes of the ‘koppie’ has been utilized extensively for grazing of cattle, while the south western portion of the hillslope seep, in the upper reaches of WET3, were observed as largely natural, with minimal disturbance noted and related to the movement of wild animals. Further to this, apart from the *A. mearnsii* observed in the channeled valley bottom HGM unit, there was very little sign of encroachment of alien and invasive species. Some isolated areas of gully formation were also observed.

The western portion of the hillslope seep associated with WET3 was categorized as *minimally modified* (ecological category B), and the eastern portion of the hillslope seep and the channeled valley bottom were both categorized as *moderately modified* (ecological category C).

- WET4:

The hillslope seep may be regarded as natural and no anthropogenic impacts were observed and may therefore be regarded as *unmodified* (ecological category A).

- WET5:

These HGM units, with the exception of the riparian zone situated further downslope and the lower portion of CVB3 (where severe encroachment of *A. mearnsii* was observed), may be regarded as natural as no anthropogenic impacts were observed. This is especially relevant for the bench wetlands and the hillslope seep zones. CVB1 and CVB2 may be regarded as modified to varying extents, with some alien and invasive encroachment (i.e. *A. mearnsii*) observed.

For WET5, the benches and the hillslope seeps were regarded as *unmodified* (ecological category A), while the unimpacted channeled valley bottom was categorized as *minimally modified* (ecological category B) and the impacted channeled valley bottom was categorized as *moderately modified* (ecological category C).

- WET6:

The portion of the hillslope seep falling within the 500 m zone of regulation may be regarded as natural, with very little alien and invasive encroachment (i.e. *A. mearnsii*) observed. The hillslope seep associated with WET6 may thus be regarded as *unmodified* (ecological category A), however, further downgradient, this wetland is affected by dense stands of *A. mearnsii* and the clearing of natural vegetation associated with croplands.

- WET7:

The upper portion of this hillslope seep may be regarded as largely natural. However, further downgradient, this wetland is affected by dense stands of *A. mearnsii*. The hillslope seep associated with WET7 was categorized as *minimally modified* (ecological category B).

- WET8:

The HGM units within this wetland range in integrity from pristine hillslope seep wetlands on the ridges, to more impacted channeled and unchanneled valley bottom wetlands in the lower lying valley. Large portions of wetland have been impacted by dense stands of *A. mearnsii*, resulting in losses to the natural biodiversity of the area, alterations to the soil characteristics, loss of carbon and water retention capacity and impacts to the natural water table. Other areas have been cleared for agricultural croplands, resulting in loss of biodiversity and soil roughness, as well as loss of the ability of the wetland to capture and trap sediments. Large areas are utilized for grazing of cattle, goats and sheep, reducing surface roughness, disturbing soils and increasing the potential for erosion. Isolated HGM units have been impounded, resulting in changes to the natural flow paths and fragmentation of the systems. Further to these impacts, a network of linear infrastructure, including roads, fences and a railway line, have resulted in some fragmentation of the wetland.

The benches and the unimpacted channeled valley bottoms draining the ‘koppie’ may be regarded as *unmodified* (ecological category A). The hillslope seeps and the unchanneled valley bottoms draining the ‘koppie’ may be regarded as *minimally modified* (ecological category B), while the impacted channeled valley bottom draining the ‘koppie’ may be regarded as *moderately modified* (ecological category C). The remaining HGM units associated with WET8 and dominating the southern portion of the study area were all categorized as *moderately modified* (ecological category C), with the exception of the unmodified hillslope seeps, which were categorized as *unmodified* (ecological category A), and the large channeled valley bottom traversing the site from the western boundary to the eastern boundary, and which as classified as *minimally modified* (ecological category B).

- WET9:

Large areas are utilized for grazing of cattle, goats and sheep, reducing surface roughness, disturbing soils and increasing the potential for erosion. Other areas have been cleared for agricultural croplands, resulting in loss of biodiversity and soil roughness, as well as loss of the ability of the wetland to capture and trap sediments.

All the HGM units associated with WET9, except for the unimpacted hillslope seep which was categorized as *minimally modified* (ecological category B), were categorized as *moderately modified* (ecological category C)

- WET10 and WET11:

These areas were largely undisturbed; however, some gully formation and erosion were observed.

The hillslope seep associated with WET10 was categorized as *minimally modified* (ecological category B), while the hillslope seep associated with WET11 was categorized as *moderately modified* (ecological category C). The channeled valley bottoms for both wetlands were categorized as *moderately modified* (ecological category C).

- WET12:

This area has been subjected to varying degrees of disturbance, with both soil disturbance as well as the proliferation of AIPs observed at this point.

The hillslope seeps and the small unchanneled valley bottom were categorized as *moderately modified* (ecological category C), while the larger unchanneled valley bottom was categorized as *largely modified* (ecological category D).

10.7.5 Wetland ecological service provision (WET-Ecoservices)

The ecological service provision of the various wetland systems and their associated HGM units were regarded as largely dependent on their respective locations in the landscape and the HGM unit type.

The large channeled valley bottom systems in WET2, WET8 and WET9 were found to perform notable services in terms of phosphate and nitrate assimilation due to the surrounding agropastoral activities. These HGM units were also found to play a large role in flood attenuation and streamflow regulation, as well as being important in the maintenance of biodiversity.

The benches associated with WET5 and WET8, were found important in the performance of services such as streamflow regulation, sediment trapping and erosion control. Biodiversity maintenance was regarded as very high.

Similarly, the unimpacted hillslope seepage HGM units played an important role in streamflow regulation and sediment trapping, with very high importance in terms of biodiversity maintenance.

Unimpacted valley bottoms were important in terms of streamflow regulation and erosion control, while impacted valley bottoms had deteriorated slightly in functionality in these respects.

The results of the WET-Ecoservices are represented graphically in Figure 10-17.

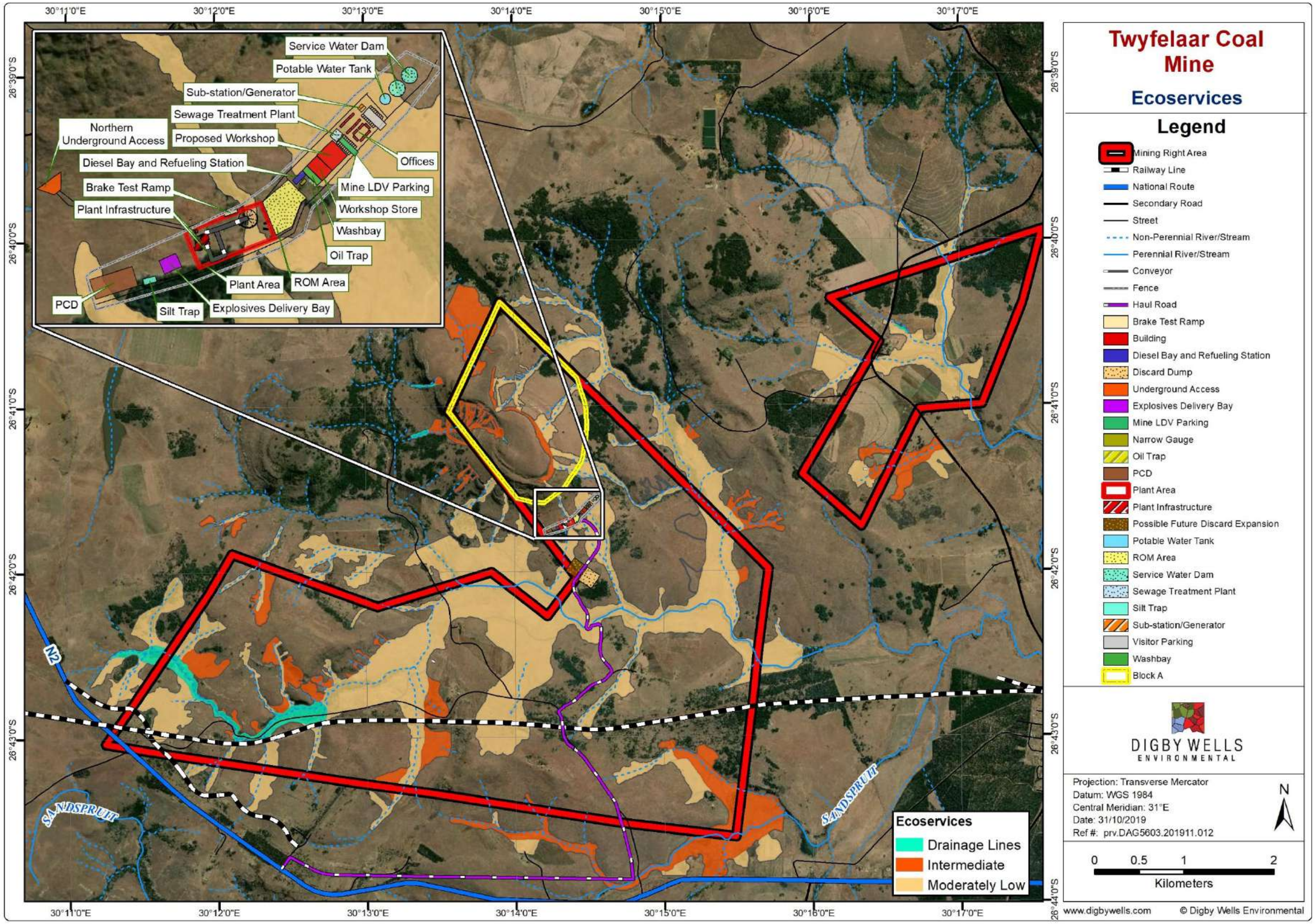


Figure 10-17: Wetland Ecoservices

10.7.6 Ecological Importance and Sensitivity

As with the ecological service provision, the Ecological Importance and Sensitivity (EIS) of the various wetland systems and their associated HGM units were regarded as largely dependent on their respective locations in the landscape and the HGM unit type. In addition to this, the level of resilience and the anthropogenic impacts affecting each HGM unit was also considered.

10.7.7 Summary of Results

Table 10-14 provides a summary of the findings pertaining to the wetlands delineated on site and their WET-Health, WET-Ecoservices and EIS ratings.

Table 10-14: Wetlands and their various HGM units within the proposed project area and within the 500 m zone of regulation

Wetland	HGM unit	WET-Health	WET-Ecoservices	EIS	Wetland	HGM unit	WET-Health	WET-Ecoservices	EIS
WET1	Unchanneled valley bottom 1-2	C (3.24)	Intermediate (1.3)	Moderate (1.5)	WET8	Benches 1-3	A (0.46)	Intermediate (1.4)	High (2.4)
	Hillslope seep 1	C (2.32)	Intermediate (1.3)	Moderate (2.0)		Hillslope seeps 1-2, 6-10	B (1.23)	Moderately low (1.2)	High (2.4)
	Hillslope seeps 2-3	C (2.97)	Moderately low (1.0)	Moderate (2.0)		Channeled valley bottoms 1,3,5,11-15	A (0.46)	Moderately low (1.0)	High (2.2)
WET2	Channeled valley bottom	D (5.30)	Moderately low (1.2)	Moderate (1.5)		Channeled valley bottom 2,4 (north-western portion),6,7,8,9,10	C (3.34)	Moderately low (0.9)	Moderate (1.5)
	Unchanneled valley bottom	C (2.99)	Moderately low (1.2)	Moderate (1.5)		Unchanneled valley bottom 1-3	B (1.01)	Moderately low (1.0)	High (2.2)
	Hillslope seeps 1-2,4	C (2.14)	Moderately low (1.2)	Moderate (2.0)		Channeled valley bottom 4 (southern portion)	A (1.94)	Intermediate (1.5)	Very high (3.3)
	Hillslope seeps 3,5-6	C (2.99)	Moderately low (0.9)	Moderate (2.0)		Hillslope seeps 15,20,21	C (3.81)	Moderately low (1.2)	Moderate (2.0)
	Riparian*	NA	NA	NA		Hillslope seeps 11-14,16-19, 22-40	A (0.91)	Intermediate (1.3)	High (2.4)
WET3	Hillslope seep (west)	B (1.67)	Intermediate (1.4)	High (2.4)		Unchanneled valley bottoms 4-14	C (3.81)	Moderately low (1.0)	Moderate (1.5)
	Hillslope seep (east)	C (2.26)	Intermediate (1.6)	Moderate (2.0)		Riparian*	NA	NA	NA
	Channeled valley bottom	C (2.53)	Intermediate (1.3)	Moderate (1.5)	WET9	Hillslope seeps 1,6-7	B (1.99)	Intermediate (1.3)	High (2.4)
WET4	Hillslope seep	A (0.46)	Intermediate (1.4)	High (2.4)		Hillslope seeps 2-5	C (3.03)	Moderately low (1.2)	Moderate (2.0)
	Riparian*	NA	NA	NA		Channeled valley bottoms 1-2	C (2.55)	Intermediate (1.5)	Moderate (1.5)
WET5	Hillslope seeps 1-8	A (0.40)	Intermediate (1.3)	High (2.4)		Unchanneled valley bottoms 1-3	C (3.86)	Moderately low (1)	Moderate (1.5)
	Benches 1-6	A (0.29)	Intermediate (1.5)	High (2.4)	WET10	Hillslope seeps 1-3	B (1.40)	Intermediate (1.3)	High (2.4)
	Channeled valley bottom 1	C (2.55)	Intermediate (1.3)	Moderate (1.5)		Channeled valley bottom	C (2.34)	Moderately low (1.1)	Moderate (1.5)
	Channeled valley bottom 2	B (1.14)	Intermediate (1.3)	High (2.2)	WET11	Hillslope seep	C (2.04)	Intermediate (1.3)	Moderate (2.0)
	Riparian*	NA	NA	NA		Channeled valley bottom	C (2.34)	Moderately low (1.1)	Moderate (1.5)
WET6	Hillslope seep	A (0.99)	Intermediate (1.4)	High (2.4)	WET12	Hillslope seeps 1-4	C (2.84)	Moderately low (1.1)	Moderate (2.0)
WET7	Hillslope seep	B (1.41)	Intermediate (1.4)	High (2.4)		Unchanneled valley bottom 1	C (3.88)	Moderately low (0.9)	Moderate (1.5)
						Unchanneled valley bottom 2	D (4.01)	Moderately low (0.9)	Moderate (1.5)

NA = Not applicable; *Refer to Aquatic Baseline Assessment (Digby Wells, 2019b)

The wetland assessment carried out in September 2019, revealed the presence of 12 wetland systems within the project area and its 500 m zone of regulation, with varied HGM units associated with each.

The HGM unit types observed within the project area included: bench, hillslope seep, channeled valley bottom and unchanneled valley bottom systems. These HGM units were categorized largely on topography and their respective locations within the landscape.

The health and integrity of each of the HGM units present varied considerably, with anthropogenic disturbances being the most significant driver of change to date. These disturbances were related largely to agropastoral activities and linear infrastructures traversing the project area.

The bench wetlands and the hillslope seep wetlands associated with the ‘koppie’ and other hillslopes situated on and directly below the ridges of most of the higher lying areas were found to be in pristine or near-pristine condition due to the reduced suitability of these areas (steep slopes and limited access) for agropastoral activities and other anthropogenic disturbances.

In the foothills and the valleys of the project area, the wetland systems were used extensively for crops and pastures, and impacts relating to these activities, such as the proliferation of alien and invasive species (with special mention of *A. mearnsii*) and an increased potential for erosion, were observed. Disturbance of soils, linear infrastructures (roads, fences, railways), and various small holdings throughout the project area and its associated zone of regulation, had resulted in additional impacts throughout the project area.

10.8 Aquatic Ecology

The Aquatic Ecology Assessment undertaken during the EIA Phase is appended to this report as Appendix G. A site visit was undertaken in August 2019. The Sandspruit is of focus for the Aquatic Study whereby preservation of this reach should be prioritised. There are two unclassified tributaries draining from the Mining Right into the Sandsprit which, for the purpose of the study, have been named as the Northern and Southern Tributary. These watercourses are discussed below.

10.8.1 Index for Habitat Integrity

The Index for Habitat Integrity (IHI) was completed on a desktop level for each aquatic ecosystem considered in the Study and populated with observations recorded during the field survey (Table 10-15). A more detailed discussion is appended in this report as Appendix G.

Table 10-15: Index for Habitat Integrity for the Northern Tributary

Assessed Reach	Habitat Component	IHI Score	Ecological Category
Northern Tributary	Instream	61.73	C
	Riparian	52.42 (14+9)*	D
Southern Tributary	Instream	64.76	C

Assessed Reach	Habitat Component	IHI Score	Ecological Category
	Riparian	62.17 (6+14)*	C
Sandspruit	Instream	78.76	C/B
	Riparian	77.40 (5+8)*	C/B
*Values in brackets represent the ratings for vegetation removal and alien invasive vegetation encroachment respectively used in the riparian ecological category surrogate during EcoClassification			

The findings from the IHI assessments conducted indicate that the habitat components ranged from largely modified / ecological category D to almost minimally modified conditions (i.e. ecological category B) within the Study Area. Findings for the habitat of each assessed aquatic ecosystem have been discussed separately below:

10.8.1.1 Northern Tributary

The instream habitat for the Northern Tributary has been classified as moderately modified/ ecological category C. The main modifications to the assessed reach are of agricultural origin. Water abstraction, flow modification and inundation as a result of the farming practices in the upper reaches of this system appear to be the major impacts pertaining to the above categorisation.

The riparian habitat was categorised as largely modified/ecological category D due largely to vegetation removal and inundation impacts associated with the reach. Farmlands have replaced and encroached on pre-existing habitat, resulting in a loss of riparian species.

10.8.1.2 Southern Tributary

The instream and riparian habitat assessed for the Southern Tributary were both categorised as moderately modified/ecological category C. Like the impacts associated with the Northern Tributary, it appears that agricultural influence in the catchment has contributed largely to these categorisations. Farm dams along the Southern Tributary have inundated various sections of the reach and have also altered the natural flow of the system.

The riparian habitat appears to be mainly modified by the encroachment of alien invasive plant species (i.e. *Acacia mearnsii*). This is further compounded by sections of the system which appear to have been modified by farm dams, resulting in the modifying of the riparian zone to typical wetland nature (i.e. unchanneled, inundated grasslands).

10.8.1.3 Sandspruit

The IHI findings for the Sandspruit were just below the categorisation score for ecological category B (i.e. indicating minimally modified conditions from natural state). According to the gathered desktop information, the Sandspruit is expected to be largely natural with “small” modifications to the instream and riparian habitat. However, the ratings allocated for both the instream and riparian components were sufficient to categorise them within the ecological category C score range (60-79).

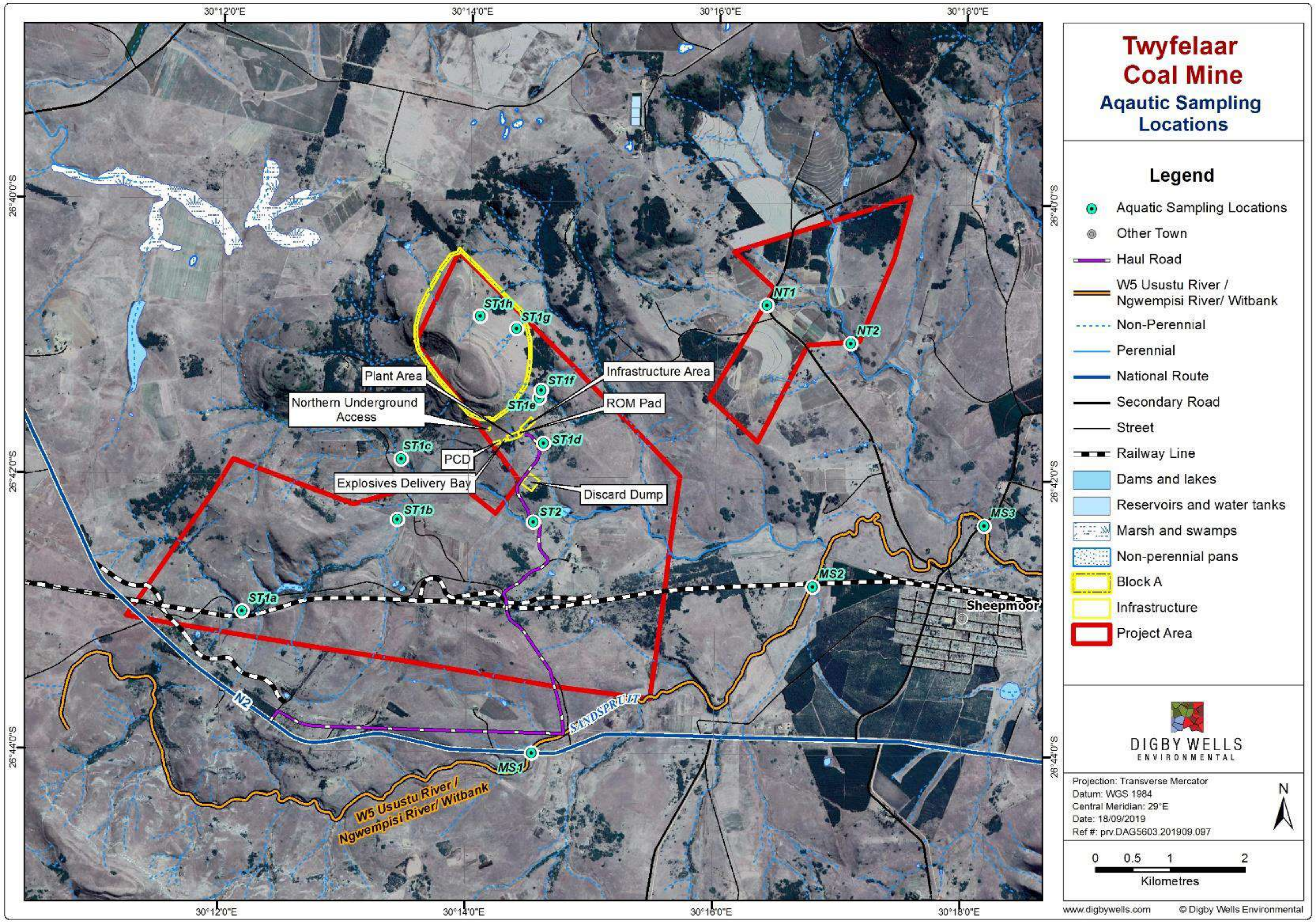


Figure 10-18: Aquatic Sampling Sites

10.8.2 Macroinvertebrate

Various macroinvertebrate related assessments were conducted at sites applicable for sampling (i.e. sufficient water level and habitat). This excludes the water quality monitoring sites (i.e. Site ST1d to ST1h). The findings from these assessments are discussed respectively in the following subsections.

10.8.2.1 Integrated Habitat Assessment System

The results of the Integrated Habitat Assessment System (IHAS) are presented in Table 10-16. These scores indicate the availability and suitability of the sampled macroinvertebrate habitat at each of the assessed monitoring sites and the findings thereof are discussed separately in detail following Table 10-16.

Table 10-16: IHAS findings for the Aquatic Study

Sampling Site	IHAS Score (%)	Interpretation
Northern Tributary		
NT1	43.6	Poor
NT2	43.6	Poor
Southern Tributary		
ST1a	69.1	Good
ST1b	32.7	Poor
ST1c	40.0	Poor
ST2	DRY	
Sandspruit		
MS1	DRY	
MS2	50.9	Poor
MS3	47.3	Poor
MS DWN	76.4	Excellent

The sampled habitat at the sites along the Sandspruit (i.e. Sites MS2 and MS3) were classified as Poor with the habitat at the furthest downstream site, Site MS DWN, classified as Excellent. The low water levels observed within the Sandspruit appears to be a main cause for these classifications. Site MS2 consisted of pooled water with limited flow and it was highly sedimented, most likely due to the road and train crossing at the site. Site MS3 was also observed to have limited flow during the survey and was dominated by a diverse range of gravel and stone biotopes. However, the water levels were so low at the site that the marginal vegetation was not reaching the water thus, not available for sampling. Site MS DWN consisted of a variety of all macroinvertebrate biotopes included in the South African Scoring System version 5 (SASS5) assessment (i.e. stones, vegetation and gravel, sand and mud/GSM). Considering solely the habitat at the sites within the Study Area, it is assumed that macroinvertebrate assemblages would be of highest diversity and sensitivity at this site due to the abundance and diversity of the biotopes available for colonisation.

10.8.2.2 South African Scoring System Version 5

The SASS5 scores recorded within the MRA, with the exception of Site ST1a, were generally low in comparison to the findings along the Sandspruit and especially in comparison to Site DWN along the Ngwempisi River. These scores provide an indication of the overall aquatic conditions (i.e. water quality and habitat availability) at the sites. Higher SASS5 scores indicate an overall more sensitive macroinvertebrate assemblage, requiring “cleaner” water and habitat of better quality and diversity for survival. The findings from the SASS5 assessments conducted during the Aquatic Study are presented in Table 10-17.

Table 10-17: SASS5 scores recorded during the Aquatic Study

Sampling Site	SASS5 Score	No. of Taxa*	ASPT**
Northern Tributary			
NT1	54	13	4.15
NT2	51	11	4.64
Southern Tributary			
ST1a	94	16	5.88
ST1b	49	10	4.90
ST1c	55	12	4.58
ST2	DRY		
Sandspruit			
MS1	DRY		
MS2	91	20	4.55
MS3	88	15	5.87
MS DWN	183	27	6.78
*Number of individual macroinvertebrate families sampled; **Average Score per Taxon			

The differences in SASS5 scores between the MRA sampling sites and the Sandspruit sites were to be expected to some extent as the macroinvertebrate habitat within the Sandspruit was more favourable, according to the IHAS scores, than most of the habitat within the Northern and Southern tributaries. Additionally, water quality was generally “worse” within the Southern Tributary sampling sites which will also influence the overall SASS5 scores. However, it is important to consider that the *in-situ* water quality findings at Site ST1a was of the poorest quality (i.e. highest pH and conductivity) in comparison to all assessed sites. Based on this, it appears that habitat availability and quality, especially within the MRA, is driving the macroinvertebrate assemblages in comparison to water quality. The Macroinvertebrate Response Assessment Index (MIRAI) section below provides further details regarding the drivers behind the macroinvertebrate assemblages.

10.8.2.3 Macroinvertebrate Response Assessment Index

It is preferred to apply the MIRAI on a reach-based level by incorporating macroinvertebrate findings at several sites which have similar aquatic conditions along the same watercourse. Looking at the gathered habitat and water quality data, it was decided that this approach takes place for the assessed Northern Tributary and Sandspruit. The lack of connectivity compounded by the differences in habitat along the Southern Tributary (i.e. upper riverine nature associated with Site ST1a compared to the wetland nature of the lower reach/Sites ST1b and ST2) do not suit a reach based MIRAI approach. Therefore, a site-based approach has been adopted for Site ST1a which talks to the macroinvertebrate ecological category for the upper reach of the Southern Tributary. A site-based MIRAI has also been applied at Site ST1c in attempt to determine the PES of the watercourse draining into the Southern Tributary. It must however be noted that Site ST1c consisted of low water levels and small pools for sampling, as discussed in the IHAS section (see Section 10.8.2.1). Therefore, the MIRAI findings are expected to be largely skewed as a result of the poor conditions.

The MIRAI findings for the various watercourses/sites considered in the Aquatic Study are outlined and discussed in the respective tables below:

Table 10-18: MIRAI findings for the Northern Tributary

Invertebrate Metric Group	Score Calculated
Flow modification	37.6
Habitat	44.0
Water Quality	45.8
Ecological Score	**42.4**
Invertebrate Ecological Category	**D**

The MIRAI findings for the Northern Tributary indicate that the macroinvertebrate assemblage within the assessed reach is in a largely modified state from reference/natural conditions for the tributary (i.e. ecological category D). It appears that modifications to flow are largely responsible for the determined score, resulting in a loss of flow dependent taxa from the reach. A large road has been constructed above the upstream sampling site as well as farm dams within the upper reaches of the Northern Tributary. These impacts appear to be severely altering the natural flow in the reach. Additionally, modifications to habitat and water quality also appear to be greatly driving the macroinvertebrate assemblage in the Northern Tributary. The low rainfall experienced prior to the survey should however be considered when interpreting these results as the findings may be negatively skewed as a result of the consequential poor aquatic conditions.

Therefore, habitat preservation within the MRA is key, although conservation of the water quality of the aquatic ecosystems should also be of priority in order to maintain the colonisation of sensitive taxa.

Table 10-19: MIRAI findings for Site ST1a

Invertebrate Metric Group	Score Calculated
Flow modification	45.8
Habitat	41.6
Water Quality	49.7
Ecological Score	**45.6**
Invertebrate Ecological Category	**D**

Before interpreting the MIRAI findings for Site ST1a, it should be noted that the determined scores were based solely on the presence or absence of macroinvertebrate families within the site. Not all families are expected to be frequent within the entirety of the reach. Therefore, the overall ecological category could be negatively skewed as “missed” taxa may be present within additional sites along the watercourse. None the less, the MIRAI scores for the relevant metric groups categorised the macroinvertebrate assemblage at Site ST1a as largely modified/ecological category D. The habitat metric scored the lowest for this assessment whereas the habitat score for the site was classified as Good according to the applied IHAS. Looking closer at the habitat metric, it appears that vegetation dependent taxa were mostly absent from this site where the Good IHAS classification was mainly due to the abundance of cobbles at the site. A sensitive vegetation dependent Odonata (i.e. dragonfly and damselfly) individual was sampled at the site.

The presence of this small individual sensitive taxa could indicate early signs of colonisation. It is expected that vegetation dependent taxa will diversify come an increase in rainfall and water levels.

Table 10-20: MIRAI findings for Site ST1c

Invertebrate Metric Group	Score Calculated
Flow modification	16.5
Habitat	28.9
Water Quality	27.8
Ecological Score	**24.4**
Invertebrate Ecological Category	**E**

Based solely on the presence/absence findings, the MIRAI scores indicate that the macroinvertebrate assemblage at Site ST1c is in a seriously modified state/ecological category E. This to some extent could be accurate based solely on the severe dry conditions of the site. However, interpretations of the metrics will not truly be accurate as the SASS5 assessment is not applicable at the shallow, pooled site. It is clear though, that the flow modifications metric, which is suspected to reflecting the complete lack of flow observed at the site, has largely driven the sampled macroinvertebrate assemblage. The Chlorolestidae family was also sampled at this site together with the moderately flow dependent Aeshnidae and Libellulidae Odonata larvae.

The presence of these taxa could also indicate the onset of early colonisation at the site which will only increase during the rainy season. Sampling later in the season is expected to observe better macroinvertebrate and overall aquatic health findings.

Table 10-21: MIRAI findings for the Sandspruit

Invertebrate Metric Group	Score Calculated
Flow modification	53.0
Habitat	56.2
Water Quality	57.0
Ecological Score	**55.4**
Invertebrate Ecological Category	**D**

The MIRAI findings for the Sandspruit indicate that the macroinvertebrates are in a largely modified state/ecological category D. The macroinvertebrates within the reach appear to be driven similarly by flow, habitat and water quality modifications according to the metric scores. Again, the dry conditions of the Study Area, especially in the upper reaches of the Sandspruit (i.e. dry Site MS1), are most likely negatively influencing the above findings. Improved water levels in the Sandspruit should support the colonisation of additional macroinvertebrate taxa which is expected to improve the above score to at least an ecological category C (i.e. >59).

10.8.3 Ichthyofaunal Assessment

Fish sampling took place at all sites with sufficient water level for the application of electroshocking techniques. This includes site ST1a, the Northern Tributary sites, the Sandspruit sites and Site MS DWN. Table 10-22 below presents the fish species collected during the survey.

Table 10-22: Sampled fish species within the Study Area

Fish Species	Conservation Status	Sampling Site	Abundance
Anguilla mossambica	LC	Not sampled	
Amphilius uranoscopus	LC	MS DWN	1
Chiloglanis anoterus	LC	MS DWN	1
Chiloglanis emarginatus	V	MS DWN	5
Clarias gariepinus	LC	MS DWN	1

Fish Species	Conservation Status	Sampling Site	Abundance
Enteromius anoplus	LC	MS2	11
		MS3	7
		MS DWN	8
		NT1	5
Enteromius crocodilensis	LC	Not sampled	
Enteromius paludinosus	LC	MS DWN	11
Labeobarbus maraquensis	LC	MS DWN	4
Labeobarbus polylepis	LC	MS DWN	7
Pseudocrenilabrus philander	LC	MS DWN	23
Tilapia sparmanii	NA	MS2	3
		MS DWN	18
LC=Least Concern; NT=Near Threatened; V=Vulnerable; NA=Not Assessed			

A total of 13 fish species were sampled during the survey, although almost all of them were sampled at the furthest downstream site from the MRA (i.e. Site MS DWN). Sampling number reflect a dry season survey as water levels were low.

No sensitive fish species or species of conservation importance were sampled within the MRA or associated Sandspruit sites. However, all the expected sensitive catfish species were sampled at Site MS DWN. This includes the Vulnerable species *Chiloglanis emarginatus* (Roux and Hoffman, 2018), *Chiloglanis anoterus* and *Amphilius uranoscopus*. These species of catfish are highly sensitive to lack of flow/flow modifications as well as water quality deterioration/modifications (DWS, 2014).

It is important to note that these species were sampled in very low abundances at the site, only occupying a small gravel bed with limited flow at the site, approximately 4 m in length. It appears that these fish are holding out in the larger sections of the Sandspruit, awaiting the rainy season and consequential increase in water levels before moving into the upper reaches. Therefore, it should be of utmost importance to preserve the quality and quantity of water entering the Sandspruit from the MRA.

It is possible that a third/undescribed species is present at the site as three of the specimens were more representative of *C. emarginatus* from a lateral view, although they keyed out to *C. anoterus* except for the elongate barbels (Skelton, 2001). For this study they have been referred to as *Chiloglanis* cf. *emarginatus*, needing confirmation.

10.8.4 Fish Response Assessment Index

The FRAI findings only incorporate the sampled fish from Sites MS2 and MS3 which informs the status of the ecological integrity of the upper Sandspruit reach and not the entire SQR. The frequency of occurrence of each species has been lowered to account for the poor conditions experienced during the survey within the dry season. According to the FRAI results, the fish assemblage with the upper reaches of the Sandspruit is in a seriously modified state/ecological category E. An assessment during the wet season of the Study Area will be required to truly determine the ichthyofaunal integrity of the upper Sandspruit.

10.8.5 Present Ecological Status

The findings of the EcoClassification for the three assessed watercourses are presented in the Table 10-23 and Table 10-24 below and discussed respectively.

Table 10-23: The PES of the Northern Tributary

Ecological Category	Score	Ecological category
Riparian Habitat	54.0	D
Macroinvertebrate assemblage	42.4	D
Ecostatus	**48.2**	**D**

According to the EcoClassification results, the assessed Northern Tributary reach appears to be in a largely modified state/ecological category D. Equal confidence was allocated to both the determined riparian and macroinvertebrate categories for the tributary. Therefore, both components are contributing proportionally to overall PES for the Northern Tributary.

Table 10-24: The PES of the Southern Tributary

Ecological Category	Score	Ecological category
Riparian Habitat	60.0	C
Macroinvertebrate assemblage	45.6	D
Ecostatus	**56.4**	**D**

According to the EcoClassification results for the assessed Southern Tributary, the reach also appears to be in a largely modified state/ecological category D. It is important to note that the macroinvertebrate ecological category sued in this assessment comes solely from the findings for Site ST1a. Therefore, a lower proportion and confidence was allocated to the macroinvertebrate score during the EcoClassification determination process.

Table 10-25: The Present Ecological Status of the Sandspruit

Ecological Category	Score	Ecological category
Riparian Habitat	74.0	C
Macroinvertebrate assemblage	55.4	D
Fish assemblage	38.7	E
Ecostatus	**62.62**	**C**

Lastly, the EcoClassification results for the upper Sandspruit indicate that the ecosystem is in a moderately modified state/ecological category C. It is important that equal proportions and confidence ratings were allocated to both the riparian and macroinvertebrate Ecological Categories in the Classification determination tool. However, the confidence and proportional contribution of the fish findings were reduced as it is felt that conditions were not favourable for fish assessments within the upper reach and during the dry period. Nonetheless, the sampled fish assemblage still provides some indication to the ecological health of the reach.

10.9 Hydrology (Surface Water)

A Surface Water Assessment was undertaken during the EIA Phase, a detailed surface water report is appended in this report as Appendix H, a site visit was conducted in August 2019 to collect water samples on the streams within and around the project area.

10.9.1 Water Quality

A baseline water quality for streams within and around the proposed Twyfelaar Coal Mine was assessed and interpreted to provide baseline conditions prior to commencement of mining activities. Five samples were collected on the Sandspruit and other unnamed streams around the Project Area, sampling points which could not be sampled due to access issues or were dry at the moment, would be included on the proposed monitoring program for the mine to continue monitoring.

The samples were submitted to Waterlab Laboratory (Pty) Ltd, a SANAS accredited laboratory, in Pretoria for analyses of physical and chemical water quality parameters. The results of the surface water quality analysis are presented in the report appended as Appendix H.

The predominant water use around the project area is agriculture (irrigation) and for that reason the results were benchmarked against the South African Water Quality Guidelines for Agricultural Use: Irrigation (DWAF, 1996).

The location and description of the monitoring localities for the proposed Twyfelaar Coal Mine site are presented in Figure 10-19.

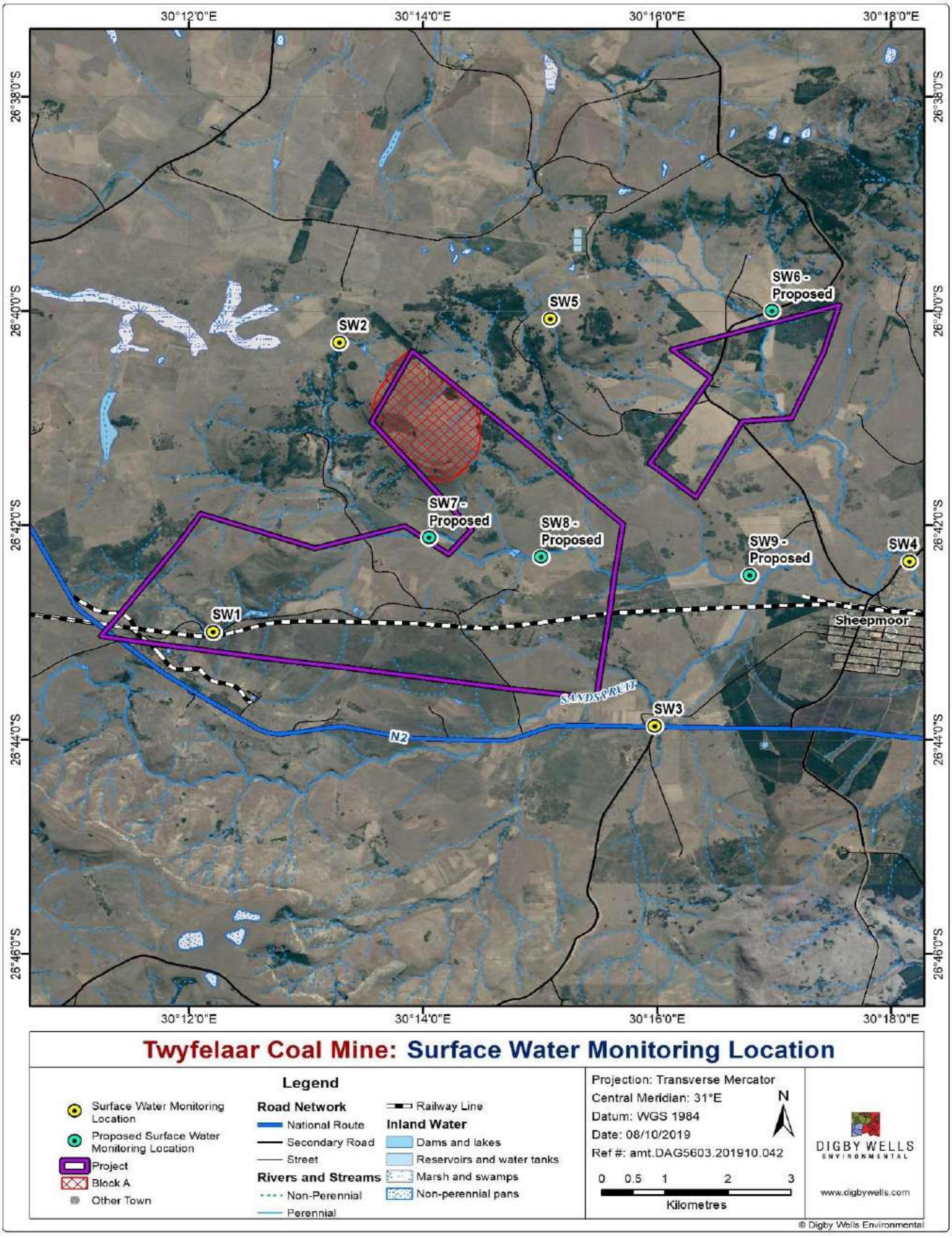


Figure 10-19: Surface Water Sampling Localities

Table 10-26: Surface water quality for streams within and around the proposed Twyfelaar Coal Mine

Parameter	SW1	SW2	SW3	SW4	SW5	DWS Domestic Use	DWS Aquatic Ecosystem	DWS Livestock Watering	DWS Irrigation
	(mg/L, unless otherwise stated)								
pH, at 25˚C *(pH meter units)*	8.6	7.2	7.7	7.8	7.6	6 - 9	NS	NS	6.5 - 8.4
Electrical Conductivity, *(mS/m)*	43.1	9.1	16	18.6	18.9	<70	NS	NS	NS or <40
Total Dissolved solids (TDS)	274	46	98	108	118	<450	NS	<1000	NS
Aluminium	< 0.100	< 0.100	< 0.10	< 0.100	< 0.100	<0.15	<0.01	<5	<5
Ammonia	Na	Na	Na	Na	Na	NS	NS	NS	NS
Arsenic	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	≤200	0.01	≤1	0.1
Barium	0.035	0.011	0.048	0.046	0.238	NS	NS	NS	NS
Beryllium	< 0.010	< 0.010	< 0.01	< 0.010	< 0.010	NS	NS	NS	0.10
Bismuth	< 0.010	< 0.010	< 0.01	< 0.010	< 0.010	NS	NS	NS	NS
Boron	0.087	0.065	< 0.01	< 0.010	< 0.010	NS	NS	<5	<0.5
Cadmium	< 0.010	< 0.010	< 0.01	< 0.010	< 0.010	<0.005	<0.00015	<0.01	<0.01
Calcium	22	10	14	13	13	<32	NS	<1000	NS
Cerium	< 0.010	< 0.010	< 0.01	< 0.010	< 0.010	NS	NS	<5	NS
Caesium	< 0.010	< 0.010	< 0.01	< 0.010	< 0.010	NS	NS	<5	NS
Chloride	10	7	5	9	8	<100	NS	<1500	<100
Chromium	< 0.010	< 0.010	< 0.01	< 0.010	< 0.010	<0.05	0.007	<1	<0.1
Cobalt	< 0.010	< 0.010	< 0.01	< 0.010	< 0.010	NS	NS	<1	<0.05
Copper	< 0.010	0.020	< 0.010	< 0.010	< 0.010	<1	<0.0003	<0.5	<0.2
Fluoride	0.6	<0.2	<0.2	<0.2	<0.2	<1	<0.75	<2	<2
Iron	0.045	0.029	0.408	0.293	1.21	<0.1	NS	<10	<5
Lead	< 0.010	0.020	< 0.01	< 0.010	< 0.010	<0.01	<0.0002	<0.1	<0.2
Lithium	< 0.010	0.020	< 0.01	< 0.010	< 0.010	NS	NS	NS	NS
Magnesium	5	2	8	9	11	<30	NS	<500	NS
Manganese	< 0.025	< 0.025	< 0.025	< 0.025	< 0.025	<0.05	<0.18	<10	<0.02

Parameter	SW1	SW2	SW3	SW4	SW5	DWS Domestic Use	DWS Aquatic Ecosystem	DWS Livestock Watering	DWS Irrigation
	(mg/L, unless otherwise stated)								
Mercury	< 0.010	< 0.010	< 0.01	< 0.010	< 0.010	<1	0.04	<1	NS
Molybdenum	< 0.010	0.020	< 0.01	< 0.010	< 0.010	NS	0.04	0.01	0.01
Nickel	Na	Na	Na	Na	Na	NS	NS	<1	<0.2
Nitrate	0.5	0.1	0.1	0.1	1.5	≤6	NS	<200	100
Total Phosphate, as P	0.330	0.013	0.011	< 0.010	< 0.010	NS	NS	NS	NS
Potassium	2.6	3.1	2.4	2.5	3.9	<50	NS	NS	NS
Selenium	< 0.010	0.020	< 0.01	< 0.010	< 0.010	<0.02	<0.002	<0.05	<0.02
Silicon	12.7	0.4	8.5	5.7	6.7	NS	NS	NS	NS
Silver	< 0.010	< 0.010	< 0.01	< 0.010	< 0.010	NS	NS	NS	NS
Sodium	66	3	7	9	6	<100	NS	<2000	<70
Strontium	0.137	0.021	0.045	0.056	0.074	NS	NS	NS	NS
Sulphate	48	4	<2	5	2	<200	NS	<1000	NS
Suspended Solids at 105º	2.7	16	11.3	2.7	5.3	NS	NS	NS	<50
Tin	< 0.010	0.020	< 0.01	< 0.010	< 0.010	NS	NS	NS	NS
Titanium	0.018	< 0.010	< 0.01	< 0.010	< 0.010	NS	NS	NS	NS
Uranium *(in Bq)*	< 0.010	0.020	< 0.01	< 0.010	< 0.010	0.070 - 0.284	NS	NS	0.01
Vanadium	< 0.010	0.020	< 0.01	< 0.010	< 0.010	<0.1	NS	<1	<0.1
Zinc	< 0.010	0.064	< 0.01	< 0.010	0.010	<3	<0.002	<20	<1

KEY:

Exceeds least stringent standard or only available standard	
Exceeds most stringent standard	
No Standard	NS
Not Analysed	Na

10.9.2 Floodlines Determination

The 1:50-year and 1:100-year floodlines for the streams and its tributaries were modelled and mapped. From the results, all the proposed infrastructure (excluding acces roads, powerlines and water pipelines) is outside of the delineated 1:50-year and 1:100-year floodlines, and outside the horizontal distance of 100 metres as required by GN R 704 of on the NWA. The general overview of the floodlines can be seen in Figure 10-20.

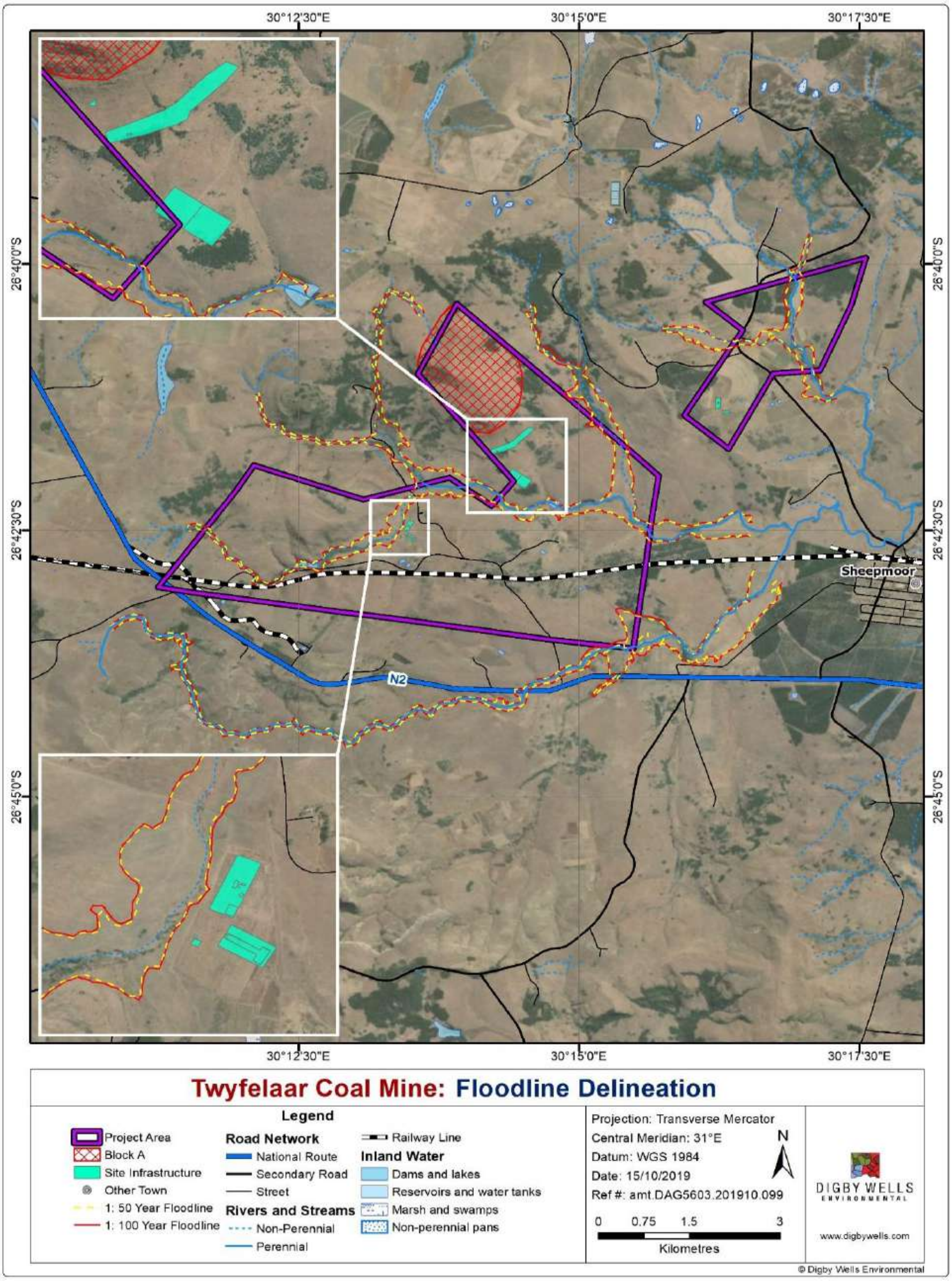


Figure 10-20: 1:50-year and 1:100-year Floodlines

10.10 Groundwater

The Groundwater Assessment undertaken during the EIA Phase is appended to this report as Appendix I. The following methodologies were utilised during the undertaking of the study:

- Geophysics was carried out to identify any anomalies or structures at the study site that could indicate aquifers and/or preferential groundwater flow paths. Based on the geophysics results, drill targets were generated to drill aquifer test boreholes. The two geophysical method used were the electromagnetic (carried out by EM34) and magnetic (carried out by Geotron G5) surveys. A total of six survey lines of between and 1.6 km in length were carried out on site based on the preliminary site layout to site aquifer test boreholes.
- Borehole Drilling: seven aquifer test/ monitoring boreholes were drilled in the pit areas to allow aquifer parameter estimation. The boreholes were drilled in to the Karro lithologies to allow testing of these hydrostratigraphic units, from which most of the groundwater inflow is expected. The boreholes drilled were at 165 mm (6.5”) and installed with plain/slotted casing at 114 mm (4.5”).
- Aquifer Testing: Six boreholes were aquifer tested using submersible pumps. The testing was carried out by Hallcore Water/VBS Leboa Consulting (Pty) Ltd. Digby Wells carried out aquifer test supervision and interpreted the test data to derive aquifer parameters.
- Numerical Modelling: The numerical model for the project area was constructed using MODFLOW and MT3DMS. MODFLOW and MT3DMS use 3D finite difference discretization and flow codes to solve the governing equations. MT3DMS will be used in updating the existing model in conjunction with MODFLOW in a phased flow and transport simulation approach.

Further detail pertaining to the methodology utilised is provided in the Groundwater Assessment report as Appendix I.

10.10.1 Aquifer Description

The conceptual hydrogeological model of the Project Area is based on the generally accepted model for the Ermelo coal fields. In this model, three principal aquifers are identified: the weathered aquifer; the fractured Karoo aquifer; and the fractured pre-Karoo aquifer (Hodgson & Krantz, 1998).

The Karoo rocks are not known for large scale development of aquifers but can occasionally produce high-yielding boreholes. The aquifers that occur in the area can therefore be classified as minor aquifers (low yielding), but of high importance (Parsons, 1995) and are understood to have a low- to medium development potential, mostly used for small-scale domestic purposes or occasionally for large-scale irrigation.

Three distinct superimposed groundwater systems are present at the Project Area and surroundings and can be classified as (Hodgson and Krantz, 1998, Woodford and Chevallier, 2002):

- The upper weathered Ecca aquifer (shallow, intergranular type aquifer formed in the weathered zone of the Karoo sediments; can locally form a perched aquifer on top of fresh bedrock);
- The fractured aquifers within the unweathered, fractured Ecca sediments; and
- The aquifer below the Ecca sediments (deeper aquifer formed by fracturing of older Karoo sediments and dolerite intrusions).

These types of groundwater systems are common to the groundwater regime in the Karoo environment. The systems do not necessarily occur in isolation and often form a composite groundwater regime that is comprised of one, some, or all of the systems.

In the Project Area the main aquifer types are the upper weathered and the deeper, fractured aquifers formed in the sedimentary rocks of the Vryheid Formation. Furthermore, numerous dolerite sills have intruded into the sediments of the Vryheid Formation and are in some cases overlying this formation, as is the case in the area where Block A is situated. As these sills are more resistant to weathering, they form hills and ridges in the landscape.

In general, the shallow aquifer depth ranges between 5-20 m overlying the fractured rock formations throughout the region. In terms of pollution risk and/ or susceptibility to pollution, the shallow primary aquifer is understood to be highly susceptible to pollution due to coal mining in the area as the pollutants travel shorter distance to reach the aquifer system (Hodgson and Krantz, 1998).

10.10.2 Groundwater Usage

Please refer to a summary of locations identified during the hydrocensus in

Table 10-27 and Figure 10-21. The following conclusions were drawn from the hydrocensus:

The main source of drinking water supply in and around the proposed mining area on the farm Twyfelaar is community hand pumps supplemented by a number of springs which are mainly used for domestic use and livestock watering (

- Table 10-27). It has been determined (after the initial hydrocensus) that additional boreholes are located on privately held farms in the surrounding area. These boreholes will be identified and included in future monitoring activities;
- The pH values (Field parameters) measured during the survey varied from 5.9 at Zwartwater spring (ZW-Spring) to 9.8 at BABH1 with an average pH of 7.2. A pH between 5.9 and 9.8 is indicative of a slightly acidic to alkaline waters. Conductivity values varied from 44.1 µS/m at ZW-Spring to 1 219 µS/m at BABH1 and thus,

indicative of moderate low to slightly high conductivity (saline water) values (Table 10-28);

- Groundwater level elevations were measured at three boreholes only;
- Table 10-29 as most of the boreholes were equipped with hand pumps. Based on the three measurements depth-to-groundwater ranges between 11 and 19 mbgl (average of 14 mbgl), with groundwater level elevations ranging between 1 662.6 metres below mean sea level (mamsl) at WBH1 and 1 591.2 mamsl at EBH1;
- The groundwater level elevations indicate a general west-northwest to southeast groundwater gradient for the site. This seems to suggest that groundwater flow directions follow general topography and drainage directions; and
-

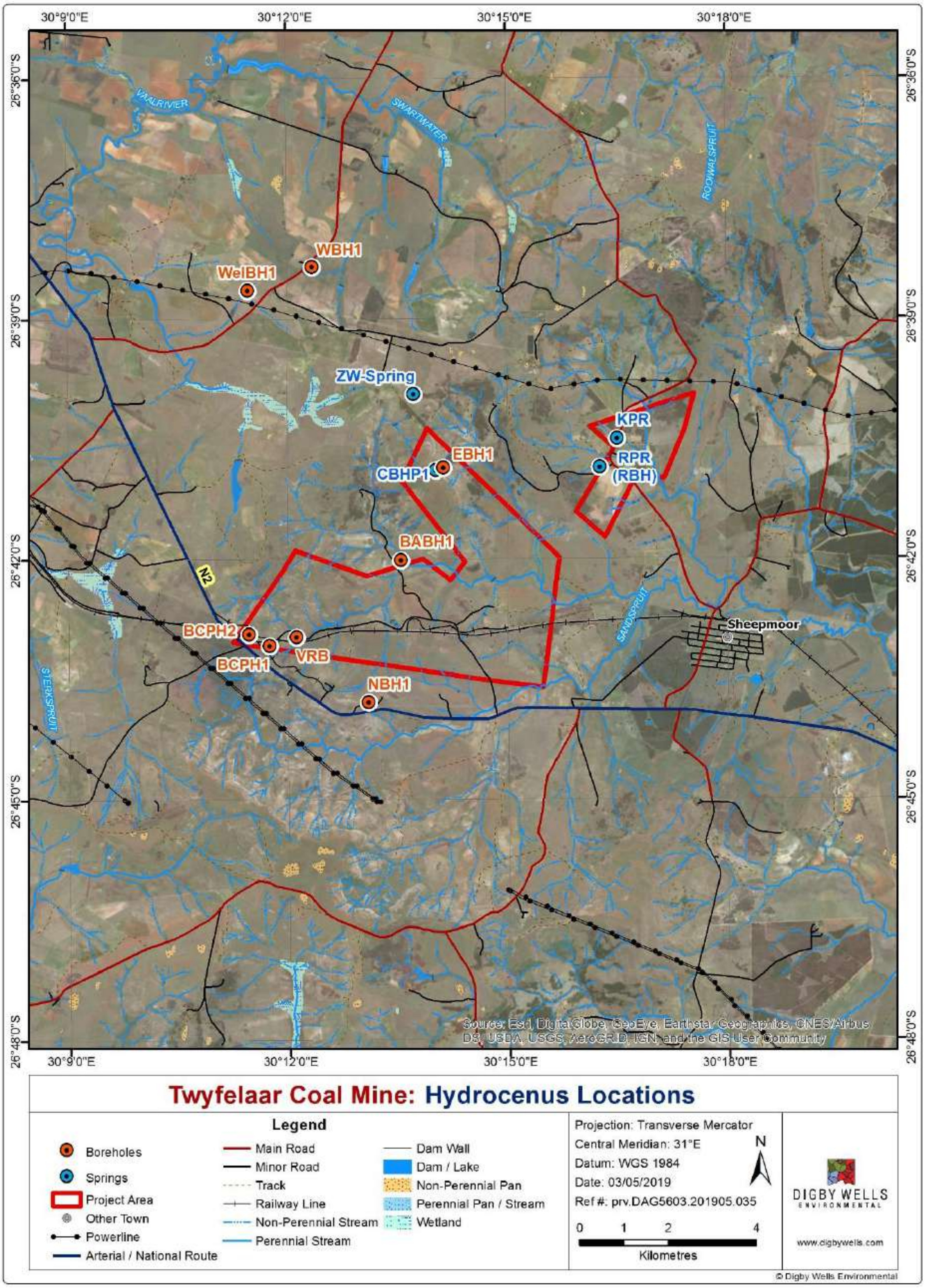


Figure 10-21: Hydrocensus Map

Table 10-27: Identified boreholes, spring and dug wells during the hydrocensus

Name	X	Y	Status	Comment
BABH1	30.225787	-26.70028	Sampled	Artesian well on Portion 1 of Blymoedig 301IT. The borehole was drilled as part of exploration. According to the residents the water has a salty taste, however it's still being used for domestic purposes
BCPH1	30.195737	-26.718042	Sampled	Water supply borehole at Bambanani CPA (communal farm). The borehole has a hand pump installed. According to the residents is that the water level is deep as they have pump for longer periods before water comes out of the borehole
BCPH2	30.191087	-26.715635	Sampled	Not functioning water supply borehole. The windmill is broken and prior being broken the borehole ran dry after Transnet drilled their water supply borehole a couple of meters from the borehole
CBP1	30.233784	-26.681652	Sampled	Spring from the proposed mining area (Phakamani, Twyfelaar)
EBH1	30.235469	-26.681075	Sampled	Exploration borehole at Twyfelaar. The water is slightly brown
KPR	30.275106	-26.675079	Sampled	A drinking water supply spring at Nick Vorster and Seuns farm
NBH1	30.218195	-26.729878	Sampled	Water supply borehole at Nhlapho`s farm. The borehole has a hand pump installed
RPR (RBH)	30.271108	-26.681063	Sampled	A Spring used for domestic uses
VRB	30.201895	-26.716252	Sampled	River entering the project area
WelBH 1	30.191154	-26.644074	Sampled	A wind pump at Weltevreden farm. The pump water into the nearby dam
WBH1	30.205812	-26.639166	Sampled	Livestock and possible irrigation (gardening) borehole at Weltevreden farm. The borehole has a pump installed
ZW-Spring	30.228773	-26.665794	Sampled	A Spring used for domestic and livestock watering purposes at on Portion 4 of Twyfelaar 298IT.

Table 10-28: Field Parameters

Sample ID	pH	EC µS/m	TDS mg/l	Temperature ◦C
BABH1	9.81	1219	851	21
BCBH1	6.89	176.5	121.3	21.2
BCBH2	6.34	164.2	111.9	24.3
CBP1	9.5	176.4	122.7	27
EBH1	7.05	268	184	25
KPR	6.21	841	585	21.4
NBH1	6.84	283	189	21.9
RBH (RPR))	6.6	871	608	20.3
WelBH1	6.84	254	175	19.6
WBH1	7.26	169.3	116.9	20.5
ZW-Spring	5.93	44.1	32.9	20.8

10.10.3 Groundwater Levels

Groundwater level measurements were taken at three Hydrocensus boreholes, six monitoring boreholes and one spring. The groundwater level ranged between 2.6 metre below ground level (mbgl) at BH7 and 28.6 mbgl at BH1 (Table 10-29).

This indicates that in general groundwater levels are relatively shallow, mostly less than ~20 mbgl near the site and mainly located within the shallow weathered aquifer. Groundwater levels were compared to surface elevations and a good correlation between surface elevation and groundwater level was found with a correlation coefficient of 0.98, indicating groundwater flow directions will mainly follow topography and the main surface water drainage directions (Figure 10-22). For the project site this indicates the main groundwater flow direction will be to the southeast towards the Nkomati River.

Table 10-29: Groundwater level elevation

Name	Elevation (mamsl)	Water level depth (mbgl)	Water level elevation (mamsl)
BCPH2	1661.8	10.6	1651.2
EBH1	1611.0	11.7	1599.2
WBH1	1691.3	19.4	1671.9
DAGBH01	1568.7	20.1	1548.5
DAGBH02	1595.2	13.1	1582.0
DAGBH03	1559.6	21	1538.6

Name	Elevation (mamsl)	Water level depth (mbgl)	Water level elevation (mamsl)
DAGBH05	1506.9	3.5	1503.4
DAGBH06	1524.5	19.4	1505.1
DAGBH07	1501.5	2.6	1498.9
ZW-Spring	1721.6	-	1721.6

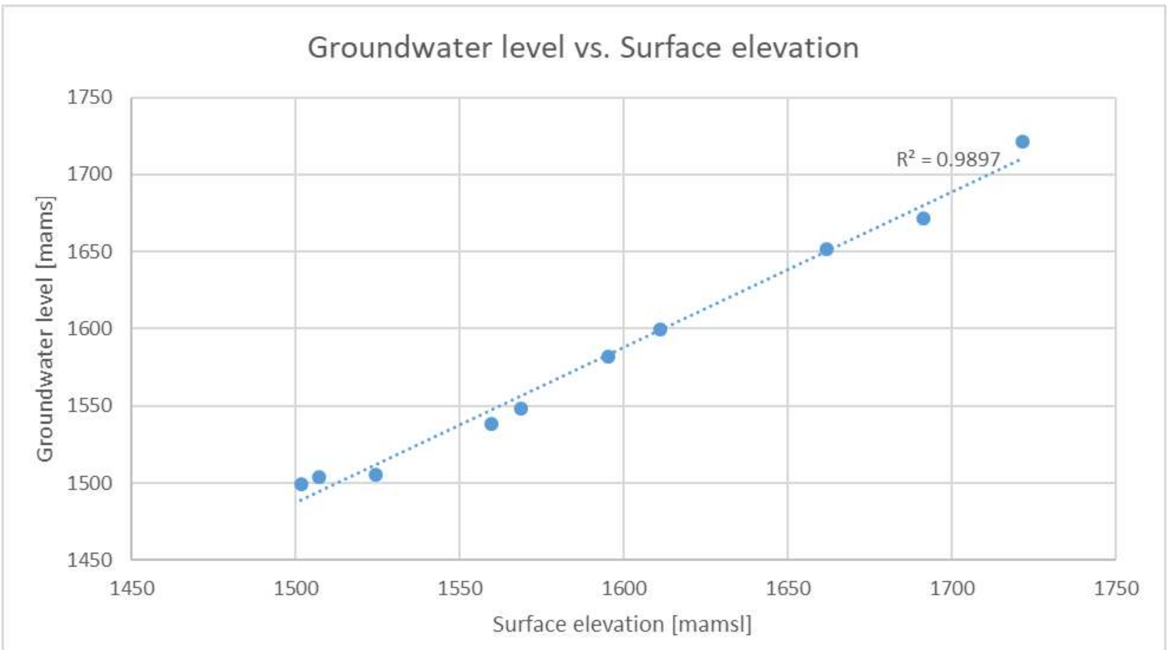


Figure 10-22: Bayesian correlation between surface elevation and groundwater level

10.10.4 Groundwater Quality

The water quality results for the tested Hydrocensus sites and the monitoring boreholes are shown in Table 10-30. These results are the basis for the baseline water quality data for the groundwater assessment. A total of four Hydrocensus samples (BABH1, CBP1, EBH1, and ZW-Spring) were sent for lab analysis in March 2019 and another six (6) monitoring borehole samples were sent in August 2019. Based on the water quality results the following summary can be made for the baseline water quality:

- The groundwater types found were a mixture of mainly calcium bicarbonate (Ca-HCO_3), magnesium bicarbonate (Mg-HCO_3), sodium bicarbonate (Na-HCO_3) with one sample showing a magnesium sulphate (Mg-SO_4) type groundwater. These water types are typical for the Vryheid Formation. Bicarbonate being the dominant cation could indicate general flowing as opposed to stagnant groundwater;
- The Ca-HCO_3 and Mg-HCO_3-type waters are indicative of recently recharged groundwater with low residence time, mostly representative for the shallow weathered aquifer. Spring CPB1 and exploration borehole EBH1 are near each other and show a

similar, Ca-Mg-HCO_3-type groundwater, as do monitoring boreholes DAGBH05, DAGBH06 and DAGBH07;

- The Na-HCO_3 type water is likely to be related to the deeper, fractured aquifer though which water flow is more restricted to fracture zones and flows at a slower rate though the rock matrix where ion exchange through water-rock interaction is allowed to take place. The sample taken from artesian borehole BABH1 showed a very strong Na-HCO_3 characteristic, of which residents noted the water was salty in taste. The sample from ZW-Spring also has a Na-HCO_3 signature, as do monitoring boreholes DAGBH01, DAGBH02 and DAGBH03;
- The dominant sulphate cation in DAGBH08 is likely related to the coal seams or carbonaceous shale layers that are present in the Vryheid Formation by solution of pyrite;
- The 10 water samples taken showed the groundwater in the area to be of good quality. Parameters exceeding the limits as per the South African National Standards (SANS) for drinking water and World Health Organisation (WHO) guidelines was mainly aluminium (Al) in three boreholes and a high pH in one borehole. Aluminium forms part of clay minerals and the elevated concentrations could be derived from interaction of water with shale lithologies; and
- Selected metals were also analysed for but were all found to be in concentrations below their respective detection limits.

Table 10-30: Baseline groundwater quality analysis

Site Name	Date Measured	pH	TDS mg/l	Ca mg/l	Mg mg/l	Na mg/l	K mg/l	Cl mg/l	SO_4 mg/l	F mg/l	Al mg/l	Fe mg/l	Mn mg/l
WHO Drinking Standards		6.5-9	600	300	NS	200	NS	250	250	1.5	0.1	0.3	0.4
SANS 241-1:2015		5-9.5	2400	NS	NS	200	NS	300	500	1.5	0.2	2	0.4
BABH1	2019/03/25	9.70	386	0.77	1.00	89.17	0.67	8.00	2.00			1.20	
CBP1	2019/03/25	8.80	108	10.80	4.89	9.37	0.91	<2.00	13.00			0.20	
EBH1	2019/03/25	7.10	208	31.15	8.38	15.96	2.92	<2.00	2.00			0.30	
ZW-Spring	2019/03/25	6.00	28	0.57	1.00	1.80	1.21	<2.00	2.00			<0.20	
DAGBH1	2019/08/29	7.70	224	4.40	0.81	62.00	2.77	<2.00	<4.00	0.20	0.43	0.54	0.02
DAGBH2	2019/08/29	6.80	240	13.30	2.54	50.00	2.40	<2.00	<4.00	0.50	1.03	0.57	0.15
DAGBH3	2019/08/29	7.60	284	11.70	1.96	57.00	4.44	2.03	<4.00	0.30	0.25	0.06	0.03
DAGBH5	2019/08/29	6.60	40	2.50	1.23	2.15	2.78	<2.00	<4.00	<0.10	0.29	0.05	0.03
DAGBH6	2019/08/29	6.90	348	33.90	21.00	14.34	5.62	6.50	119	0.20	<0.02	0.01	0.15
DAGBH7	2019/08/29	7.50	288	37.60	12.89	42.00	2.41	2.84	0.20	0.50	0.03	0.00	0.23

10.11 Geochemistry

The waste classification conducted on the coal and waste material is a geochemical classification done in accordance with the National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008) (NEM: WA) and no physical material or engineering characterisation was undertaken.

A total of six waste rock (discard) and two coal samples from exploration boreholes were available for testing with each sample weighing approximately 1 kg.

Table 10-31: Sample Description

No.	Laboratory ID	Reporting ID	Origin/Description	Exploration Boreholes
1	L5001	DSD1	Roof Sample of TW009	TW009
2	L5002	DSD2	Floor sample of TW009	TW009
3	L5003	DSD3	Roof Sample of TW002	TW002
4	L5004	DSD4	Floor sample of TW002	TW002
5	L5005	DSD5	Roof Sample of TW006	TW006
6	L5006	DSD6	Floor sample of TW006	TW006
7	1256419/ 1256936	DSC1	Coal Sample	
8	T7	DSC2	Coal Sample	DAGBH07

For acid generating potential and waste classification purposes the provided samples were submitted for the following laboratory test work:

- X-ray Diffraction (XRD) and X-Ray Fluorescence (XRF);
- Acid Base Accounting (ABA), Net Acid Generation (NAG) and sulphur speciation tests;
- *Aqua regia* digestion to determine total concentrations; and
- Distilled (reagent) water leachate tests to determine the leachable concentrations.

The Project Area and surrounds is predominantly underlain by Formations of the Karoo Supergroup with dominant lithologies present in the area being coal-bearing sandstone, mudstone, siltstone, carbonaceous shale and coal seams of the Vryheid Formation with dolerite dyke and sill type intrusions of the Karoo Dolerite Suite. The mineralogy of samples collected indicated there were coal materials demonstrated by amorphous minerals and there was also presence of sedimentary rocks from the waste rock material indicated by clay minerals. Apart from coal sample DSC1, no acid generating minerals detected in the remaining samples.

The Acid Potential (AP) and Neutralising Potential (NP) of a sample is linked to the mineralogy and the reactions formed under aerobic conditions. When these parameters are used to calculate the

Net Neutralising Potential (NNP = NP – AP) and Neutralising Potential Ration (NPR = NP/AP) an indication of the non-acid mine drainage potential can be reached. All waste rock material and coal sample DSC1 are potentially acid generating with negative while DSC2 is non-acid forming.

The coal and waste materials situated in the boreholes are classified as a Type 3 waste and needs to be disposed at a Class C landfill site or a facility with a similarly performing liner system. The Type 3 waste classification is only due to the leachate concentration results being above the LCT0 guideline values. LCT0 limits derived from human health effect values for drinking water, as published by the Department of Water and Sanitation (DWS), South African National Standards (SANS), World Health Organization (WHO) or the United States Environmental Protection Agency (USEPA). According to the test methodologies followed and the results of the leachable concentrations the risk of elements leaching into the receiving environment from the waste facility is low.

10.12 Heritage

The Heritage Impact Assessment (HIA) undertaken during the EIA Phase is appended to this report as Appendix J. A desktop study during the Scoping Phase which provided a detailed description of the cultural heritage baseline is presented below. Subsequently an updated baseline which included the primary data collection results was provided in the HIA.

It has been observed that two geological features of the Karoo Supergroup specifically underlie the Project area, the geological features consist of the Karoo dolerites and the Vryheid formation which are further discussed below:

10.12.1 Vryheid Formation

The *Vryheid Formation* is the second significant geological formation underlying the study area. The formation comprises of shales, mudstones, sandstones and coals. In addition, this layer is the primary fossil-bearing layer in the regional study area and is considered of very-high palaeolontological sensitivity (SAHRA, 2013; Groenewald & Groenewald, 2014). Common fossil plants within the *Vryheid Formation* include *Glossopteris* leaves, roots and inflorescences; and *Calamites* stems. Coal deposits can potentially also include fossils of mammal-like reptiles and amphibians. These are however, rarely, if ever, preserved with plant fossils. Heritage resources identified on site are presented in Figure 10-23 below.

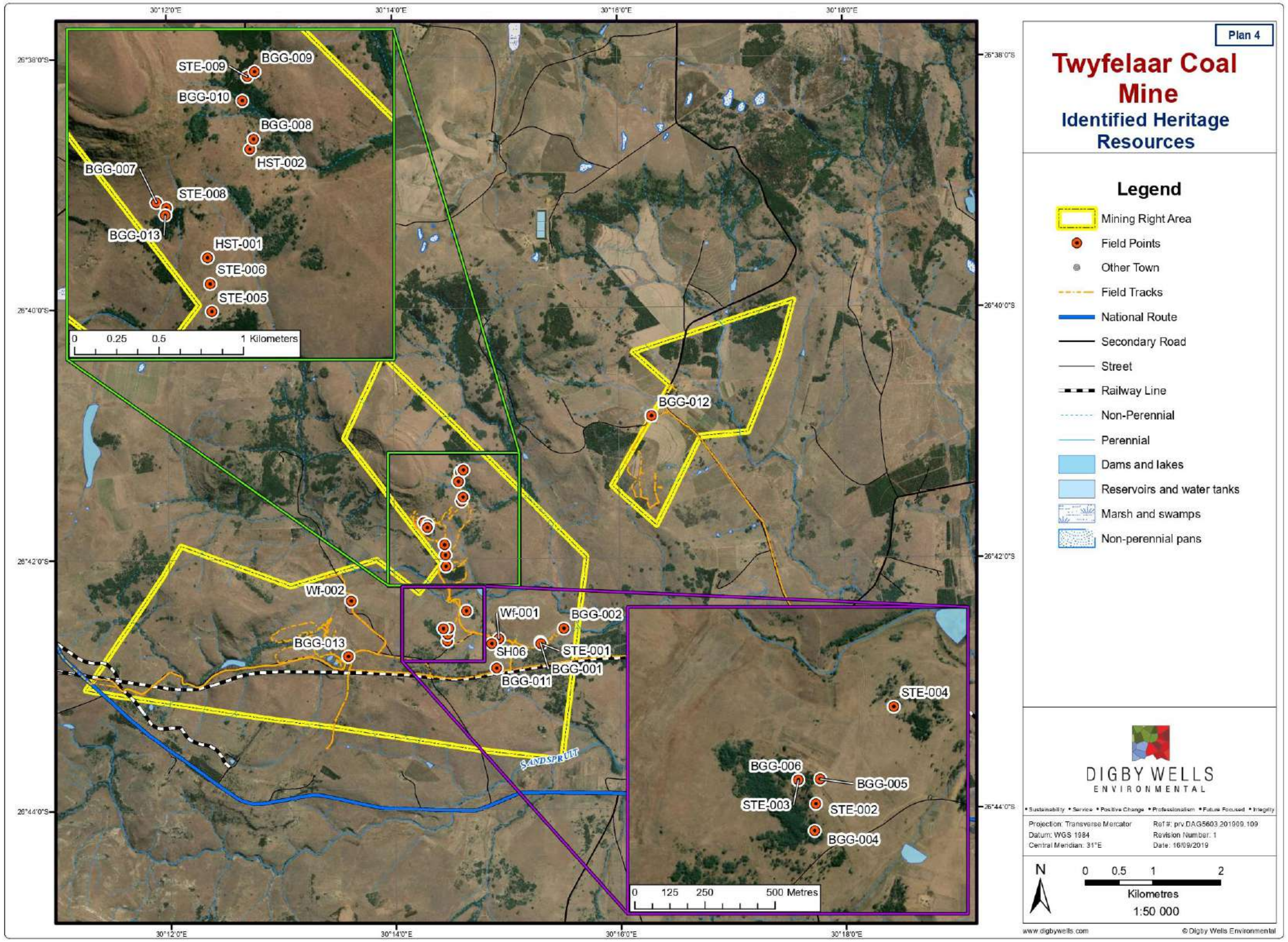


Figure 10-23: Heritage resources identified within the regional study area

10.12.2 Cultural Heritage Landscape

The cultural heritage landscape is dominated by the historical built environment and burial grounds and graves, although there are expressions of the Middle Stone Age (MSA) and Late Stone Age (LSA) and Late Farming Community (LFC) periods.

The Stone Age is divided into three phases defined by the production of stone tools by various hominid species: the ESA, the MSA and the LSA. This section is further discussed in the report appended in Appendix J.

10.12.3 The Current Environment

An overview of the current state of the environment at which the proposed Project is situated is depicted in Table 10-32 below. The Project area has been disturbed through anthropogenic activity, including cultivation, the grazing of livestock, houses, and modern structures, agricultural feature and informal/untarred roads. Figure 10-24 presents the condition of the Project area at the time of the pre-disturbance survey. Additionally, the Project area is intersected by a national road and a railway line. There is a quarry and a Waste Rock Dump (WRD) adjacent to the railway line within the Project area.

Table 10-32: Summary of the vegetation setting of the Project

Biome	Bio-region	Vegetation Type
Grassland	Mesic Highveld Grassland	<u>Eastern Highveld Grassland (GM12)</u> Short dense grassland dominated by the typical Highveld grass composition with small, scattered rocky outcrops. These outcrops include wiry sour grasses and some woody species. This vegetation type occurs on slightly to moderately undulating plains with some low hills and pan depressions and typically occurs between 1 520 to 1 780 m altitude. This type is associated with the shales and sandstones of the *Madzaringwe Formation* within the Karoo Supergroup. This vegetation type is endangered and large portions of the unit have been transformed by cultivation, plantations, mines, urbanisation and dams. Erosion in this vegetation type is generally very low.
		<u>Wakkerstroom Montane Grassland (GM 14)</u> This vegetation type consists predominantly of short montane grasslands on plateaus and flatter areas with short forests and thickets occurring in steep slopes and drainage areas. This unit type is generally found between 1 440 and 2 200 m elevation and includes low mountains and undulating plains. This vegetation type is associated with the mudstones, sandstones and shales of the *Madzaringwe* and *Volksrust Formations* of the Karoo Supergroup. This vegetation type is considered 'Least Threatened' and occurs in South African Natural Heritage Sites, although very little of the vegetation type is protected formally. Agriculture does not pose a serious threat to the transformation of this type, as it is generally associated with lower temperatures and shallower soil. Black wattle is an aggressive invasive species in riparian areas of this vegetation type.

Adapted from Mucina & Rutherford (The Vegetation of South Africa, Lesotho and Swaziland, 2010)

Figure 10-24: Photographs illustrating the current environment within the Project area

10.12.4 Results from the Pre-disturbance survey

The heritage resources identified during the pre-disturbance and ground-truthing surveys comprises the numerous different burial grounds, remains of a historical building, structural remains of a rectangular structure made up of stones and cement. Other structures included the remains of old kraal, ceramic sherd as well as the remains of one to three roomed structures. All the identified heritage resources are further discussed in the Heritage Report and appended in Appendix J. Figure 10-26 and Figure 10-27 below present photographs of select heritage resources identified during the pre-disturbance and ground-truth surveys.

A historical imagery which presents a landscape that is a mix of cultivated land and natural flora is presented in Figure 10-25. Some parts of the Project area included large stands of dense trees. There are several roads within the Project area, some of which are still in use today. The railway track does not appear in the historical imagery and parts of the road to the town of Sheepmoor have been altered.

Several points of interest were identified on the historical imagery and current aerial imagery as potential stonewalled settlements. These points were verified in the second survey and were confirmed to not be stonewalled settlements.

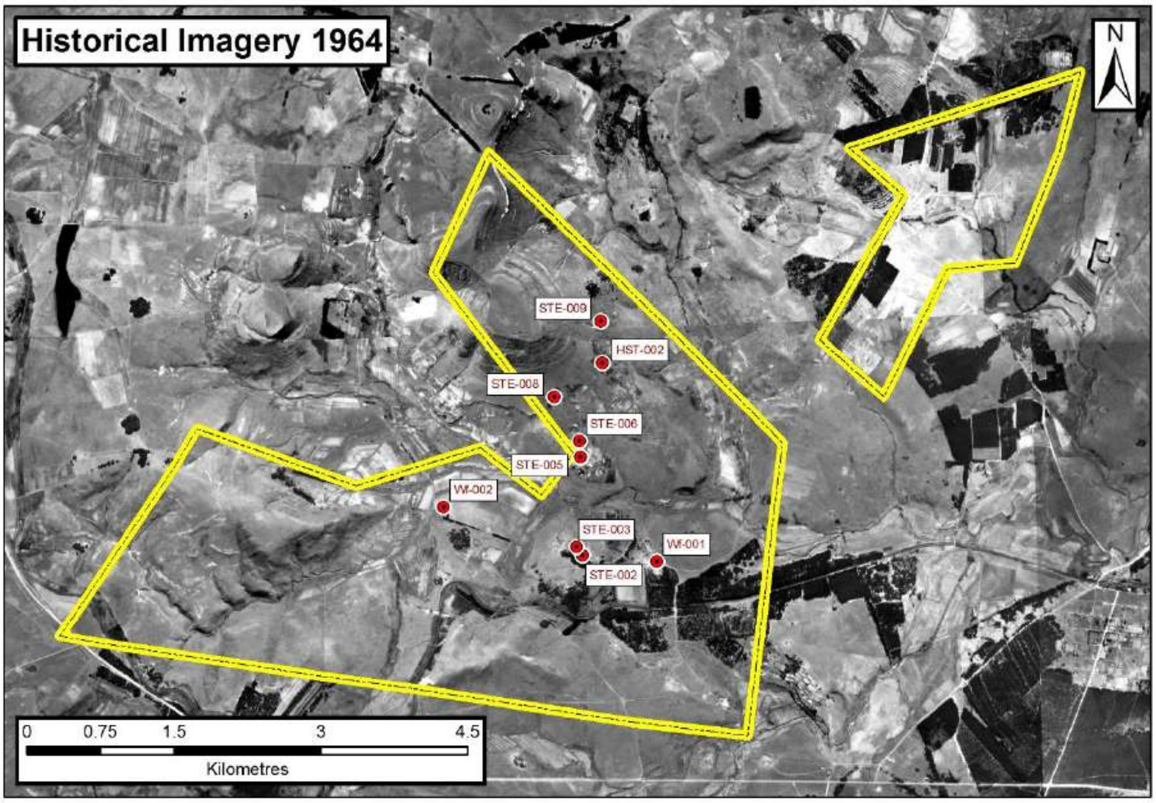


Figure 10-25: Historical imagery showing the Project area in 1964 with points of interest

STE-001: Small kraal of indeterminate age

Historical structures at Wf-001

Graves within the stand of Black Wattle trees that had been cleared (BGG-004)

Two graves marked by stone and soil heaps in overgrown grass (BGG-006)

Structural remains of STE-005

Remains of one of the farm labourers houses at HST-002

Figure 10-26: Photographs of select heritage resources identified during the pre-disturbance survey

Isolated ceramic sherd (HST-001)

Main structure of Wf-002 with rubble and material culture scatter

Grave marked by stone and soil heap at BGG-001

Grave marked by cement slabs with small markers as headstones (BGG-007)

Figure 10-27: Photographs of select heritage resources identified during the pre-disturbance survey

10.13 Blasting and Vibration

A report titled, *Blast Impact Assessment, Proposed Twyfelaar Project*, compiled by Blast Management & Consulting, dated September 2019 and updated in October 2019 to consider underground blasting, is appended hereto as Appendix K. The baseline section contained herein is summarised from the Blasting report. Refer to the report for further detail.

10.13.1 Structure profile

To establish the baseline, infrastructure within a 2,500 m radius was identified, classified and mapped to enable a model the foreseeable blasting impacts. The list of infrastructure identified, referred to a points of interests (POIs), is shown in Table 10-33. This assists in determining the allowable ground vibration limits and air blast limits.

Table 10-33: Classification System for Structures

Class	Description
1	Rural Building and structures of poor construction
2	Private Houses and people sensitive areas
3	Office and High-rise buildings
4	Animal related installations and animal sensitive areas
5	Industrial buildings and installations
6	Earth like structures – no surface structure
7	Graves & Heritage
8	Water Borehole

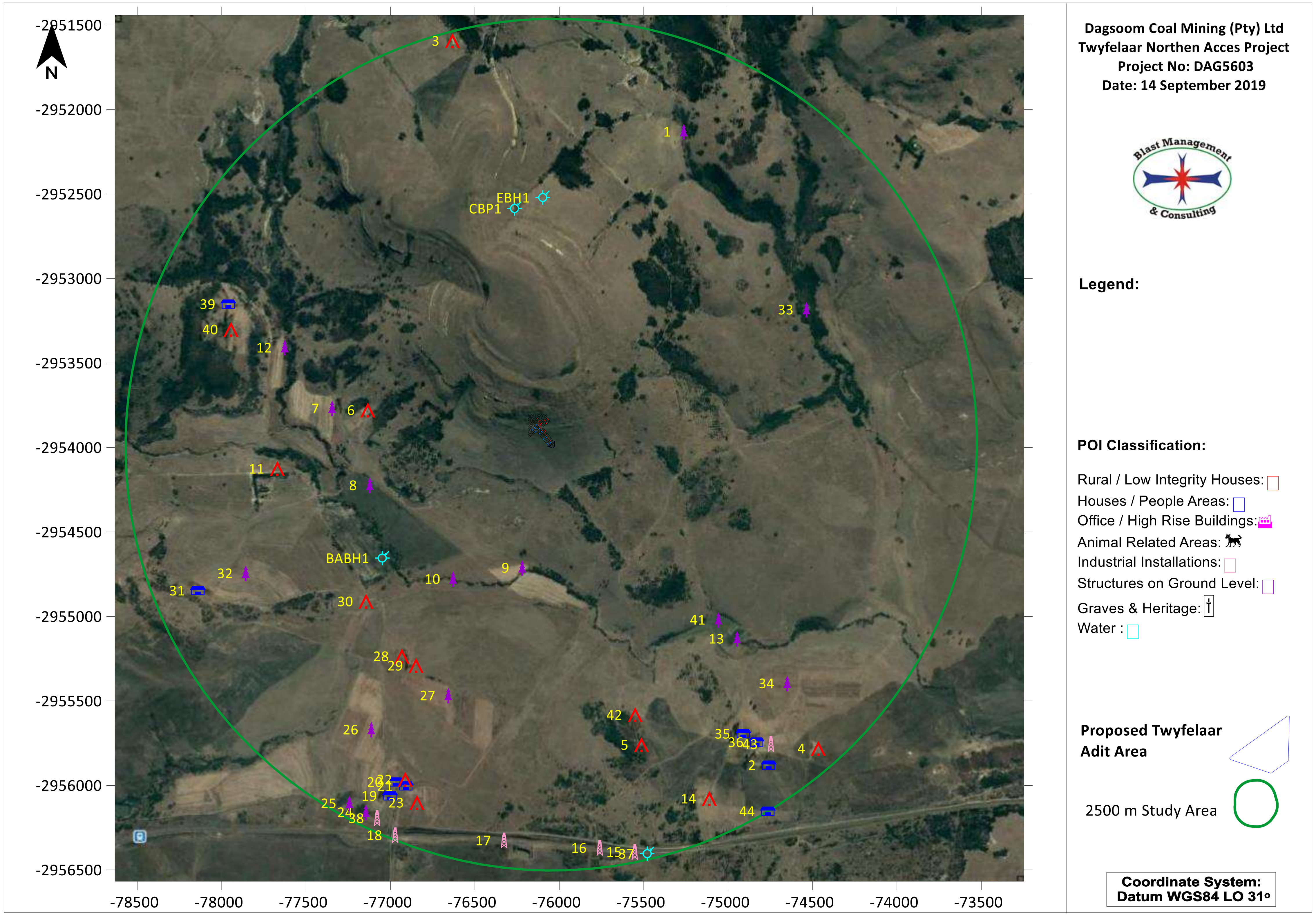


Figure 10-28: Aerial view and surface plan and POIs

A review of the project and the surrounding areas is done before any specific analysis is undertaken and sensitivity mapping is done, based on typical areas and distance from the proposed mining area. This sensitivity map uses distances normally associated where possible influences may occur and where influence is expected to be very low or none. Two different areas were identified in this regard:

- A highly sensitive area of 500 m around the mining area. Normally, this 500 m area is considered an area that should be cleared of all people and animals prior to blasting. Levels of ground vibration and air blast are also expected to be higher closer to the box-cut area.
- An area 500 m to 1500 m around the box-cut area can be considered as being a medium sensitive area. In this area, the possibility of impact is still expected, but it is lower. The expected level of influence may be low, but there may still be reason for concern, as levels could be low enough not to cause structural damage but still upset people.
- An area greater than 1500 m is considered low sensitivity area. In this area, it is relatively certain that influences will be low with low possibility of damages and limited possibility to upset people.

Figure 10-29 shows the sensitivity mapping with the identified points of interest (POI) in the surrounding areas for the Twyfelaar Northern Access box-cut area for the Project. The specific influences will be determined through the work done for this project in this report.

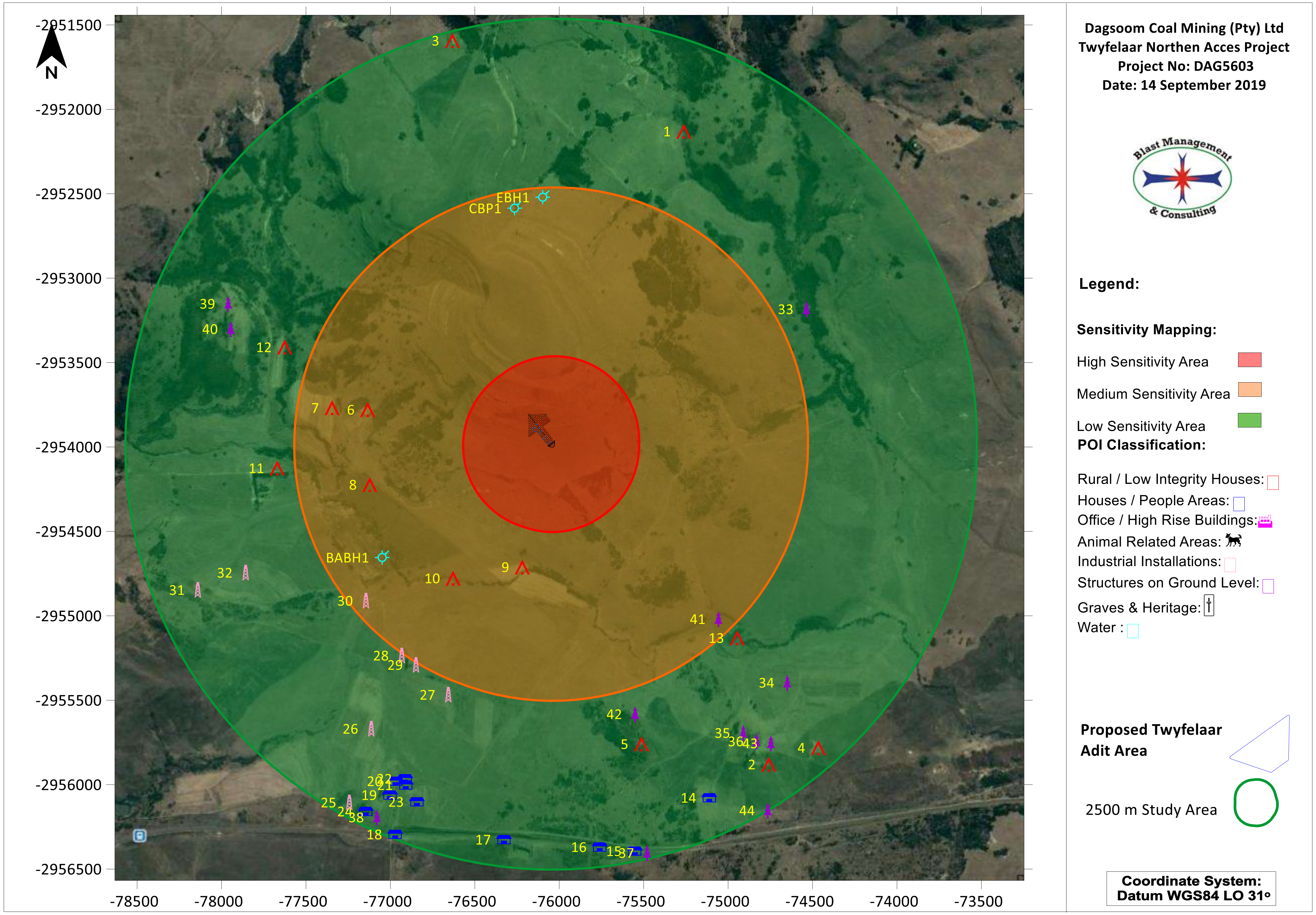


Figure 10-29: Identified sensitive areas for the proposed Twyfelaar Northern Access Box-cut area

10.14 Air Quality

The Air Quality Impact Assessment (AQIA) undertaken during the EIA Phase is appended to this report as Appendix L.

10.14.1 Receptors

The town of Sheepmoor is the mail cluster of dwellings in the area and is residential in nature, with facilities such as schools and clinics. The site is rural, with isolated farm dwellings scattered around the Project area (white circle with black dots at the middle) in Figure 10-30. These sensitive receptors are locations where people work or reside, and may include hospitals, schools, day-care facilities, elderly housing and convalescent facilities (United States Environmental Protection Agency (USEPA), 2016). These are areas where the occupants are more susceptible to the adverse effects of exposure to toxic chemicals, pesticides, and other pollutants. Human settlements where involuntary exposure is likely to occur are not exempted. The different dwellings and their proximate distances from the Block A infrastructure are depicted in Figure 10-30.

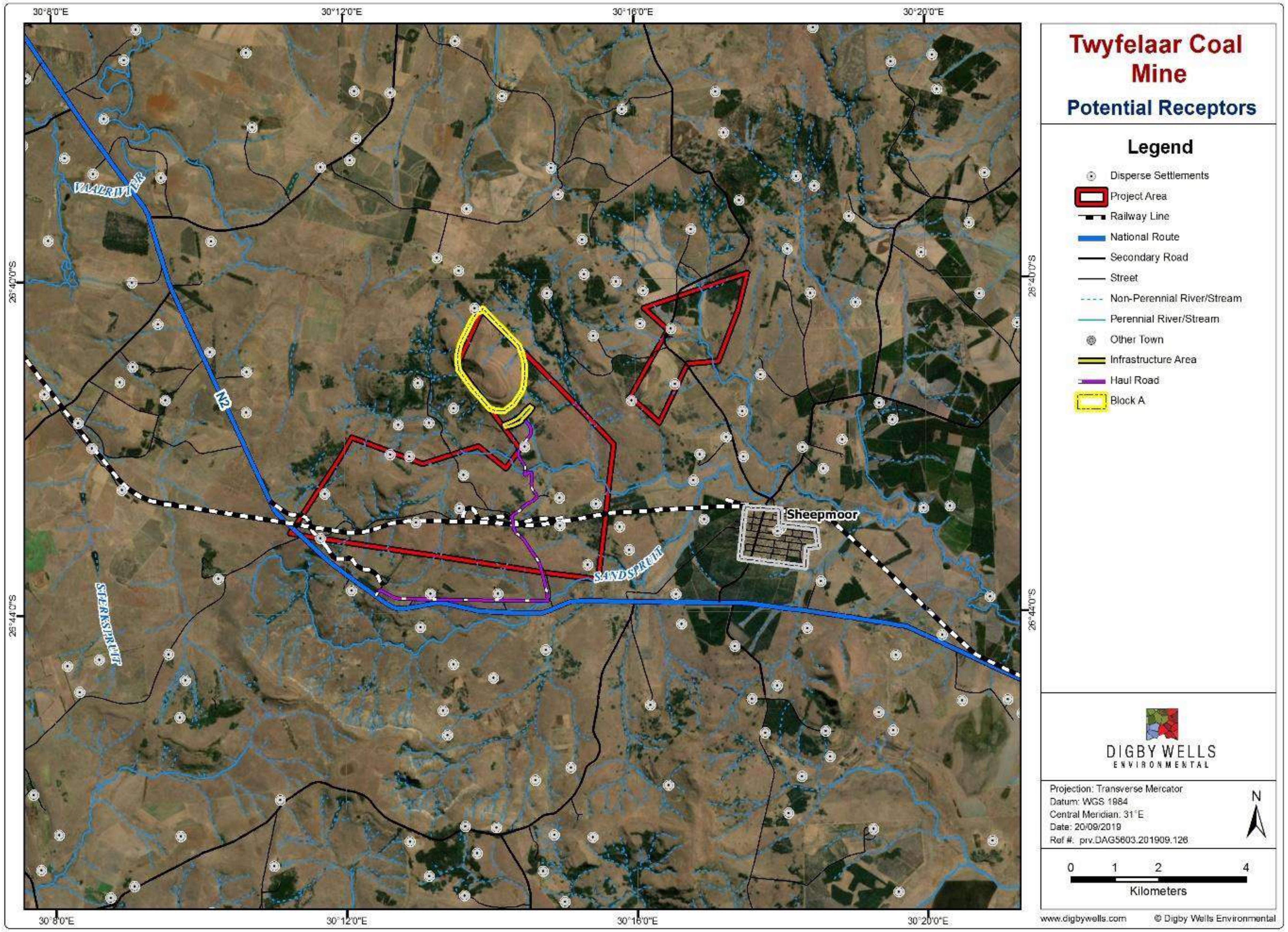


Figure 10-30: Potential Receptors

10.14.2 Wind Speed

The wind rose for the period 2016 – 2018 is depicted in Figure 10-31. The dominant winds are blowing from the east (13%) and the west northeast (12%). However, the stronger winds, ≥ 5.4 m/s are concentrated more in the western sector. The average wind speed at the project site is 3.8 m/s and calm conditions (wind speeds <0.5 m/s) occurred for 2.3% of the time. The wind class frequency is shown in Figure 10-32.

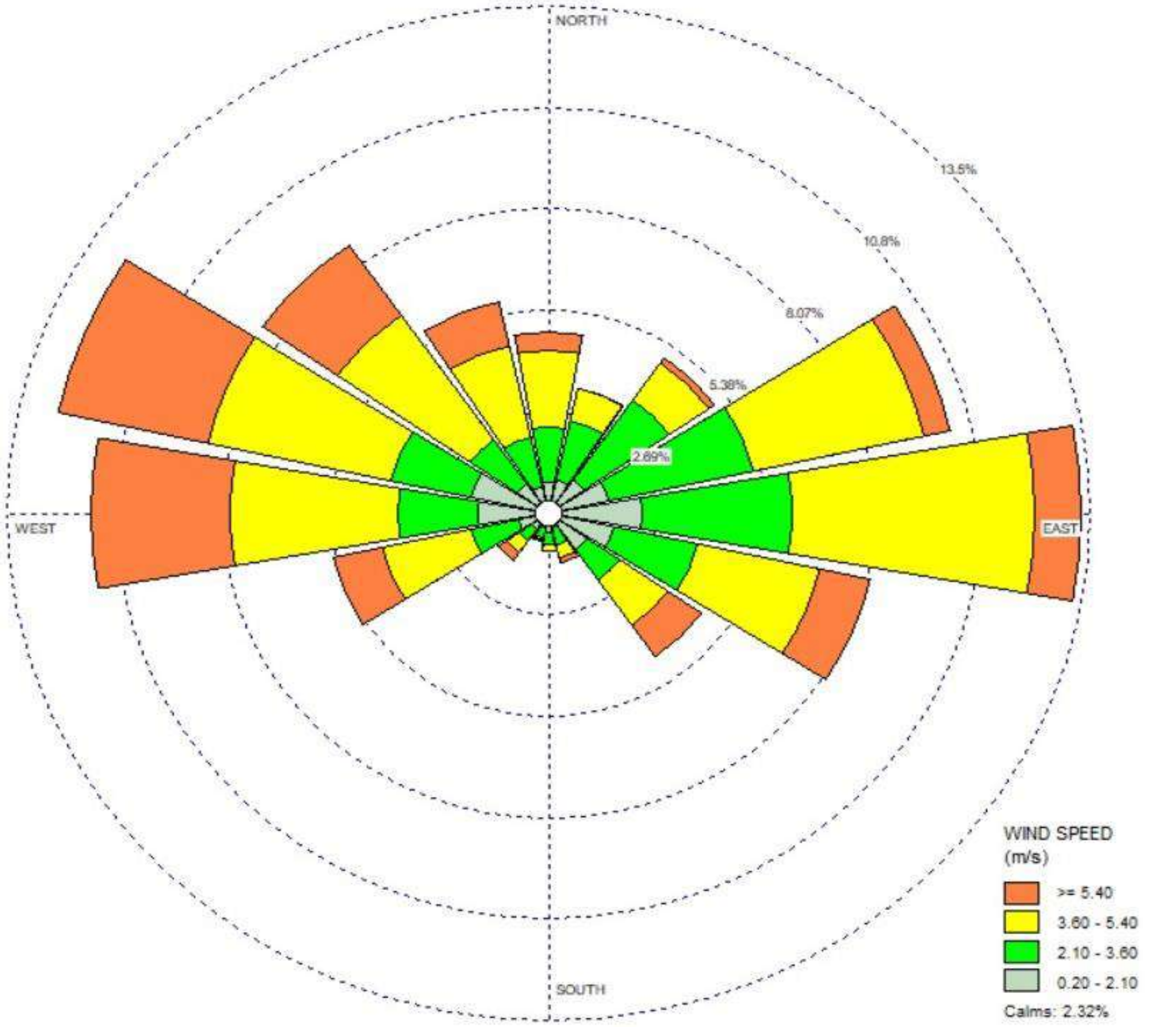


Figure 10-31: Surface wind rose (Lakes 2019)

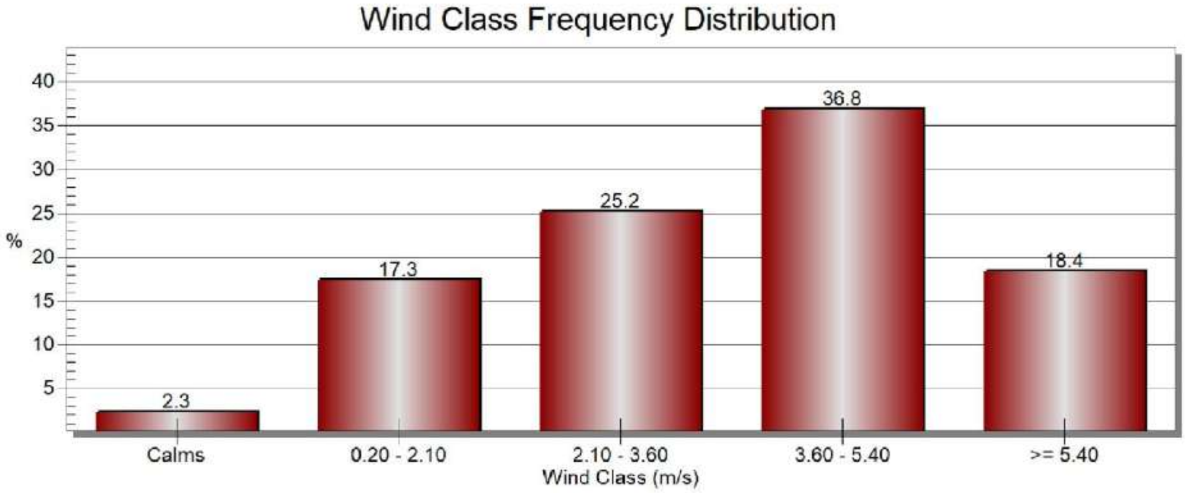


Figure 10-32: Wind Class Frequency (Lakes 2019)

10.14.3 Emissions Inventory

The development of an emissions inventory forms the basis for any AQIA. Emission rates are typically obtained using actual sampling equipment at the point of emission or are estimated from mass and energy balances or emission factors which have been established at similar operations. Emission factors published by the USEPA in its AP-42 document “Compilation of Air Pollution Emission Factors” (USEPA, 2016) and Australian National Pollutant Inventory “Emission Estimation Technique (EET, 2012)” manuals were employed.

10.14.4 Existing Air Quality

Data from the emission inventory served as input parameters used in the dispersion model simulations to predict pollutants Ground Level Concentrations (GLC) for Total Suspended Particulate (TSP), particulate matter with aerodynamic diameter less than 10 micron (PM_{10}), particulate matter with aerodynamic diameter less than 2.5 micron ($PM_{2.5}$), nitrogen dioxide (NO_2) and carbon monoxide(CO).

10.14.4.1 Legislated Air Quality Limitations

The National Environment Management: Air Quality Act (Act No. 39 of 2004) (NEM:AQA) puts in place various measures for the prevention of pollution and national norms and standards for the regulation of air quality in South Africa. In line with NEM:AQA, the Department of Environmental Affairs (DEA) published the acceptable dust fallout limits for residential and non-residential areas 01 November 2013. The dust fallout standard is given in the Table 10-34 below.

Table 10-34: Dust Fall Standards (NEMAQA - NDCR, 2013)

Restriction Areas	Dust fall rate (mg/m^2/day, 30-days average)	Permitted Frequency of exceeding dust fall rate
Residential Area	< 600	Two within a year, not sequential months
Non-Residential Area	< 1200	Two within a year, not sequential months

DEA has established National Ambient Air Quality Standards for PM_{10} and gases in Table 10-35 since December 2009 and $PM_{2.5}$, since June 2012 (GN 486: 2012) as in Table 10-36.

Table 10-35: National Ambient Air Quality Standards for PM_{10} (2009)

Averaging Period	Limit Value (µg/m^3)	Limit Value (ppb)	Frequency of Exceedance	Compliance Date
National Ambient Air Quality Standard for Sulphur Dioxide (SO_2)				
10 Minutes	500	191	526	Immediate
1 hour	350	134	88	Immediate
24 hours	125	48	4	Immediate
1 year	50	19	0	Immediate
The reference method for the analysis of SO_2 shall be ISO 6767.				
National Ambient Air Quality Standard for Nitrogen Dioxide (NO_2)				
1 hour	200	106	88	Immediate
1 year	40	21	0	Immediate
The reference method for the analysis of NO_2 shall be ISO 7996.				
National Ambient Air Quality Standard for Particulate Matter (PM_{10})				
24 hour	75		4	1 January 2015
1 year	40		0	1 January 2015
The reference method for the determination of the PM10 fraction of suspended particulate matter shall be EN 12341.				
National Ambient Air Quality Standard for Ozone (O_3)				
8 hours (running)	120 (61ppb)		11	Immediate
The reference method for the analysis of ozone shall be the UV photometric method as described in SANS 13964.				
National Ambient Air Quality Standard for Carbon Monoxide (CO) mg/m3				
1 hour	30	26 (ppm)	88	Immediate
8 hour (calculated on 1 hourly averages)	10	8.7 (ppm)	11	Immediate

Averaging Period	Limit Value (µg/m^3)	Limit Value (ppb)	Frequency of Exceedance	Compliance Date
The reference method for analysis of CO shall be ISO 4224.				

The levels of criteria pollutants in the underground working environment published in by the Department of Mineral Resources, Mine Health and Safety Act, (Act No. 29 of 1996), as amended in Government Gazette No. 29276, Government Notice 989 in 2006 were used as input parameters in assessing the contribution from this source.

Table 10-36: National Ambient Air Quality Standards for $PM_{2.5}$ (2012)

National Ambient Air Quality Standards for Particulate Matter ($PM_{2.5}$)			
Averaging Period	**Limit Value (µg/m^3)**	**Frequency of Exceedance**	**Compliance Date**
24 hours	40	0	1 January 2016 – 31 December 2029
24 hours	25	0	01 January 2030
1 year	20	0	1 January 2016 – 31 December 2029
1 year	15	0	01 January 2030
The reference method for the determination of PM2.5 fraction of suspended particulate matter shall be EN 14907.			

10.14.4.2 Fine Particulate Matter and Dust Fall

Dagsoom has not commenced the monitoring of fine particulate matter PM_{10} and $PM_{2.5}$. The same applies for dustfall, with aerodynamic diameter greater than 30 µm in the Project area. Monitoring of these criteria pollutants will ensure background levels are established prior to the commencement of mining.

10.14.4.3 Gaseous Pollutants

In addition to the above mentioned, data collection for the other criteria gaseous pollutants, such as SO_2, NO_2 and CO has not yet commenced in the Project area.

Monitoring of these pollutants prior to the commencement of mining is invaluable as this will represent a reference point to which future perturbations can be compared.

10.15 Noise

The Noise Impact Assessment report is attached in Appendix M. The baseline noise investigation was carried out in from the 2nd to the 5th of September 2019. The noise specialist used the “A Cirrus”, Optimus Green, precision integrating sound level meter to collect baseline noise measurements. The instrument was field calibrated with a Cirrus, sound level calibrator. The locations of the noise measurements and weather conditions recorded during the study are given in Table 10-37 below.

Table 10-37: Noise Measurement Locations

Location	Coordinates		Category of receptor	Weather conditions
Twyfelaar portion 298 IT	26°42'47.6"S	30°14'42.6"E	Residential	Clear Sky, wind speed <5m/s, Humidity: 20%
Private farm	26°42'09.3"S	30°13'29.6"E	Residential	Clear Sky, wind speed <5m/s, Humidity: 30%
Twyfelaar portion 298	26°42'43.99"S	30°13'36.07"E	Residential	Clear Sky, wind speed <5m/s, Humidity: 80%

The noise time history graphs (Figure 10-33 to Figure 10-35) and results from that investigation were used to obtain estimates of a baseline noise level for the environment of the proposed Project. Table 10-38 summaries the results obtained at each location in comparison with the regulatory limits.

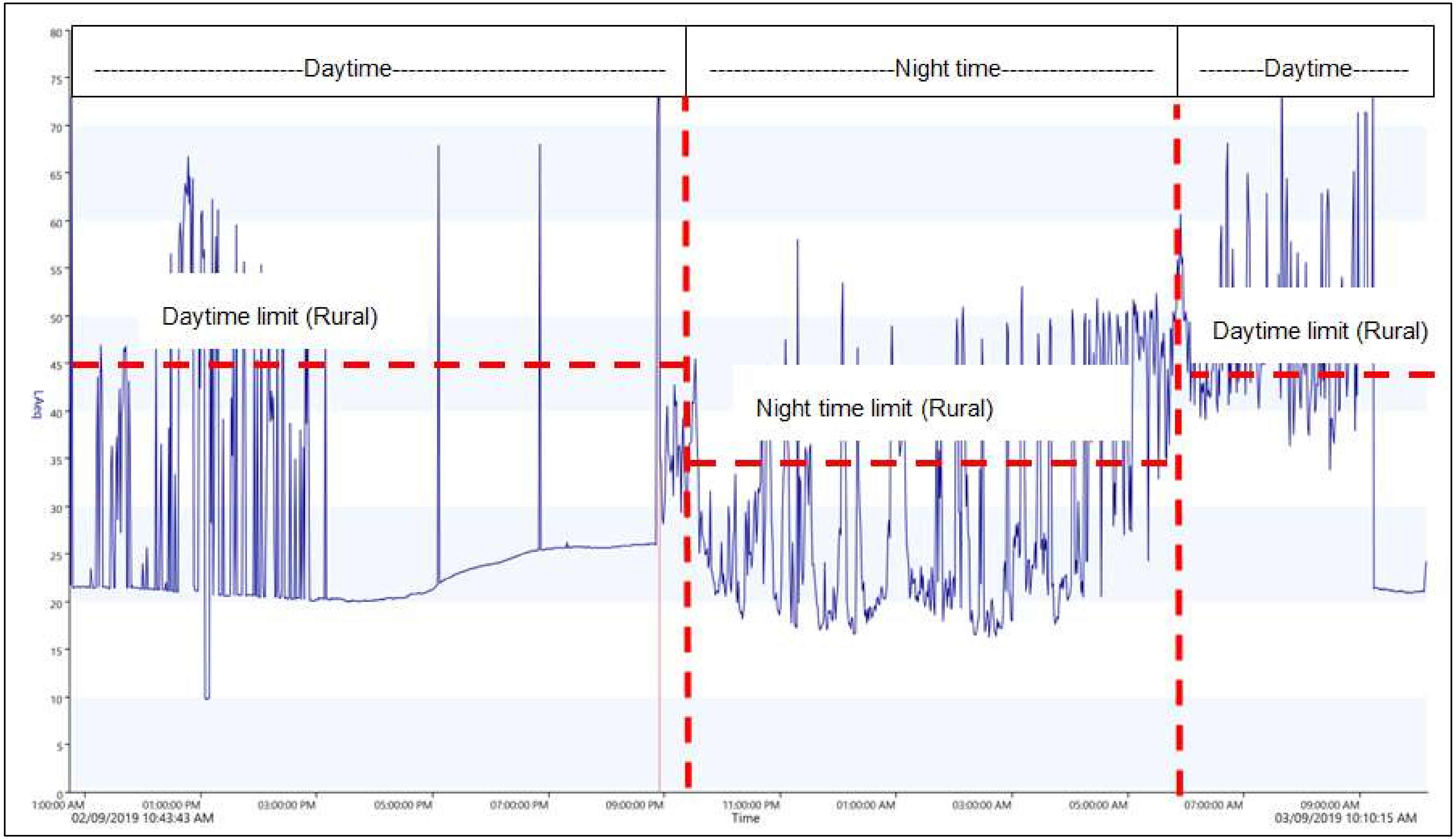


Figure 10-33: Noise Time History Graph at the Farm Twyfelaar 298 IT

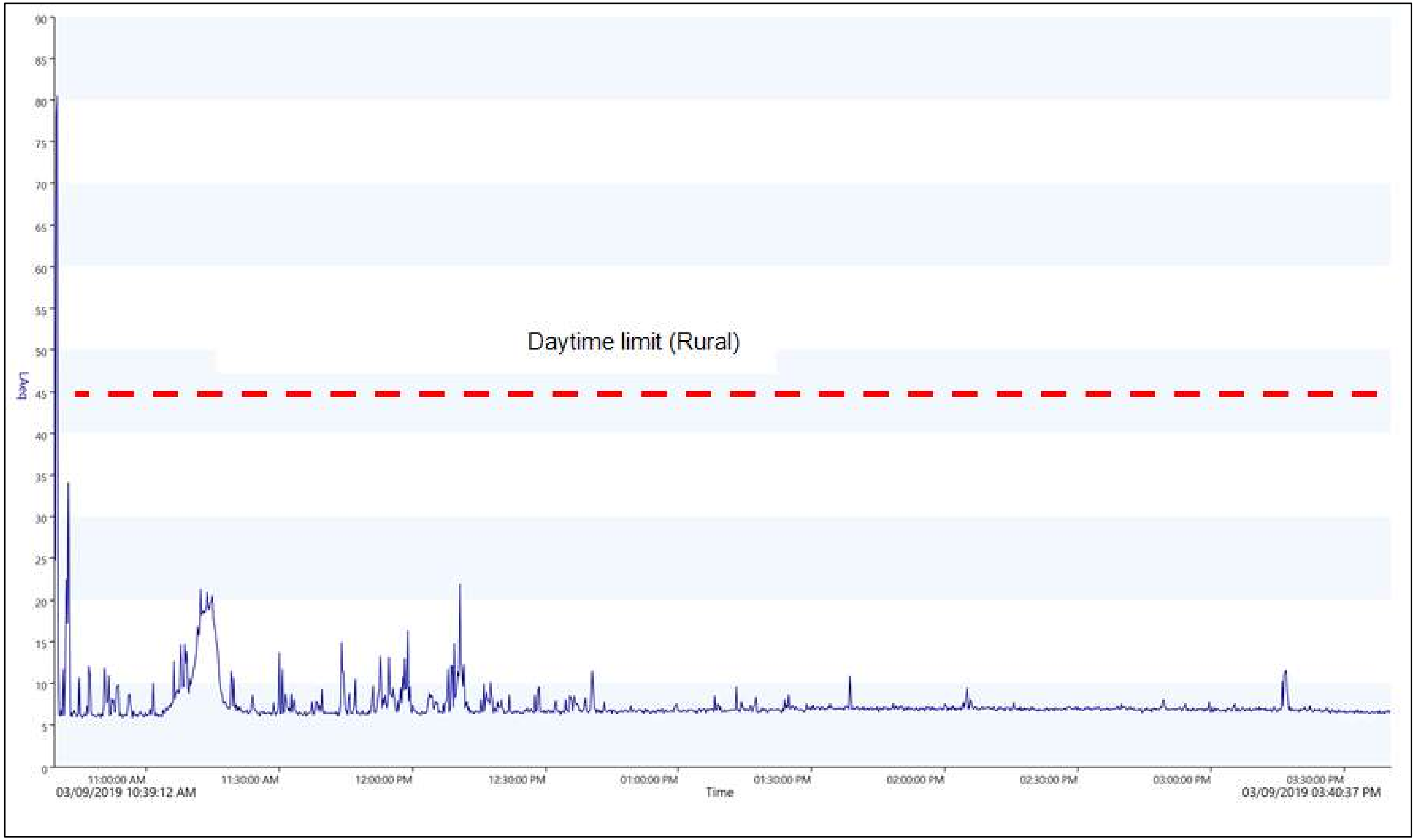


Figure 10-34: Noise Time History Graph at a Private Farm

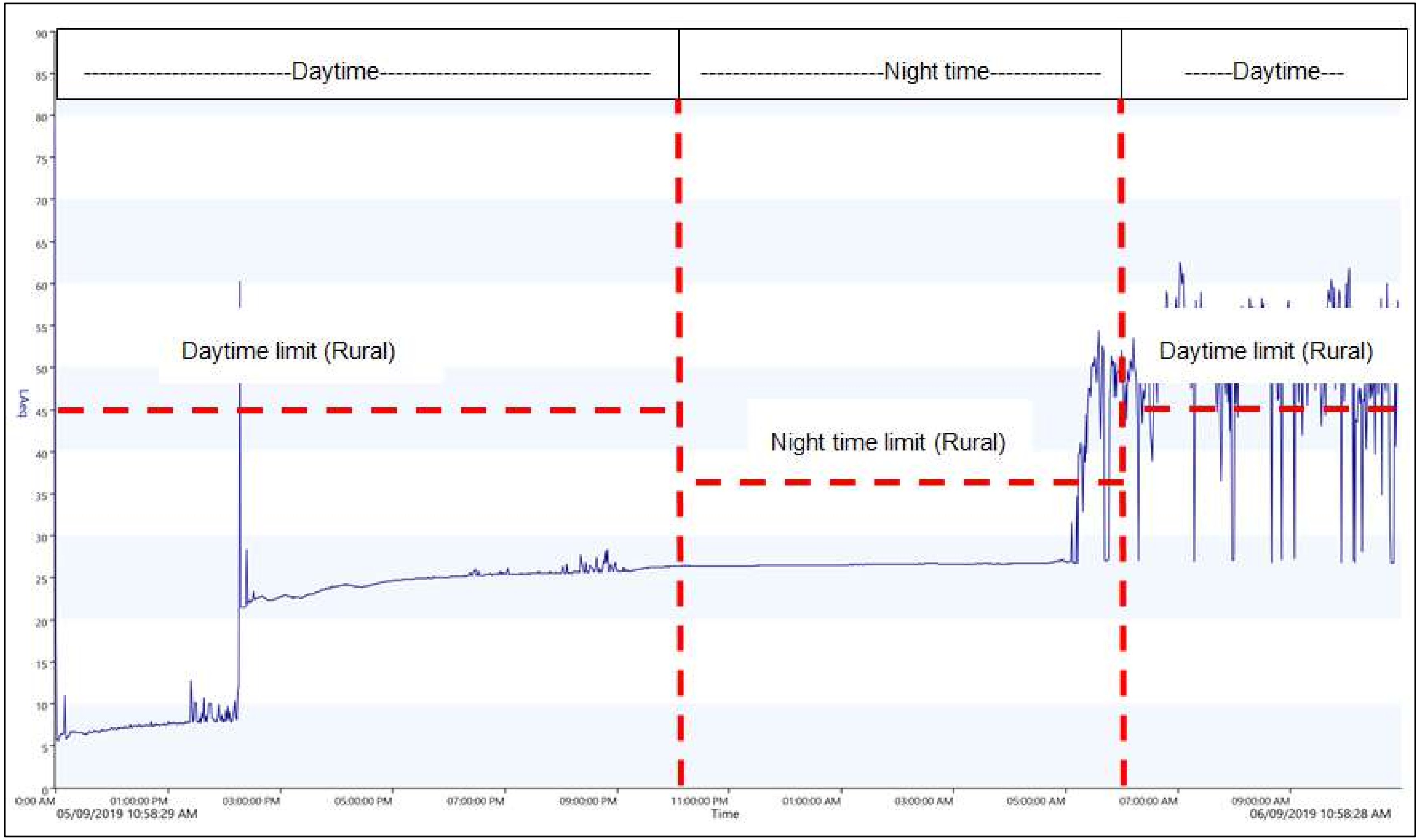


Figure 10-35: Noise Time History Graph

Table 10-38: Results of the Baseline Noise Measurements

Location ID	SANS 10103:2008 – Rural District Guidelines						
	Type of receptor	Period	Acceptable rating level dBA	L_{Aeq} dBA	L_{A90}	Maximum/Minimum dBA	Date
Twyfelaar portion 298 IT	Residential	Daytime	45	55	20	93/16	02/09/2019
		Night time	35	43			
Private farm (Molton Mpheti)	Residential	Daytime	45	51	20	91/4	03/09/2019
Twyfelaar farm portion 298 (Communal farm)	Residential	Daytime	45	53	20	91/4	05/09/2019
		Night time	35	38			
	Indicates current LAeq levels above either the daytime rating limit or the night-time rating limit						

The results of the baseline noise survey at three sampling points have shown that the noise levels were above SANS 10103:2008 guidelines for ambient noise in rural district for daytime (45 dBA) and for night time (35 dBA) respectively. However, LA90 for the three sites were at 20 dBA and below the recommended limits for daytime and night time. The main intrusive noise sources impacting on the background soundscape in the area included the trains transporting coal, and cattle. Various parts of a train produce noise

It is important to indicate that measurements of Twyfelaar farm portion 298 were partially influenced by the rain during the night time and the second period of daytime. With the train identified as the major source impacting the environmental noise background, mining and related activities can represent a cumulative addition to the ambient noise levels.

10.16 Traffic

As mentioned above, the Traffic Impact Assessment (TIA) is appended to this report as Appendix N was undertaken by EDL Engineers (Pty) Ltd (EDL) in support of the EIA to determine the traffic characteristics of the area. A road network exists around the Project area which has been discussed below.

10.16.1 Existing Surrounding Network

N2 freeway- this is a surfaced single carriageway road with no median and one (1) lane per direction in the vicinity of the site and links Ermelo to the North west with Piet Retief (also known as Mkhonto) to the south east.

10.16.2 Future Road Master Planning

Road Master Planning was done to determine the spacing requirements of future interchanges on the N2 and their most probable positions. These interchange positions will dictate where the mine access onto the N2 should be located. A minimum of 2.4 km spacing between future interchanges is allowed as measured from the Sheepmoor on to the N2 Freeway.

10.16.3 Proposed Site Access

The mine access road is by means of proposed “T-Junction” type intersection with the N2 according to the relevant standard of SANRAL. The access road will consist of one entrance lane of 5.2 m wide and one exit lane of 5m wide. A deceleration lane and taper of 120 m long and 3.7 m wide is proposed for the western approach. This deceleration lane will be accompanied by a large radius of 45 m left turning slip lane of 5m wide.

10.16.4 Existing Traffic Flows

Weekday (AM) and Weekday (PM) Traffic Counts were therefore carried out during the Weekday AM and Weekday PM commuter peak periods on Thursday the 12 the September 2019 on the N2 Freeway where the access intersection is proposed. Table 10-39 and Table 10-40 shows the existing Weekday AM and PM peak hour traffic volumes.

Table 10-39: Summary of the Estimated Development Traffic (Heavy Vehicles) (EDL, 2019)

Land Use	Peak Hour	Trip Rate	Reduction Factors	Split %	TRIPS		
					In	Out	Total
Coal Mine (2063ha)	Weekday (AM)	8vph/ 1ha	-	50/50	4	4	8
	Weekday (PM)	8vph/ 1ha	-	50/50	4	4	8
Total Trips	**Weekday (AM)**				**4**	**4**	**8**
	Weekday (PM)				**4**	**4**	**8**

Table 10-40: Summary of the Estimated Development Traffic (Light Vehicles) (EDL, 2019)

Employees	Peak Hour	Trip Rate	Reduction Factors	Split %	TRIPS		
					In	Out	Total
100	Weekday (AM)	0.5vph / empl.	-	75/25	38	12	50
	Weekday (PM)	0.5vph / empl.	-	25/75	12	38	50
Total Trips	**Weekday (AM)**				**38**	**12**	**50**
	Weekday (PM)				**12**	**38**	**50**

10.17 Socio-Economic

The Social Impact Assessment (SIA) undertaken during the EIA Phase is appended to this report Appendix O. The baseline profile of the receiving socio-economic environment is presented in this section.

In defining the study areas, the manner in which publicly-available socio-economic data is aggregated was taken into account. The study areas were thus defined to correspond to *existing administrative boundaries*. The study areas for the SIA are:

- The ***primary study area*** – the area likely to experience impacts related to the physical intrusion of the Project infrastructure and Project-related activities. This study area is defined as the extent of the properties that fall within the proposed Mining Right boundary (see Figure 10-36).
- The ***secondary study area*** – the area likely to experience impacts related to the economic pull exerted by the Project. This area is defined as Ward 11 within the

Msukaligwa Local Municipality (MLM), Gert Sibande District Municipality (GSDM), that encompasses the proposed Project area (see Figure 10-37); and

- The ***regional study area*** **–** the area likely to experience the indirect or induced impacts of the proposed Project. This area is defined as the Gert Sibande District Municipality in its entirety as well as the Mpumalanga Province (see Figure 10-38).

10.17.1 Primary Study Area

The primary study area was defined as the properties situated within the proposed Mining Right boundary. The land owners (including private individuals, CPA, and government) and households and communities residing on the properties in the Mining Right application area are described below.

- On the farm Twyfelaar 298IT
  - Bambanani-Sakhisizwe CPA (Surface right holder on the RE of Twyfelaar 298 IT);
  - Mpheti M.J (Surface right holder of Portion 7 of Twyfelaar 298 IT);
  - National Government of the Republic of South Africa (RSA) (Surface right holder of Portions 2, 5 and 1; the Phakamani community / households reside on Portion 1); and
  - Transnet Limited (surface right holder on Portion 8 and 9 of Twyfelaar 298 IT).
- On the farm Klipfontein 283IT
  - National Government of the RSA (Surface right holder of Portions 1 and 2 of Klipfontein 283 IT on which the Kliphoek Pump Station is located); and
  - Vorster N.W.J (Surface Rights holders on Remaining Extent of Klipfontein 283 IT).

The portion of land that will be affected by initial mining activities (Block A, Northern Underground Access) is owned by the National Government of the RSA (Twyfelaar 298 IT, Portion 2), as indicated in Figure 10-36.

The Mpheti land owners do not currently live on their farm but will reportedly be returning to the farm in the near future to practice crop farming.

The Vorster landowners live on their farm and practice commercial agriculture.

The tenure status of the Phakamani community / households is currently uncertain but the Department of Rural Development and Land Restitution has advised Dagsoom that the tenure status of these occupants will be clarified in due course. Households with insecurity of tenure are more vulnerable to Project-related land losses. During the consultation process, land owners and occupants in the primary study area stated that they do not want to be relocated due to Project activities. While no households will need to be relocated during the mining activities that will be undertaken on Twyfelaar North (Block A), future expansion into the other two mining areas (Southern Section and Eastern/Klipfontein Section) may require the relocation of households within the primary study area.

Transnet owns a rail reserve and associated structures. A railway line traverses the site near its southern border and trains were seen using the track during the site visit.

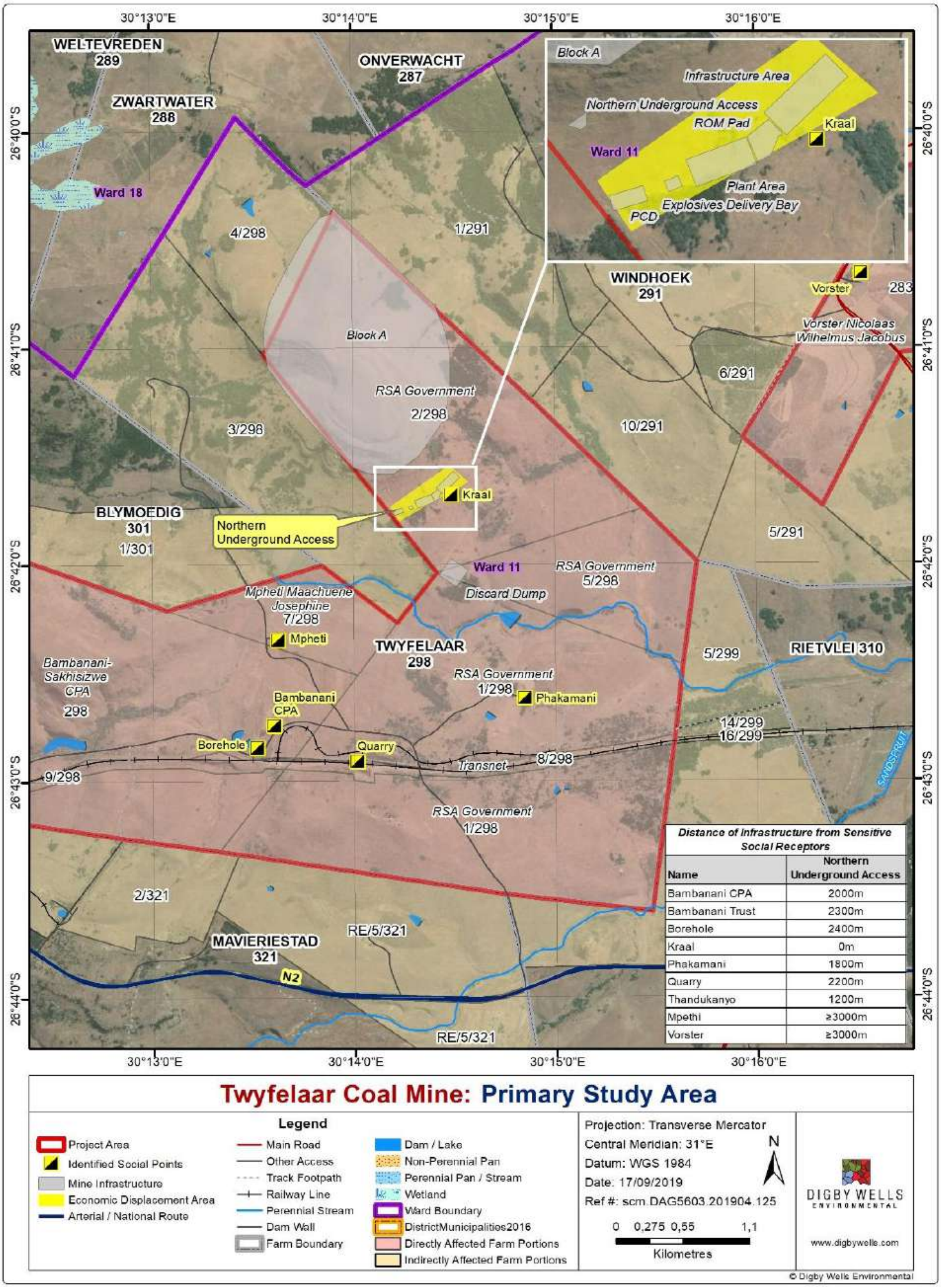


Figure 10-36: Primary Study Area

10.17.2 Secondary Study Area

The secondary study area is comprised of Ward 11 of Msukaligwa Local Municipality, Gert Sibande District Municipality, and the properties adjacent to the Mining Right boundary. As indicated in Figure 10-37, the secondary study area includes the Nsibande and Thandukanyo households, located approximately 1,200 m from Block A, where the mining activities will take place, other private and commercial land owners adjacent to the Mining Right boundary, as well as Sheepmoor Town.

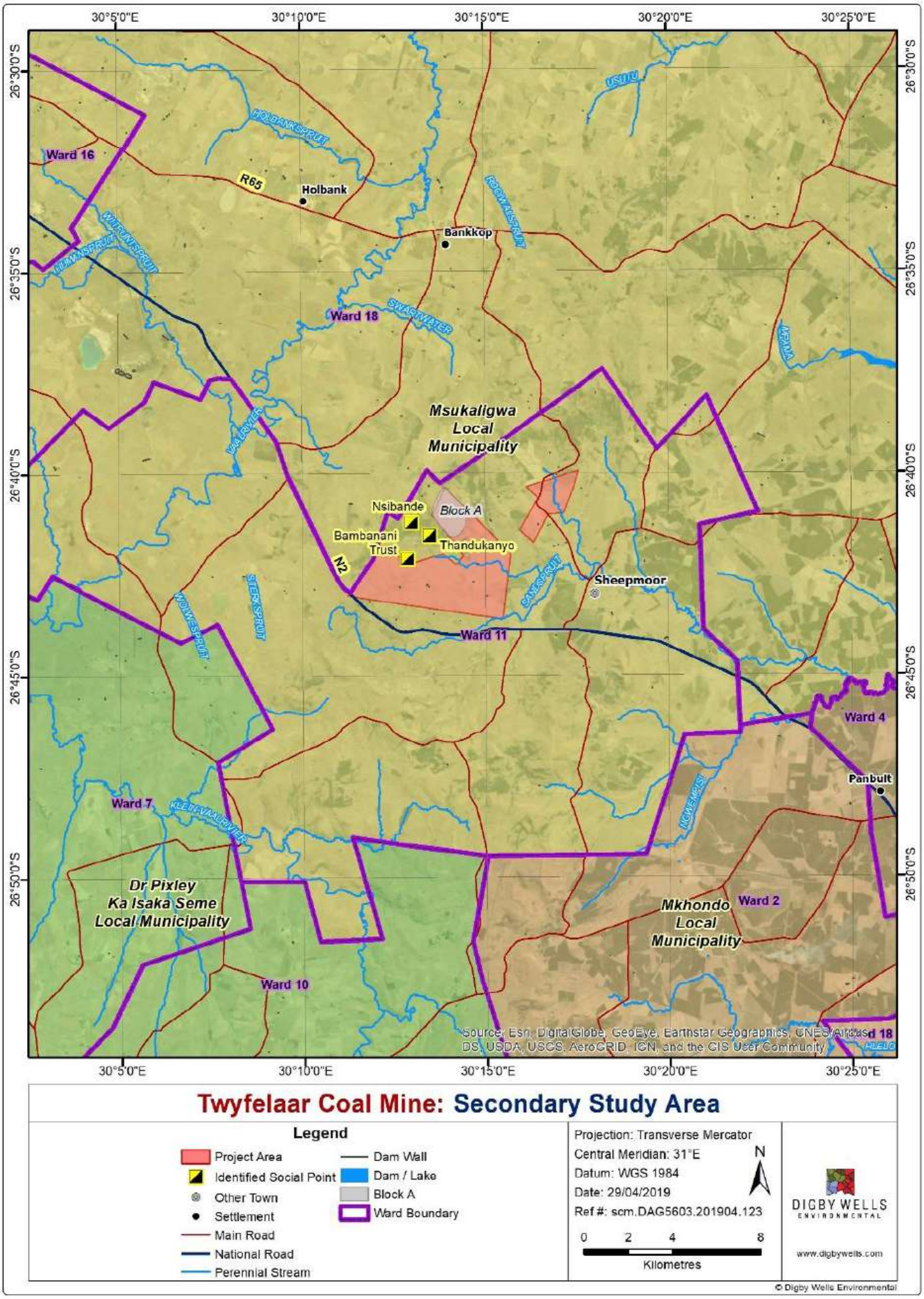


Figure 10-37: Secondary Study Area

10.17.3 Regional Study Area

The regional study area is comprised of the seven local municipalities of the Gert Sibande District, followed by the Mpumalanga Province (Figure 10-38).

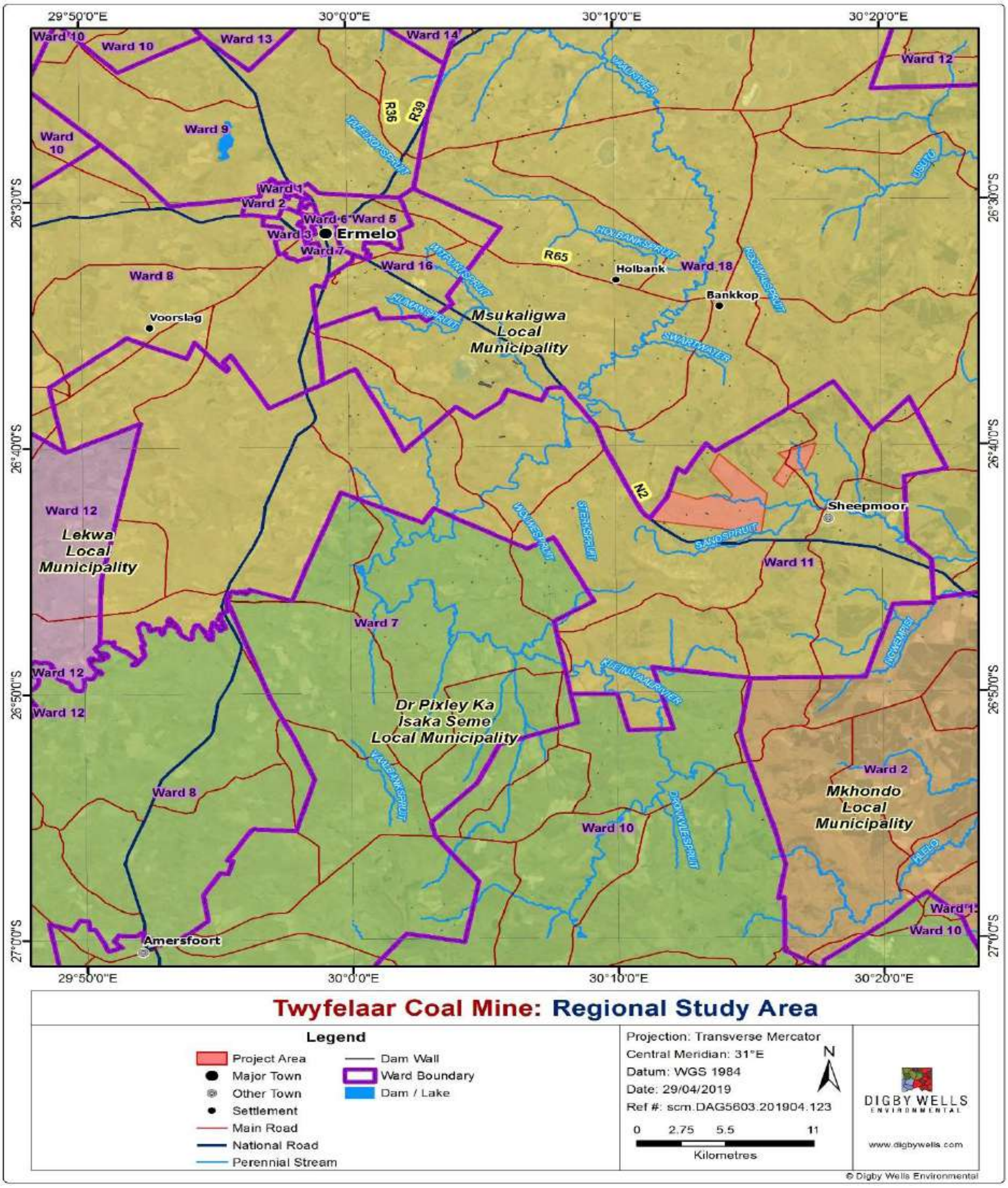


Figure 10-38: Regional Study Area

10.17.3.1 Secondary Study Area

10.17.3.1.1 Demographic Characteristics

In terms of population and population density, Ward 11 within both the primary and secondary study areas are located, covers a geographical area of approximately 809 km², which represents 13.4% of the MLM.

Considering the municipality's estimated growth rate of around 2.04% per annum, the population in Ward 11 in 2019 is approximately 6,297 people. The low population density is indicative of the rural nature of the ward. Refer to Table 10-41.

Table 10-41: Population and Population Density

Administrative Level	Population	Persons per km2
Mpumalanga Province	4 335 963	56.6
Gert Sibande District Municipality	1 135 409	35.4
Msukaligwa Local Municipality	164 408	27.3
Ward 11	5 924	7.3

10.17.3.1.2 Age and Gender

The percentage of the population in the under-18 age category is higher in Ward 11 (47.6%) than at the local, district and provincial levels. The percentage of the population in the 18 to 64 age category is lower in Ward 11 (47.9%) than at the local, district and provincial levels (Figure 10-39)

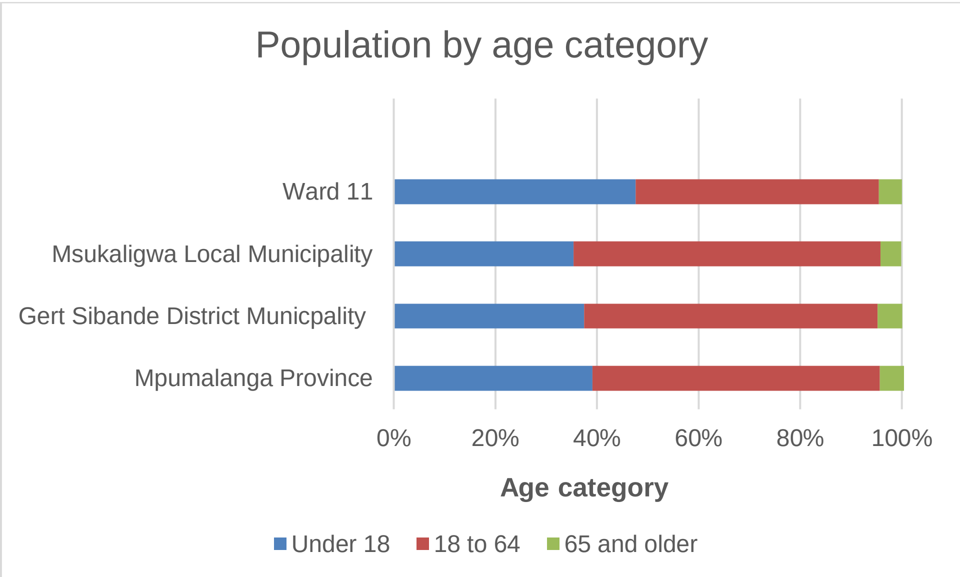


Figure 10-39: Population by Age Category

The proportion of females in Ward 11 (51.7%) is higher than the proportion of females at the local, district and provincial levels (Figure 10-40).

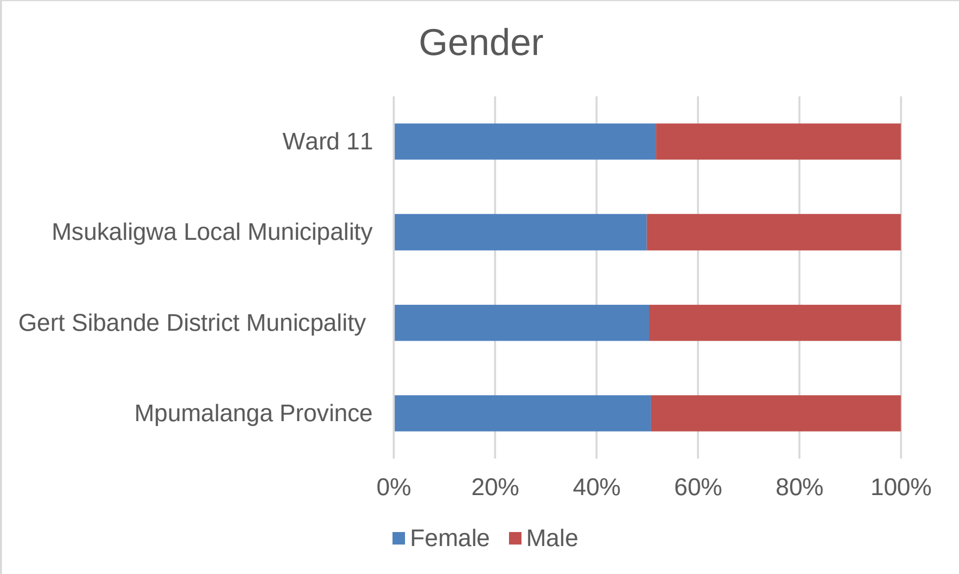


Figure 10-40: Gender Distribution

10.17.3.1.3 Education

The percentage of the population that has obtained a Grade 12, undergraduate or postgraduate qualification was significantly lower in Ward 11 than at the local, district and provincial levels. Similarly, the percentage of the population that has no formal education was significantly higher for Ward 11 than for the local, district and provincial populations (Figure 10-41).

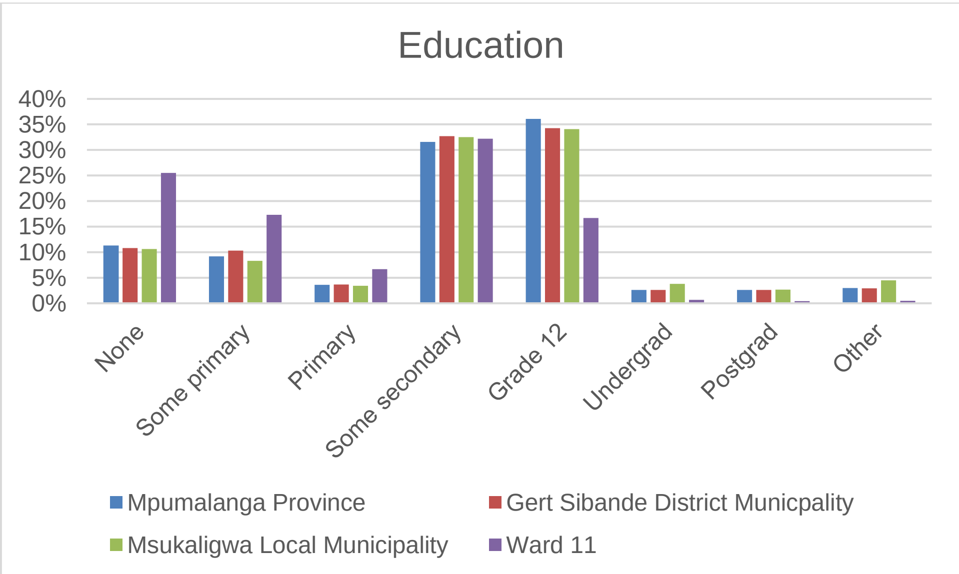


Figure 10-41: Education Levels

The Census 2011 data demonstrated that education plays a key role in reducing poverty, with the attainment of a Grade 12 qualification significantly reducing poverty amongst both men and women[3]. According to the SLP developed for the Project, the minimum education level for employment will be Grade 10 which will subsequently exclude those with lower education levels. The successful implementation of the other economic, education and community development initiatives listed in the SLP will therefore be crucial for ensuring that as many people as possible in the affected communities benefit from the Project.

10.17.3.1.4 Household Information

There were 1 236 households in Ward 11, constituting 2.4% of the households in MLM and 0.4% of the households in GSDM.

10.17.3.1.5 Households Headed by Women and Children

Forty seven percent of households in Ward 11 were headed by women, which is 10% higher than the district rate and 20% higher than the provincial rate. The percentage of households headed by children under 18 was also higher in Ward 11 (2.6%) than at local, district and provincial levels (Figure 10-42).

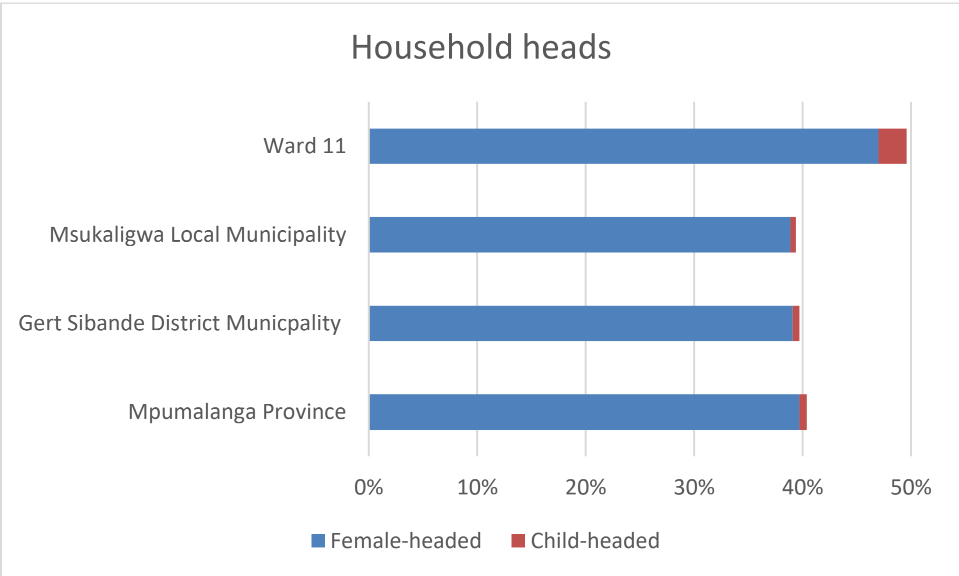


Figure 10-42: Female and Child-Headed Households

Female-headed households and child-headed households are considered vulnerable (IFC, 2012) and in the South African context, female-headed households are almost twice as likely to be poor than male-headed households. Female and child-headed households, especially in the primary study area, may be more vulnerable to negative Project impacts than male-headed households. The Project may enhance the positive Project impacts for women by ensuring that a policy of gender equity is adhered to for employment opportunities, skills training, learnerships, ABET training, bursaries and community development projects.

[3] http://www.statssa.gov.za/?p=10334

10.17.3.1.6 Tenure Status of Households

The percentage of households in Ward 11 that own their houses (45%) is lower than at local, district and provincial levels while the percentage of households that occupy their houses rent free (39%) is significantly higher than at local, district and provincial levels (Figure 10-43).

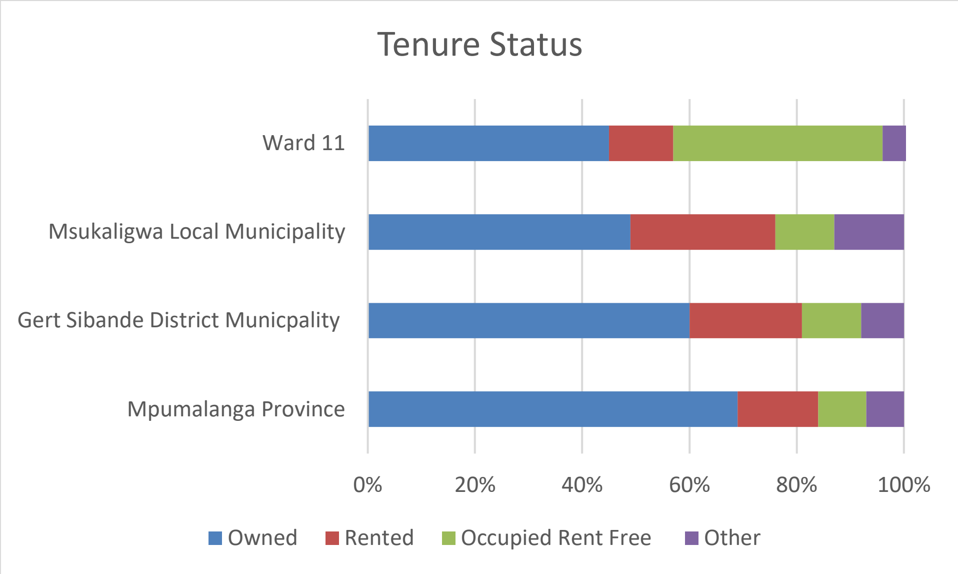


Figure 10-43: Tenure Status of Households

10.17.3.2 Economics

10.17.3.2.1 Employment

The percentage of the population over 15 years of age who were unemployed, not economically active and discouraged work seekers was higher in Ward 11 (17.8%, 44.5% and 9.4% respectively) than at the local, district and provincial levels (Figure 10-44). There was therefore a high level of dependency in Ward 11 households.

In terms of employment sectors, of the 28.4% of the population who were employed, 64.2% were employed in the formal sector, 24.6% in the informal sector, and 8.6% in private households.

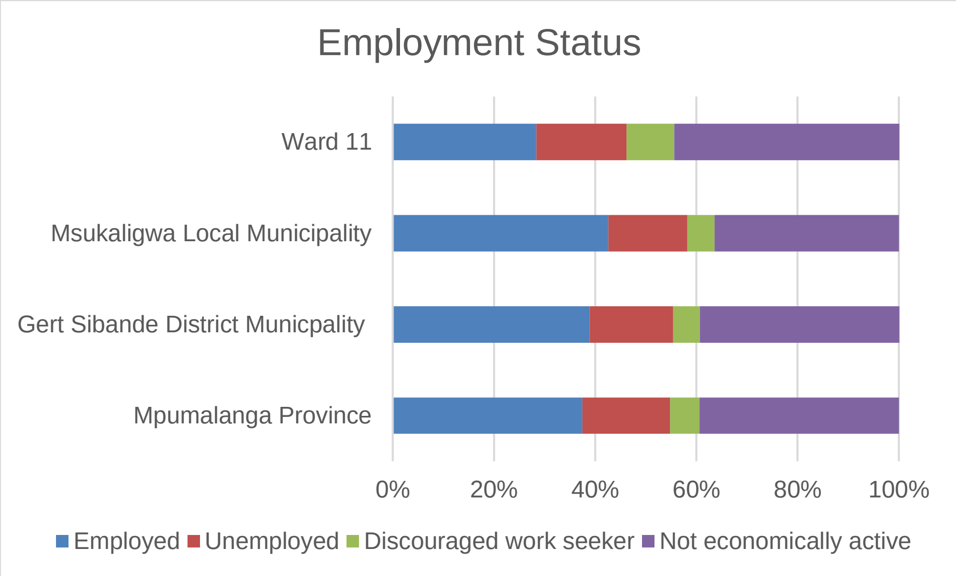


Figure 10-44: Employment Status

10.17.3.2.2 Income Profiles

Eleven percent of households in Ward 11 did not earn an income while 27% earned an annual income of less than R10 000 per annum, 22% earned an annual income of between R10 000 and R20 000, 23% an annual income of R20 000 to R40 000, and 16% an annual income between R40 000 to R 75 000. Thirty-eight percent of income earning households in Ward 11 are categorized as low-income households, earning an annual income of R1 to R20 000. The percentage of low-income households was higher in Ward 11 than at local, district, and provincial levels (Figure 10-45).

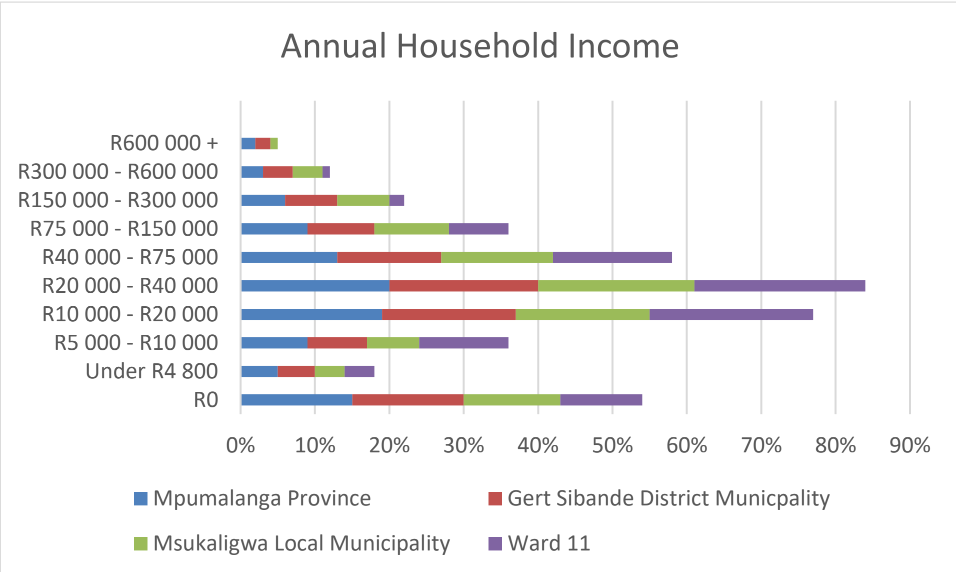


Figure 10-45: Annual Household Income Levels

10.17.3.3 Services and Infrastructure

10.17.3.3.1 Water

The percentage of the population that got water from a regional or local service provider was significantly lower in Ward 11 (28%) than at the local, district and provincial levels. The percentage of the population that sourced their water from a borehole was three times higher for Ward 11 (15%) than for the local, district and provincial levels. Forty-four percent of the population in Ward 11 sourced their water from rivers and dams which is 10 times higher than the local, district and provincial levels. Refer to Figure 10-46.

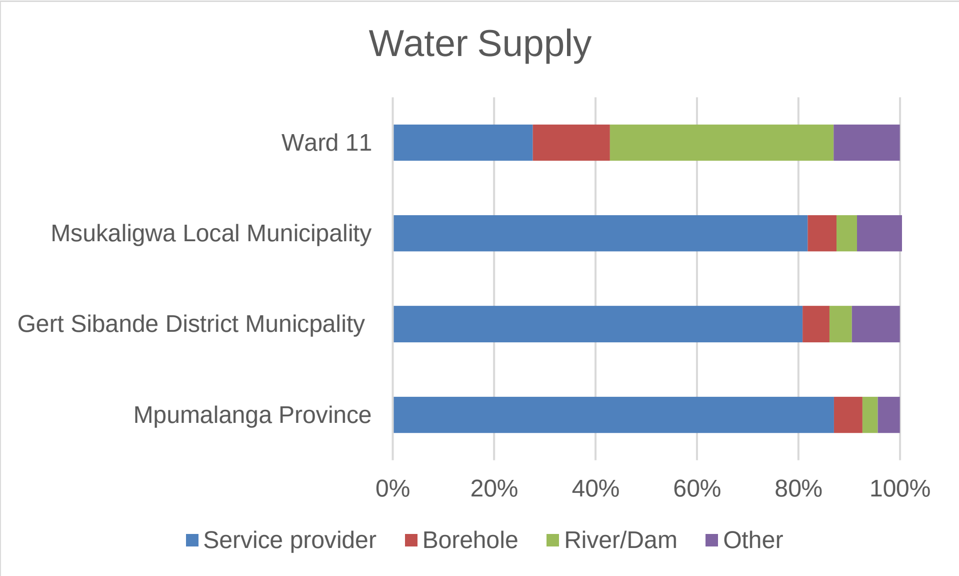


Figure 10-46: Water Supply

10.17.3.3.2 Sanitation

In Ward 11, 11% of the population had access to flush toilets, 62% used pit latrines and 24% did not have access to any sanitation facilities (Figure 10-47).

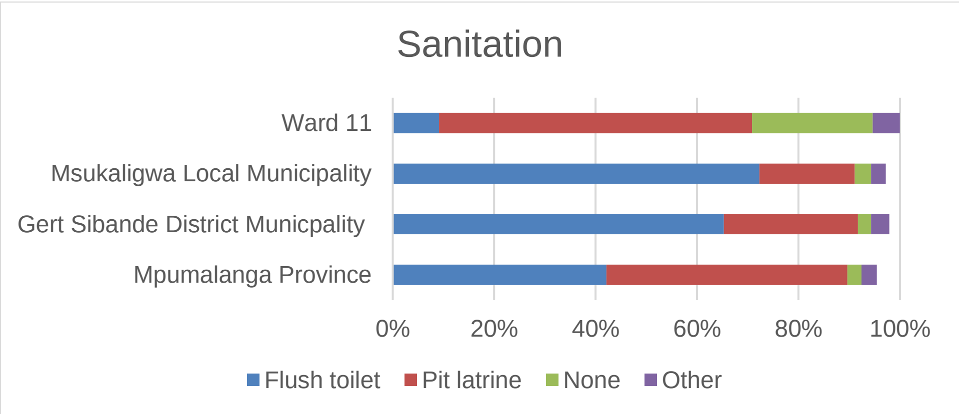


Figure 10-47: Sanitation Facilities

10.17.3.3.3 Refuse Disposal

The percentage of the population in Ward 11 who benefited from refuse removal by a local authority or private company (0.2%) was marginal in comparison to local, district and provincial populations (Figure 10-48).

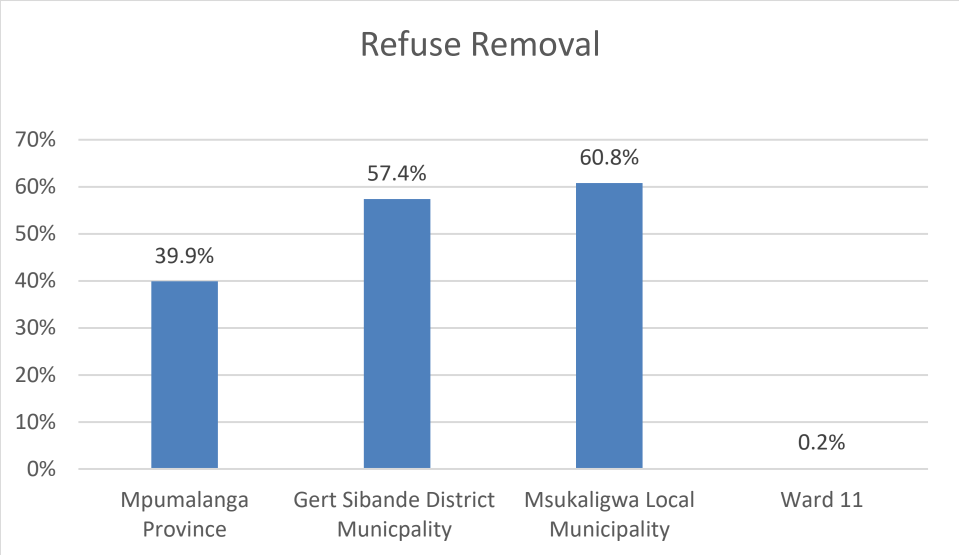


Figure 10-48: Refuse Removal by Local Authority or Private Company

10.17.3.3.4 Electricity

The percentage of households in Ward 11 that used electricity for cooking (25%), heating (17%) and lighting (57%) was significantly lower than for households at local, ward and provincial level.

Sixty-nine percent of households in Ward 11 used wood for cooking, 73% used wood for heating, and 41% used candles for lighting. Refer to Figure 10-49.

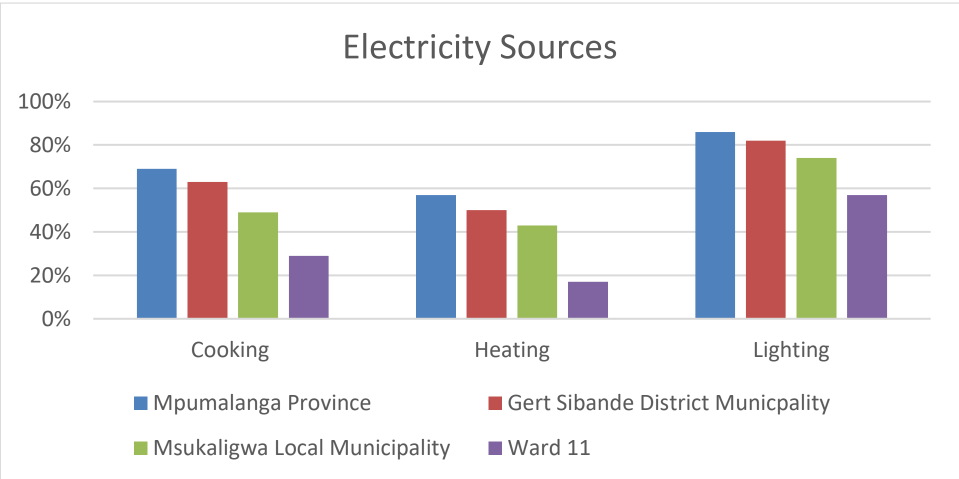


Figure 10-49: Electricity Sources

10.17.3.3.5 Housing

Forty-nine percent of households in Ward 11 indicated that they lived in a brick or concrete house, which was significantly lower than households at the local, district, and provincial levels. Ward 11 had the highest percentage of households living in traditional dwellings (40%) and the lowest percentage of households living in informal dwellings (shacks). Refer to Figure 10-50.

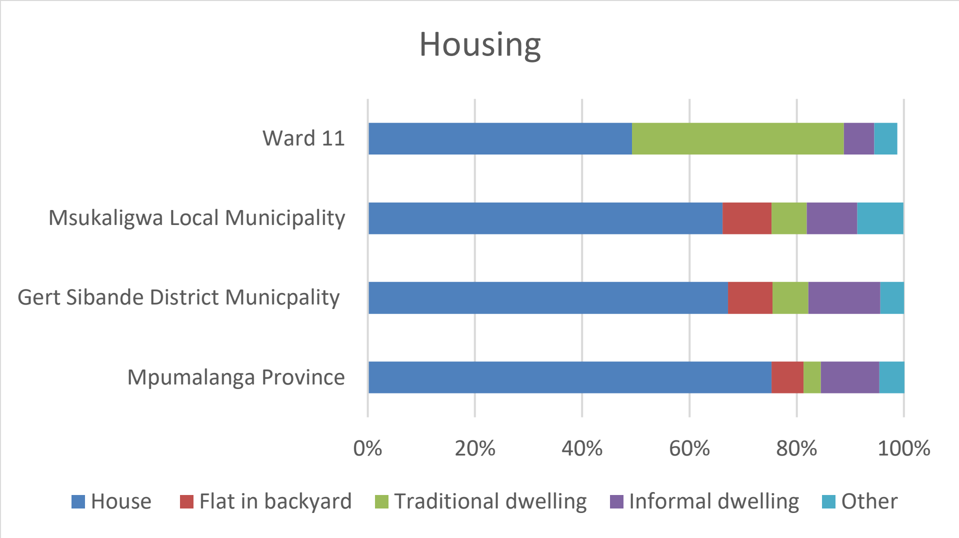


Figure 10-50: Housing Structures

10.17.3.4 Primary Study Area

10.17.3.4.1 Socio-economic Context

The primary study area is rural in nature with households sparsely located across the area. The primary livelihood activities are subsistence and commercial crop farming (maize and legumes) and livestock keeping of cattle, sheep, goats and chickens. There were reportedly 200 head of cattle grazing in the primary study area.

It was reported that many of those living in the primary study area are unemployed and expectations regarding economic benefits such as employment opportunities, skills training, and SMME development were therefore high. Moreover, residents in the primary study area insisted that they be given preference in terms of employment and other economic opportunities. These competing expectations may potentially create conflict between primary and secondary study area residents as well as between residents in these study areas and job seekers from outside.

Dagsoom will implement an Agricultural Livelihoods Programme to improve agricultural production as part of its SLP commitments.

10.17.3.4.2 Social Services and Infrastructure

Building structures on the primary study area include brick buildings (that belonged to the previous occupants), newly-built brick structures, and buildings constructed with mud and thatch (Figure 10-51). There are expectations that the Project benefits will include improved housing, and also, concerns that the mud and thatch structures will be particularly vulnerable to the impacts of blasting and other mining activities.

Figure 10-51: Traditional Household Structures in the Primary Study Area

It was reported that households in the primary study area source water primarily from rivers, streams and dams, although some have access to boreholes with hand pumps. Many households do not have access to flush toilets and improved pit latrines, and do not benefit from refuse removal by a municipal or private service provider. Expectations regarding the Project's assistance with service provision, especially in terms of clean water supply, sanitation facilities and a refuse disposal site were high. As indicated in the SLP, the Project has taken the decision to invest in water infrastructure development by installing two boreholes and associated handpumps at appropriate locations within the primary study area.

The road infrastructure within the primary study area is poor and it was reported that this impedes access to other areas and social services.

11 Item 3(g)(v): Impacts and Risks Identified including the Nature, Significance, Consequence, Extent, Duration and Probability

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 project activity takes place, as well as the activity itself. The identification of potential impacts is performed by determining the potential source, possible pathways and receptors. In essence, the potential for any change to a resource or receptor (i.e. environmental aspect) brought about by the presence of a Project component or by a Project-related activity has been identified as a potential impact.

The potential impacts are discussed per environmental feature/aspect and according to each phase of the project i.e. the Construction, Operational and Decommissioning/ Post Closure Phases. The significance, probability and duration of these potential impacts have been assessed based on the detailed specialist studies undertaken on the sensitivity of the receiving environment. The main Project activities to take place during the construction, operational and decommissioning phases may pose potential impacts on the receiving environment and are described in Table 11-1 below. Cumulative impacts are discussed in Section 11.2.

Table 11-1: Project Activities per Phase

Project Phase	Project Activity
Construction Phase	■ Site/vegetation clearance; ■ Access and haul road construction; ■ Infrastructure construction; ■ Development of a box cut; ■ Power line construction; ■ Diesel storage and explosives magazine; and ■ Topsoil stockpiling.

Project Phase	Project Activity
Operational Phase	■ Removal of rock (blasting); ■ Stockpile (rock dumps, soils, ROM, discard dump) establishment and operation; ■ Diesel storage and explosives magazine; ■ Operation of the underground workings; ■ Operating processing plant; ■ Operating sewage treatment plant; ■ Water use and storage on-site – during the operation water will be required for various domestic and industrial uses. Dams will be constructed that capture water from the mining area which will be stored and used accordingly; ■ Storage, handling and treatment of hazardous products (including fuel, explosives and oil) and waste; and ■ Maintenance activities – through the operations maintenance will need to be undertaken to ensure that all infrastructure in operating optimally and does not pose a threat to human or environmental health. Maintenance will include haul roads, pipelines, processing plant, machinery, water and stormwater management infrastructure, stockpile areas.
Decommissioning Phase	■ Demolition and removal of infrastructure – once mining activities have been concluded infrastructure will be demolished in preparation of the final land rehabilitation; ■ Rehabilitation – rehabilitation mainly consists of spreading of the preserved subsoil and topsoil, profiling of the land and re-vegetation; and ■ Post-closure monitoring and rehabilitation.

11.1 Impacts and Mitigations Per Project Phase

The impacts that will be assessed during the construction, operational and decommissioning phase are discussed in Table 11-3 below. Table 11-2

Table 11-2: Impact Matrix Abbreviations

Abbreviation	Definition
D	Duration
E	Extent
I	Intensity
P	Probability
S	Significance

Table 11-3: Impact Assessment Associated with the Construction, Operational and Decommissioning Phases

Phase	Activity	Aspect	Impacts	D	E	I	P	S	Rating (Pre-Mitigation)	Mitigation Measures	D	E	I	P	S	Rating (Post Mitigation)
Construction	Site clearance for construction work disturbs soils, exposure to erosion by wind and water and stockpiling	Soil, land use and land capability	Soil loss by wind and water erosion from cleared land surfaces, and incorrect stockpiling	5	4	5	6	84	Moderate negative	▪ Areas where stripping occurs must be clearly demarcated to ensure only those areas are affected; ▪ Topsoil must be stripped to a depth of 300mm and stockpiled to a maximum height of 4 m; ▪ The subsoil of 0.4 – 1.2 m will then be stripped and stockpiled separately for deep soils; ▪ A Topsoil Management Plan (TMP) must be prepared to demonstrate how topsoil will be preserved in a condition as near as possible to its pre-mining condition in order to allow successful mine rehabilitation; ▪ Vehicles must be prohibited from driving over stockpiles; ▪ Runoff must be controlled and managed by use of effective stormwater management measures; ▪ Re-fuelling must take place on bunded impervious surfaces to prevent seepage of hydrocarbons into the soil; ▪ Establishment of effective vegetation around constructed infrastructure for adequate soil protection from wind and water erosion; ▪ If any erosion occurs, corrective actions must be taken to minimise any further erosion from taking place at regular intervals or after high rainfall events; ▪ Restriction of vehicle movement over sensitive areas to reduce compaction; ▪ Minimise unnecessary removal of the natural vegetation cover outside the development footprint; ▪ All vehicles and machines must be parked within hard park areas and must be checked daily for fluid leaks; ▪ Place drip trays where there are vehicles or machinery leaks occurring; ▪ Fuel, grease and oil spills should be remediated using commercially available emergency clean up kits; ▪ For major spills (>5L), if soils are contaminated, they must be stripped and disposed of at a licensed waste disposal site; and ▪ Any contractors on site must ensure that all employees are aware of the procedure for dealing with spills and leaks and undergo training on site.	4	2	2	4	32	Negligible negative
Construction	Movement of vehicles and machinery and general handling of hydrocarbons may result in spillages of hydrocarbons such as oils, fuels and grease	Soil, land use and land capability	Soil contamination by hydrocarbon spillages and leakages	5	3	3	6	66	Minor negative		4	2	1	4	28	Negligible negative
Construction	Movement of heavy machinery	Soil, land use and land capability	Soil compaction resulting from the movement of heavy machinery within the Project Area or on stockpiles	5	3	4	5	60	Minor negative		4	2	2	4	32	Negligible negative
Construction	Site Clearance within vegetated areas	Fauna and Flora	Loss of high sensitivity vegetation type and landscape (*Hyparrhenia – Themeda* Grassland, Sandstone Ridges, Riparian areas)	7	2	3	7	84	Moderate negative	▪ Except where critical to the project development and where absolutely necessary and by offset, the Primary grassland, Riparian areas and Sandstone ridges should be excluded from the mine plan to prevent deterioration of these areas; ▪ All Primary grassland and Sandstone ridges must be managed as sensitive landscapes and designated as no- go areas; ▪ The footprint of disturbance area should be kept as small as possible and only the access roads (which will follow existing roads and tracks where possible) should be used to reach the site for clearing and vehicles should not be allowed to traverse natural areas or leave the demarcated road; and ▪ An alien and invasive plant species management programme must be in place during the construction phase. In this regard, special mention is made of *A. mearnsii*, which is the dominant alien invasive tree species observed in the watercourses at the time of the assessment. Existing AIP's within the areas demarcated for infrastructure will be eradicated. The disturbed site	5	1	1	7	49	Minor negative

Phase	Activity	Aspect	Impacts	D	E	I	P	S	Rating (Pre-Mitigation)	Mitigation Measures	D	E	I	P	S	Rating (Post Mitigation)
										will be monitored quarterly for at least the life of the project and a minimum of two years post closure to ensure that alien invasion does not take place;						
Construction	Site Clearance within vegetated areas	Fauna and Flora	Loss of habitat of moderate to low sensitivity (AIP vegetation types)	7	2	1	7	70	Moderate negative	▪ The footprint area should be kept as small as possible and only access roads (which will follow existing roads and tracks) should be used to reach the site for clearing and vehicles should not be allowed to traverse natural areas or leave the demarcated road; ▪ An AIP management plan must be implemented, whereby existing AIP's within the areas demarcated for infrastructure will be eradicated. The disturbed site will be monitored quarterly for at least two years to ensure that alien invasion does not take place.	5	1	1	7	49	Minor negative

Phase	Activity	Aspect	Impacts	D	E	I	P	S	Rating (Pre-Mitigation)	Mitigation Measures	D	E	I	P	S	Rating (Post Mitigation)
Construction	Site clearing, including the removal of vegetation and disturbance of soils	Wetlands	Construction and development activities within a greenfield site are likely to result in negative impacts to functioning freshwater resources and the catchment. This is realised through the resultant habitat fragmentation, spreading of alien and invasive species, soil disturbance and/or compaction, increased incidence of erosion, sedimentation from erosion, potential water quality deterioration, and disturbance to avifauna and other fauna utilising the freshwater resources thus resulting in an overall loss of biodiversity	7	4	4	5	75	Moderate negative	▪ Environmental Practitioner to be present during vegetation clearing to prevent unnecessary clearing of extensive areas not part of the direct footprint area; ▪ Clearly marked buffer zones must be established, which are defined as regions of natural vegetation between watercourses/wetlands and developments or activities (WRC, 2015). This is a key management action that should take place by revising proposed infrastructure locations in line with the sensitivity mapping; ▪ Limit vegetation removal and construction activities to the infrastructure footprint area only, where removed or damaged vegetation areas should be revegetated as soon as possible; ▪ An alien and invasive plant species management programme must be in place during the construction phase. In this regard, special mention is made of *A. mearnsii*, which is the dominant alien invasive tree species observed in the watercourses at the time of the assessment; ▪ Bare land surfaces downstream of construction activities must be vegetated to limit erosion from surface runoff associated with infrastructure areas. Actively re-vegetate disturbed areas immediately after construction; ▪ Ensure a soil management programme is implemented and maintained to minimise erosion and sedimentation; ▪ If destruction of wetlands is unavoidable disturbance must be minimised and suitably rehabilitated; ▪ Ensure no incision and canalisation of the wetland features takes place; ▪ Erosion berms must be installed on roadways and downstream of the discard dump to prevent gully formation and siltation of the freshwater resources. The following points should serve to guide the placement of erosion berms: ▪ Where the track has a slope of less than 2%, berms every 50m should be installed; ▪ Where the track slopes between 2% and 10%, berms every 25m should be installed; ▪ Where the track slopes between 10%-15%, berms every 20m should be installed; and ▪ Where the track has a slope greater than 15%, berms every 10m should be installed. ▪ All erosion within the construction footprint should be remedied immediately and included as part of an ongoing rehabilitation plan; ▪ Limit personnel within the buffer areas for all freshwater features identified and such personnel can only enter as and when necessary; ▪ All areas of increased ecological sensitivity should be designated as "No-Go" areas and be off limits to all unauthorised vehicles and personnel; ▪ No crossing of the wetland features and their associated buffers should take place (excluding the access road, powerline and water pipleline) and the substrate conditions of the wetlands and downstream stream connectivity must be maintained; ▪ At areas where road crossings have been designed, these roads should cross wetland or river features at the narrowest point and at a 90-degree angle with suitable drainage designed into the relevant bridge/culvert crossing;	3	3	2	4	32	Negligible negative
Construction	Construction of mine related infrastructure including the plant area, the infrastructure area, the ROM pad, the PCD, the discard dump, the	Wetlands	Fragmentation of the freshwater resources as a result of road crossings. Loss of freshwater resource habitat (soils and vegetation) due to both direct and indirect impacts.	7	4	6	7	119	Major negative		7	3	3	5	65	Minor negative

Phase	Activity	Aspect	Impacts	D	E	I	P	S	Rating (Pre-Mitigation)	Mitigation Measures	D	E	I	P	S	Rating (Post Mitigation)
	explosives delivery bay, the northern underground access point, and access and haul roads.		These impacts may result in complete loss of wetland ecosystems or part thereof. Although some of these freshwater resources are not in pristine condition, they are providing significant ecological services at the local and catchment scale							▪ No material will be dumped or stockpiled within any rivers, tributaries or drainage lines in the vicinity of the proposed footprint area. ▪ Environmentally friendly barrier systems, such as silt nets or, in severe cases, use of trenches, downstream from construction sites to limit erosion and possibly trap contaminated runoff from construction; ▪ Stormwater must be diverted from construction activities and managed in such a manner to disperse runoff and prevent the concentration of stormwater flow; ▪ Water used at construction sites should be utilised in such a manner that it is kept on site and not allowed to run freely into nearby watercourses (i.e. installation of clean and dirty water separation systems); ▪ Construction during high rainfall periods (usually November to March) should be avoided to decrease surface runoff in areas of vegetation removal and disturbed soils in an attempt to limit erosion and sedimentation into wetlands and instream aquatic systems; ▪ The clean and dirty water separation systems must be some of the first infrastructures installed on site and care must be taken to ensure that contamination of the receiving environment as a result of mining activities is minimised as far as possible; ▪ No vehicles or heavy machinery may be allowed to drive indiscriminately within any wetland areas and their associated buffer zones. All vehicles must remain on demarcated roads and within the construction footprint and access roads; ▪ All vehicles must be regularly inspected for leaks; ▪ Re-fuelling must take place on a concrete lined or bunded surface area away from wetlands to prevent ingress of hydrocarbons into the topsoil; ▪ Construction chemicals, such as paints and hydrocarbons, should be used in an environmentally safe manner with correct storage as per each chemical's specific storage descriptions; ▪ All spills should be immediately cleaned up and treated accordingly; ▪ Appropriate sanitary facilities must be provided for the duration of the construction activities and all waste must be removed to an appropriate waste facility, and ▪ Wetland monitoring must be carried out quarterly during the construction phase by a wetland specialist to ensure no unnecessary impact to the freshwater resources occur; and if so, a solution must be put in place as soon as possible.						
Construction	Site clearance and construction of proposed infrastructure	Aquatics	Land and vegetation manipulation/clearing for infrastructure in proximity to the Southern Tributary and within non-perennial drainage lines.	5	3	5	4	52	Minor negative	▪ Mitigation measures detailed for the site and vegetation clearing impact should be applied to areas leading up to the watercourse crossing points. However, the infrastructure construction over a watercourse needs additional attention due to the proximity of the activity to aquatic ecosystems. Essentially, the watercourse is going to be directly affected unless a "suspension" approach is adopted (e.g. suspending the infrastructure, allowing only contact with the banks of the watercourse of concern). This is recommended where applicable but will most likely only be a viable option for pipelines that cross watercourses, if any. Larger constructions over watercourses, more specifically the proposed road constructions and associated culverts (if any), are of focus.	5	2	3	2	20	Negligible negative

Phase	Activity	Aspect	Impacts	D	E	I	P	S	Rating (Pre-Mitigation)	Mitigation Measures	D	E	I	P	S	Rating (Post Mitigation)
Construction	Physical construction of infrastructure over natural aquatic ecosystems	Aquatics	Vegetation removal for site access and potential hydrological disturbance of associated watercourses	6	3	4	4	52	Minor negative	▪ The design as well as the physical construction of roads should not alter the natural hydrology and connectivity of the watercourses in any way (i.e. damming or creating barriers). Any infrastructure proposed to be in contact with the substrate/channel bottom should allow for the free flow of water and material. If hard surfaces are going to be used as foundation or if culverts are going to be installed, their base should not be noticeable above the natural channel bottom to maintain connectivity. Biannual aquatics monitoring of the crossing points should also form part of the management actions to ensure correct flow occurs through the crossing point, especially during the wet season.	6	2	2	2	20	Negligible negative
Construction	Site preparation including vegetation clearance and excavations, leading to exposure of soils	Surface water	Sedimentation and siltation of nearby watercourses	5	4	4	6	78	Moderate negative	▪ Clearing of vegetation must be limited to the development footprint, and the use of any existing access roads must be prioritised so as to minimise creation of new ones; ▪ If possible, construction activities must be prioritised to the dry months of the year to limit mobilisation of sediments, dust generation and hazardous substances from construction vehicles used during site clearing; ▪ Dust suppression with water on the haul roads and cleared areas must be undertaken to limit dust; ▪ Avoid placement of any infrastructure within the 100-year floodlines or 100 m buffer from watercourses, whichever is greater; ▪ Hydrocarbon and hazardous waste storage facilities must be appropriately bunded to ensure that leakages can be contained. Spill kits should be in place and construction workers should be trained in the use of spill kits, to contain and immediately clean up any potential leakages or spills; ▪ Vehicles should regularly be maintained as per the developed maintenance program. This should also be inspected daily before use to ensure there are no leakages underneath ▪ Drip trays must be used to capture any oil leakages. Servicing of vehicles and machinery should be undertaken at designated hard park areas. Any used oil should be disposed of by accredited contractors;	2	2	2	3	18	Negligible negative
Construction	Construction and installation of infrastructural facilities including administration offices, ablutions, storerooms, workshops, pollution control dams, processing plant, roads, pipelines etc.	Surface water	Increase of impermeable surfaces, subsequently increasing runoff and potential flooding	5	4	3	5	60	Minor negative		5	2	2	3	27	Negligible negative
Construction	Handling of hydrocarbons and other chemicals; Loading, hauling and transportation of product coal.	Surface water	Surface water contamination leading to deterioration of water quality	5	4	3	5	60	Minor negative		5	2	2	2	18	Negligible negative
Construction	Fuel storage, construction vehicles causing potential groundwater contamination	Groundwater	Storage of fuel and the usage of construction vehicles on-site could cause spillages of hydrocarbons. These spillages may seep into the underlying aquifers, causing contamination of groundwater with hydrocarbons.	1	1	2	3	10	Negligible negative	▪ Regular service of vehicles in designated repair bays as per the developed maintenance program; and ▪ Refuelling of vehicles only in designated areas with correct liners and surfaces	1	1	2	1	6	Negligible negative
Construction	Mine access dewatering causing groundwater level drawdown	Groundwater	During construction of the adit into the underground mine, small scale	1	1	2	2	8	Negligible negative	▪ Keep the box cut construction time as short as possible; and ▪ Keep the extents and depth of the box cuts as small as possible	1	1	2	1	6	Negligible negative

Phase	Activity	Aspect	Impacts	D	E	I	P	S	Rating (Pre-Mitigation)	Mitigation Measures	D	E	I	P	S	Rating (Post Mitigation)
			dewatering associated with the construction could lead to local drawdown of groundwater levels in the vicinity of the adit.													
Construction	The current proposed infrastructure design layout suggests that the Project will directly impact only STE-005	Heritage	Indirect impact on burial grounds and graves	5	3	6	4	56	Moderate negative	▪ Dagsoom must develop and implement a CMP to prevent the degradation of the fabric of the burial grounds and graves through the Project lifecycle and preserve the CS of the heritage resources. ▪ Dagsoom must also develop and implement an Access Protocol to allow individuals access to the burial grounds and graves. This Access Protocol can be developed considering the relevant safety and security measures of the mine, the requirements of the Mine Health and Safety Act, 1996 (Act No. 29 of 1996) (MHSA) and the needs of the community. ▪ Information regarding the Access Protocol must be made publicly available and can be developed as part of the CMP.	6	3	5	6	84	Moderate (positive)
Construction	Site Clearing, Excavation / Transport, Tipping and Spreading of Materials	Air Quality	Nuisance and reduction in ambient air quality	2	2	2	5	30	Negligible negative	▪ Develop a traffic management plan for site to enforce a speed limit; ▪ Apply wetting agents, dust suppressant or binders on exposed areas (including excavated stockpiled material and on dirt roads); ▪ Enforce adherence to set vehicle speed limits; ▪ Conduct activities judiciously during windy days (≥5.4 m/s); and ▪ Minimise the drop heights when loading, offloading and tipping material.	2	1	1	2	5	Negligible negative
Construction	Blasting the adit	Blasting	Ground vibration impact on community houses and heritage resources	2	3	2	3	16	Negligible negative	▪ Specific blast design to be done, shorter blast holes, smaller diameter blast hole, using electronic initiation instead of shock tube systems to obtain single hole firing. ▪ Monitor ground vibration and air blast from blasting operations	2	3	2	3	16	Negligible negative
Construction		Blasting	Air blast impact on community houses	2	2	2	2	16	Negligible negative	▪ Specific blast design to be done, shorter blast holes, smaller diameter blast hole, use of specific stemming materials to manage air blast, increased stemming lengths to reduce air blast effect. Used of specific stemming to manage fly rock - crushed aggregate of specific size. Re-design with increased stemming lengths ▪ Monitor ground vibration and air blast from blasting operations	2	2	2	2	16	Negligible negative
Construction		Blasting	Fly rock impact on community houses	2	2	2	2	10	Negligible negative	▪ Specific blast design to be done, shorter blast holes, smaller diameter blast hole, use of specific stemming materials to manage air blast, increased stemming lengths to reduce air blast effect. ▪ Monitor fly rock situation using video camera	2	2	2	2	10	Negligible negative
Construction	Site clearing, and the construction of infrastructure will result in the generation of noise.	Noise	Noise will emanate from the machinery, and vehicles during the site preparation, haul road construction as well as processing plant construction activities and may exceed the South African	3	2	1	3	18	Negligible negative	▪ Restrict construction activities to daylight hours (06:00 – 18:00 ▪ Vehicles to be serviced as per their design requirements to ensure noise suppression mechanisms are effective e.g. installed exhaust mufflers; ▪ Regulate vehicle speeds on the access and haul roads; and ▪ Switch off equipment when not in use during the working hours.	3	1	1	3	15	Negligible negative

Phase	Activity	Aspect	Impacts	D	E	I	P	S	Rating (Pre-Mitigation)	Mitigation Measures	D	E	I	P	S	Rating (Post Mitigation)
			standard SANS 10103 [2]													
Construction	Recruitment / Appointment of Construction Workforce	Socio-economic	Employment creation during construction	3	5	2	4	40	Minor (positive)	▪ Develop and implement an abbreviated Stakeholder Engagement Plan (SEP), inclusive of a communications plan and grievance mechanism, as well as the appointment of community liaison personnel; ▪ Undertake a skills survey of the communities located in the primary and secondary study areas, allowing residents to register their interest and particular skills for upcoming employment and skills training opportunities; ▪ Use the results of the skills survey to develop a skills register to inform the Skills Development Plan to maximize employment opportunities for residents in the primary and secondary study areas; ▪ Provide skills training prior to and during the Construction Phase to improve local employability during both Construction and Operational Phases; ▪ Explore the possibility of expanding job opportunities beyond mining-related work to also include hiring contract workers to assist with community development projects; ▪ Comply with minimum wage requirements for unskilled labour and all other requirements, including gender equity, of the Employment Equity Act[4] to ensure maximum benefits accrue to workers; ▪ Monitor Dagsoom and its subcontractors in terms of the commitments stipulated in Dagsoom's Social and Labour Plan (SLP) on an annual basis through external auditors; ▪ Ensure that local communities understand the Project's employment requirements in terms of skills and type of employment, by communicating relevant aspects of the SLP and its overarching objectives at community forums in the primary and secondary study areas; and ▪ Prepare for the Operational Phase by updating the Project's local labour database to include local community members employed during the Construction Phase.	3	5	4	6	78	Major positive
Operational	Soil chemical pollution	Soil, land use and land capability	Soil Contamination from Hydrocarbon waste (lubricants, explosives and fuels)	5	3	3	6	66	Minor negative	▪ Soil pollution monitoring should be conducted at selected locations on the project site to detect any extreme levels of pollutants; ▪ Any spillages of hydrocarbons or sewage effluent from the treatment plant or ablution facilities should be cleaned-up immediately and the contaminated soils removed fordiposal of at accredited disposal sites; ▪ A Topsoil Management Plan (TMP) must be prepared to demonstrate how topsoil will be preserved in a condition as near as possible to its pre-mining condition in order to allow successful mine rehabilitation; ▪ Long term stockpiles should be revegetated to minimise loss of soil quality. This will minimise weed infestation, maintain soil organic matter levels, maintain soil structure and microbial activity and maximise the vegetative cover of the stockpile; ▪ Topsoil stripping should be scheduled for the dry season, where possible; and ▪ All long-term topsoil material stockpiles should be located outside the active mine path and away from drainage lines.	4	2	1	4	28	Negligible negative
Operational	During the stripping and stockpiling process there may be some unexpected changes in the depth and the nature of the soil.	Soil, land use and land capability	Deterioration of Topsoil Quality from in Topsoil Stockpiles	4	2	4	6	60	Minor negative		4	2	1	6	28	Negligible negative

[4] The Employment Equity Amendment Act 47 of 2013, Government Gazette, RSA, Volume 583, 16 January 2014, Cape Town.

Phase	Activity	Aspect	Impacts	D	E	I	P	S	Rating (Pre-Mitigation)	Mitigation Measures	D	E	I	P	S	Rating (Post Mitigation)
Operational	Underground mining of coal and the operation of the rock dumps, soils, ROM, discard dump.	Fauna and Flora	Potential for road kills, injuring or poaching and faunal disturbance	5	2	3	4	40	Minor negative	▪ Erect signage with speed limits. ▪ Restrict vehicle movement to daylight hours. ▪ Additional surveys should be conducted to determine the presence of Grass Owl and Serval on site. If these species are present, a management plan should be implemented. ▪ Concurrent rehabilitation should take place.	5	2	3	3	30	Negligible negative
Operational	Operation of powerlines that could cause bird fatalities through collisions and electrocutions.	Fauna and Flora	Collisions and electrocutions	5	2	3	4	40	Minor negative	▪ Install Bird Diverters ▪ Utilise best practice with pylon construction and type.	5	2	3	3	30	Negligible negative
Operational	Operational underground mining activities, including excavation and dewatering	Wetlands	Operational activities of the proposed underground mining activities have the potential to result in impacts to the water quality of the groundwater, local and downstream resources as well as the potential loss of water supply from the groundwater aquifer. Dewatering activities are likely to result in the loss of water supply to the wetlands, with special mention of the lower lying wetlands such as CVB4, and moisture stress to the surrounding wetland areas.	7	5	6	6	108	Moderate negative	The following management actions are recommended to guide the effective management of stormwater and water generated on site: ▪ Channelled water should not be dispersed in a concentrated manner. Baffles should be incorporated into artificial drainage lines/channels around the surface infrastructure to decrease the kinetic energy of water as it flows into the natural environment; ▪ Bare surfaces downstream from the developments where silt traps are not an option should be vegetated in order to attempt to limit erosion and runoff that might be carrying contaminants; ▪ All erosion noted within the operational footprint should be remedied immediately and included as part of an ongoing rehabilitation plan; ▪ Ensure that no incision and canalisation of the wetland features present takes place; ▪ Erosion berms should be installed on roadways and downstream of stockpiles and the discard dump to prevent gully formation and siltation of the freshwater resources. The following points should serve to guide the placement of erosion berms: ▪ Where the track has a slope of less than 2%, berms every 50m should be installed; ▪ Where the track slopes between 2% and 10%, berms every 25m should be installed; ▪ Where the track slopes between 10%-15%, berms every 20m should be installed; and ▪ Where the track has a slope greater than 15%, berms every 10m should be installed; ▪ Quarterly monitoring of all wetland areas affected as a result of infrastructure developments, including linear infrastructures such as roads watercourses should be carried out by a suitably qualified wetland ecologist in order to determine localities of areas subjected to erosion and increased runoff; where after, new mitigation actions should be implemented as per the specialist's recommendations.	6	3	4	5	65	Minor negative
Operational	Uncontrolled runoff of stormwater or water generated from the mining operations from or through the surface infrastructure	Wetlands	Water quality and habitat deterioration of watercourses receiving unnatural/contaminated runoff	5	4	5	4	56	Minor negative		5	2	3	3	30	Negligible negative
Operational	Operational underground mining activities, including excavation and dewatering	Wetlands	Operational activities of the proposed underground mining activities have the potential to result in	7	5	6	6	108	Moderate negative	The following management and mitigation measures should be put in place to minimise the impact of the underground operational activities: ▪ During the operational phase of the project the Storm Water Management Plan (SWMP) contained in the Surface Water Report should already be	6	3	4	5	65	Minor negative

Phase	Activity	Aspect	Impacts	D	E	I	P	S	Rating (Pre-Mitigation)	Mitigation Measures	D	E	I	P	S	Rating (Post Mitigation)
			impacts to the water quality of the groundwater, local and downstream resources as well as the potential loss of water supply from the groundwater aquifer. Dewatering activities are likely to result in the loss of water supply to the wetlands, with special mention of the lower lying wetlands such as CVB4, and moisture stress to the surrounding wetland areas.							implemented. This should consider all wetlands and other watercourses associated with the new developments/infrastructure which should divert stormwater away from the surface infrastructure and back into natural watercourses to maintain catchment yield as far as possible. The SWMP should also convey stormwater to silt traps where needed in order to limit erosion and the subsequent increase of suspended solids in downstream watercourses; ▪ If possible, clean water removed as part of the dewatering activities should be released downgradient of the operational areas to ensure water supply to the lower lying wetlands is maintained. The following management and mitigation measures should be put in place to ensure impacts to the wetland ecology of the area as a result of (and in specific areas that could be effected by the operation) the general operational activities is reduced: ▪ Environmental Practitioner to be present during operational phase to prevent any additional clearing of extensive areas or vegetation or dumping of waste rock and/or coal in areas not part of the direct footprint area. ▪ The edge of the non-directly impacted freshwater resources, and at least a 100m buffer or 1:100 floodline buffer, should be clearly demarcated in the field with wooden stakes painted white as no-go zones that will last for the duration of the operational phase. ▪ All areas of increased ecological sensitivity should be designated as "No-Go" areas and be off limits to all unauthorised vehicles and personnel; ▪ Freshwater resource monitoring must be carried out during the operational phase by a wetland specialist to ensure no unnecessary impact to the freshwater resources present; and if so that a remedy is put in place as soon as possible. ▪ Ensure soil management programme is implemented and maintained to minimise erosion and sedimentation; ▪ Implement and maintain alien vegetation management programme; ▪ If it is absolutely unavoidable that any of the wetland areas present will be affected, disturbance must be minimised and suitably rehabilitated; ▪ No material is to be dumped or stockpiled within any rivers, tributaries or drainage lines; ▪ No vehicles or heavy machinery may be allowed to drive indiscriminately within any wetland areas or their buffer areas. All vehicles must remain on demarcated roads and within the operational footprint; ▪ All vehicles must be regularly inspected for leaks; ▪ Re-fuelling must take place on a sealed surface area away from wetlands to prevent ingress of hydrocarbons into topsoil; ▪ All spills should be immediately cleaned up and treated accordingly; and ▪ Appropriate sanitary facilities must be provided for the duration of the operational phase and all waste must be removed to an appropriate waste facility.						
Operational	Uncontrolled runoff of stormwater or water generated from the mining operations from or through the surface infrastructure	Wetlands	Water quality and habitat deterioration of watercourses receiving unnatural/contaminated runoff	5	4	5	4	56	Minor negative		5	2	3	3	30	Negligible negative
Operational	Loading, hauling and stockpiling	Wetlands	These activities have the potential to result in an increased potential for soil compaction, erosion, sedimentation, loss of water quality, habitat and biodiversity	5	4	4	5	65	Minor negative		5	1	2	4	34	Negligible negative
Operational	Use and maintenance of haul roads for the transportation of coal and waste rock	Wetlands	Fragmentation of the freshwater resources as a result of road crossings, contamination of freshwater resources and impacts to water quality as a result of spills, compaction of soils, loss of habitat and biodiversity. Increased potential for sheet runoff from paved/cleared surfaces and increased potential for erosion	7	4	3	4	56	Minor negative		5	2	1	4	32	Negligible negative

Phase	Activity	Aspect	Impacts	D	E	I	P	S	Rating (Pre-Mitigation)	Mitigation Measures	D	E	I	P	S	Rating (Post Mitigation)
Operational	Uncontrolled runoff of stormwater or water generated from the mining operations from or through the surface infrastructure	Aquatics	Water quality and habitat deterioration of watercourses receiving unnatural/ contaminated runoff	5	4	5	4	56	Minor negative	▪ During the Operational Phase of the Project a SWMP should already be implemented. This should consider all drainage lines associated with the new developments/infrastructure which should divert stormwater away from the surface infrastructure and back into natural watercourses. The SWMP should also convey stormwater to silt traps where needed in order to limit erosion and an increase of suspended solids in downstream watercourses; ▪ Channelled water should not be dispersed in a concentrated manner. Baffles should be incorporated into artificial drainage lines/channels around the surface infrastructure to decrease the kinetic energy of water as it flows into the natural environment; ▪ Bare surfaces downstream from the developments where silt traps are not an option should be vegetated in order to attempt to limit erosion and runoff that might be carrying contaminants; ▪ Careful monitoring of the areas where dust suppression is proposed should be undertaken regularly. Areas concentrating water runoff should be addressed and not allowed to flow freely into associated watercourses; and ▪ Monitoring of infrastructure over watercourses should be done by an aquatic specialist in order to determine localities of areas subjected to erosion and increased runoff where after new mitigation actions should be implemented as per the specialist's recommendations	5	2	3	3	30	Negligible negative
Operational	Runoff from the dirty water areas or catchments (coal stockpile areas, mine processing plant, workshops etc.)	Surface water	Surface water contamination by runoff from dirty water areas	6	5	4	7	105	Moderate negative	▪ Infrastructure development must be limited to the demarcated footprint to minimize the dirty runoff generating catchments within the project area. ▪ As per the SWMP, clean water runoff from the upstream catchment of the mine should be diverted around the site into the natural environment, this will minimize the runoff that will potentially be contaminated by mine waste ▪ All the runoff captured on the stormwater dam and RWD should be re-used in the mine processes to avoid sourcing water from external sources. ▪ Should the contaminated water stored water be more than the storage capacities and discharge is considered, this water should be treated to acceptable water quality prior to discharge into the natural environment. In this case, acceptable water quality should at least be benchmarked with the baseline surface water quality of the surrounding streams	5	2	2	2	18	Negligible negative
Operational	Hydrocarbons and chemicals spillages and leakages from equipment, moving haulage trucks and machinery	Surface water	Surface water Contamination from hydrocarbon and chemical spillages and leakages	5	4	3	6	72	Minor negative		5	2	2	2	18	Negligible negative
Operational	Containment of dirty runoff in the PCDs	Surface water	Reduction of catchment runoff yield	5	4	4	7	91	Moderate negative		5	4	4	7	91	Moderate negative
Operational	Mine dewatering causing a decrease in groundwater reserves	Groundwater	Due to active mine dewatering required to ensure dry working conditions in the underground mine, certain groundwater volumes will be extracted from the underground void, limiting the groundwater resource.	6	2	3	2	30	Negligible negative	▪ Mining should progress as swiftly as possible to reduce the period of active dewatering; ▪ The mining-related surface infrastructure area extent should be kept to a minimum ▪ Underground mining can only take place in the areas associated with this application ▪ Dewatering of the underground mine should stop as soon as the mining activities cease ▪ Dewatering volumes should be monitored frequently throughout the LoM to note deviations from the predicted inflows as soon as possible	5	2	3	2	27	Negligible negative

Phase	Activity	Aspect	Impacts	D	E	I	P	S	Rating (Pre-Mitigation)	Mitigation Measures	D	E	I	P	S	Rating (Post Mitigation)
Operational	Mine dewatering causing lowering of groundwater levels	Groundwater	Active mine dewatering will be required to ensure dry working conditions in the underground void. The dewatering will cause ground levels to be drawn down in the vicinity of the mining area.	6	2	3	6	42	Minor negative	▪ Mining should progress as swiftly as possible to reduce the period of active dewatering ▪ The mining area extent should be kept to a minimum ▪ Dewatering of the underground mine should stop as soon as the mining activities cease ▪ Groundwater levels surrounding the mine void should be monitored on a regular basis throughout the LoM to verify the extent of the cone of drawdown	5	2	3	6	39	Minor negative
Operational	AMD formation in the underground void and discard dump causing groundwater contamination	Groundwater	Due to AMD forming within the underground void and in the discard dump, potential groundwater contamination with sulphate and a lower pH could occur, which would have an impact on the groundwater quality.	6	2	2	3	22	Negligible negative	▪ Groundwater abstraction should continue for the LoM to maintain a cone of drawdown ▪ Biannual aquatic monitoring of groundwater quality in the area surrounding the mine void should continue throughout the LoM ▪ Groundwater levels surrounding the mine void should be monitored on a quarterly basis throughout the LoM to verify the extent of the cone of drawdown.	5	2	2	2	18	Negligible negative
Operational	Material Handing, Hauling of Ore and Discard Waste, Crushing and Screening, Wind Erosion, and Generator Sets	Air Quality	Nuisance and potential health effects from exposure to fine particulate matter, gases and volatile	5	3	3	4	44	Minor negative	▪ Apply wetting agents, dust suppressant or binders on the dirt roads; ▪ Construct surfaces of haul roads from lateritic soils if possible and avoid fine/colloidal (e.g. clays and silts) materials; ▪ Vegetate exposed areas as soon as practicably possible; ▪ Enclose the crusher, screens, transfer and discharge points and conveyors; ▪ The area of disturbance shall be kept to a minimum at all times and no unnecessary stripping must occur, especially on windy days (wind speed ≥ 5.4 m/s); ▪ Set maximum vehicle speed limits on site and enforce these limits; ▪ Ensure generators are operated at optimal conditions; and ▪ Minimise the drop heights when loading and unloading material onto trucks and at tipping points.	5	2	2	3	27	Negligible negative
Operational	Drill and blast underground	Blasting	Ground vibration impact on community houses	5	5	5	5	9	Negligible negative	▪ No mitigation required	5	5	5	5	9	Negligible negative
Operational	Mining and Processing of Ore	Noise	Noise will emanate from the crusher, screening and washer plants and hauling of coal. However, the noise levels will not exceed the SANS 10103 guidelines in the immediate environment of the	5	2	1	3	24	Negligible negative	▪ Vehicles are to be serviced to the design requirements to ensure noise suppression mechanisms are effective e.g. installed exhaust mufflers; ▪ Switch off equipment when not in use; ▪ Regulate the speed of vehicles traveling on access and haul roads.	5	2	2	2	18	Negligible negative

Phase	Activity	Aspect	Impacts	D	E	I	P	S	Rating (Pre-Mitigation)	Mitigation Measures	D	E	I	P	S	Rating (Post Mitigation)
			mining operation boundaries.													
Operational	Recruitment / appointment of Operational Phase workforce	Socio-economic	Employment Creation during Operation	5	5	2	4	48	Minor positive	▪ Continue enforcement of SLP commitments for giving preference for employment to suitably qualified members of local communities; ▪ Monitor the contractors and sub-contractors on an annual basis through an external auditor to ensure their compliance with SLP commitments; and ▪ Ensure the skills development initiatives proposed in the SLP are targeted at as many local community members as possible, thereby improving skills training beneficiaries' chances at employment on the Project. ▪ Use the Project database, developed during the Construction Phase, listing local community members who were employed during the Construction Phase to select locals for employment in the Operational Phase.	5	5	4	6	84	Moderate positive
Operational	Operational Activity Impacts on the Local Economy	Socio-economic	Growth of the local economy	5	6	2	4	52	Minor positive	▪ Continue implementation of the measures recommended to enhance local employment, skills development, community development, and multiplier effects on the local economy for the Construction Phase; ▪ Set targets to progressively increase local and regional procurement over the life of the Project; and ▪ Incorporate SMME capacity development programmes into future iterations of the SLP to enable local suppliers to take maximum advantage of procurement opportunities during the Operational Phase.	6	6	4	6	96	Moderate positive
Decommissioning	Demolition of infrastructure and rehabilitation of affected areas	Soil, land use and land capability	Disturbance of soils and subsequent erosion by wind and water	6	3	4	5	65	Minor negative	▪ Implement land rehabilitation measures; ▪ Compacted areas are to be ripped to loosen the soil and vegetation cover re-instated; ▪ Inventory of hazardous waste materials stored on site should be compiled and arrange complete removal; ▪ Monitor decant of AMD and implement management measures which include in-situ passive treatment or neutralisation and electrolytic treatment using a Water Treatment Plant (WTP) to get purified water for discharge to the natural environment or for other beneficial uses. ▪ Seal the shaft by placing concrete plugs; ▪ Underground materials should be disconnected prior to removal; ▪ Ensure effective stormwater management designs are in place to ensure no run-off or pooling occurs; ▪ Conduct soil contamination assessment to assess if any remediation is required prior to future land use development; ▪ Only designated access routes are to be used to reduce any unnecessary compaction; and ▪ The backfilled, reprofiled landscape should be top soiled and revegetated to allow free drainage close to the pre-mining conditions. ▪	2	2	2	4	24	Negligible negative
Decommissioning	Reaction of sulphide compounds in extracted coal residues with water and oxygen	Soil, land use and land capability	Contamination from Acid Mine Drainage	6	5	3	7	98	Moderate negative		2	2	2	5	30	Negligible negative
Decommissioning	Dismantling and removal of infrastructure	Fauna and Flora	Demolition could induce habitat loss and continual pressure by the operations on the ecosystem can lead to pressure on the populations of threatened species or could lead to direct loss of individuals. Alien plant invasion may take place due to soil disturbance.	3	2	4	4	36	Minor negative	▪ An alien plant species management plan for the affected areas should be implemented for two years after rehabilitation is completed. ▪ All emergent alien plant species should be removed before they reach a seed-bearing or flowering maturity. ▪ Ensure that the controls of noise, dust, waste generation, vehicle speed limits, food waste disposal, hazardous waste disposal, human interaction with the ecology are monitored regularity and controls to prevent adverse conditions arising from the activities which are likely to affect fauna and flora are updated and implemented. ▪ Ensure continuous environmental awareness training takes place.	3	2	1	4	24	Negligible (negative)

Phase	Activity	Aspect	Impacts	D	E	I	P	S	Rating (Pre-Mitigation)	Mitigation Measures	D	E	I	P	S	Rating (Post Mitigation)
Decommissioning	Activity and Interaction: Rehabilitation of infrastructure footprint areas	Fauna and Flora	Restoration of vegetation and habitat types.	2	2	3	3	21	Small positive	▪ An alien plant species management plan for the affected areas should be implemented for two years. ▪ All emergent alien plant species should be removed before they reach a seed-bearing or flowering maturity. ▪ At least five species should be used for rehabilitation and only species that are native to the area and stipulated in the Rehabilitation and Closure Plan (Digby Wells, 2019) should be utilised.	7	2	4	6	78	Moderate positive
Decommissioning	Rehabilitation of site and dismantling of infrastructure	Wetlands	Erosion onset, sedimentation and establishment of alien plants	4	4	5	5	65	Minor negative	▪ High rainfall periods should be avoided during decommissioning; ▪ Stormwater must be diverted from decommissioning activities; ▪ Stored mine-affected water should be treated before decommissioning of any mine-related water retention areas, such as PCDs; ▪ In the areas that could be affected by mining activities tThe edge of the non-directly impacted freshwater resources, and at least a 100m buffer or 1:100 floodline buffer, should be clearly demarcated in the field with wooden stakes painted white as no-go zones that will last for the duration of the decommissioning phase; ▪ All areas of increased ecological sensitivity should be designated as "No-Go" areas and be off limits to all unauthorised vehicles and personnel; ▪ Actively re-vegetate disturbed areas as well as decommissioned footprint areas as part of the decommissioning process; ▪ Implement and maintain an alien vegetation management programme for the duration of the decommissioning phase and into closure; ▪ No material should be dumped within any wetlands or watercourses; ▪ No vehicles or heavy machinery should be allowed to drive indiscriminately within any wetland areas or their buffer areas. All vehicles must remain on demarcated roads; ▪ All vehicles must be regularly inspected for leaks; ▪ Re-fuelling must take place on a sealed surface area away from wetlands to prevent ingress of hydrocarbons into the topsoil; ▪ All spills should be immediately cleaned up and treated accordingly; ▪ Appropriate sanitary facilities must be provided for the duration of the decommissioning phase and all waste must be removed to an appropriate waste facility; and ▪ Wetland monitoring must be carried out during the decommissioning phase to ensure no unnecessary impact to wetlands takes place.	3	3	3	4	36	Minor negative
Decommissioning	Physical removal of surface infrastructure and rehabilitation activities near and within drainage lines	Aquatics	Water quality and habitat deterioration of watercourses in contact with heavy machinery and receiving runoff from surface workings	3	4	4	4	44	Minor negative	▪ High rainfall periods should be avoided during decommissioning; ▪ Removed or damaged vegetation areas should be revegetated; ▪ Stormwater must be diverted from decommissioning activities; ▪ Water used during decommissioning should be kept onsite and not be allowed to freely flow into nearby watercourses; ▪ Stored mine-affected water should be treated before decommissioning of any mine-related water retention areas, such as PCDs; ▪ Land reprofiling should be done during the dry season to allow for attempts to restore the morphology of the drainage lines prior to rainfall/flow events; and ▪ Ensure the revegetation activities use appropriate indigenous plant species.	3	2	2	4	28	Negligible (negative)
Decommissioning	Demolition of mine infrastructure (PCDs, workshops, haul roads, processing plant etc.) Disturbance of soils and erosion by overland flow	Surface water	Sedimentation and siltation of nearby watercourses and deterioration of water quality	2	4	3	7	63	Minor negative	▪ Disturbance of soils during infrastructure demolition should be restricted to relevant footprint areas; and ▪ Movement of demolition machinery and vehicles should be restricted to designated access roads to minimise the extent of soil disturbance.	2	2	2	2	12	Negligible (negative)
Decommissioning	Rehabilitation of disturbed sites close to pre-mining conditions	Surface water	Restoration of pre-mining streamflow regime in nearby watercourses	7	4	5	7	112	Major (positive)		7	4	5	7	112	Major (positive)

Phase	Activity	Aspect	Impacts	D	E	I	P	S	Rating (Pre-Mitigation)	Mitigation Measures	D	E	I	P	S	Rating (Post Mitigation)
Decommissioning	Rehabilitation and Demolition of Infrastructure	Air Quality	Demolition and the removal of infrastructure may result in fugitive dust emissions. Nuisance dust and possible health implications from exposure to airborne particulate matter	2	2	2	3	18	Negligible (negative)	▪ Apply wetting agents, dust suppressant or binders on the exposed areas (including excavated material and roads); ▪ Enforce vehicle speed limits on site; ▪ Keep the area of disturbance to a minimum at all times; ▪ Minimise the drop heights when loading and unloading material onto trucks; ▪ Dismantling of infrastructure should be done in phases; and ▪ Implement routine maintenance, vegetation (and if required secondary-vegetation).	2	1	1	1	4	Negligible (negative)
Decommissioning	Removal of infrastructure and surface rehabilitation	Noise	Noise will emanate from the machinery and vehicles undertaking the decommissioning and rehabilitation activities.	2	2	1	2	10	Negligible (negative)	▪ Restrict decommissioning activities to daylight hours (06:00 – 18:00); ▪ Regularly service decommissioning related machines and vehicles to ensure noise suppression mechanisms are effective e.g. installed exhaust mufflers; ▪ Regulate speed limits on access roads; and ▪ Switch off equipment when not in use.	2	1	1	2	8	Negligible (negative)
Decommissioning	Closure of the Mine	Socio-economic	Job Losses and Negative Effects on the Local Economy	6	4	4	5	84	Moderate negative	▪ Develop a detailed Social Closure Plan at least 5 years prior to decommissioning, that includes a retrenchment plan for Project staff as well as a communication strategy that will keep employees and surrounding communities informed about closure timing and management strategies; ▪ Develop and implement the required Human Resource systems to provide references for employees; ▪ Ensure that employment contracts release employees from non-compete clauses following the closure of the Project; ▪ Design community development initiatives that will be sustainable beyond the life of the Project and independent of mining operations; ▪ Increase opportunities for ABET, portable skills training, and mining skills-related skills development during the Operational Phase; and ▪ Proactively assess and manage the social and economic impacts on individuals, regions and economies where retrenchment and/or closure of the Project are certain.	6	4	3	4	52	Negligible (negative)

11.2 Cumulative Impacts

The cumulative impacts considered by the relevant specialists are discussed per environmental aspect, below.

11.2.1 Soils, Land Use and Land Capability

Cumulative impacts on soil resources were viewed in the light of similar mining or related operations within the W53A quaternary catchment that contribute similar or related pollutants to soil resources within or downstream of the Project Area. No cumulative impacts are expected since there are no similar mining activities closer than 12 km to- or immediately upslope of the Project Area.

11.2.2 Flora and Fauna

The Wakkerstroom Montane Grassland and Eastern Highveld Grassland vegetation types are present within the project area, the latter has been listed as Vulnerable (VU). Impacts through project activities are expected to impact the aforementioned grasslands as well as Sandstone rocky outcrops and Alien tree stands. Further loss of the sensitive habitats should be prevented and therefore, all grassland and sandstone rocky areas within the site must be preserved by excluding them from development as far as possible. Consideration must be given to amending the layout of the surface mine infrastructure to reduce the overall footprint area. Rehabilitation to restore the impacted areas must be carried out and prove to be successful prior to closure. Further to this, there will be a loss of wetland areas, due to the haul road that will have to cross a river system, this will have a negative cumulative impact (refer to Wetlands Impact Assessment in Appendix F) specifically for amphibians and aquatic biota.

11.2.3 Wetlands

The current impacts to the project area were related largely to the agropastoral activities observed. In addition to this were the linear infrastructures observed throughout the project area such as roads and powerlines.

Grazing activities and the spread and proliferation of dense areas of alien and invasive plant species had resulted in severe impacts to the health and integrity of large portions of the wetlands present, which in turn had aggravated impacts related to erosion, sedimentation and loss of carbon and biodiversity. Further to this, some impacts related to fragmentation, the creation of preferential flow paths and compaction of soils due to the presence of existing roads and infrastructure had resulted in loss of water retention and erosion.

The influx of people to the area as a result of mining activities have the potential to result in further impacts related to subsistence farming activities, informal settlements and additional linear infrastructures. This may result in further degradation of the wetland systems and reflect greater modification of scores as indicated by the determined PES.

Forestry activities in the vicinity of the town of Sheepmoor was regarded as likely to contribute to impacts in relation to wetland integrity, with impacts such as loss of carbon, changes in soil chemistry and water retention capacity, and loss of surface roughness (increasing surface runoff) had the potential to increase runoff resulting in an increased potential for erosion.

The dominant land-use of the project area was related to agropastoral activities and forestry. The approval of mining activities within the project area has the potential to result in further approvals for mining within the greater area, thus resulting in a significant overall land-use change and with this, the loss of sensitive habitats important for the maintenance of biodiversity, loss of catchment yields and decreases in water quality, the latter being of special concern as the freshwater resources downstream of the project area, with special mention of the Sandspruit River, which is classified as an ecological category B (minimally modified), flowing into the Ngwempisi River, which flows into Swaziland, is deemed important for the maintenance of biodiversity as well as for water supply.

11.2.4 Aquatic Ecology

The main cumulative impact identified for the aquatic ecosystems within the Mining Right Area appears to be the influence of agriculture. Areas of elevated conductivity and algal presence were identified during the survey (e.g. Site ST1a). In addition, almost all sampling sites associated with the Southern Tributary showed signs of livestock utilising the reach as a water source (e.g. trampling of vegetation and substrate disturbance). Growing areas of agriculture within the Mining Right Area will certainly add to the existing aquatic related impacts such as increased conductivity, nutrient content and associated algal growth. This, in turn, will place additional stress on the aquatic biota within the Mining Right Area and potentially those within the receiving Sandspruit SQR. This will ultimately result in further degradation of the assessed aquatic ecosystems and reflect in greater modification scores as indicated by the determined PES.

Forestry associated with and downstream from the town of Sheepmoor is also worth mentioning as a cumulative impact. Although not associated with the Mining Right Area, forestry has the potential to increase runoff into the associated aquatic ecosystems which could erode/sediment the ecosystem and be of poor water quality. Continuation and potential expansion of this industry in the area could result in additional stress on the lower Sandspruit reach as well as the Ngwempisi River which could displace the sensitive biota and species of conservation importance identified during the Aquatic Study.

11.2.5 Surface Water

The predominant water use around the project area is farming and irrigational use. Mining and associated activities require a significant amount of water, and this may pose a threat to water availability for the available water resources in the area.

The proposed mine infrastructure has the potential to reduce catchment yields if not properly managed. Coal mining and processing, through use of water for dust suppression and in processing plants, are relatively water intensive activities. Although mines recycle water extensively, a significant amount of additional (make-up) water is required for such activities. Furthermore, contaminated (acidic/high sulphate) decant water from the mined areas often finds its way to surface streams, reducing the quality of water in these streams. Against this background the cumulative effect may be significant.

11.2.6 Groundwater

Groundwater drawdown during the operational phase could impact on streams and associated wetlands located on the hillslopes. However, as these are fed by a perched aquifer in the dolerite sill forming the top of the hill, it is not expected that the drawdown will have a significant impact.

Contaminant flow from the proposed discard dump could reach a non-perennial stream and associated wetland east of the dump if not mitigated against. However, with an appropriate liner and proper rehabilitation of the dump, this impact can be mitigated.

11.2.7 Heritage

Cumulative impacts occur from in-combination effects of various impacts on heritage resources acting within a host of processes that result in an incremental effect. The importance of identifying and assessing cumulative impacts is that the whole is often greater than the sum of its parts. This implies that the total effect of multiple stressors or change processes acting simultaneously on a system may be greater than the sum of their effects when acting in isolation.

This Project in conjunction with other planned developments in line with the strategic development plans for the Mpumalanga Province requires consideration to identify the possible in-combination effects of various impacts to known heritage resources.

The development and operation of the proposed Project will add to the existing and proposed infrastructure in the area and will contribute to the degradation of the sense-of-place of the cultural landscape. Considering the greater development landscape, the effects from the various proposed developments will interact to produce a total greater effect on the cultural landscape and degradation thereof.

The in-situ conservation of some or all of the identified heritage resources will conserve tangible markers of the historical landscape. This will be a positive cumulative impact on the cultural landscape and may counter some of the degradation of the sense-of-place as described above.

11.2.8 Socio-economic

Cumulative impacts are those impacts that result from the incremental impact, on areas or resources used or directly impacted by the project, from other existing, planned or reasonably defined developments (including third-party developments) at the time that the risk and impact identification process is conducted (IFC PS 1, 2012).

There are four other mines within a 30 km radius of the proposed mine. These are Mooiplaats Colliery approximately 15 km northwest of the proposed mine, Vunene Mine across from the Camden power station, approximately 26km northwest of the proposed mine and 12km southeast of Ermelo along the N2, La Brie Colliery, approximately 31km northwest of the proposed mine and 6.5km southeast of Ermelo along the N2, and Penumbra coal mine, approximately 45km north-northwest of the proposed mine and 6km south of Ermelo, along the N11.

Potential cumulative impacts associated with the Project are:

- Improved standard of living through increased employment opportunities, local business development, and improved public and community services and facilities (the latter will be dependent on government and private-sector contributions);
- Urban sprawl, housing backlog and / or growth of informal settlements;
- Added pressure on local public service delivery and infrastructure, including housing, health systems, water and sanitation facilities, schools, and police services;
- The use of non-local labour, due to unavailability of local skilled workers, may cause tension in local communities due to expectations that the Project should provide employment to locals;
- The visual impact of mining infrastructure and other industrial developments, and associated changes in land use, are significant and imprint an industrial character onto the rural agricultural landscape, impacting on sense of place;
- Increased pressure on water resources to maintain the reserves required to supply basic human and ecological needs;
- Compounded effects of lighting, noise, traffic, water pollution, dust emission, groundwater abstraction and physical reduction in habitat impacts community health and safety;
- Reduced land availability for agricultural use (crop and livestock production); and
- Economic dependency on surrounding mines will negatively impact local, regional and national economies with decommissioning and mine closure

Isolated attempts by Dagsoom to ameliorate the above impacts will have only limited success. It is essential that Dagsoom collaborates with the appropriate governmental and non-governmental structures and forums as well as the mining projects listed above to address these impacts.

12 Item 3(g)(vi): Methodology used in Determining and Ranking the Nature, Significance, Consequence, Extent, Duration and Probability of Potential Environmental Impacts and Risks

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

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 measure proposed in this report. The significance of an impact is then determined and categorised into one of eight 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 some mitigation included in the engineering design). If the specialist determines the potential impact is still too high, additional mitigation measures are proposed.

Table 12-1: Impact assessment parameter ratings

Rating	Intensity		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. <80% probability.

Rating	Intensity		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.	<u>Province/ Region</u> 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.	<u>Municipal Area</u> 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		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.	<u>Local</u> Local extending only as far as the development site 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.	<u>Limited</u> Limited to the site and its immediate surroundings.	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		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

Significance

Probability																																						
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) (-)

12.1 Item 3(g)(vii): The Positive and Negative Impacts that the Proposed Activity (in terms of the initial site layout) and Alternatives will have on the Environment and the Community that may be affected

Section 8.1above provides an explanation of the site layout, alternatives and aspects that were considered during the finalisation of the layout. The Impact Assessment detailed in Section 11 describes all identified potential impacts associated with the preferred site layout and planned project activities.

12.2 Item 3(g)(viii): The possible Mitigation Measures that could be applied and the level of risk

Mitigation measures for each identified impact have been proposed and are presented in Section 11 (Part A).

12.3 Item 3(g)(ix): Motivation where No Alternatives Sites were considered

The alternatives considered for the Project include the infrastructure layout, the method of mining, the transportation of coal off site and the "No-Go" alternative.

In terms of mining, alternative sites were not considered as the location of the mineral resource determines the location of the mining operation. However, alternative site layouts have been considered as discussed in Section 8 above.

12.4 Item 3(g)(x): Statement motivating the Alternative Development Location within the Overall Site

The preferred overall site is based on the location of the identified coal seam, however, the various specialist reports which have formed part of this impact assessment process have recommended an amendment to the layout to avoid sensitive areas such as the pristine wetlands surrounding the 'koppie' of Block A, and to reduce the impact of vegetation removal to the Vulnerable Eastern Highveld Grassland.

13 Item 3(h): Full Description of the Process undertaken to Identify, Assess and Rank the Impacts and Risks the Activity will impose on the Preferred Site (In respect of the Final Site Layout Plan) through the Life of the Activity

The identification, assessment and ranking of potential new impacts associated with the Project were informed by the environmental and technical specialist investigations undertaken. The impacts associated with the decommissioning and rehabilitation Project are presented in Table 14-1.

14 Item 3(i): Assessment of each identified potentially significant impact and risk

Table 14-1 provides all identified impacts associated with the decommissioning, rehabilitation and post closure phase aspects.

Table 14-1: Assessment of each identified potentially significant impact

Activity	Potential Impact	Aspect Affected	Phase	Significance (Pre-Mitigation)	Mitigation Measures	Significance (Post Mitigation)
Site clearance for construction work disturbs soils, exposure to erosion by wind and water and stockpiling	Soil loss by wind and water erosion from cleared land surfaces, and incorrect stockpiling	Soil, land use and land capability	Construction	Moderate negative	▪ Areas where stripping occurs must be clearly demarcated to ensure only those areas are affected; ▪ Topsoil must be stripped to a depth of 300mm and stockpiled to a maximum height of 4 m; ▪ The subsoil of 0.4 – 1.2 m will then be stripped and stockpiled separately for deep soils; ▪ A Topsoil Management Plan (TMP) must be prepared to demonstrate how topsoil will be preserved in a condition as near as possible to its pre-mining condition in order to allow successful mine rehabilitation; ▪ Vehicles must be prohibited from driving over stockpiles; ▪ Runoff must be controlled and managed by use of effective stormwater management measures; ▪ Re-fuelling must take place on bunded impervious surfaces to prevent seepage of hydrocarbons into the soil; ▪ Establishment of effective vegetation around constructed infrastructure for adequate soil protection from wind and water erosion; ▪ If any erosion occurs, corrective actions must be taken to minimise any further erosion from taking place at regular intervals or after high rainfall events; ▪ Restriction of vehicle movement over sensitive areas to reduce compaction; ▪ Minimise unnecessary removal of the natural vegetation cover outside the development footprint; ▪ All vehicles and machines must be parked within hard park areas and must be checked daily for fluid leaks; ▪ Place drip trays where there are vehicles or machinery leaks occurring; ▪ Fuel, grease and oil spills should be remediated using commercially available emergency clean up kits; ▪ For major spills (>5L), if soils are contaminated, they must be stripped and disposed of at a licensed waste disposal site; and ▪ Any contractors on site must ensure that all employees are aware of the procedure for dealing with spills and leaks and undergo training on site.	Negligible negative
Movement of vehicles and machinery and general handling of hydrocarbons may result in spillages of hydrocarbons such as oils, fuels and grease	Soil contamination by hydrocarbon spillages and leakages	Soil, land use and land capability	Construction	Minor negative		Negligible negative
Movement of heavy machinery	Soil compaction resulting from the movement of heavy machinery within the Project Area or on stockpiles	Soil, land use and land capability	Construction	Minor negative		Negligible negative
Site Clearance within vegetated areas	Loss of high sensitivity vegetation type and landscape (*Hyparrhenia – Themeda* Grassland, Sandstone Ridges, Riparian areas)	Fauna and Flora	Construction	Moderate negative	▪ Except where critical to the project development and where absolutely necessary and by offset The Primary grassland, Riparian areas and Sandstone ridges should be excluded from the mine plan to prevent deterioration of these areas; ▪ All Primary grassland and Sandstone ridges must be managed as sensitive landscapes and designated as no- go areas except for the exclusion above.; ▪ The footprint of disturbance area should be kept as small as possible and only access roads which will follow existing roads and tracks should be used to reach the site for clearing and vehicles should not be allowed to traverse natural areas or leave the demarcated road; and ▪ An alien and invasive plant species management programme must be in place during the construction phase. In this regard, special mention is made of *A. mearnsii*, which is the dominant alien invasive tree species observed in the watercourses at the time of the assessment. Existing AIP's within the infrastructure footprint will be eradicated and the disturbed site will be monitored quarterly for at least the life of the project and a minimum of two years post closure to ensure that alien invasion does not take place;	Minor negative
Site Clearance within vegetated areas	Loss of habitat of moderate to low sensitivity (AIP vegetation types)	Fauna and Flora	Construction	Moderate negative	▪ The footprint area should be kept as small as possible and only the access roads should be used to reach the site for clearing and vehicles should not be allowed to traverse natural areas or leave the demarcated road;	Minor negative

Activity	Potential Impact	Aspect Affected	Phase	Significance (Pre-Mitigation)	Mitigation Measures	Significance (Post Mitigation)
					▪ An AIP management plan must be implemented, whereby existing AIP's within the infrastructure footprint will be eradicated and the disturbed site will be monitored quarterly for at least two years to ensure that alien invasion does not take place.	

Site clearing, including the removal of vegetation and disturbance of soils	Construction and development activities within a greenfield site are likely to result in negative impacts to functioning freshwater resources and the catchment. This is realised through the resultant habitat fragmentation, spreading of alien and invasive species, soil disturbance and/or compaction, increased incidence of erosion, sedimentation from erosion, potential water quality deterioration, and disturbance to avifauna and other fauna utilising the freshwater resources thus resulting in an overall loss of biodiversity	Wetlands	Construction	Moderate negative	▪ Environmental Practitioner to be present during vegetation clearing to prevent unnecessary clearing of extensive areas not part of the direct footprint area;
					▪ Clearly marked buffer zones must be established, which are defined as regions of natural vegetation between watercourses/wetlands and developments or activities (WRC, 2015). This is a key management action that should take place by revising proposed infrastructure locations in line with the sensitivity mapping;
					▪ Limit vegetation removal and construction activities to the infrastructure footprint area only, where removed or damaged vegetation areas should be revegetated as soon as possible;
					▪ An alien and invasive plant species management programme must be in place during the construction phase. In this regard, special mention is made of *A. mearnsii*, which is the dominant alien invasive tree species observed in the watercourses at the time of the assessment;
					▪ Bare land surfaces downstream of construction activities must be vegetated to limit erosion from surface runoff associated with infrastructure areas. Actively re-vegetate disturbed areas immediately after construction;
					▪ Ensure a soil management programme is implemented and maintained to minimise erosion and sedimentation;
					▪ If destruction of wetlands is unavoidable disturbance must be minimised and suitably rehabilitated;
					▪ Ensure no incision and canalisation of the wetland features takes place;
					▪ Erosion berms must be installed on roadways and downstream of the discard dump to prevent gully formation and siltation of the freshwater resources. The following points should serve to guide the placement of erosion berms:
					  ▪ Where the track has a slope of less than 2%, berms every 50m should be installed;
					  ▪ Where the track slopes between 2% and 10%, berms every 25m should be installed;
					  ▪ Where the track slopes between 10%-15%, berms every 20m should be installed; and
					  ▪ Where the track has a slope greater than 15%, berms every 10m should be installed.
					▪ All erosion within the construction footprint should be remedied immediately and included as part of an ongoing rehabilitation plan;
					▪ Limit personnel within the buffer areas for all freshwater features identified and such personnel can only enter as and when necessary;
					▪ All areas of increased ecological sensitivity should be designated as "No-Go" areas and be off limits to all unauthorised vehicles and personnel;
					▪ No crossing of the wetland features and their associated buffers should take place and the substrate conditions of the wetlands and downstream stream connectivity must be maintained;
					▪ At areas where road crossings have been designed, these roads should cross wetland or river features at the narrowest point and at a 90-degree angle with suitable drainage designed into the relevant bridge/culvert crossing;
					▪ No material will be dumped or stockpiled within any rivers, tributaries or drainage lines in the vicinity of the proposed footprint area.
					▪ Environmentally friendly barrier systems, such as silt nets or, in severe cases, use of trenches, downstream from construction sites to limit erosion and possibly trap contaminated runoff from construction;
					▪ Stormwater must be diverted from construction activities and managed in such a manner to disperse runoff and prevent the concentration of stormwater flow;
					▪ Water used at construction sites should be utilised in such a manner that it is kept on site and not allowed to run freely into nearby watercourses (i.e. installation of clean and dirty water separation systems);
						Negligible negative

Construction of mine related infrastructure including the plant area, the infrastructure area, the ROM pad, the PCD, the discard dump, the	Fragmentation of the freshwater resources as a result of road crossings. Loss of freshwater resource habitat (soils and vegetation) due to both direct and	Wetlands	Construction	Major negative		Minor negative

Activity	Potential Impact	Aspect Affected	Phase	Significance (Pre-Mitigation)	Mitigation Measures	Significance (Post Mitigation)
explosives delivery bay, the northern underground access point, and access and haul roads.	indirect impacts. These impacts may result in complete loss of wetland ecosystems or part thereof. Although some of these freshwater resources are not in pristine condition, they are providing significant ecological services at the local and catchment scale				▪ Construction during high rainfall periods (usually November to March) should be avoided to decrease surface runoff in areas of vegetation removal and disturbed soils in an attempt to limit erosion and sedimentation into wetlands and instream aquatic systems; ▪ The clean and dirty water separation systems must be some of the first infrastructures installed on site and care must be taken to ensure that contamination of the receiving environment as a result of mining activities is minimised as far as possible; ▪ No vehicles or heavy machinery may be allowed to drive indiscriminately within any wetland areas and their associated buffer zones. All vehicles must remain on demarcated roads and within the construction footprint and access roads; ▪ All vehicles must be regularly inspected for leaks; ▪ Re-fuelling must take place on a concrete lined or bunded surface area away from wetlands to prevent ingress of hydrocarbons into the topsoil; ▪ Construction chemicals, such as paints and hydrocarbons, should be used in an environmentally safe manner with correct storage as per each chemical's specific storage descriptions; ▪ All spills should be immediately cleaned up and treated accordingly; ▪ Appropriate sanitary facilities must be provided for the duration of the construction activities and all waste must be removed to an appropriate waste facility, and ▪ Wetland monitoring must be carried out quarterly during the construction phase by a wetland specialist to ensure no unnecessary impact to the freshwater resources occur; and if so, a solution must be put in place as soon as possible.	
Site clearance and construction of proposed infrastructure	Land and vegetation manipulation/clearing for infrastructure in proximity to the Southern Tributary and within non-perennial drainage lines.	Aquatics	Construction	Minor negative	▪ Mitigation measures detailed for the site and vegetation clearing impact should be applied to areas leading up to the watercourse crossing points. However, the infrastructure construction over a watercourse needs additional attention due to the proximity of the activity to aquatic ecosystems. Essentially, the watercourse is going to be directly affected unless a "suspension" approach is adopted (e.g. suspending the infrastructure, allowing only contact with the banks of the watercourse of concern). This is recommended where applicable but will most likely only be a viable option for pipelines that cross watercourses, if any. Larger constructions over watercourses, more specifically the proposed road constructions and associated culverts (if any), are of focus. ▪ The design as well as the physical construction of roads should not alter the natural hydrology and connectivity of the watercourses in any way (i.e. damming or creating barriers). Any infrastructure proposed to be in contact with the substrate/channel bottom should allow for the free flow of water and material. If hard surfaces are going to be used as foundation or if culverts are going to be installed, their base should not be noticeable above the natural channel bottom to maintain connectivity. Biannual aquatics monitoring of the crossing points should also form part of the management actions to ensure correct flow occurs through the crossing point, especially during the wet season.	Negligible negative
Physical construction of infrastructure over natural aquatic ecosystems	Vegetation removal for site access and potential hydrological disturbance of associated watercourses	Aquatics	Construction	Minor negative		Negligible negative
Site preparation including vegetation clearance and excavations, leading to exposure of soils	Sedimentation and siltation of nearby watercourses	Surface water	Construction	Moderate negative	▪ Clearing of vegetation must be limited to the development footprint, and the use of any existing access roads must be prioritised so as to minimise creation of new ones; ▪ If possible, construction activities must be prioritised to the dry months of the year to limit mobilisation of sediments, dust generation and hazardous substances from construction vehicles used during site clearing; ▪ Dust suppression with water on the haul roads and cleared areas must be undertaken to limit dust; ▪ Avoid placement of any infrastructure within the 100-year floodlines or 100 m buffer from watercourses, whichever is greater; ▪ Hydrocarbon and hazardous waste storage facilities must be appropriately bunded to ensure that leakages can be contained. Spill kits should be in place and construction workers should be trained in the use of spill kits, to contain and immediately clean up any potential leakages or spills;	Negligible negative
Construction and installation of infrastructural facilities including administration offices, ablutions, storerooms, workshops, pollution control dams, processing plant, roads, pipelines etc.	Increase of impermeable surfaces, subsequently increasing runoff and potential flooding	Surface water	Construction	Minor negative		Negligible negative

Activity	Potential Impact	Aspect Affected	Phase	Significance (Pre-Mitigation)	Mitigation Measures	Significance (Post Mitigation)
Handling of hydrocarbons and other chemicals; Loading, hauling and transportation of product coal.	Surface water contamination leading to deterioration of water quality	Surface water	Construction	Minor negative	▪ Vehicles should regularly be maintained as per the developed maintenance program. This should also be inspected daily before use to ensure there are no leakages underneath ▪ Drip trays must be used to capture any oil leakages. Servicing of vehicles and machinery should be undertaken at designated hard park areas. Any used oil should be disposed of by accredited contractors;	Negligible negative
Fuel storage, construction vehicles causing potential groundwater contamination	Storage of fuel and the usage of construction vehicles on-site could cause spillages of hydrocarbons. These spillages may seep into the underlying aquifers, causing contamination of groundwater with hydrocarbons.	Groundwater	Construction	Negligible negative	▪ Regular service of vehicles in designated repair bays as per the developed maintenance program; and ▪ Refuelling of vehicles only in designated areas with correct liners and surfaces	Negligible negative
Mine access dewatering causing groundwater level drawdown	During construction of the adit into the underground mine, small scale dewatering associated with the construction could lead to local drawdown of groundwater levels in the vicinity of the adit.	Groundwater	Construction	Negligible negative	▪ Keep the box cut construction time as short as possible; and ▪ Keep the extents and depth of the box cuts as small as possible	Negligible negative
The current proposed infrastructure design layout suggests that the Project will directly impact only STE-005	Indirect impact on burial grounds and graves	Heritage	Construction	Moderate negative	▪ Dagsoom must develop and implement a CMP to prevent the degradation of the fabric of the burial grounds and graves through the Project lifecycle and preserve the CS of the heritage resources. ▪ Dagsoom must also develop and implement an Access Protocol to allow individuals access to the burial grounds and graves. This Access Protocol can be developed considering the relevant safety and security measures of the mine, the requirements of the Mine Health and Safety Act, 1996 (Act No. 29 of 1996) (MHSA) and the needs of the community. ▪ Information regarding the Access Protocol must be made publicly available and can be developed as part of the CMP.	Moderate (positive)
Site Clearing, Excavation / Transport, Tipping and Spreading of Materials	Nuisance and reduction in ambient air quality	Air Quality	Construction	Negligible negative	▪ Develop a traffic management plan for site to enforce a speed limit; ▪ Apply wetting agents, dust suppressant or binders on exposed areas (including excavated stockpiled material and on dirt roads); ▪ Enforce adherence to set vehicle speed limits; ▪ Conduct activities judiciously during windy days (≥5.4 m/s); and ▪ Minimise the drop heights when loading, offloading and tipping material.	Negligible negative
Blasting the adit	Ground vibration impact on community houses and heritage resources	Blasting	Construction	Negligible negative	▪ Specific blast design to be done, shorter blast holes, smaller diameter blast hole, using electronic initiation instead of shock tube systems to obtain single hole firing. ▪ Monitor ground vibration and air blast from blasting operations	Negligible negative
	Air blast impact on community houses	Blasting	Construction	Negligible negative	▪ Specific blast design to be done, shorter blast holes, smaller diameter blast hole, use of specific stemming materials to manage air blast, increased stemming lengths to reduce air blast effect. Used of specific stemming to manage fly rock - crushed aggregate of specific size. Re-design with increased stemming lengths ▪ Monitor ground vibration and air blast from blasting operations	Negligible negative
	Fly rock impact on community houses	Blasting	Construction	Negligible negative	▪ Specific blast design to be done, shorter blast holes, smaller diameter blast hole, use of specific stemming materials to manage air blast, increased stemming lengths to reduce air blast effect. ▪ Monitor fly rock situation using video camera	Negligible negative

Activity	Potential Impact	Aspect Affected	Phase	Significance (Pre-Mitigation)	Mitigation Measures	Significance (Post Mitigation)
Site clearing, and the construction of infrastructure will result in the generation of noise.	Noise will emanate from the machinery, and vehicles during the site preparation, haul road construction as well as processing plant construction activities and may exceed the South African standard SANS 10103 [2]	Noise	Construction	Negligible negative	▪ Restrict construction activities to daylight hours (06:00 – 18:00 ▪ Vehicles to be serviced as per their design requirements to ensure noise suppression mechanisms are effective e.g. installed exhaust mufflers; ▪ Regulate vehicle speeds on the access and haul roads; and ▪ Switch off equipment when not in use during the working hours.	Negligible negative
Recruitment / Appointment of Construction Workforce	Employment creation during construction	Socio-economic	Construction	Minor (positive)	▪ Develop and implement an abbreviated Stakeholder Engagement Plan (SEP), inclusive of a communications plan and grievance mechanism, as well as the appointment of community liaison personnel; ▪ Undertake a skills survey of the communities located in the primary and secondary study areas, allowing residents to register their interest and particular skills for upcoming employment and skills training opportunities; ▪ Use the results of the skills survey to develop a skills register to inform the Skills Development Plan to maximize employment opportunities for residents in the primary and secondary study areas; ▪ Provide skills training prior to and during the Construction Phase to improve local employability during both Construction and Operational Phases; ▪ Explore the possibility of expanding job opportunities beyond mining-related work to also include hiring contract workers to assist with community development projects; ▪ Comply with minimum wage requirements for unskilled labour and all other requirements, including gender equity, of the Employment Equity Act5 to ensure maximum benefits accrue to workers; ▪ Monitor Dagsoom and its subcontractors in terms of the commitments stipulated in Dagsoom's Social and Labour Plan (SLP) on an annual basis through external auditors; ▪ Ensure that local communities understand the Project's employment requirements in terms of skills and type of employment, by communicating relevant aspects of the SLP and its overarching objectives at community forums in the primary and secondary study areas; and ▪ Prepare for the Operational Phase by updating the Project's local labour database to include local community members employed during the Construction Phase.	Major positive
Soil chemical pollution	Soil Contamination from Hydrocarbon waste (lubricants, explosives and fuels)	Soil, land use and land capability	Operational	Minor negative	▪ Soil pollution monitoring should be conducted at selected locations on the project site to detect any extreme levels of pollutants; ▪ Any spillages of hydrocarbons or sewage effluent from the treatment plant or ablution facilities should be cleaned-up immediately and the contaminated soils removed for disposal of at accredited disposal sites; ▪ A Topsoil Management Plan (TMP) must be prepared to demonstrate how topsoil will be preserved in a condition as near as possible to its pre-mining condition in order to allow successful mine rehabilitation; ▪ Long term stockpiles should be revegetated to minimise loss of soil quality. This will minimise weed infestation, maintain soil organic matter levels, maintain soil structure and microbial activity and maximise the vegetative cover of the stockpile; ▪ Topsoil stripping should be scheduled for the dry season, where possible; and ▪ All long-term topsoil material stockpiles should be located outside the active mine path and away from drainage lines.	Negligible negative
During the stripping and stockpiling process there may be some unexpected changes in the depth and the nature of the soil.	Deterioration of Topsoil Quality from in Topsoil Stockpiles	Soil, land use and land capability	Operational	Minor negative		Negligible negative

[5] The Employment Equity Amendment Act 47 of 2013, Government Gazette, RSA, Volume 583, 16 January 2014, Cape Town.

<table>
<tr><th>Activity</th><th>Potential Impact</th><th>Aspect Affected</th><th>Phase</th><th>Significance (Pre-Mitigation)</th><th>Mitigation Measures</th><th>Significance (Post Mitigation)</th></tr>
<tr><td>Underground mining of coal and the operation of the rock dumps, soils, ROM, discard dump.</td><td>Potential for road kills, injuring or poaching and faunal disturbance</td><td>Fauna and Flora</td><td>Operational</td><td>Minor negative</td><td>▪ Erect signage with speed limits.
▪ Restrict vehicle movement to daylight hours.
▪ Additional surveys should be conducted to determine the presence of Grass Owl and Serval on site. If these species are present, a management plan should be implemented.
▪ Concurrent rehabilitation should take place.</td><td>Negligible negative</td></tr>
<tr><td>Operation of powerlines that could cause bird fatalities through collisions and electrocutions.</td><td>Collisions and electrocutions</td><td>Fauna and Flora</td><td>Operational</td><td>Minor negative</td><td>▪ Install Bird Diverters
▪ Utilise best practice with pylon construction and type.</td><td>Negligible negative</td></tr>
<tr><td>Operational underground mining activities, including excavation and dewatering</td><td>Operational activities of the proposed underground mining activities have the potential to result in impacts to the water quality of the groundwater, local and downstream resources as well as the potential loss of water supply from the groundwater aquifer. Dewatering activities are likely to result in the loss of water supply to the wetlands, with special mention of the lower lying wetlands such as CVB4, and moisture stress to the surrounding wetland areas.</td><td>Wetlands</td><td>Operational</td><td>Moderate negative</td><td rowspan="3">The following management actions are recommended to guide the effective management of stormwater and water generated on site:
▪ Channelled water should not be dispersed in a concentrated manner. Baffles should be incorporated into artificial drainage lines/channels around the surface infrastructure to decrease the kinetic energy of water as it flows into the natural environment;
▪ Bare surfaces downstream from the developments where silt traps are not an option should be vegetated in order to attempt to limit erosion and runoff that might be carrying contaminants;
▪ All erosion noted within the operational footprint should be remedied immediately and included as part of an ongoing rehabilitation plan;
▪ Ensure that no incision and canalisation of the wetland features present takes place;
▪ Erosion berms should be installed on roadways and downstream of stockpiles and the discard dump to prevent gully formation and siltation of the freshwater resources. The following points should serve to guide the placement of erosion berms:
  ▪ Where the track has a slope of less than 2%, berms every 50m should be installed;
  ▪ Where the track slopes between 2% and 10%, berms every 25m should be installed;
  ▪ Where the track slopes between 10%-15%, berms every 20m should be installed; and
  ▪ Where the track has a slope greater than 15%, berms every 10m should be installed;
▪ Quarterly monitoring of all wetland areas affected as a result of infrastructure developments, including linear infrastructures such as roads watercourses should be carried out by a suitably qualified wetland ecologist in order to determine localities of areas subjected to erosion and increased runoff; where after, new mitigation actions should be implemented as per the specialist's recommendations.
The following management and mitigation measures should be put in place to minimise the impact of the underground operational activities:
▪ During the operational phase of the project the Storm Water Management Plan (SWMP) contained in the Surface Water Report should already be implemented. This should consider all wetlands and other watercourses associated with the new developments/infrastructure which should divert stormwater away from the surface infrastructure and back into natural watercourses to maintain catchment yield as far as possible. The SWMP should also convey stormwater to silt traps where needed in order to limit erosion and the subsequent increase of suspended solids in downstream watercourses;
▪ If possible, clean water removed as part of the dewatering activities should be released downgradient of the operational areas to ensure water supply to the lower lying wetlands is maintained.
The following management and mitigation measures should be put in place to ensure impacts to the wetland ecology of the area as a result of the general operational activities is reduced:
▪ Environmental Practitioner to be present during operational phase to prevent any additional clearing of extensive areas or vegetation or dumping of waste rock and/or coal in areas not part of the direct footprint area.</td><td>Minor negative</td></tr>
<tr><td>Uncontrolled runoff of stormwater or water generated from the mining operations from or through the surface infrastructure</td><td>Water quality and habitat deterioration of watercourses receiving unnatural/contaminated runoff</td><td>Wetlands</td><td>Operational</td><td>Minor negative</td><td>Negligible negative</td></tr>
<tr><td>Operational underground mining activities, including excavation and dewatering</td><td>Operational activities of the proposed underground mining activities have the potential to result in impacts to the water quality of the groundwater, local and downstream resources as well as the potential loss of water supply from the groundwater aquifer. Dewatering activities are</td><td>Wetlands</td><td>Operational</td><td>Moderate negative</td><td>Minor negative</td></tr>
</table>

Activity	Potential Impact	Aspect Affected	Phase	Significance (Pre-Mitigation)	Mitigation Measures	Significance (Post Mitigation)
	likely to result in the loss of water supply to the wetlands, with special mention of the lower lying wetlands such as CVB4, and moisture stress to the surrounding wetland areas.				▪ The edge of the non-directly impacted freshwater resources, and at least a 100m buffer or 1:100 floodline buffer, should be clearly demarcated in the field with wooden stakes painted white as no-go zones that will last for the duration of the operational phase. ▪ All areas of increased ecological sensitivity should be designated as "No-Go" areas and be off limits to all unauthorised vehicles and personnel; ▪ Freshwater resource monitoring must be carried out during the operational phase by a wetland specialist to ensure no unnecessary impact to the freshwater resources present; and if so that a remedy is put in place as soon as possible. ▪ Ensure soil management programme is implemented and maintained to minimise erosion and sedimentation; ▪ Implement and maintain alien vegetation management programme; ▪ If it is absolutely unavoidable that any of the wetland areas present will be affected, disturbance must be minimised and suitably rehabilitated; ▪ No material is to be dumped or stockpiled within any rivers, tributaries or drainage lines; ▪ No vehicles or heavy machinery may be allowed to drive indiscriminately within any wetland areas or their buffer areas. All vehicles must remain on demarcated roads and within the operational footprint; ▪ All vehicles must be regularly inspected for leaks; ▪ Re-fuelling must take place on a sealed surface area away from wetlands to prevent ingress of hydrocarbons into topsoil; ▪ All spills should be immediately cleaned up and treated accordingly; and ▪ Appropriate sanitary facilities must be provided for the duration of the operational phase and all waste must be removed to an appropriate waste facility.	
Uncontrolled runoff of stormwater or water generated from the mining operations from or through the surface infrastructure	Water quality and habitat deterioration of watercourses receiving unnatural/contaminated runoff	Wetlands	Operational	Minor negative		Negligible negative
Loading, hauling and stockpiling	These activities have the potential to result in an increased potential for soil compaction, erosion, sedimentation, loss of water quality, habitat and biodiversity	Wetlands	Operational	Minor negative		Negligible negative
Use and maintenance of haul roads for the transportation of coal and waste rock	Fragmentation of the freshwater resources as a result of road crossings, contamination of freshwater resources and impacts to water quality as a result of spills, compaction of soils, loss of habitat and biodiversity. Increased potential for sheet runoff from paved/cleared surfaces and increased potential for erosion	Wetlands	Operational	Minor negative		Negligible negative
Uncontrolled runoff of stormwater or water generated from the mining operations from or through the surface infrastructure	Water quality and habitat deterioration of watercourses receiving unnatural/ contaminated runoff	Aquatics	Operational	Minor negative	▪ During the Operational Phase of the Project a SWMP should already be implemented. This should consider all drainage lines associated with the new developments/infrastructure which should divert stormwater away from the surface infrastructure and back into natural watercourses. The SWMP should also convey stormwater to silt traps where needed in order to limit erosion and an increase of suspended solids in downstream watercourses; ▪ Channelled water should not be dispersed in a concentrated manner. Baffles should be incorporated into artificial drainage lines/channels around the surface infrastructure to decrease the kinetic energy of water as it flows into the natural environment; ▪ Bare surfaces downstream from the developments where silt traps are not an option should be vegetated in order to attempt to limit erosion and runoff that might be carrying contaminants; ▪ Careful monitoring of the areas where dust suppression is proposed should be undertaken regularly. Areas concentrating water runoff should be addressed and not allowed to flow freely into associated watercourses; and ▪ Monitoring of infrastructure over watercourses should be done by an aquatic specialist in order to determine localities of areas subjected to erosion and increased runoff where after new mitigation actions should be implemented as per the specialist's recommendations	Negligible negative

Activity	Potential Impact	Aspect Affected	Phase	Significance (Pre-Mitigation)	Mitigation Measures	Significance (Post Mitigation)
Runoff from the dirty water areas or catchments (coal stockpile areas, mine processing plant, workshops etc.)	Surface water contamination by runoff from dirty water areas	Surface water	Operational	Moderate negative	▪ Infrastructure development must be limited to the demarcated footprint to minimize the dirty runoff generating catchments within the project area. ▪ As per the SWMP, clean water runoff from the upstream catchment of the mine should be diverted around the site into the natural environment, this will minimize the runoff that will potentially be contaminated by mine waste ▪ All the runoff captured on the stormwater dam and RWD should be re-used in the mine processes to avoid sourcing water from external sources. ▪ Should the contaminated water stored water be more than the storage capacities and discharge is considered, this water should be treated to acceptable water quality prior to discharge into the natural environment. In this case, acceptable water quality should at least be benchmarked with the baseline surface water quality of the surrounding streams	Negligible negative
Hydrocarbons and chemicals spillages and leakages from equipment, moving haulage trucks and machinery	Surface water Contamination from hydrocarbon and chemical spillages and leakages	Surface water	Operational	Minor negative		Negligible negative
Containment of dirty runoff in the PCDs	Reduction of catchment runoff yield	Surface water	Operational	Moderate negative		Moderate negative
Mine dewatering causing a decrease in groundwater reserves	Due to active mine dewatering required to ensure dry working conditions in the underground mine, certain groundwater volumes will be extracted from the underground void, limiting the groundwater resource.	Groundwater	Operational	Negligible negative	▪ Mining should progress as swiftly as possible to reduce the period of active dewatering; ▪ The mining-related surface infrastructure area extent should be kept to a minimum ▪ Underground mining can only take place in the areas associated with this application ▪ Dewatering of the underground mine should stop as soon as the mining activities cease ▪ Dewatering volumes should be monitored frequently throughout the LoM to note deviations from the predicted inflows as soon as possible	Negligible negative
Mine dewatering causing lowering of groundwater levels	Active mine dewatering will be required to ensure dry working conditions in the underground void. The dewatering will cause ground levels to be drawn down in the vicinity of the mining area.	Groundwater	Operational	Minor negative	▪ Mining should progress as swiftly as possible to reduce the period of active dewatering ▪ The mining area extent should be kept to a minimum ▪ Dewatering of the underground mine should stop as soon as the mining activities cease ▪ Groundwater levels surrounding the mine void should be monitored on a regular basis throughout the LoM to verify the extent of the cone of drawdown	Minor negative
AMD formation in the underground void and discard dump causing groundwater contamination	Due to AMD forming within the underground void and in the discard dump, potential groundwater contamination with sulphate and a lower pH could occur, which would have an impact on the groundwater quality.	Groundwater	Operational	Negligible negative	▪ Groundwater abstraction should continue for the LoM to maintain a cone of drawdown ▪ Biannual aquatic monitoring of groundwater quality in the area surrounding the mine void should continue throughout the LoM ▪ Groundwater levels surrounding the mine void should be monitored on a quarterly basis throughout the LoM to verify the extent of the cone of drawdown.	Negligible negative
Material Handing, Hauling of Ore and Discard Waste, Crushing and Screening, Wind Erosion, and Generator Sets	Nuisance and potential health effects from exposure to fine particulate matter, gases and volatile	Air Quality	Operational	Minor negative	▪ Apply wetting agents, dust suppressant or binders on the dirt roads; ▪ Construct surfaces of haul roads from lateritic soils where possible and avoid fine/colloidal (e.g. clays and silts) materials; ▪ Vegetate exposed areas as soon as practicably possible; ▪ Enclose the crusher, screens, transfer and discharge points and conveyors; ▪ The area of disturbance shall be kept to a minimum at all times and no unnecessary stripping must occur, especially on windy days (wind speed ≥ 5.4 m/s); ▪ Set maximum vehicle speed limits on site and enforce these limits; ▪ Ensure generators are operated at optimal conditions; and ▪ Minimise the drop heights when loading and unloading material onto trucks and at tipping points.	Negligible negative
Drill and blast underground	Ground vibration impact on community houses	Blasting	Operational	Negligible negative	▪ No mitigation required	Negligible negative

Activity	Potential Impact	Aspect Affected	Phase	Significance (Pre-Mitigation)	Mitigation Measures	Significance (Post Mitigation)
Mining and Processing of Ore	Noise will emanate from the crusher, screening and washer plants and hauling of coal. However, the noise levels will not exceed the SANS 10103 guidelines in the immediate environment of the mining operation boundaries.	Noise	Operational	Negligible negative	▪ Vehicles are to be serviced to the design requirements to ensure noise suppression mechanisms are effective e.g. installed exhaust mufflers; ▪ Switch off equipment when not in use; ▪ Regulate the speed of vehicles traveling on access and haul roads.	Negligible negative
Recruitment / appointment of Operational Phase workforce	Employment Creation during Operation	Socio-economic	Operational	Minor positive	▪ Continue enforcement of SLP commitments for giving preference for employment to suitably qualified members of local communities; ▪ Monitor the contractors and sub-contractors on an annual basis through an external auditor to ensure their compliance with SLP commitments; and ▪ Ensure the skills development initiatives proposed in the SLP are targeted at as many local community members as possible, thereby improving skills training beneficiaries' chances at employment on the Project. ▪ Use the Project database, developed during the Construction Phase, listing local community members who were employed during the Construction Phase to select locals for employment in the Operational Phase.	Moderate positive
Operational Activity Impacts on the Local Economy	Growth of the local economy	Socio-economic	Operational	Minor positive	▪ Continue implementation of the measures recommended to enhance local employment, skills development, community development, and multiplier effects on the local economy for the Construction Phase; ▪ Set targets to progressively increase local and regional procurement over the life of the Project; and ▪ Incorporate SMME capacity development programmes into future iterations of the SLP to enable local suppliers to take maximum advantage of procurement opportunities during the Operational Phase.	Moderate positive
Demolition of infrastructure and rehabilitation of affected areas	Disturbance of soils and subsequent erosion by wind and water	Soil, land use and land capability	Decommissioning	Minor negative	▪ Implement land rehabilitation measures; ▪ Compacted areas are to be ripped to loosen the soil and vegetation cover re-instated; ▪ Inventory of hazardous waste materials stored on site should be compiled and arrange complete removal; ▪ Monitor decant of AMD and implement management measures which include in-situ passive treatment or neutralisation and electrolytic treatment using a Water Treatment Plant (WTP) to get purified water for discharge to the natural environment or for other beneficial uses. ▪ Seal the shaft by placing concrete plugs; ▪ Underground materials should be disconnected prior to removal; ▪ Ensure effective stormwater management designs are in place to ensure no run-off or pooling occurs; ▪ Conduct soil contamination assessment to assess if any remediation is required prior to future land use development; ▪ Only designated access routes are to be used to reduce any unnecessary compaction; and ▪ The backfilled, reprofiled landscape should be top soiled and revegetated to allow free drainage close to the pre-mining conditions. ▪	Negligible negative
Reaction of sulphide compounds in extracted coal residues with water and oxygen	Contamination from Acid Mine Drainage	Soil, land use and land capability	Decommissioning	Moderate negative		Negligible negative
Dismantling and removal of infrastructure	Demolition could induce habitat loss and continual pressure by the operations on the ecosystem can lead to pressure on the populations of threatened species or could lead to direct loss of individuals. Alien plant invasion may take place due to soil disturbance.	Fauna and Flora	Decommissioning	Minor negative	▪ An alien plant species management plan for the affected mining areas should be implemented for two years after rehabilitation is completed. ▪ All emergent alien plant species should be removed before they reach a seed-bearing or flowering maturity. ▪ Ensure that the controls of noise, dust, waste generation, vehicle speed limits, food waste disposal, hazardous waste disposal, human interaction with the ecology are monitored regularity and controls to prevent adverse conditions arising from the activities which are likely to affect fauna and flora are updated and implemented. ▪ Ensure continuous environmental awareness training takes place.	Negligible (negative)
Activity and Interaction: Rehabilitation of infrastructure footprint areas	Restoration of vegetation and habitat types.	Fauna and Flora	Decommissioning	Small positive	▪ An alien plant species management plan for the affected mining areas should be implemented for two years. ▪ All emergent alien plant species should be removed before they reach a seed-bearing or flowering maturity. ▪ At least five species should be used for rehabilitation and only species that are native to the area and stipulated in the Rehabilitation and Closure Plan (Digby Wells, 2019) should be utilised.	Moderate positive

Activity	Potential Impact	Aspect Affected	Phase	Significance (Pre-Mitigation)	Mitigation Measures	Significance (Post Mitigation)
Rehabilitation of site and dismantling of infrastructure	Erosion onset, sedimentation and establishment of alien plants	Wetlands	Decommissioning	Minor negative	▪ High rainfall periods should be avoided during decommissioning; ▪ Stormwater must be diverted from decommissioning activities; ▪ Stored mine-affected water should be treated before decommissioning of any mine-related water retention areas, such as PCDs; ▪ The edge of the non-directly impacted freshwater resources, and at least a 100m buffer or 1:100 floodline buffer, should be clearly demarcated in the field with wooden stakes painted white as no-go zones that will last for the duration of the decommissioning phase; ▪ All areas of increased ecological sensitivity should be designated as “No-Go” areas and be off limits to all unauthorised vehicles and personnel; ▪ Actively re-vegetate disturbed areas as well as decommissioned footprint areas as part of the decommissioning process; ▪ Implement and maintain an alien vegetation management programme for the duration of the decommissioning phase and into closure; ▪ No material should be dumped within any wetlands or watercourses; ▪ No vehicles or heavy machinery should be allowed to drive indiscriminately within any wetland areas or their buffer areas. All vehicles must remain on demarcated roads; ▪ All vehicles must be regularly inspected for leaks; ▪ Re-fuelling must take place on a sealed surface area away from wetlands to prevent ingress of hydrocarbons into the topsoil; ▪ All spills should be immediately cleaned up and treated accordingly; ▪ Appropriate sanitary facilities must be provided for the duration of the decommissioning phase and all waste must be removed to an appropriate waste facility; and ▪ Wetland monitoring must be carried out during the decommissioning phase to ensure no unnecessary impact to wetlands takes place.	Minor negative
Physical removal of surface infrastructure and rehabilitation activities near and within drainage lines	Water quality and habitat deterioration of watercourses in contact with heavy machinery and receiving runoff from surface workings	Aquatics	Decommissioning	Minor negative	▪ High rainfall periods should be avoided during decommissioning; ▪ Removed or damaged vegetation areas should be revegetated; ▪ Stormwater must be diverted from decommissioning activities; ▪ Water used during decommissioning should be kept onsite and not be allowed to freely flow into nearby watercourses; ▪ Stored mine-affected water should be treated before decommissioning of any mine-related water retention areas, such as PCDs; ▪ Land reprofiling should be done during the dry season to allow for attempts to restore the morphology of the drainage lines prior to rainfall/flow events; and ▪ Ensure the revegetation activities use appropriate indigenous plant species.	Negligible (negative)
Demolition of mine infrastructure (PCDs, workshops, haul roads, processing plant etc.) Disturbance of soils and erosion by overland flow	Sedimentation and siltation of nearby watercourses and deterioration of water quality	Surface water	Decommissioning	Minor negative	▪ Disturbance of soils during infrastructure demolition should be restricted to relevant footprint areas; and ▪ Movement of demolition machinery and vehicles should be restricted to designated access roads to minimise the extent of soil disturbance.	Negligible (negative)
Rehabilitation of disturbed sites close to pre-mining conditions	Restoration of pre-mining streamflow regime in nearby watercourses	Surface water	Decommissioning	Major (positive)		Major (positive)
Rehabilitation and Demolition of Infrastructure	Demolition and the removal of infrastructure may result in fugitive dust emissions. Nuisance dust and possible health implications from exposure to airborne particulate matter	Air Quality	Decommissioning	Negligible (negative)	▪ Apply wetting agents, dust suppressant or binders on the exposed areas (including excavated material and roads); ▪ Enforce vehicle speed limits on site; ▪ Keep the area of disturbance to a minimum at all times; ▪ Minimise the drop heights when loading and unloading material onto trucks; ▪ Dismantling of infrastructure should be done in phases; and ▪ Implement routine maintenance, vegetation (and if required secondary-vegetation).	Negligible (negative)
Removal of infrastructure and surface rehabilitation	Noise will emanate from the machinery and vehicles undertaking the decommissioning and rehabilitation activities.	Noise	Decommissioning	Negligible (negative)	▪ Restrict decommissioning activities to daylight hours (06:00 – 18:00); ▪ Regularly service decommissioning related machines and vehicles to ensure noise suppression mechanisms are effective e.g. installed exhaust mufflers; ▪ Regulate speed limits on access roads; and ▪ Switch off equipment when not in use.	Negligible (negative)

Activity	Potential Impact	Aspect Affected	Phase	Significance (Pre-Mitigation)	Mitigation Measures	Significance (Post Mitigation)
Closure of the Mine	Job Losses and Negative Effects on the Local Economy	Socio-economic	Decommissioning	Moderate negative	▪ Develop a detailed Social Closure Plan at least 5 years prior to decommissioning, that includes a retrenchment plan for Project staff as well as a communication strategy that will keep employees and surrounding communities informed about closure timing and management strategies; ▪ Develop and implement the required Human Resource systems to provide references for employees; ▪ Ensure that employment contracts release employees from non-compete clauses following the closure of the Project; ▪ Design community development initiatives that will be sustainable beyond the life of the Project and independent of mining operations; ▪ Increase opportunities for ABET, portable skills training, and mining skills-related skills development during the Operational Phase; and ▪ Proactively assess and manage the social and economic impacts on individuals, regions and economies where retrenchment and/or closure of the Project are certain.	Negligible (negative)

15 Item 3(j): Summary of specialist reports

Numerous specialist impact assessments were undertaken for the proposed Project, as set out in Table 15-1. Separate specialist reports were compiled and have been attached as appendices to this report. The specialist input included the baseline environment, potential impacts and the recommended mitigation measures.

Table 15-1: Specialist Studies undertaken for the Proposed Twyfelaar Coal Mine

List of studies undertaken	Recommendations of specialist reports	Specialist Recommendations that have been included in the EIA report	Reference to applicable section of report where specialist recommendations have been included
Soils, Land Capability and Land Use Assessment	▪ A soil management plan including pegging where soil should be removed, depth at which it should be removed, how to transport and stockpile etc; ▪ 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 seepage of hydrocarbons into the soil; ▪ Establishment of effective soil cover such as lawn grass around constructed infrastructure for adequate protection from wind and water erosion; ▪ If any erosion occurs, corrective actions must be taken to minimise any further erosion from taking place at regular intervals or after high rainfall events; ▪ Restriction of vehicle movement over sensitive areas to reduce compaction; ▪ Minimise unnecessary removal of the natural vegetation cover outside the development footprint; ▪ All vehicles and machines must be parked within hard park areas and must be checked daily for fluid leaks; ▪ Place drip trays where there are vehicles or machinery leaks occurring; ▪ Fuel, grease and oil spills should be remediated using commercially available emergency clean up kits; ▪ For major spills (>5L), if soils are contaminated, they must be stripped and disposed of at a licensed waste disposal site. Alternatively, consider bioremediation to replace the affected soils back on site; ▪ Any contractors on site must ensure that all employees are aware of the procedure for dealing with spills and leaks and undergo training on site; and ▪ Soil pollution monitoring should be conducted at selected locations on the project site to detect any extreme levels of pollutants.	X - All recommendations have been considered and included in this report.	Appendix D
Fauna and Flora Assessment	▪ The Primary grassland area should be excluded from the mine infrastructure plan (except where critical for the mine's development), any future developments must also adhere to this. ▪ Through a detailed sweep of infrastructure areas, all protected SSC are located and counted for the permitting process. ▪ Through a detailed sweep of infrastructure areas, all floral SSC observed are located and documented. ▪ Ensure a monitoring and management plan is implemented for all SSC recorded on site. ▪ The footprint area should be kept as small as possible and only existing access roads should be used. ▪ An integrated AIP Plan should be implemented in areas disturbed by the mine's activities. ▪ Erect signage with speed limits, ensure this is enforced.	X - All recommendations have been considered and included in this report.	Appendix E

List of studies undertaken	Recommendations of specialist reports	Specialist Recommendations that have been included in the EIA report	Reference to applicable section of report where specialist recommendations have been included
	▪ Restrict non-essential vehicle movement to daylight hours. ▪ Concurrent rehabilitation should take place. ▪ Additional surveys should be conducted to determine the presence of Grass Owl and Serval on site. If these species are present, a management plan should be implemented. ▪ Bird diverters must be installed on powerlines that cross wetlands, riparian areas and grasslands, these are the areas where the large heavy bodied birds, that are prone to collision, forage and prefer to nest in. ▪ Furthermore, bird friendly designs and innovations must be used when deciding on the type of pylons. ▪ Implement monitoring plans for fauna and flora, avifauna, rehabilitation and soil disturbance.		
Wetland Assessment	▪ The extent of the loss of water supply to the lower lying wetlands from the deeper groundwater aquifer should be quantified, to determine the potential impacts to wetland integrity and functionality. ▪ A wet season aquatic survey must be undertaken prior to commencement of the Project; and ▪ A wetland biomonitoring programme must be developed and adopted on commencement of the project. This programme should continue for the life of the project and for at least three years post the decommissioning phase	X - All recommendations have been considered and included in this report.	Appendix F
Aquatic Ecology Assessment	▪ A wet season aquatic survey must be undertaken prior to commencement of the Project; ▪ The Project should adopt a water and habitat quality preservation mindset throughout the life of the Project. In other words, the proposed Project activities should not result in the deterioration/degradation of aquatic habitat (i.e. riparian and instream habitat) and water quality within the associated aquatic ecosystems, especially where the drainage line associated with the surface infrastructure; and ▪ The developed Aquatic Biomonitoring Programme must be adopted on an annual basis after commencement of the Construction Phase of the Project. This programme should continue for the life of the Project and for at least three years post the Decommissioning Phase.	X - All recommendations have been considered and included in this report.	Appendix G
Surface water Assessment	It is recommended that the dirty water channels be lined to prevent contamination of groundwater resources through seepage.	X - All recommendations have been considered and included in this report.	Appendix H
Groundwater Assessment	▪ A closure water management plan should be developed. This should assess the management of a critical water level to minimise contamination of the shallow weathered aquifer. The discard dump should also be assessed in terms of a remediation action plan. This should all be analysed in a financial model to further inform the most effective closure water management options. The groundwater model should be used as a management tool to inform this process; ▪ All mining areas should be flooded as soon as possible to restrict oxygen ingress into the backfill and lower sulphate levels in seepage; ▪ The rate of water level recovery in the underground void should be monitored. Stage curves should be developed which would aid in the management of closure phase; ▪ A groundwater monitoring network should be put in place;	X - All recommendations have been considered and included in this report.	Appendix I

List of studies undertaken	Recommendations of specialist reports	Specialist Recommendations that have been included in the EIA report	Reference to applicable section of report where specialist recommendations have been included
	▪ The numerical model should be updated once every two to three years or after significant changes in mine schedules or plans by using the measured water ingress and water levels to re-calibrate and refine the impact predictive scenario. Updates to the model should be carried out more frequently if significant changes are made to the mine schedule or plan; ▪ Based on the NEM:WA classification the discard material does show a potential for the generation of AMD and is therefore classed as a Type 3 waste. This type of waste would require a Class C liner. However, alternative mitigations or liner options can be implemented if it can be shown to the authorities (liner exemption motivation), by following a risk-based approach, that these alternatives will perform in a similar manner to a standard Class C liner; ▪ Additional geochemical assessment giving more insight in the variability of the NAG of the coal material should be performed, and if applicable, the liner requirement re-assessed; ▪ If further expansion of the mining activities is proposed, it is recommended to update the hydrocensus and to drill additional monitoring boreholes; ▪ Additional water boreholes in the mine vicinity should be identified and sampled ; ▪ The groundwater model must be updated to model the proposed impacts of the nitrate plume associated with blasting underground; and ▪ Rock fracturing must also be assessed to determine the extent of impact to the shallow aquifer, if any.		
Heritage Assessment	To mitigate against the identified direct and indirect impacts against cultural heritage resources, Digby Wells recommends: ▪ Dagsoom amends the infrastructure design of the discard dump, where possible, to avoid STE-005. Despite its negligible CS value, this structure is afforded general protection under Section 34 of the NHRA and Dagsoom must obtain a Section 34 Permit to destroy or alter this structure; ▪ Where the redesign of the infrastructure layout is not feasible, Dagsoom must complete the Permit application process in compliance with Section 34 of the NHRA and Chapter III of the NHRA Regulations and obtain a permit prior to the commencement of construction of the discard dump; ▪ Dagsoom must develop and implement a CMP to manage in situ heritage resource. The CMP must include any applicable mitigation measures, management strategies and proposed monitoring schedules and outline the roles and responsibilities of those involved. This document must be submitted to the HRAs for approval prior to implementation; ▪ Where rock art sites are identified within the Project area, Dagsoom must immediately notify the HRAs and must include such sites in the Project-specific CMP; and ▪ A project-specific CFP must be developed and approved by the HRAs prior to the commencement of the construction of Project-related infrastructure.	X - All recommendations have been considered and included in this report.	Appendix J
Blasting	▪ Regulatory requirements indicate specific requirements for all non-mining structures and installations within 500 m from the mining operation. There are no external infrastructure or houses within 500 m from the box-cut. No actions will be required; ▪ No infrastructure or houses is observed within 100 m from the planned box-cut. The application of Mine Health and Safety Act regulation 17.6(a) will not be applicable;	X - All recommendations have been considered and included in this report.	Appendix K

List of studies undertaken	Recommendations of specialist reports	Specialist Recommendations that have been included in the EIA report	Reference to applicable section of report where specialist recommendations have been included
	▪ Review of the planned blast design will be required. A detail design with blast planning will be required for efficient and safe mining of this box-cut. Blast designs should be reviewed prior to first blast planned and done. The geology for the box-cut area and the required drill depths should be confirmed. Due to stripping of topsoil that will take place there may be variances in required final depths and thus design applied to be confirmed; ▪ The current proposed stemming lengths used provides for some control on fly rock. Consideration can be given to increase this length for better control. Specific designs where distances between blast and point of concern are known should be considered. Recommended stemming length should range between 20 and 30 times the blast hole diameter. In cases for better fly control this should range between 30 and 34 times the blast holes diameter. Increased stemming lengths will also contribute to more acceptable air blast levels ▪ Calculated minimum safe distance is 233 m. The final blast designs that may be used will determine the final decision on safe distance to evacuate people and animals. This distance may be greater pending the final code of practice of the mine and responsible blaster's decision on safe distance. The blaster has a legal obligation concerning the safe distance and he needs to determine this distance. ▪ The option of photographic survey of all structures up to 1500 m from the pit area is recommended. The mine will be operating for a significant number of years. This will give advantage on any negotiations with regards to complaints from neighbours on structural issues due to blasting. This process can however only succeed if done in conjunction with a proper monitoring program. It is expected that ground vibration levels will be significantly less than proposed limits at 1500 m, but this process will ensure record of the pre-blasting status of the nearest structures to the pit area. At 1500 m the expected level of ground vibration will be perceptible ▪ Ground vibration and air blast levels limits recommended for blasting operations in this area are contained in section 21.6 in the blasting report (Table 24) and must be adhered to ▪ A further consideration of blasting times is when weather conditions could influence the effects yielded by blasting operations. It is recommended not to blast too early in the morning when it is still cool or when there is a possibility of atmospheric inversion or too late in the afternoon in winter. Do not blast in fog. Do not blast in the dark. Refrain from blasting when wind is blowing strongly in the direction of an outside receptor. Do not blast with low overcast clouds. These 'do nots' stem from the influence that weather has on air blast. The energy of air blast cannot be increased but it is distributed differently and therefore is difficult to mitigate. It is recommended that a standard blasting time is fixed and blasting notice boards setup at various routes around the project area that will inform the community of blasting dates and times ▪ Third party consultation and monitoring should be considered for all ground vibration and air blast monitoring work. This will bring about unbiased evaluation of levels and influence from an independent group. Monitoring could be done using permanent installed stations. Audit functions may also be conducted to assist the mine in maintaining a high level of performance with regards to blast results and the effects related to blasting operations. ▪ Video of each blast will help to define if fly rock occurred and from where. Immediate mitigation measure can then be applied if necessary. The video will also be a record of blast conditions		
Air Quality Assessment	The following recommendations based on the results presented in this report will be applied to this Project to ensure compliance with the regulatory standards:	X - All recommendations have been considered and included in this report.	Appendix L

List of studies undertaken	Recommendations of specialist reports	Specialist Recommendations that have been included in the EIA report	Reference to applicable section of report where specialist recommendations have been included
	▪ Administer mitigation measures as described in the impact assessment above (i.e. use of dust suppressants / binders on haul roads and exposed areas, set maximum speed limits on haul roads and have these limits enforced and enclosure of crushers; ▪ Commission an ambient air quality monitoring network and maintain this for the life of the Project, as data will provide useful information to management on the efficiency of the mitigation measures in place; and ▪ The mine should start monitoring prior to the commencement of operation. This will ensure baseline data is available to which future perturbations can be compared.		
Noise Assessment	The mine management must adhere to the mitigation measures in place to further limit noise propagation once operational.	X - All recommendations have been considered and included in this report.	Appendix M
Traffic Assessment	▪ Regarding public transport, space (50m x 40m) must be provided for public transport vehicles at the intersection of the N2 with the access road with enough space for these vehicles to manoeuvre safely; and ▪ It is therefore recommended that the proposed coal mine development is supported from a traffic engineering perspective, provided that the road upgrades on the N2 Freeway and the construction of the access road / T-Junction intersection is implemented as proposed in this report (and Drawing No. 19041/AL/01) and to the relevant standards of SANRAL and the Msukaligwa Local Municipality.	X - All recommendations have been considered and included in this report.	Appendix N
Socio-economic Assessment	▪ The mitigation and enhancement measures listed for each impact, negative and positive, must be implemented; ▪ A social management plan and social monitoring plan must be developed to manage and monitor the implementation of these measures and recommend corrective measures, where necessary; and ▪ Implement mitigation measures recommended in other specialist studies, including traffic, dust, blasting, ground and surface water and others, that are likely to have socio-economic impacts.	X - All recommendations have been considered and included in this report.	Appendix O

16 Item 3(k): Environmental Impact Statement

16.1 Item 3(k)(i): Summary if the Key Findings of the Environmental Impact Assessment

The Environmental Impact Statement is utilised to summarise all of the potential environmental impacts identified during each phase of the proposed Project. The significance of the impacts associated with the relevant project phases, pre-mitigation and post-mitigation, is summarised shown in Table 14-1, above.

The key finding is that of the infrastructure layout and the requirement to adjust the current layout to avoid CBAs, as advised by the Flora Ecologist.

16.2 Item 3(k)(ii): Final Site Map

Due to the recommendations contained herein, the Applicant will be required to adjust the layout of surface infrastructure to avoid or reduce certain impacts. The preliminary site map on which the impact assessment was based in attached in Appendix B, however, this is subject to change.

16.3 Item 3(k)(iii): Summary of the Positive and Negative Implications and Risks of the Proposed Activity and Identified Alternatives

The negative and positive impacts are tabulated in section 11 of this report, in Table 11-3.

17 Item 3(l): Proposed Impact Management Objectives and the Impact Management Outcomes for Inclusion in the EMPR

The EMP seeks to achieve a required end state and describes how activities that have, or could have, an adverse impact on the environment and surrounding communities will be mitigated, controlled and monitored.

The EMP will address the environmental impacts and possible unplanned events during each phase of the Project (construction, operational, decommissioning and post-closure). Due regard must be given to environmental protection during the entire Project; a number of environmental recommendations are made to achieve environmental protection. These recommendations are aimed at ensuring that the Applicant and contractors maintain adequate control over the Project to:

- Minimise the extent of an impact during the life of the Project;
- Ensure appropriate restoration of areas affected by the Project; and
- Prevent long term environmental degradation.

18 Item 3(m): Final Proposed Alternatives

The placement of infrastructure will need to be reconsidered to avoid the ecologically highly sensitive areas. The adit, ROM pad and conveyor cannot be moved, and will form part of an offset report. The remaining infrastructure must be replaced within the least sensitive delineated areas. With reference to the composite map shown in Figure 3-1 (Part B), there is an area of significantly lower sensitivity south of the discard dump, amongst others, which can be considered for the remainder of the required mining infrastructure on Portions 1, 2 and 5 of the Farm Twyfelaar 298IT.

A Biodiversity off set report must be compiled in which the offset requirements and receiving area is identified, at this stage the removal of all AIP tree species, and returning these areas to natural grasslands within the project are can be considered. The ecosystem processes patterns and services will possibly be enhanced with the removal of the AIP infestations from sensitive ecosystems such as wetlands, riparian areas all of which fall within the CBA's present on site, and will increase the CBA, percentage as defined by the Mpumalanga Conservation plan.

The extent of changing the mining method from continuous miners to drill and blasting must be considered by all specialists involved in this impact assessment to determine the full extent of the impact. The groundwater model must be updated to consider the nitrate plume and potential for rock fracturing.

19 Item 3(n): Aspects for Inclusion as Conditions of Authorisation

The studies and impact assessment has been based on the proposed mine layout and mine works programme. Should there be any changes to the proposed project description, the adequacy and accuracy of the work may be affected, and additional work may be required to fill in the gaps.

The EAP and Specialist team will be required to review the mine infrastructure layout and provided opportunity to amend the respective impact assessments. The Applicant will amend the layout based on the outcomes of this impact assessment process. The full extent of the proposed Mining Right area has been assessed to establish the environmental baseline

20 Item 3(o): Description of any Assumptions, Uncertainties and Gaps in Knowledge

This section highlights the assumptions, uncertainties, limitations and knowledge gaps relevant to the various specialist studies undertaken. Refer to Table 20-1 below.

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Table 20-1: Specialist studies assumptions, uncertainties and gaps

Specialist Study	Assumptions, Uncertainties and Gaps
Soils, Land Capability and Land Use	▪ The increase and decrease of a soil's fertility status within the topsoil over time was assumed to be non-restrictive for land capability assessments. This is because the fertility property can be rectified through use of additives; ▪ Land suited to crop production was assumed also suitable for other less intensive uses such as pasture, natural grazing, forestry and wildlife; ▪ Soils are contiguous hence differentiation is not abrupt, and the transition zone cannot be fully captured during any given soil survey. The number and spatial extent of surveyed points in this study were, however, considered adequate to capture the differentiation in soil form distribution; ▪ The soils within a capability class are similar only with respect to the degree of limitations in soil use for agricultural purposes or with respect to the impact on the soils when they are so used; ▪ The land capability classification is not a productivity rating for specific crops but an indication of the potential use to which the soil can be put; ▪ The land capability classification is not, however, a grouping of soils according to the most profitable use to be made of the land; and ▪ The land capability groupings are subject to change as new information about the behaviour and responses of the soils becomes available.
Fauna and Flora	▪ Whilst every effort is made to cover as much of the site as possible, representative sampling was completed as per the nature of this type of investigation. It is therefore possible that some plant and animal species that are present on site were not recorded during the field investigations. ▪ Every effort is made to identify all plant species on site in the late winter season, very few if any species will be seeding, fruiting and/or flowering at the times of sampling. Therefore, some species may not have been identified at all or only to species level due to the lack of identifying features.

Specialist Study	Assumptions, Uncertainties and Gaps
	▪ This report lists the findings of an on-site baseline evaluation within the area selected by Dagsoom for its mining activities. Potential impacts of the proposed mining operations were evaluated based on the layout provided at the time of writing, and where necessary, recommendations for the most appropriate mitigation measures have been noted. ▪ To obtain a comprehensive understanding of the dynamics of the biota on a site, including SSC, studies should include investigations through the different seasons of the year, over a number of years, and extensive sampling of the area. Due to project time constraints, such long-term research was not feasible, and information contained within this report is based on a dry season field survey. ▪ In terms of limitations relevant to this study, it must be noted that field investigations did not include a night survey, for safety reasons, therefore nocturnal species (specifically bat and owl species) were not recorded.
Wetlands	▪ This wetland assessment was based on a single site visit conducted at the end of the winter season and prior to the spring rains (early September 2019), and as a consequence, many floral species (wetland indicators) were unidentifiable owing to a lack of flowers and identifying features. Hydrophilic plants are an important indicator used for delineation of wetland boundaries and the determination of wetland integrity and biodiversity; ▪ Due to the high level of biodiversity and sensitivity observed in the September 2019 assessment, it is highly recommended that a wet season assessment be carried out prior to project approval so as to verify the dry season delineations against those of the wet season and to fully determine the extent of the expected biodiversity support (much of which would have been overlooked due to the nature of the sampling season), and which is expected to be significant; ▪ With ecology being dynamic and complex, certain aspects, some of which may be important, may have been overlooked. However, wherever possible, it is expected that the wetlands associated with the proposed project have been accurately assessed and considered, based on the field observations undertaken, the consideration of historical and existing studies, and the desktop data available. ▪ Wetlands situated within the 500 m zone of regulation were assessed largely on a desktop level with very limited ground-truthing and some discrepancies within this zone may occur.

Specialist Study	Assumptions, Uncertainties and Gaps
Aquatic Ecology	During the proposal phase of the Project, it was recommended that the Aquatic Study should take place during the wet season associated with the Study Area. However, due to the limited time allowed during the EIA application process, the survey was scheduled forward to take place during the month of August 2019. According to rainfall data gathered from World Weather Online, the town of Sheepmoor only received a total of 7.2 mm of rainfall during the three months leading up to August (i.e. May-July). Additionally, the months from December 2018 to March 2019 received the highest rainfall since 2010. This could have resulted in a "flushing like effect" of the associated aquatic ecosystems, which consequently, followed by the extreme low rainfall period prior to the August survey, could have negatively affected the aquatic ecology within the ecosystems. This should be considered when interpreting the ecological findings determined for the Study Area, as it is most likely that conditions are deteriorated/below the norm.
Surface water	▪ Five water quality samples were collected from the streams within and around the Project Area. Sampling points which could not be sampled due to access issues or which were dry at the time of sampling have been included in the proposed monitoring programme for the mine to continue monitoring; ▪ Water balance process flow was obtained from the Storm Water Management Plan process report and this was adopted for the current excel based static water balance model developed for this project; ▪ The ALOS 3D 30m DEM used for floodline modelling was of low resolution, hence some topographical detail was missed. It should, however, be noted that this data is sufficient for the intended purpose of environmental indicative floodlines.
Air Quality	▪ No historical ambient air quality data for the Project area and therefore the AQIA did not consider cumulative impacts due to lack of background air quality data; ▪ Electricity will be supplied solely from the national grid, while a 250kVA generator will be used for emergency supply (Scorpion Mineral Processing, 2014) which would result in fewer particulate and gaseous emissions to the ambient environment; ▪ Since the Project activities demonstrate the worst-case scenario, model GLC may have shown results over-estimating the magnitude; and

Specialist Study	Assumptions, Uncertainties and Gaps
	▪ The placement of the ventilation fan may be inaccurate due to data inaccuracy and therefore only the x;y coordinate of the emission source may be inaccurate. Other than that, emissions from this source is accounted for in the assessment.
Blasting	▪ The project is evaluated as a new operation with no blasting activities currently being done.; ▪ The anticipated levels of influence estimated in this report are calculated using standard accepted methodology according to international and local regulations; ▪ The assumption is made that the predictions are a good estimate with significant safety factors to ensure that expected levels are based on worst case scenarios. These will have to be confirmed with actual measurements once the operation is active; ▪ The limitation is that no data is available from this operation for a specific confirmation of the predicted values as no blasting activities are currently being done; ▪ No final box-cut blast design is not yet available. Data is based basic design parameters with information from scoping phase report. A generic box-cut blast design was applied; ▪ Blast Management & Consulting created a basic blast design; and ▪ The work done is based on the author’s knowledge and information provided by the project applicant.
Noise	▪ Option 3 involves considerably more mechanisation than both options 1 and 2. It was decided to model Option 3 since it had to assumed that it will cause the highest noise emission levels of the three. Therefore, Option 3 will represent a worst-case scenario; ▪ The meteorological data supplied on https://www.worldweatheronline.com/ermelo-weather-history/mpumalanga/za.aspx is representative for the purpose of this noise study; ▪ Initial modelling results indicated that the maximum noise impact will occur during the winter (July) when cold meteorological conditions favour the propagation of noise over longer distances. Therefore, the calculations were made assuming these meteorological and atmospheric conditions;

Specialist Study	Assumptions, Uncertainties and Gaps
	▪ The equipment and operational procedures had to be assumed, based on previous experiences. Therefore, it had to be assumed that the sound power emission levels of equipment and processes used for the calculations are representative of those that will be employed on the Project; ▪ Traffic flow on the N2 for modelling purposes was based on desktop research. This data is dated 2013 and a growth rate of 3% was assumed to estimate traffic flow in 2019; ▪ All the activities during construction and production take place simultaneously at all the locations of the mining operation, therefore no specific sequence of events was modelled; ▪ The hauling of mined coal to the surface is done by an underground conveyor system; ▪ During construction all activities take place at ground level; and ▪ Haulage was calculated for an estimated 480 000 tpa.
Socio-economic	▪ The impact assessment was based on primary data collected during site visits undertaken for the socio-economic baseline report, the Public Participation Process (PPP), and the SLP; and ▪ A socio-economic survey not conducted with households located in primary study area. The socio-economic indicators for these households are derived from official census data (2011; 2016). The socio-economic indicators for the population and households in Ward 11, the secondary study area within which the primary study area is located, are assumed to be indicative for the households residing within the primary study area.
Rehabilitation and Closure	▪ All infrastructure will be removed from the mine; ▪ The concrete will only be demolished up to 1000 mm below natural ground level; ▪ All waste will be disposed on site or buried 1 m underground prior to closure; ▪ All powerlines are Eskom’s liability/responsibility; ▪ All roads have an average width of 8.5 m;

Specialist Study	Assumptions, Uncertainties and Gaps
	▪ All fences will be removed at end of LoM; ▪ The PCDs are HDPE lined and it was assumed that 300 mm silt will require removal over the dam area; ▪ Costing to infill the dams has been included in the costing; ▪ All temporary structures will be removed from site prior to closure; ▪ General surface rehabilitation must involve the shaping of the surface topography to match the surrounding landscape and 600 mm of topsoil, where available, needs to be added to the site. During the process of shaping the landscape, drainage lines must be properly reinstated into the topography. Any heaps of excess material also need to be removed so that effective revegetation can take place; ▪ At this stage, no engineering design has been completed for the rehabilitation of the discard facility. Thus, is it is assumed that a cover design will need to be completed. For costing purposes 600 mm of soil has been provided for cover material of the discard facility; ▪ It has been assumed that 40-50% of some of the infrastructure footprints will require rehabilitation, such as the workshops, plant area, wash-bays, etc; ▪ Costs to correct subsidence and water treatment costs have been excluded at this stage and will need to be included once more information becomes available; ▪ Allowance has been made to transport rubble material to the adit as fill material; ▪ Monitoring costs have been included; ▪ A 12% allowance has been included for project management fees and a 10% contingency. These fees account for the costs required to manage the closure and rehabilitation phase as well as provide personnel to monitor and maintain the rehabilitated areas after closure; ▪ The financial provision estimate is based on the latest mine plans and information received; and ▪ The financial provision estimate has been calculated for LoM and excludes 15% VAT.

21 Item 3(p): Reasoned Opinion as to whether the Proposed Activity should or should not be authorised

A summary of the specialists' findings which has informed the EAP's opinion is summarised in Section 21.1 below.

21.1 Item 3(p)(i): Reasons why the activity should be authorised or not

Although the site is characterised by ecologically sensitive areas, especially with regards to flora, every effort has been made to reduce the impacts thereof. In the instance that the Applicant follows the mitigation measures proposed herein and relocates infrastructure as advised by the Ecologist, coupled with the monitoring programme and proposed off-sets, the overall impact should be manageable.

21.2 Item 3(p)(ii): Conditions that must be included in the authorisation

All mitigation measures included in this EIA/EMPr and the associated specialist studies should be conditions to the authorisation. This is discussed further in the sections below.

21.2.1 Specific conditions to be included into the compilation and approval of EMPR

The following specific conditions are proposed:

- All mitigation measures proposed in this report should be implemented;
- Wet season (summer) surveys must be conducted for Aquatics, Surface Water, Wetlands, Fauna and Flora, and the impact assessments must be updated to inform more robust mitigation measures;
- Environmental monitoring should take place as recommended;
- The Groundwater report and associated model must be updated to reflect the change in mining method;
- The extent of rock fracturing must be investigated to determine the extent of impacts associated with groundwater, wetlands and surface water;
- A grievance system or communication platform must be established to create a forum for the public to interact with the mining house; and
- The closure cost assessment should be updated and submitted as per the legislative requirements.

21.2.2 Rehabilitation Requirements

Closure and Rehabilitation is a continuous series of activities that begin with planning prior to the Project's design and construction, and end with achievement of long-term site stability and establishing a self-sustaining ecosystem. Not only will the implementation of this concept result in a more satisfactory environmental conclusion, but it will also reduce the financial burden of closure and rehabilitation. The following points outline the main objectives for rehabilitation and closure:

- Make all areas safe for both humans and animals;
- Make all areas stable and sustainable;
- Follow a process of closure that is progressive and integrated into the short- and long-term plans, and that will assess the closure impacts proactively at regular intervals throughout project life;
- Maintain and monitor all rehabilitated areas following re-vegetation and, if this monitoring shows that the objectives have been met, make an application for closure;
- Comply with local, district and national regulatory requirements; and
- Follow a comprehensive consultation and communication process with all stakeholders.

Rehabilitation and closure objectives have been tailored to the project at hand. This Rehabilitation, Decommissioning and Mine Closure Plan aims to assist Dagsoom in carrying out successful rehabilitation for the Project.

22 Item 3(q): Period for which the Environmental Authorisation is required

The period for which Block A (Northern Section) will be mined is five years and therefore the Environmental Authorisation will be required for five years, excluding rehabilitation and closure.

It is noted that the development of the Southern and Eastern/Klipfontein sections is planned to commence in 2026 by which time it is expected that the relevant EIA/EMPr to be undertaken for these sections will have been approved along with an amendment to the Mine Works Programme as may be required. It is expected that certain of the mine infrastructure (mainly the washing plant) may be required to treat coal arising from these sections

23 Item 3(s): Financial Provision

The financial provision estimate was calculated based on a third-party model (Digby Wells Model). The estimated financial provision required for the rehabilitation and closure of the Proposed Twyfelaar Mine is **R 11,901,761.67** (excl. VAT). The estimated financial provision associated with the proposed operations is included in Table 7-2 below.

Table 23-1: Dagsoom Twyfelaar Financial Provision Estimate

DIGBY WELLS ENVIRONMENTAL	Digby Wells Environmental Dagsoom Coal Mining, Twyfelaar, DAG5603
Area and Description	**Life of Mine**
Infrastructure and Rehabilitation	
Area 1: Eastern Underground Access	R0.00
Area 2: Northern Underground Access	R5,662,955.10
Area 3: Western Underground Access	R0.00
Area 4: Discard Dumps	R2,379,051.64
Sub-total	**R8,042,006.74**
Monitoring and Maintenance	
Monitoring Costs (Groundwater and Surface water)	R1,579,661.00
Monitoring Costs (Vegetation)	R74,858.02
Maintenance Costs (Vegetation)	R435,994.43
Sub-total	**R2,090,513.45**
Project Management (12%)	R965,040.81
Contingency (10%)	R804,200.67
GRAND TOTAL	**R11,901,761.67**

23.1 Item 3(s)(i): Explain how the aforesaid amount was derived

A financial provision model was compiled using Microsoft Excel. The financial provision model calculates the cost of demolishing, removing and rehabilitating each component of the Project's infrastructure which may include (but is not limited to):

- Demolition of all surface infrastructure including steel, wood, brick and concrete structures;
- Rehabilitation of yards and roads;

- Removal and rehabilitation of process solution facilities (e.g. pads, evaporation ponds etc), in the case of an operational;
- Generalised rehabilitation and vegetation management strategies; and
- Long term maintenance and monitoring costs.

23.2 Item 3(s)(ii): Confirm that this amount can be provided for from operating expenditure

Provided the Mining Right is approved, Dagsoom will provide for closure as per the legal requirements. A liability assessment will also need to be undertaken annually to ensure the financial provision is in line with the closure cost.

24 Item 3(t): Deviations from the Approved Scoping Report and Plan of Study

The Mine Works Programme (which was submitted with the Mining Right Application) anticipated the establishment of three mining sections within the Mining Right Boundary during the Life of Mine as defined below:

- Northern section known as Block A in this report, located on Portion 2 of the farm Twyfelaar 298IT (the Project),
- Southern section on the Remaining Extent of the farm Twyfelaar 298IT (now excluded from this application), and
- Eastern/Klipfontein section on the farm Klipfontein 283IT (now excluded from this application).

Dagsoom intends to extract coal and undertake the associated mining activities on the Northern Section (Portion 2 of the Farm Twyfelaar 298IT) in the period 2022 until 2026, and thereafter mining is planned to commence on the Southern Section and Eastern/Klipfontein Section from 2026

During the Scoping Phase of this Project, all three mining sections were included in the basic assessment as per the Mining Work Programme. The mine schedule contemplated in the Mining Right Application was based on current knowledge of the coal resources, coal markets and pricing.

The potential effects of pricing and markets on future mining layouts and mining methods for the Southern Section and Eastern/Klipfontein sections (that will only commence mining in 2026), have resulted in Dagsoom preparing this EIA/EMPr for Block A only (the Northern section) due to the near-term nature of these activities.

Due to the possible amendments that may be required in the future for the Southern and Eastern/Klipfontein sections, the mining activities contemplated for these sections will be subject to possible future amendments to the mining work programme and environmental authorization that will be prepared at a future date (in terms of the provisions of the relevant acts and regulations) in order to procure the necessary environmental authorisation for the activities contemplated for these two sections. Further to this, at the time of the specialist reports being compiled, the preferred mining method assessed was underground mining with continuous miners. Dagsoom has recently been advised that conventional drill and blasting will be more economical and sensible considering the undulating coal seam. The Blast Impact Assessment has assessed drill and blast as the mining method, however, the remainder of the specialist reports have not. The remainder of the specialists will consider this mining method for submission of the Final EIA/EMP. Based on high level risk assessments, the risks of drill and blast pertain to groundwater and wetlands should rock fracturing occur and dewatering of the shallow aquifer located above the mining area, which feeds the surrounding wetlands. It is not possible to determine the likelihood of this occurring without conducting an impact assessment of this activity and considering the Blast Impact Assessment report.

24.1 Item 3(t)(i): Deviations from the methodology used in determining the significance of potential environmental impacts and risks

The impact assessment methodology remains unchanged from the Scoping Report plan of study.

24.2 Item 3(t)(ii): Motivation for the deviation

Due to the potential for changes to the mining layouts for the Eastern and Southern/Klipfontein mining sections (which are only planned to commence in 2026) an environmental impact assessment was not undertaken for those two areas and has therefore been excluded. The environmental authorisation will therefore only pertain to Block A. Dagsoom will apply for environmental authorisation for the remaining two mining sections at a later stage.

As previously discussed, amendments to some specialist reports may be required to assess the potential impact of mining using drilling and blasting methods versus continuous miners.

25 Item 3(u)(i)(1): Impact on the socio-economic conditions of any directly affected person

The potential socio-economic impacts expected to arise as a result of the Project have been investigated and assessed in the Socio-economic Impact Assessment (Appendix O). The impacts were also quantified based on the pre-determined baseline conditions in Section 11 of this report.

People in the vicinity of the mine will experience positive and negative impacts of the proposed Project, as demonstrated in Table 25-1, below.

Table 25-1: Socio-Economic Impacts per Project Phase

Phase	Impacts	Rating (Pre-Mitigation)	Mitigation Measures	Rating (Post Mitigation)
Construction Phase	Employment creation during construction	Minor (positive)	▪ Develop and implement an abbreviated Stakeholder Engagement Plan (SEP), inclusive of a communications plan and grievance mechanism, as well as the appointment of community liaison personnel; ▪ Undertake a skills survey of the communities located in the primary and secondary study areas, allowing residents to register their interest and particular skills for upcoming employment and skills training opportunities; ▪ Use the results of the skills survey to develop a skills register to inform the Skills Development Plan to maximize employment opportunities for residents in the primary and secondary study areas; ▪ Provide skills training prior to and during the Construction Phase to improve local employability during both Construction and Operational Phases; ▪ Explore the possibility of expanding job opportunities beyond mining-related work to also include hiring contract workers to assist with community development projects; ▪ Comply with minimum wage requirements for unskilled labour and all other requirements, including gender equity, of the Employment Equity Act6 to ensure maximum benefits accrue to workers; ▪ Monitor Dagsoom and its subcontractors in terms of the commitments stipulated in Dagsoom's Social and Labour Plan (SLP) on an annual basis through external auditors;	Moderate positive

[6] The Employment Equity Amendment Act 47 of 2013, Government Gazette, RSA, Volume 583, 16 January 2014, Cape Town.

Phase	Impacts	Rating (Pre-Mitigation)	Mitigation Measures	Rating (Post Mitigation)
			▪ Ensure that local communities understand the Project's employment requirements in terms of skills and type of employment, by communicating relevant aspects of the SLP and its overarching objectives at community forums in the primary and secondary study areas; and ▪ Prepare for the Operational Phase by updating the Project's local labour database to include local community members employed during the Construction Phase.	
Operational Phase	Employment Creation during Operation	Minor positive	▪ Continue enforcement of SLP commitments for giving preference for employment to suitably qualified members of local communities; ▪ Monitor the contractors and sub-contractors on an annual basis through an external auditor to ensure their compliance with SLP commitments; and ▪ Ensure the skills development initiatives proposed in the SLP are targeted at as many local community members as possible, thereby improving skills training beneficiaries' chances at employment on the Project. ▪ Use the Project database, developed during the Construction Phase, listing local community members who were employed during the Construction Phase to select locals for employment in the Operational Phase.	Moderate positive
Operational Phase	Growth of the local economy	Minor positive	▪ Continue implementation of the measures recommended to enhance local employment, skills development, community development, and multiplier effects on the local economy for the Construction Phase; ▪ Set targets to progressively increase local and regional procurement over the life of the Project; and ▪ Incorporate SMME capacity development programmes into future iterations of the SLP to enable local suppliers to take	Moderate positive

Phase	Impacts	Rating (Pre-Mitigation)	Mitigation Measures	Rating (Post Mitigation)
			maximum advantage of procurement opportunities during the Operational Phase.	
Decommissioning Phase	Job Losses and Negative Effects on the Local Economy	Moderate negative	▪ Develop a detailed Social Closure Plan at least 5 years prior to decommissioning, that includes a retrenchment plan for Project staff as well as a communication strategy that will keep employees and surrounding communities informed about closure timing and management strategies; ▪ Develop and implement the required Human Resource systems to provide references for employees; ▪ Ensure that employment contracts release employees from non-compete clauses following the closure of the Project; ▪ Design community development initiatives that will be sustainable beyond the life of the Project and independent of mining operations; ▪ Increase opportunities for ABET, portable skills training, and mining skills-related skills development during the Operational Phase; and ▪ Proactively assess and manage the social and economic impacts on individuals, regions and economies where retrenchment and/or closure of the Project are certain.	Negligible (negative)

26 Item 3(u)(i)(2): Impact on any national estate referred to in section 3(2) of the National Heritage Resources Act

The Heritage Impact Assessment (Appendix J) was completed as part of this Project. Potential impacts and risks on heritage resources were investigated and assessed, and where possible, mitigation measures were provided.

27 Item 3(v): Other matters required in terms of Sections 24(4)(a) and (b) of the Act

This section is not applicable to the proposed Project.

28 Item 3(r): Undertaking

The EAP, Xanthe Taylor, herewith confirms: -

(a) the correctness of the information provided in the reports

(b) the inclusion of comments and inputs from stakeholders and I&APs ;

(c) the inclusion of inputs and recommendations from the specialist reports where relevant; and

(d) the acceptability of the project in relation to the finding of the assessment and level of mitigation proposed.

Part B: Environmental Management Programme Report

1 Item 1(a): Details of the EAP

Digby Wells Environmental has been appointed by Dagsoom as the Environmental Assessment Practitioner (EAP) to manage the application processes. The details of the EAP are contained in Table 2-2 and the Curriculum Vitae of the EAP is attached in Appendix A.

Table 1-1: Contact Details of the EAP

Name of Practitioner:	Xanthe Taylor
Telephone:	011 789 9495
Fax:	011 789 9498
Email:	Xanthe.Taylor@digbywells.com

2 Item 1(b): Description of the aspects of the activity

Refer to Part A: Section10 for the list of aspects associated with the proposed Project.

3 Item 1(c): Composite Map

The composite map is shown in Figure 3-1. The environmental baseline for the full extent of the proposed Mining Right area was assessed, however, mining activities will only be taking place at Block A. in the period 2022-2026.

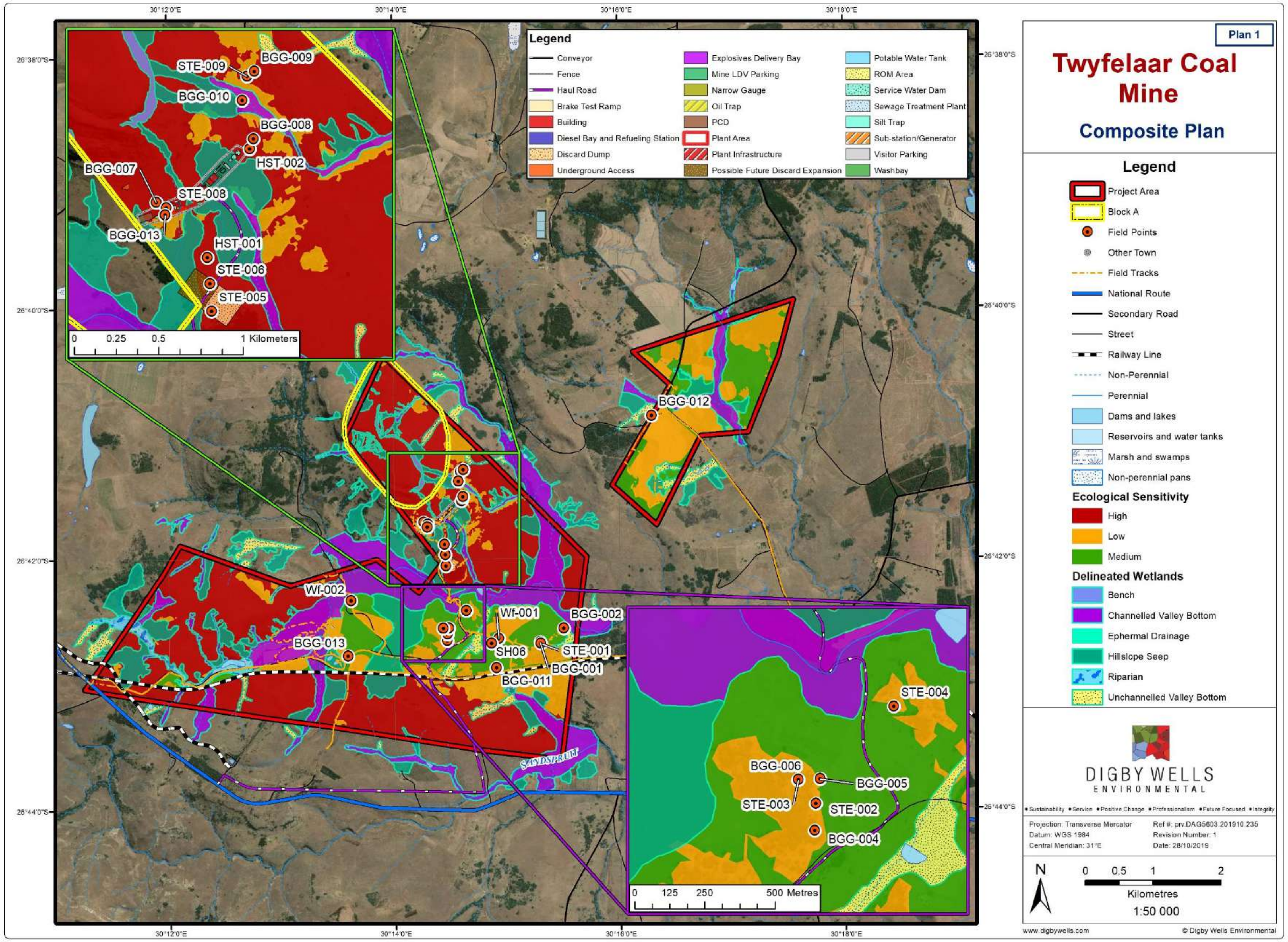

Figure 3-1: Composite Map of Environmental Sensitivities within the Mining Right Boundary

4 Item 1(d): Description of Impact management objectives including management statements

4.1 Item 1(d)(i): Determination of closure objectives

Closure and rehabilitation is a continuous series of activities that begin with planning prior to the project's design and construction, and end with achievement of long-term site stability and the establishment of a self-sustaining ecosystem. Not only will the implementation of this concept result in a more satisfactory environmental conclusion, but it will also reduce the financial burden of closure and rehabilitation. Rehabilitation and closure objectives have been tailored to the project at hand with the objective of assisting Dagsoom in carrying out successful rehabilitation.

It is recommended that the following actions be taken prior to the update of the Rehabilitation, Decommissioning and Mine Closure Plan:

- Care must be taken when stripping and stockpiling soil due to the sensitive nature of the soils on site;
- Soil stockpile locations need to be determined and sited away from sensitive landscapes, such as wetlands;
- Implement the measures as outlined in the specialist studies to minimise the risk to surface/groundwater contamination from the operations during rehabilitation and closure;
- There should be a constant interaction and communication with local stakeholders, so that their requirements can be taken into consideration in the rehabilitation process;
- Regular audits should be undertaken by a soil scientist during the soil stripping process. This will guarantee that soils are stripped and stockpiled correctly;
- Regular monitoring of groundwater should take place to determine if there is a potential for mine affected water to occur as identified within the Groundwater Report (Digby Wells, 2019;
- Regular update of the Environmental Risk Assessment as more information becomes available;
- AIPs should be removed on an ongoing basis; and
- Monitoring and maintenance of the rehabilitated areas should take place on an annual basis for at least five years after closure.

4.2 Item 1(d)(ii): The process for managing any environmental damage, pollution, pumping and treatment of extraneous water or ecological degradation as a result of undertaking a listed activity

An Emergency Response Plan details a process to respond rapidly and effectively to and manage emergency situations that may arise at the mine. The Environmental Response Plan must have the following objectives:

- Categorisation of emergency situations through hazard identification and to define procedures for responses to the situations;
- Assigning responsibilities for responding to emergency situations;
- Implementation of an effective system to receive, record and communicate reports of environmental incidents and emergencies; and
- Ensuring that all environmental incidents or emergencies are investigated, and the necessary procedures are in place to implement corrective and preventative actions to a recurrence of the incident.

The Emergency Preparedness and Response Code of Practice will be compiled in accordance with the following:

- Occupational Health and Safety OHSAS 18001; and
- The Mine Health and Safety Act, 1996 (Act No. 29 of 1996).

In the event of an emergency, the Emergency Response Plan/Procedure will be consulted, and the required actions implemented. To facilitate the effective implementation of the procedures, copies of the Emergency Response Plan will be placed in accessible and visible locations around the site. Figure 4-1 provides a general overview of the Emergency Response Procedure.

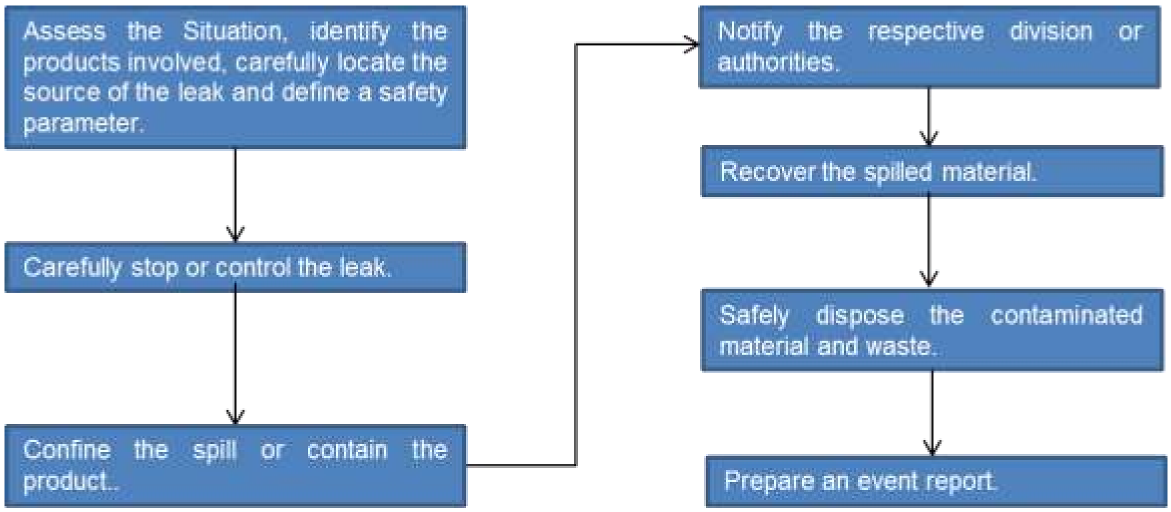

Figure 4-1: Emergency response procedure overview

4.2.1 Communication

A list of emergency contact numbers will be displayed at various locations around the site. If the emergency has the potential to affect surrounding communities, the communities will be alerted via alarm signals or contacted in person.

4.2.2 Training and Emergency Situation

The efficiency of the Emergency Response Plan must be tested by running training programmes and frequent emergency simulations. This will aid to prepare employees to respond in case of emergencies.

4.3 Item 1(d)(iii): Potential risk of Acid Mine Drainage

A geochemical assessment was undertaken for this application process to assess the potential for Acid Mine Drainage from the proposed coal mining activities. The methodology used for this assessment is described below. The Geochemical and Waste Classification Report is appended to the Groundwater Report in Appendix I.

4.4 Item 1(d)(iv): Steps taken to investigate, assess, and evaluate the impact of acid mine drainage

4.4.1 Site visit and Sampling

Fresh ore and waste samples were collected by Dagsoom and Digby Wells, with Dagsoom providing Digby Wells the samples for submission to an accredited laboratory for analysis. Approximately 1 kg per sample of coal and waste rock materials were collected from exploration and monitoring boreholes. The sampling process is explained in further detail in the sections below.

4.4.2 Laboratory Tests

The sample preparation techniques and tests were done on the samples submitted as discussed in the below sections.

4.4.2.1 Coal and Discard Material

Two coal samples and six waste rock samples were taken for laboratory analyses. The samples were submitted for the following test work:

- XRD and XRF to determine the mineralogy of each sample;
- ABA, NAG and Sulphur Speciation to determine the acid generating and/or acid neutralising potential of each sample. This allows an evaluation of the potential for AMD;
- *Aqua Regia* Digestion with full Inductively Coupled Plasma-Mass Spectrometry (ICP-MS) Quant to evaluate the total chemical makeup of the material and to determine the Total Concentrations (TC) for evaluation against the waste classification Total Concentration Threshold (TCT) guideline values; and
- Distilled water leachate tests at a ratio of 1:20 (solid: liquid) with pH, Electrical Conductivity (EC), Alkalinity, P-Alkalinity (for carbonate and bicarbonate calculations), Total Dissolved Solids (TDS), Fluorine (F), Chlorine (Cl), Nitrate (NO_3), Cyanide (CN), Sulphate (SO_4), Nickel (Ni), Arsenic (As) and Manganese (Mn)to determine the leachable concentrations of the material to compare it to the waste classification Leachable Concentration Threshold (LCT) National Environmental Management: Waste Amendment Act 2014 (Act No. 26 of 2014) guideline values.

4.4.3 Waste Classification Legislative Guidelines

On 2 June 2014, the National Environmental Management: Waste Amendment Act 2014 (Act No. 26 of 2014) was published, which for the first time included “residue deposits” and “residue stockpiles" under the environmental waste legislation. Previously mining residue was covered under the Mineral and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002) (MPRDA). A new regulation, on the planning and management of residue stockpiles and residue deposits, was included into the NEM: WA in July 2015. The purpose of these regulations is to regulate the planning and the management of residue stockpiles and residue deposits from prospecting, mining, exploration or operation. Residue deposits and residue stockpiles are listed under Schedule 3, under the category "Hazardous Waste", therefore the understanding is that mine waste is hazardous unless the applicant can prove otherwise.

As residue deposits and residue stockpiles are waste, they are regulated by the following regulations (both promulgated on 23 August 2013):

- GN R 635 – National Norms and Standards for Assessment of Waste for Landfill Disposal; and
- GN R 636 – National Norms and Standards for Disposal of Waste to Landfill.

According to these regulations, waste that is generated must be classified in accordance with South African National Standards 10234 within 180 days of generation. SANS 10234 is based on the Globally Harmonised System (GHS). It illustrates a comprehensive classification that is used to determine whether a waste is hazardous based on its physical, health and environmental properties. Classification in terms of SANS 10234 means establishing whether the waste is hazardous based on its properties. The norms and standards specify the waste classification methodologies for determining the waste category, and the specifications for pollution control barrier systems (liners) for each of the waste categories.

The Department of Environmental Affairs (DEA) has published Notice 1005 of 2014 (14 November 2014), Proposed Regulations Regarding the Planning and Management of Residue Stockpiles and Residue Deposits from a Prospecting, Mining, Exploration or Production Operation.

In terms of a waste disposal assessment, these Regulations state that residue stockpiles and residue deposits must be characterised to identify any potential risk to health or safety and environmental impact in terms of physical characteristics, chemical characteristics (toxicity, propensity to oxidise and decompose, propensity to undergo spontaneous combustion, pH and chemical composition of the water separated from the solids, stability and reactivity and the rate thereof, neutralising potential and concentration of volatile organic compounds), and mineral content.

In addition, the quality of seepage from residue facilities needs to be predicted:

- Notice 1006 of 2014 (14 November 2014): Proposed Regulations to Exclude a Waste Stream or a Portion of a Waste Stream from the Definition of Waste.

These Regulations state that waste generated from a source listed in Category A of Schedule 3 of NEM: WA may be excluded from being defined as hazardous on demonstration that the waste is non-hazardous in accordance with the Waste Management and Classification regulations. Exclusion of a waste stream from the definition of waste may be considered if it can be demonstrated that any contaminant of concern originating from the waste reaching the receptor will not exceed the acceptable environmental limits for any contaminant of concern for such a receptor. The acceptable environmental limits have not been defined.

4.4.4 Waste Classification Methodology

In the Regulations, the terms "Total Concentration Threshold" and "TCT" mean the total concentration threshold limit for certain elements or chemical substances in a waste, expressed as mg/kg, prescribed in section 6 of the Norms and Standards. The terms "Leachable Concentration Threshold" and "LCT" mean the leachable concentration threshold limit for certain elements and chemical substances in a waste, expressed as mg/L, prescribed in section 6 of these Norms and Standards.

TCT limits are subdivided into three categories:

- TCT0 limits based on screening values for the protection of water resources, as contained in the Framework for the Management of Contaminated Land (DEA, March 2010);
- TCT1 limits derived from land remediation values for commercial/industrial land (DEA, March 2010); and
- TCT2 limits derived by multiplying the TCT1 values by a factor of 4, as used by the Environmental Protection Agency, Australian State of Victoria.

LCT limits are subdivided into four categories:

- LCT0 limits derived from human health effect values for drinking water, as published by the DWS, SANS, World Health Organization (WHO) or the United States Environmental Protection Agency (USEPA);
- LCT1 limits derived by multiplying LCT0 values by a Dilution Attenuation Factor (DAF) of 50, as proposed by the Australian State of Victoria;
- LCT2 limits derived by multiplying LCT1 values by a factor of 2; and
- LCT3 limits derived by multiplying the LCT2 values by a factor of 4.

GN R 634 identifies waste classes (Waste Types 0 to 4) ranging from high risk to low risk, based on comparison of the TCT and LCT of individual constituents in the waste against the following threshold limits. Waste is assessed by comparison of the total and leachable concentration of elements and chemical substances in the waste material to TCT and LCT limits as specified in the National Norms and Standards for Waste Classification and the National Norms and Standards for Disposal to Landfill as per Table 4-1 and .

Table 4-1: Waste Classification Criteria

Waste Type	Element or chemical substance concentration	Disposal
0	LC > LCT3 OR TC > TCT2	Not allowed
1	LCT2 < LC ≤ LCT3 **OR** TCT1 < TC ≤ TCT2	Class A or Hh:HH landfill
2	LCT1 < LC ≤ LCT2 **AND** TC ≤ TCT1	Class B or GLB+ landfill
3	LCT0 < LC ≤ LCT1 **AND** TC ≤ TCT1	Class C or GLB- landfill
4	LC ≤ LCT0 **AND** TC ≤ TCT0 for metal ions and inorganic anions **AND** all chemical substances are below the total concentration limits provided for organics and pesticides listed	Class D or GLB- landfill

4.5 Item i(d)(v): Engineering or mine design solutions to be implemented to avoid or remedy acid mine drainage

Results of the analysis of LC and TC are shown in Table 4-2 and Table 4-3 respectively and compared to threshold concentrations published in the NEM: WA Waste Classification and Management Regulations.

Waste Samples:

- DSD1
  - LCT0<Arsenic (As)<LCT1, and LCT0<cyanide (CN) < LCT1 values; and
  - Based on total concentrations, all parameters are below the TCT0 values.
- DSD1, DSD3 and DSD5
  - LCT0< CN< LCT1 values; and
  - Based on total concentrations, all parameters are below the TCT0 values.
- DSD4 and DSD6L5004 and L5006
  - All parameters for these samples are below LCT0; and
  - Based on total concentrations, all parameters are below the TCT0 values.

Coal Samples:

- DSC1
  - LCT0<As<LCT1, LCT0<Manganese (Mn), Nickel (Ni) and sulphate (SO_4) < LCT1 values; and
  - Based on total concentrations, all parameters are below the TCT0 values.
- DSC2
  - LCT0 <As <LCT1 values; and
  - Based on total concentrations, all parameters are below the TCT0 values.

Based on the outcome of leachate concentration at least one parameter such As, Mn, Ni, SO_4 and CN failed to be below the LCT0 in all samples with an exception of DSD1 and DSD6. On these bases, the waste and coal material are classified as Type 3. If disposed of at a landfill disposal site or alternative site on surface requires a Class C liner or similar demonstrated in

Class C Landfill:

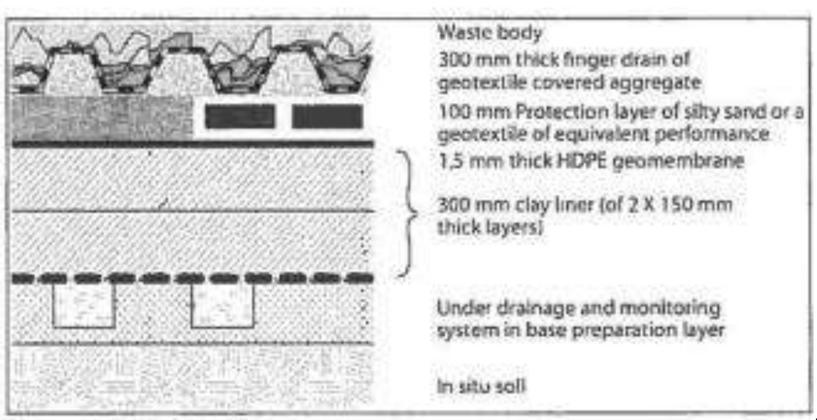

Figure 4-2 .

Class C Landfill:

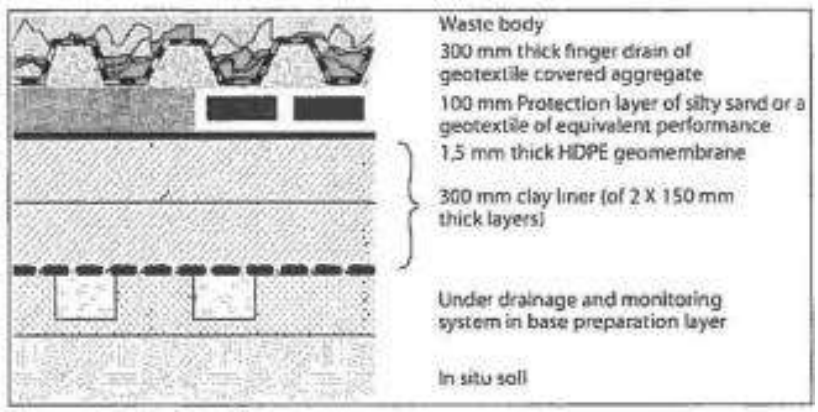

Figure 4-2: Class C Liner Design

Table 4-2: LCT Classification (mg/L) Results

Parameter	Unit	SANS241-2015 Drinking Water	DSD1	DSD2	DSD3	DSD4	DSD5	DSD6	DSC1	DSC2	LCT0	LCT1	LCT2	LCT3
As, Arsenic	mg/L	0.01	0.022	<0.02	<0.02	<0.02	<0.02	<0.02	0.022	0.028	**0,01**	**0.5**	**1**	**4**
B, Boron	mg/L	2.4	0.063	0.066	0.12	0.093	0.049	0.037	0.23	0.23	**0,5**	**25**	**50**	**200**
Cd, Cadmium	mg/L	0.003	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.002	0.001	**0,003**	**0,15**	**0,3**	**1,2**
Co, Cobalt	mg/L		<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.27	<0.001	**0,5**	**25**	**50**	**200**
Cr total	mg/L	0.05	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	**0,1**	**5**	**10**	**40**
Cu, Copper	mg/L	2	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	**2**	**100**	**200**	**800**
Mn, Manganese	mg/L	0.4	0.017	0.1	<0.001	<0.001	<0.001	<0.001	0.57	<0.001	**0,5**	**25**	**50**	**200**
Mo, Molybdenum	mg/L		0.004	0.001	0.012	0.011	0.011	0.006	0.003	0.031	**0.07**	**3.5**	**7**	**28**
Ni, Nickel	mg/L	0.07	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	0.8	<0.003	**0.07**	**3.5**	**7**	**28**
Pb, Lead	mg/L		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	**0.01**	**0.5**	**1**	**4**
Chloride as Cl	mg/L	300	1.5	1.24	1.83	1.65	1.43	0.98	3.3	2.8	**300**	**15000**	**30000**	**120000**
Sulphate as SO4	mg/L	500	58	62	28	31	19.7	20	364.2	7.33	**250**	**12500**	**25000**	**100000**
Nitrate as N	mg/L	11	0.1	0.1	0.2	0.1	<0.1	<0.1	0.35	0.37	**11**	**550**	**1100**	**4400**
F, Fluoride	mg/L	1.5	0.26	0.16	1.18	1.31	0.44	0.18	0.5	0.38	**1,5**	**75**	**150**	**600**
CN total, Cyanide total	mg/L		0.27	0.44	0.41	0.05	0.07	0.031			**0,07**	**3,5**	**7**	**28**
pH		5 to 9.7	7	6.5	7.3	7.4	7.5	7.5	6.94	7.11				

Table 4-3: TCT Classification (mg/kg) Results

Parameter	Unit	DSD1	DSD2	DSD3	DSD4	DSD5	DSD6	DSC1	DSC2	TCT0	TCT1	TCT2
As, Arsenic	mg/kg	<2.0	3.44	4.23	4.79	<2.0	2.01	5.3	3.89	5,8	500	2000
B, Boron	mg/kg	54	22	121	105	55	55	23	111	150	15000	60000
Cd, Cadmium	mg/kg	<0.10	0.15	0.47	0.19	<0.10	<0.10	<0.05	<0.14	7,5	260	1040
Co, Cobalt	mg/kg	14.32	3.52	14.21	8.24	8.82	11.79	13.68	11.49	50	5000	20000
Cr (IV), Chromium (IV)	mg/kg	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	6,5	500	2000
Hg, Mercury	mg/kg	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0,93	160	640
Mo, Molybdenum	mg/kg	<0.10	<0.10	<0.10	<0.10	0.59	<0.10	<0.10	<0.10	40	1000	4000
Ni, Nickel	mg/kg	26	9.88	45	26	15.23	27	29	27	91	10600	42400
Sb, Antimony	mg/kg	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	10	75	300
Se, Selenium	mg/kg	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	10	50	200
Chloride as Cl	mg/kg	<1	<1	<1	<1	3	<1	11	21	n/a	n/a	n/a
Sulphate as SO_4	mg/kg	0.07	<0.01	0.13	0.08	<0.01	0.04	0.23	<0.0	n/a	n/a	n/a
Nitrate as N	mg/kg	1.15	1.1	1.25	0.45	<0.5	<0.5			n/a	n/a	n/a
F, Fluoride	mg/kg	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.1	0.6	100	10000	40000
CN total, Cyanide total	mg/kg	0.65	0.81	0.63	0.81	0.42	0.67			14	10500	42000
pH		8.3	7.5	9.2	9.2	8.5	8.1	6.3	9.3			

4.6 Item 1(d)(vi): Measures that will be put in place to remedy any residual or cumulative impact that may result from acid mine drainage

The following recommendation were made based on the waste classification results:

- The waste and coal materials are classified as a Type 3 waste and disposal of the material should be done to a Class C landfill facility or a facility with a similar performing liner system;
- Due to the variation of the coal samples one being potential acid generating while the other is not, additional sampling and test work is required to determine the average AMD potential of the coal seam that will be mined. This will need to be done on a larger sample population distributed across all coal seams and waste rock lithologies to statistically back any conclusions;
- Implementation of the stormwater management plan as recommended in the surface water assessment; and
- The leachate factor of 1:20 used for waste classification is conservative and diluted approach. The leachate results of these tests can lead to a diluted result not always presenting the true concentrations to be expected on site once mining has started. For this reason, the expected sulphate concentration in the seepage water will be more than what has been observed in the results and a conservative approach of SO_4 of more than 1200 mg/L should be used for the contaminant transport modelling in the groundwater assessment.

4.7 Item 1(d)(vii): Volumes and rate of water use required for the mining, trenching or bulk sampling operation

Sustainable water resource management forms part of the mine’s integrated water management principles and involves the development of an integrated water accounting approach that accurately reflects the reality of water use on the mine. Water accounting uses a site wide water balance approach to quantify the amount of water entering a system (external sources, precipitation, groundwater inflows etc.) and the amount leaving a system (evaporation, portable consumption, loss on product, seepage, dust suppression etc.

As indicated, the water balance was based on the water Process Flow Diagram (PFD) shown in the processing report compiled by Scorpion Mineral Processing (SMP) South Africa Ltd for Twyfelaar Greenfields Coal Mine in September 2014.

There are three processing options in consideration for the proposed Dagsoom which include the Sell ROM (base case), DMS Upgrade3 (Option 2) and XRT Sorting Upgrade (Option 3). It must be noted that the base case and Option 3 water balances have similar water use requirements while the water balance for option 2 is different since Option 3 considers a dry processing circuit which has additional water requirements for the DMS plant. The additional water requirements for option 3 have been indicated (highlighted in green) on the water balance for areas where the required volume differs with the requirements for the other processing options

The different water use requirements for the processing plant based on the three processing options, consumption volumes and required dust suppression volumes were provided in the SMP processing report and only the rainfall, runoff and evaporation volumes were calculated or adjusted based on the updated WRC, 2015 climate data, a monthly rainfall time series record of 89 years from 1920 to 2009 was used (WRC, 2015). It is recommended that storm water runoff contained in the PCD must be re used in mine process to reduce the raw water intake, thereby preventing potential water resource pollution should water sitting at the PCD overflow onto the natural environment. Table 4-4 present the key assumption and data input used as part of the water balance model and the water process flow, together with the site wide water balance can be seen on Figure 4-3.

Table 4-4: Data input and key assumptions used for the site water balance

Description	Value	Unit	Source/comment
Runoff coefficient	0.6	%	Assumed
Dust suppression	75 000	litres/day	SMP Report
Groundwater Inflow range	50 - 80	m3/d	Digby Wells, 2019
Mean annual rainfall	817	mm/yr	WRC,2015
Mean annual evaporation	1 400	mm/yr	WRC,2015
Groundwater recharge	1870	litres/day	SMP Report (0.34 l/d/ha)
PCD West	480	m2	Dagsoom Site Layout Plan
PCD East	480	m2	Dagsoom Site Layout Plan
PCD North	3000	m2	Dagsoom Site Layout Plan
Loss of water on STP	20	%	Assumed
Process Water Tank/Dam	192	m2	Assumed (40% of PCD west size)
Process Water Tank/Dam	192	m2	Assumed (40% of PCD west size)

The water management boundaries are defined according to the mine processes and these are subdivided into water demand, water sources and water storage.

4.7.1 Water Sources

There are three proposed main water sources which include:

- Rainfall and runoff;
- Groundwater; and

- Raw water from a dam/river (Potable water supply)

4.7.2 Water Storage/ Containment Facilities

The water storage infrastructure will include:

- Three PCDs;
- Process water dam; and
- Water tanks.

4.7.3 Water Demand/ Usage

Water uses will include:

- Potable water at the mine offices and workshops (Drinking, washing and ablution);
- Process water for coal washing; and
- Dust suppression at the mine.

The water balance estimates total new water inflows to the mine system of approximately 21,242 m^3/month on average, while an additional volumes of 6,355 m^3/month will be required for processing option 2 which involves a density medium separation plant and required additional use of water.

About half of the inflow volume (21,242 m^3/month) goes out of the mine system with the other half (approximately 10,931 m^3/annum) remains in circulation within the mine system (Figure 4-3). The amount of water in circulation include a water recovered or recycled from the sewage treatment plant and water that is recovered from the mine processes thereby saving on new water intakes to the mine.

The total volume of potable water obtained from the nearby river is indicated to be 858 m^3/month for the base case and 908 m^3/month for option 2. This water will be sent to a water treatment plant where the output volume will be shared the Offices, Change houses and Workshops areas.

From the adopted process flow, storm water collected at the three PCD's is only kept within the PCD's for evaporation purposes. The PCD at Block A will also receive an overflow volume from the process water dam. It is recommended to recycle the storm water runoff the PCD's for use in mine Processes including dust suppression, mining process and washing of coal.

Also, once the final processing option and the layout designs have been decided upon, the water balance will be updated.

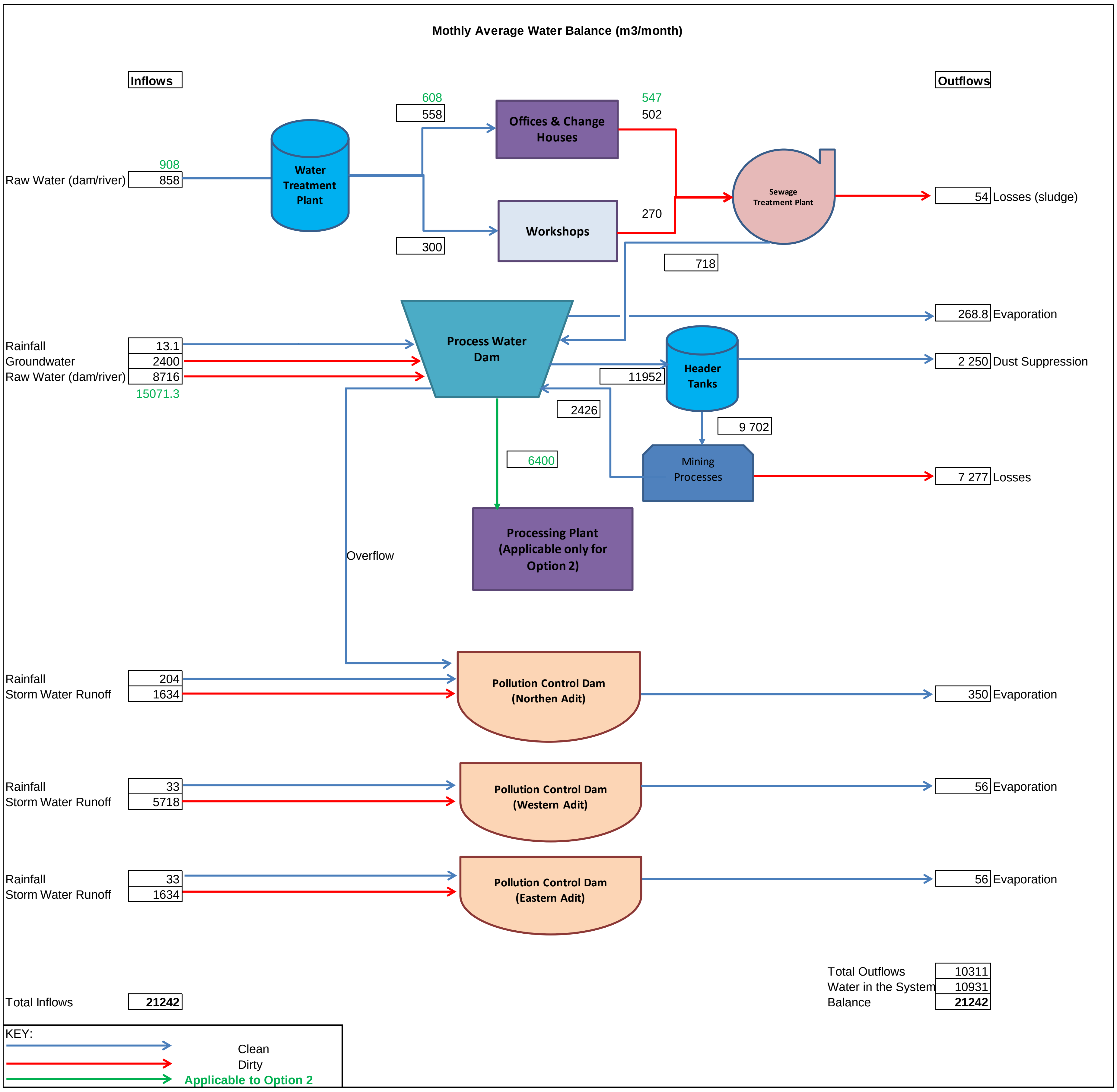

Figure 4-3: Water Process Flow and the Site Wide Water Balance for the Proposed Twyfelaar Coal Mine

4.8 Item 1(d)(viii): Has a water use licence has been applied for

Dagsoom is yet to apply for a water use license for the various Section 21 water uses proposed to be undertaken on site, from the DWS as per the requirements of the NWA.

The application process will commence immediately informed by the results of the EIA studies.

4.9 Item 1(d)(ix): Impacts to be mitigated in their respective phases

The proposed mitigation measures and its compliance with relevant standards as presented in Table 4-5.

Table 4-5: Impacts to be mitigated

Phase	Activity	Aspect	Impacts	Mitigation Measures	Compliance with standards	Time frame for implementation
Construction	Site clearance for construction work disturbs soils, exposure to erosion by wind and water and stockpiling	Soil, land use and land capability	Soil loss by wind and water erosion from cleared land surfaces, and incorrect stockpiling	▪ Areas where stripping occurs must be clearly demarcated to ensure only those areas are affected; ▪ Topsoil must be stripped to a depth of 300mm and stockpiled to a maximum height of 4 m; ▪ The subsoil of 0.4 – 1.2 m will then be stripped and stockpiled separately for deep soils; ▪ A Topsoil Management Plan (TMP) must be prepared to demonstrate how topsoil will be preserved in a condition as near as possible to its pre-mining condition in order to allow successful mine rehabilitation; ▪ Vehicles must be prohibited from driving over stockpiles; ▪ Runoff must be controlled and managed by use of effective stormwater management measures; ▪ Re-fuelling must take place on bunded impervious surfaces to prevent seepage of hydrocarbons into the soil; ▪ Establishment of effective vegetation around constructed infrastructure for adequate soil protection from wind and water erosion; ▪ If any erosion occurs, corrective actions must be taken to minimise any further erosion from taking place at regular intervals or after high rainfall events; ▪ Restriction of vehicle movement over sensitive areas to reduce compaction; ▪ Minimise unnecessary removal of the natural vegetation cover outside the development footprint; ▪ All vehicles and machines must be parked within hard park areas and must be checked daily for fluid leaks; ▪ Place drip trays where there are vehicles or machinery leaks occurring; ▪ Fuel, grease and oil spills should be remediated using commercially available emergency clean up kits; ▪ For major spills (>5L), if soils are contaminated, they must be stripped and disposed of at a licensed waste disposal site; and ▪ Any contractors on site must ensure that all employees are aware of the procedure for dealing with spills and leaks and undergo training on site.	▪ NEMA ▪ The Conservation of Agricultural Resources Act, 1983 (Act No. 43 of 1983) (CARA).	Construction
Construction	Movement of vehicles and machinery and general handling of hydrocarbons may result in spillages of hydrocarbons such as oils, fuels and grease	Soil, land use and land capability	Soil contamination by hydrocarbon spillages and leakages			Construction
Construction	Movement of heavy machinery	Soil, land use and land capability	Soil compaction resulting from the movement of heavy machinery within the Project Area or on stockpiles			Construction
Construction	Site Clearance within vegetated areas	Fauna and Flora	Loss of high sensitivity vegetation type and landscape (*Hyparrhenia – Themeda* Grassland, Sandstone Ridges, Riparian areas)	▪ Except where critical to the project development and where absolutely necessary and by offset, the Primary grassland, Riparian areas and Sandstone ridges should be excluded from the mine plan to prevent deterioration of these areas; ▪ All Primary grassland and Sandstone ridges must be managed as sensitive landscapes and designated as no- go areas; ▪ The footprint of disturbance area should be kept as small as possible and only the access roads (which will follow existing roads and tracks where possible) should be used to reach the site for clearing and	▪ National Environmental Management Biodiversity Act, 2004 (Act No. 10 of 2014) (NEM: BA); ▪ NEMA; ▪ National Environmental Management: Protected Areas Act, 2003 (Act No. 57 of 2003) (NEM: PAA) as amended;	Construction

Phase	Activity	Aspect	Impacts	Mitigation Measures	Compliance with standards	Time frame for implementation
				vehicles should not be allowed to traverse natural areas or leave the demarcated road; and ▪ An alien and invasive plant species management programme must be in place during the construction phase. In this regard, special mention is made of *A. mearnsii*, which is the dominant alien invasive tree species observed in the watercourses at the time of the assessment. Existing AIP's within the areas demarcated for infrastructure will be eradicated. The disturbed site will be monitored quarterly for at least the life of the project and a minimum of two years post closure to ensure that alien invasion does not take place.	▪ National Forest Act,1998, (Act No. 84 of 1998) (NFA); ▪ Mpumalanga Nature Conservation Act, 1998 (Act No.10 of 1998) (MPNCA); and ▪ CARA	
Construction	Site Clearance within vegetated areas	Fauna and Flora	Loss of habitat of moderate to low sensitivity (AIP vegetation types)	▪ The footprint area should be kept as small as possible and only access roads (which will follow existing roads and tracks) should be used to reach the site for clearing and vehicles should not be allowed to traverse natural areas or leave the demarcated road; ▪ An AIP management plan must be implemented, whereby existing AIP's within the areas demarcated for infrastructure will be eradicated. The disturbed site will be monitored quarterly for at least two years to ensure that alien invasion does not take place.		Construction

<table>
<tr><th>Phase</th><th>Activity</th><th>Aspect</th><th>Impacts</th><th>Mitigation Measures</th><th>Compliance with standards</th><th>Time frame for implementation</th></tr>
<tr><td>Construction</td><td>Site clearing, including the removal of vegetation and disturbance of soils</td><td>Wetlands</td><td>Construction and development activities within a greenfield site are likely to result in negative impacts to functioning freshwater resources and the catchment. This is realised through the resultant habitat fragmentation, spreading of alien and invasive species, soil disturbance and/or compaction, increased incidence of erosion, sedimentation from erosion, potential water quality deterioration, and disturbance to avifauna and other fauna utilising the freshwater resources thus resulting in an overall loss of biodiversity</td><td rowspan="2">▪ Environmental Practitioner to be present during vegetation clearing to prevent unnecessary clearing of extensive areas not part of the direct footprint area;
▪ Clearly marked buffer zones must be established, which are defined as regions of natural vegetation between watercourses/wetlands and developments or activities (WRC, 2015). This is a key management action that should take place by revising proposed infrastructure locations in line with the sensitivity mapping;
▪ Limit vegetation removal and construction activities to the infrastructure footprint area only, where removed or damaged vegetation areas should be revegetated as soon as possible;
▪ An alien and invasive plant species management programme must be in place during the construction phase. In this regard, special mention is made of A. mearnsii, which is the dominant alien invasive tree species observed in the watercourses at the time of the assessment;
▪ Bare land surfaces downstream of construction activities must be vegetated to limit erosion from surface runoff associated with infrastructure areas. Actively re-vegetate disturbed areas immediately after construction;
▪ Ensure a soil management programme is implemented and maintained to minimise erosion and sedimentation;
▪ If destruction of wetlands is unavoidable disturbance must be minimised and suitably rehabilitated;
▪ Ensure no incision and canalisation of the wetland features takes place;
▪ Erosion berms must be installed on roadways and downstream of the discard dump to prevent gully formation and siltation of the freshwater resources. The following points should serve to guide the placement of erosion berms:
  ▪ Where the track has a slope of less than 2%, berms every 50m should be installed;
  ▪ Where the track slopes between 2% and 10%, berms every 25m should be installed;
  ▪ Where the track slopes between 10%-15%, berms every 20m should be installed; and
  ▪ Where the track has a slope greater than 15%, berms every 10m should be installed.
▪ All erosion within the construction footprint should be remedied immediately and included as part of an ongoing rehabilitation plan;
▪ Limit personnel within the buffer areas for all freshwater features identified and such personnel can only enter as and when necessary;
▪ All areas of increased ecological sensitivity should be designated as “No-Go” areas and be off limits to all unauthorised vehicles and personnel;
▪ No crossing of the wetland features and their associated buffers should take place (excluding the access road, powerline and water pipleline) and the substrate conditions of the wetlands and downstream stream connectivity must be maintained;
▪ At areas where road crossings have been designed, these roads should cross wetland or river features at the narrowest point and at a</td><td rowspan="2">▪ NWA;
▪ NEM:BA;
▪ NEMA</td><td>Construction</td></tr>
<tr><td>Construction</td><td>Construction of mine related infrastructure including the plant area, the infrastructure area, the ROM pad, the PCD, the discard dump, the explosives delivery bay, the northern underground access point, and access and haul roads.</td><td>Wetlands</td><td>Fragmentation of the freshwater resources as a result of road crossings. Loss of freshwater resource habitat (soils and vegetation) due to both direct and indirect impacts. These impacts may result in complete loss of</td><td>Construction</td></tr>
</table>

Phase	Activity	Aspect	Impacts	Mitigation Measures	Compliance with standards	Time frame for implementation
			wetland ecosystems or part thereof. Although some of these freshwater resources are not in pristine condition, they are providing significant ecological services at the local and catchment scale	90-degree angle with suitable drainage designed into the relevant bridge/culvert crossing; ▪ No material will be dumped or stockpiled within any rivers, tributaries or drainage lines in the vicinity of the proposed footprint area. ▪ Environmentally friendly barrier systems, such as silt nets or, in severe cases, use of trenches, downstream from construction sites to limit erosion and possibly trap contaminated runoff from construction; ▪ Stormwater must be diverted from construction activities and managed in such a manner to disperse runoff and prevent the concentration of stormwater flow; ▪ Water used at construction sites should be utilised in such a manner that it is kept on site and not allowed to run freely into nearby watercourses (i.e. installation of clean and dirty water separation systems); ▪ Construction during high rainfall periods (usually November to March) should be avoided to decrease surface runoff in areas of vegetation removal and disturbed soils in an attempt to limit erosion and sedimentation into wetlands and instream aquatic systems; ▪ The clean and dirty water separation systems must be some of the first infrastructures installed on site and care must be taken to ensure that contamination of the receiving environment as a result of mining activities is minimised as far as possible; ▪ No vehicles or heavy machinery may be allowed to drive indiscriminately within any wetland areas and their associated buffer zones. All vehicles must remain on demarcated roads and within the construction footprint and access roads; ▪ All vehicles must be regularly inspected for leaks; ▪ Re-fuelling must take place on a concrete lined or bunded surface area away from wetlands to prevent ingress of hydrocarbons into the topsoil; ▪ Construction chemicals, such as paints and hydrocarbons, should be used in an environmentally safe manner with correct storage as per each chemical’s specific storage descriptions; ▪ All spills should be immediately cleaned up and treated accordingly; ▪ Appropriate sanitary facilities must be provided for the duration of the construction activities and all waste must be removed to an appropriate waste facility, and ▪ Wetland monitoring must be carried out quarterly during the construction phase by a wetland specialist to ensure no unnecessary impact to the freshwater resources occur; and if so, a solution must be put in place as soon as possible.		

Phase	Activity	Aspect	Impacts	Mitigation Measures	Compliance with standards	Time frame for implementation
Construction	Site clearance and construction of proposed infrastructure	Aquatics	Land and vegetation manipulation/clearing for infrastructure in proximity to the Southern Tributary and within non-perennial drainage lines.	▪ Mitigation measures detailed for the site and vegetation clearing impact should be applied to areas leading up to the watercourse crossing points. However, the infrastructure construction over a watercourse needs additional attention due to the proximity of the activity to aquatic ecosystems. Essentially, the watercourse is going to be directly affected unless a "suspension" approach is adopted (e.g. suspending the infrastructure, allowing only contact with the banks of the watercourse of concern). This is recommended where applicable but will most likely only be a viable option for pipelines that cross watercourses, if any. Larger constructions over watercourses, more specifically the proposed road constructions and associated culverts (if any), are of focus. ▪ The design as well as the physical construction of roads should not alter the natural hydrology and connectivity of the watercourses in any way (i.e. damming or creating barriers). Any infrastructure proposed to be in contact with the substrate/channel bottom should allow for the free flow of water and material. If hard surfaces are going to be used as foundation or if culverts are going to be installed, their base should not be noticeable above the natural channel bottom to maintain connectivity. Biannual aquatics monitoring of the crossing points should also form part of the management actions to ensure correct flow occurs through the crossing point, especially during the wet season.	▪ NWA	Construction
Construction	Physical construction of infrastructure over natural aquatic ecosystems	Aquatics	Vegetation removal for site access and potential hydrological disturbance of associated watercourses			Construction
Construction	Site preparation including vegetation clearance and excavations, leading to exposure of soils	Surface water	Sedimentation and siltation of nearby watercourses	▪ Clearing of vegetation must be limited to the development footprint, and the use of any existing access roads must be prioritised so as to minimise creation of new ones; ▪ If possible, construction activities must be prioritised to the dry months of the year to limit mobilisation of sediments, dust generation and hazardous substances from construction vehicles used during site clearing; ▪ Dust suppression with water on the haul roads and cleared areas must be undertaken to limit dust; ▪ Avoid placement of any infrastructure within the 100-year floodlines or 100 m buffer from watercourses, whichever is greater; ▪ Hydrocarbon and hazardous waste storage facilities must be appropriately bunded to ensure that leakages can be contained. Spill kits should be in place and construction workers should be trained in the use of spill kits, to contain and immediately clean up any potential leakages or spills; ▪ Vehicles should regularly be maintained as per the developed maintenance program. This should also be inspected daily before use to ensure there are no leakages underneath ▪ Drip trays must be used to capture any oil leakages. Servicing of vehicles and machinery should be undertaken at designated hard park areas. Any used oil should be disposed of by accredited contractors;	▪ NEMA; ▪ NEM:WA; ▪ NWA; ▪ GN R 704; ▪ GN R 718; and ▪ DWA Best Practice Guidelines (BPGs) series (2008)	Construction
Construction	Construction and installation of infrastructural facilities including administration offices, ablutions, storerooms, workshops, pollution control dams, processing plant, roads, pipelines etc.	Surface water	Increase of impermeable surfaces, subsequently increasing runoff and potential flooding			Construction
Construction	Handling of hydrocarbons and other chemicals; Loading, hauling and transportation of product coal.	Surface water	Surface water contamination leading to deterioration of water quality			Construction
Construction	Fuel storage, construction vehicles causing potential groundwater contamination	Groundwater	Storage of fuel and the usage of construction vehicles on-site could cause spillages of	▪ Regular service of vehicles in designated repair bays as per the developed maintenance program; and ▪ Refuelling of vehicles only in designated areas with correct liners and surfaces	▪ NWA ▪ NEM:WA	Construction

Phase	Activity	Aspect	Impacts	Mitigation Measures	Compliance with standards	Time frame for implementation
			hydrocarbons. These spillages may seep into the underlying aquifers, causing contamination of groundwater with hydrocarbons.			
Construction	Mine access dewatering causing groundwater level drawdown	Groundwater	During construction of the adit into the underground mine, small scale dewatering associated with the construction could lead to local drawdown of groundwater levels in the vicinity of the adit.	▪ Keep the box cut construction time as short as possible; and ▪ Keep the extents and depth of the box cuts as small as possible		Construction
Construction	The current proposed infrastructure design layout suggests that the Project will directly impact only STE-005	Heritage	Indirect impact on burial grounds and graves	▪ Dagsoom must develop and implement a CMP to prevent the degradation of the fabric of the burial grounds and graves through the Project lifecycle and preserve the CS of the heritage resources. ▪ Dagsoom must also develop and implement an Access Protocol to allow individuals access to the burial grounds and graves. This Access Protocol can be developed considering the relevant safety and security measures of the mine, the requirements of the Mine Health and Safety Act, 1996 (Act No. 29 of 1996) (MHSA) and the needs of the community. ▪ Information regarding the Access Protocol must be made publicly available and can be developed as part of the CMP.	▪ National Heritage Resources Act, 1999 (Act No. 25 of 1999) (NHRA)	Construction
Construction	Site Clearing, Excavation / Transport, Tipping and Spreading of Materials	Air Quality	Nuisance and reduction in ambient air quality	▪ Develop a traffic management plan for site to enforce a speed limit; ▪ Apply wetting agents, dust suppressant or binders on exposed areas (including excavated stockpiled material and on dirt roads); ▪ Enforce adherence to set vehicle speed limits; ▪ Conduct activities judiciously during windy days (≥5.4 m/s); and ▪ Minimise the drop heights when loading, offloading and tipping material.	▪ NEM:AQA; ▪ National Ambient Air Quality Standards	Construction
Construction	Blasting the adit	Blasting	Ground vibration impact on community houses and heritage resources	▪ Specific blast design to be done, shorter blast holes, smaller diameter blast hole, using electronic initiation instead of shock tube systems to obtain single hole firing. ▪ Monitor ground vibration and air blast from blasting operations	▪ Mine Health and Safety Act, 1996 (Act No. 29 of 1996) (MHSA); ▪ MPRDA ▪ Explosives Act, 2003 (Act No. 15 of 2003) ▪ United States Bureau of Mines (USBM)	Construction
Construction		Blasting	Air blast impact on community houses	▪ Specific blast design to be done, shorter blast holes, smaller diameter blast hole, use of specific stemming materials to manage air blast, increased stemming lengths to reduce air blast effect. Used of specific stemming to manage fly rock - crushed aggregate of specific size. Re-design with increased stemming lengths ▪ Monitor ground vibration and air blast from blasting operations		Construction
Construction		Blasting	Fly rock impact on community houses	▪ Specific blast design to be done, shorter blast holes, smaller diameter blast hole, use of specific stemming materials to manage air blast, increased stemming lengths to reduce air blast effect. ▪ Monitor fly rock situation using video camera		Construction
Construction	Site clearing, and the construction of infrastructure	Noise	Noise will emanate from the machinery, and vehicles during the	▪ Restrict construction activities to daylight hours (06:00 – 18:00	▪ South African National Standard (SANS) 10103	Construction

Phase	Activity	Aspect	Impacts	Mitigation Measures	Compliance with standards	Time frame for implementation
	will result in the generation of noise.		site preparation, haul road construction as well as processing plant construction activities and may exceed the South African standard SANS 10103 [2]	▪ Vehicles to be serviced as per their design requirements to ensure noise suppression mechanisms are effective e.g. installed exhaust mufflers; ▪ Regulate vehicle speeds on the access and haul roads; and ▪ Switch off equipment when not in use during the working hours.		
Construction	Recruitment / Appointment of Construction Workforce	Socio-economic	Employment creation during construction	▪ Develop and implement an abbreviated Stakeholder Engagement Plan (SEP), inclusive of a communications plan and grievance mechanism, as well as the appointment of community liaison personnel; ▪ Undertake a skills survey of the communities located in the primary and secondary study areas, allowing residents to register their interest and particular skills for upcoming employment and skills training opportunities; ▪ Use the results of the skills survey to develop a skills register to inform the Skills Development Plan to maximize employment opportunities for residents in the primary and secondary study areas; ▪ Provide skills training prior to and during the Construction Phase to improve local employability during both Construction and Operational Phases; ▪ Explore the possibility of expanding job opportunities beyond mining-related work to also include hiring contract workers to assist with community development projects; ▪ Comply with minimum wage requirements for unskilled labour and all other requirements, including gender equity, of the Employment Equity Act7 to ensure maximum benefits accrue to workers; ▪ Monitor Dagsoom and its subcontractors in terms of the commitments stipulated in Dagsoom's Social and Labour Plan (SLP) on an annual basis through external auditors; ▪ Ensure that local communities understand the Project's employment requirements in terms of skills and type of employment, by communicating relevant aspects of the SLP and its overarching objectives at community forums in the primary and secondary study areas; and ▪ Prepare for the Operational Phase by updating the Project's local labour database to include local community members employed during the Construction Phase.	▪ NEMA	Construction
Operational	Soil chemical pollution	Soil, land use and land capability	Soil Contamination from Hydrocarbon waste (lubricants, explosives and fuels)	▪ Soil pollution monitoring should be conducted at selected locations on the project site to detect any extreme levels of pollutants; ▪ Any spillages of hydrocarbons or sewage effluent from the treatment plant or ablution facilities should be cleaned-up immediately and the contaminated soils removed fordiposal of at accredited disposal sites; ▪ A Topsoil Management Plan (TMP) must be prepared to demonstrate how topsoil will be preserved in a condition as near as possible to its pre-mining condition in order to allow successful mine rehabilitation;	▪ NEMA ▪ CARA.	Operational
Operational	During the stripping and stockpiling process there may be some unexpected changes in the depth and the nature of the soil.	Soil, land use and land capability	Deterioration of Topsoil Quality from in Topsoil Stockpiles			Operational

[7] The Employment Equity Amendment Act 47 of 2013, Government Gazette, RSA, Volume 583, 16 January 2014, Cape Town.

Phase	Activity	Aspect	Impacts	Mitigation Measures	Compliance with standards	Time frame for implementation
				▪ Long term stockpiles should be revegetated to minimise loss of soil quality. This will minimise weed infestation, maintain soil organic matter levels, maintain soil structure and microbial activity and maximise the vegetative cover of the stockpile; ▪ Topsoil stripping should be scheduled for the dry season, where possible; and ▪ All long-term topsoil material stockpiles should be located outside the active mine path and away from drainage lines.		
Operational	Underground mining of coal and the operation of the rock dumps, soils, ROM, discard dump.	Fauna and Flora	Potential for road kills, injuring or poaching and faunal disturbance	▪ Erect signage with speed limits. ▪ Restrict vehicle movement to daylight hours. ▪ Additional surveys should be conducted to determine the presence of Grass Owl and Serval on site. If these species are present, a management plan should be implemented. ▪ Concurrent rehabilitation should take place.	▪ NEM: BA; ▪ NEMA ▪ NEM: PAA (as amended); ▪ NFA; ▪ MPNCA; and ▪ CARA	Operational
Operational	Operation of powerlines that could cause bird fatalities through collisions and electrocutions.	Fauna and Flora	Collisions and electrocutions	▪ Install Bird Diverters ▪ Utilise best practice with pylon construction and type.		Operational

Operational	Operational underground mining activities, including excavation and dewatering	Wetlands	Operational activities of the proposed underground mining activities have the potential to result in impacts to the water quality of the groundwater, local and downstream resources as well as the potential loss of water supply from the groundwater aquifer. Dewatering activities are likely to result in the loss of water supply to the wetlands, with special mention of the lower lying wetlands such as CVB4, and moisture stress to the surrounding wetland areas.	The following management actions are recommended to guide the effective management of stormwater and water generated on site:
				▪ Channelled water should not be dispersed in a concentrated manner. Baffles should be incorporated into artificial drainage lines/channels around the surface infrastructure to decrease the kinetic energy of water as it flows into the natural environment;
				▪ Bare surfaces downstream from the developments where silt traps are not an option should be vegetated in order to attempt to limit erosion and runoff that might be carrying contaminants;
				▪ All erosion noted within the operational footprint should be remedied immediately and included as part of an ongoing rehabilitation plan;
				▪ Ensure that no incision and canalisation of the wetland features present takes place;
				▪ Erosion berms should be installed on roadways and downstream of stockpiles and the discard dump to prevent gully formation and siltation of the freshwater resources. The following points should serve to guide the placement of erosion berms:
				  ▪ Where the track has a slope of less than 2%, berms every 50m should be installed;
				  ▪ Where the track slopes between 2% and 10%, berms every 25m should be installed;
				  ▪ Where the track slopes between 10%-15%, berms every 20m should be installed; and
				  ▪ Where the track has a slope greater than 15%, berms every 10m should be installed;
				▪ Quarterly monitoring of all wetland areas affected as a result of infrastructure developments, including linear infrastructures such as roads watercourses should be carried out by a suitably qualified wetland ecologist in order to determine localities of areas subjected to
					▪ NWA;
					▪ NEM:BA;
					▪ NEMA
						Operational

Operational	Uncontrolled runoff of stormwater or water generated from the mining operations from or through the surface infrastructure	Wetlands	Water quality and habitat deterioration of watercourses receiving unnatural/contaminated runoff			Operational

Phase	Activity	Aspect	Impacts	Mitigation Measures	Compliance with standards	Time frame for implementation
Operational	Operational underground mining activities, including excavation and dewatering	Wetlands	Operational activities of the proposed underground mining activities have the potential to result in impacts to the water quality of the groundwater, local and downstream resources as well as the potential loss of water supply from the groundwater aquifer. Dewatering activities are likely to result in the loss of water supply to the wetlands, with special mention of the lower lying wetlands such as CVB4, and moisture stress to the surrounding wetland areas.	erosion and increased runoff; where after, new mitigation actions should be implemented as per the specialist's recommendations. The following management and mitigation measures should be put in place to minimise the impact of the underground operational activities: ▪ During the operational phase of the project the Storm Water Management Plan (SWMP) contained in the Surface Water Report should already be implemented. This should consider all wetlands and other watercourses associated with the new developments/infrastructure which should divert stormwater away from the surface infrastructure and back into natural watercourses to maintain catchment yield as far as possible. The SWMP should also convey stormwater to silt traps where needed in order to limit erosion and the subsequent increase of suspended solids in downstream watercourses; ▪ If possible, clean water removed as part of the dewatering activities should be released downgradient of the operational areas to ensure water supply to the lower lying wetlands is maintained. The following management and mitigation measures should be put in place to ensure impacts to the wetland ecology of the area as a result of (and in specific areas that could be effected by the operation) the general operational activities is reduced: ▪ Environmental Practitioner to be present during operational phase to prevent any additional clearing of extensive areas or vegetation or dumping of waste rock and/or coal in areas not part of the direct footprint area. ▪ The edge of the non-directly impacted freshwater resources, and at least a 100m buffer or 1:100 floodline buffer, should be clearly demarcated in the field with wooden stakes painted white as no-go zones that will last for the duration of the operational phase. ▪ All areas of increased ecological sensitivity should be designated as "No-Go" areas and be off limits to all unauthorised vehicles and personnel; ▪ Freshwater resource monitoring must be carried out during the operational phase by a wetland specialist to ensure no unnecessary impact to the freshwater resources present; and if so that a remedy is put in place as soon as possible. ▪ Ensure soil management programme is implemented and maintained to minimise erosion and sedimentation; ▪ Implement and maintain alien vegetation management programme; ▪ If it is absolutely unavoidable that any of the wetland areas present will be affected, disturbance must be minimised and suitably rehabilitated; ▪ No material is to be dumped or stockpiled within any rivers, tributaries or drainage lines; ▪ No vehicles or heavy machinery may be allowed to drive indiscriminately within any wetland areas or their buffer areas. All vehicles must remain on demarcated roads and within the operational footprint; ▪ All vehicles must be regularly inspected for leaks; ▪ Re-fuelling must take place on a sealed surface area away from wetlands to prevent ingress of hydrocarbons into topsoil;		Operational
Operational	Uncontrolled runoff of stormwater or water generated from the mining operations from or through the surface infrastructure	Wetlands	Water quality and habitat deterioration of watercourses receiving unnatural/contaminated runoff			Operational
Operational	Loading, hauling and stockpiling	Wetlands	These activities have the potential to result in an increased potential for soil compaction, erosion, sedimentation, loss of water quality, habitat and biodiversity			Operational
Operational	Use and maintenance of haul roads for the transportation of coal and waste rock	Wetlands	Fragmentation of the freshwater resources as a result of road crossings, contamination of freshwater resources and impacts to water quality as a result of spills, compaction of soils, loss of habitat and biodiversity. Increased potential for sheet runoff from paved/cleared surfaces and increased potential for erosion			Operational

Phase	Activity	Aspect	Impacts	Mitigation Measures	Compliance with standards	Time frame for implementation
				▪ All spills should be immediately cleaned up and treated accordingly; and ▪ Appropriate sanitary facilities must be provided for the duration of the operational phase and all waste must be removed to an appropriate waste facility.		
Operational	Uncontrolled runoff of stormwater or water generated from the mining operations from or through the surface infrastructure	Aquatics	Water quality and habitat deterioration of watercourses receiving unnatural/ contaminated runoff	▪ During the Operational Phase of the Project a SWMP should already be implemented. This should consider all drainage lines associated with the new developments/infrastructure which should divert stormwater away from the surface infrastructure and back into natural watercourses. The SWMP should also convey stormwater to silt traps where needed in order to limit erosion and an increase of suspended solids in downstream watercourses; ▪ Channelled water should not be dispersed in a concentrated manner. Baffles should be incorporated into artificial drainage lines/channels around the surface infrastructure to decrease the kinetic energy of water as it flows into the natural environment; ▪ Bare surfaces downstream from the developments where silt traps are not an option should be vegetated in order to attempt to limit erosion and runoff that might be carrying contaminants; ▪ Careful monitoring of the areas where dust suppression is proposed should be undertaken regularly. Areas concentrating water runoff should be addressed and not allowed to flow freely into associated watercourses; and ▪ Monitoring of infrastructure over watercourses should be done by an aquatic specialist in order to determine localities of areas subjected to erosion and increased runoff where after new mitigation actions should be implemented as per the specialist's recommendations	▪ NWA	Operational
Operational	Runoff from the dirty water areas or catchments (coal stockpile areas, mine processing plant, workshops etc.)	Surface water	Surface water contamination by runoff from dirty water areas	▪ Infrastructure development must be limited to the demarcated footprint to minimize the dirty runoff generating catchments within the project area. ▪ As per the SWMP, clean water runoff from the upstream catchment of the mine should be diverted around the site into the natural environment, this will minimize the runoff that will potentially be contaminated by mine waste ▪ All the runoff captured on the stormwater dam and RWD should be re-used in the mine processes to avoid sourcing water from external sources. ▪ Should the contaminated water stored water be more than the storage capacities and discharge is considered, this water should be treated to acceptable water quality prior to discharge into the natural environment. In this case, acceptable water quality should at least be benchmarked with the baseline surface water quality of the surrounding streams	▪ NEMA; ▪ NEM:WA; ▪ NWA; ▪ GN R 704; ▪ GN R 718; and ▪ DWA BPGs, 2008	Operational
Operational	Hydrocarbons and chemicals spillages and leakages from equipment, moving haulage trucks and machinery	Surface water	Surface water Contamination from hydrocarbon and chemical spillages and leakages			Operational
Operational	Containment of dirty runoff in the PCDs	Surface water	Reduction of catchment runoff yield			Operational
Operational	Mine dewatering causing a decrease in groundwater reserves	Groundwater	Due to active mine dewatering required to ensure dry working conditions in the underground mine, certain groundwater volumes will be extracted from the	▪ Mining should progress as swiftly as possible to reduce the period of active dewatering; ▪ The mining-related surface infrastructure area extent should be kept to a minimum ▪ Underground mining can only take place in the areas associated with this application	▪ NWA ▪ NEM:WA	Operational

Phase	Activity	Aspect	Impacts	Mitigation Measures	Compliance with standards	Time frame for implementation
			underground void, limiting the groundwater resource.	▪ Dewatering of the underground mine should stop as soon as the mining activities cease ▪ Dewatering volumes should be monitored frequently throughout the LoM to note deviations from the predicted inflows as soon as possible		
Operational	Mine dewatering causing lowering of groundwater levels	Groundwater	Active mine dewatering will be required to ensure dry working conditions in the underground void. The dewatering will cause ground levels to be drawn down in the vicinity of the mining area.	▪ Mining should progress as swiftly as possible to reduce the period of active dewatering ▪ The mining area extent should be kept to a minimum ▪ Dewatering of the underground mine should stop as soon as the mining activities cease ▪ Groundwater levels surrounding the mine void should be monitored on a regular basis throughout the LoM to verify the extent of the cone of drawdown		Operational
Operational	AMD formation in the underground void and discard dump causing groundwater contamination	Groundwater	Due to AMD forming within the underground void and in the discard dump, potential groundwater contamination with sulphate and a lower pH could occur, which would have an impact on the groundwater quality.	▪ Groundwater abstraction should continue for the LoM to maintain a cone of drawdown ▪ Biannual aquatic monitoring of groundwater quality in the area surrounding the mine void should continue throughout the LoM ▪ Groundwater levels surrounding the mine void should be monitored on a quarterly basis throughout the LoM to verify the extent of the cone of drawdown.		Operational
Operational	Material Handing, Hauling of Ore and Discard Waste, Crushing and Screening, Wind Erosion, and Generator Sets	Air Quality	Nuisance and potential health effects from exposure to fine particulate matter, gases and volatile	▪ Apply wetting agents, dust suppressant or binders on the dirt roads; ▪ Construct surfaces of haul roads from lateritic soils if possible and avoid fine/colloidal (e.g. clays and silts) materials; ▪ Vegetate exposed areas as soon as practicably possible; ▪ Enclose the crusher, screens, transfer and discharge points and conveyors; ▪ The area of disturbance shall be kept to a minimum at all times and no unnecessary stripping must occur, especially on windy days (wind speed ≥ 5.4 m/s); ▪ Set maximum vehicle speed limits on site and enforce these limits; ▪ Ensure generators are operated at optimal conditions; and ▪ Minimise the drop heights when loading and unloading material onto trucks and at tipping points.	▪ NEM:AQA; ▪ National Ambient Air Quality Standards	Operational
Operational	Drill and blast underground	Blasting	Ground vibration impact on community houses	▪ No mitigation required	▪ MHSA; ▪ MPRDA ▪ Explosives Act, 2003 (Act No. 15 of 2003) ▪ USBM	Operational
Operational	Mining and Processing of Ore	Noise	Noise will emanate from the crusher, screening and washer plants and hauling of coal. However, the noise levels will not exceed the SANS 10103 guidelines in the immediate	▪ Vehicles are to be serviced to the design requirements to ensure noise suppression mechanisms are effective e.g. installed exhaust mufflers; ▪ Switch off equipment when not in use; ▪ Regulate the speed of vehicles traveling on access and haul roads.	▪ SANS 10103	Operational

Phase	Activity	Aspect	Impacts	Mitigation Measures	Compliance with standards	Time frame for implementation
			environment of the mining operation boundaries.			
Operational	Recruitment / appointment of Operational Phase workforce	Socio-economic	Employment Creation during Operation	▪ Continue enforcement of SLP commitments for giving preference for employment to suitably qualified members of local communities; ▪ Monitor the contractors and sub-contractors on an annual basis through an external auditor to ensure their compliance with SLP commitments; and ▪ Ensure the skills development initiatives proposed in the SLP are targeted at as many local community members as possible, thereby improving skills training beneficiaries' chances at employment on the Project. ▪ Use the Project database, developed during the Construction Phase, listing local community members who were employed during the Construction Phase to select locals for employment in the Operational Phase.	▪ NEMA	Operational
Operational	Operational Activity Impacts on the Local Economy	Socio-economic	Growth of the local economy	▪ Continue implementation of the measures recommended to enhance local employment, skills development, community development, and multiplier effects on the local economy for the Construction Phase; ▪ Set targets to progressively increase local and regional procurement over the life of the Project; and ▪ Incorporate SMME capacity development programmes into future iterations of the SLP to enable local suppliers to take maximum advantage of procurement opportunities during the Operational Phase.		Operational
Decommissioning	Demolition of infrastructure and rehabilitation of affected areas	Soil, land use and land capability	Disturbance of soils and subsequent erosion by wind and water	▪ Implement land rehabilitation measures; ▪ Compacted areas are to be ripped to loosen the soil and vegetation cover re-instated; ▪ Inventory of hazardous waste materials stored on site should be compiled and arrange complete removal; ▪ Monitor decant of AMD and implement management measures which include in-situ passive treatment or neutralisation and electrolytic treatment using a Water Treatment Plant (WTP) to get purified water for discharge to the natural environment or for other beneficial uses. ▪ Seal the shaft by placing concrete plugs; ▪ Underground materials should be disconnected prior to removal; ▪ Ensure effective stormwater management designs are in place to ensure no run-off or pooling occurs; ▪ Conduct soil contamination assessment to assess if any remediation is required prior to future land use development; ▪ Only designated access routes are to be used to reduce any unnecessary compaction; and ▪ The backfilled, reprofiled landscape should be top soiled and revegetated to allow free drainage close to the pre-mining conditions.	▪ NEMA ▪ CARA.	Decommissioning
Decommissioning	Reaction of sulphide compounds in extracted coal residues with water and oxygen	Soil, land use and land capability	Contamination from Acid Mine Drainage			Decommissioning
Decommissioning	Dismantling and removal of infrastructure	Fauna and Flora	Demolition could induce habitat loss and continual pressure by the operations on the ecosystem can lead to	▪ An alien plant species management plan for the affected areas should be implemented for two years after rehabilitation is completed. ▪ All emergent alien plant species should be removed before they reach a seed-bearing or flowering maturity. ▪ Ensure that the controls of noise, dust, waste generation, vehicle speed limits, food waste disposal, hazardous waste disposal, human	▪ NEM: BA; ▪ NEMA ▪ NEM: PAA (as amended); ▪ NFA; ▪ MPNCA; and	Decommissioning

Phase	Activity	Aspect	Impacts	Mitigation Measures	Compliance with standards	Time frame for implementation
			pressure on the populations of threatened species or could lead to direct loss of individuals. Alien plant invasion may take place due to soil disturbance.	interaction with the ecology are monitored regularity and controls to prevent adverse conditions arising from the activities which are likely to affect fauna and flora are updated and implemented. ▪ Ensure continuous environmental awareness training takes place.	▪ CARA	
Decommissioning	Activity and Interaction: Rehabilitation of infrastructure footprint areas	Fauna and Flora	Restoration of vegetation and habitat types.	▪ An alien plant species management plan for the affected areas should be implemented for two years. ▪ All emergent alien plant species should be removed before they reach a seed-bearing or flowering maturity. ▪ At least five species should be used for rehabilitation and only species that are native to the area and stipulated in the Rehabilitation and Closure Plan (Digby Wells, 2019) should be utilised.		Decommissioning
Decommissioning	Rehabilitation of site and dismantling of infrastructure	Wetlands	Erosion onset, sedimentation and establishment of alien plants	▪ High rainfall periods should be avoided during decommissioning; ▪ Stormwater must be diverted from decommissioning activities; ▪ Stored mine-affected water should be treated before decommissioning of any mine-related water retention areas, such as PCDs; ▪ In the areas that could be affected by mining activities tThe edge of the non-directly impacted freshwater resources, and at least a 100m buffer or 1:100 floodline buffer, should be clearly demarcated in the field with wooden stakes painted white as no-go zones that will last for the duration of the decommissioning phase; ▪ All areas of increased ecological sensitivity should be designated as “No-Go” areas and be off limits to all unauthorised vehicles and personnel; ▪ Actively re-vegetate disturbed areas as well as decommissioned footprint areas as part of the decommissioning process; ▪ Implement and maintain an alien vegetation management programme for the duration of the decommissioning phase and into closure; ▪ No material should be dumped within any wetlands or watercourses; ▪ No vehicles or heavy machinery should be allowed to drive indiscriminately within any wetland areas or their buffer areas. All vehicles must remain on demarcated roads; ▪ All vehicles must be regularly inspected for leaks; ▪ Re-fuelling must take place on a sealed surface area away from wetlands to prevent ingress of hydrocarbons into the topsoil; ▪ All spills should be immediately cleaned up and treated accordingly; ▪ Appropriate sanitary facilities must be provided for the duration of the decommissioning phase and all waste must be removed to an appropriate waste facility; and ▪ Wetland monitoring must be carried out during the decommissioning phase to ensure no unnecessary impact to wetlands takes place.	▪ NWA; ▪ NEM:BA; ▪ NEMA	Decommissioning

Phase	Activity	Aspect	Impacts	Mitigation Measures	Compliance with standards	Time frame for implementation
Decommissioning	Physical removal of surface infrastructure and rehabilitation activities near and within drainage lines	Aquatics	Water quality and habitat deterioration of watercourses in contact with heavy machinery and receiving runoff from surface workings	▪ High rainfall periods should be avoided during decommissioning; ▪ Removed or damaged vegetation areas should be revegetated; ▪ Stormwater must be diverted from decommissioning activities; ▪ Water used during decommissioning should be kept onsite and not be allowed to freely flow into nearby watercourses; ▪ Stored mine-affected water should be treated before decommissioning of any mine-related water retention areas, such as PCDs; ▪ Land reprofiling should be done during the dry season to allow for attempts to restore the morphology of the drainage lines prior to rainfall/flow events; and ▪ Ensure the revegetation activities use appropriate indigenous plant species.	▪ NWA	Decommissioning
Decommissioning	Demolition of mine infrastructure (PCDs, workshops, haul roads, processing plant etc.) Disturbance of soils and erosion by overland flow	Surface water	Sedimentation and siltation of nearby watercourses and deterioration of water quality	▪ Disturbance of soils during infrastructure demolition should be restricted to relevant footprint areas; and ▪ Movement of demolition machinery and vehicles should be restricted to designated access roads to minimise the extent of soil disturbance.	▪ NEMA; ▪ NEM:WA; ▪ NWA; ▪ GN R 704; ▪ GN R 718; and ▪ DWA BPGs, 2008	Decommissioning
Decommissioning	Rehabilitation of disturbed sites close to pre-mining conditions	Surface water	Restoration of pre-mining streamflow regime in nearby watercourses			Decommissioning
Decommissioning	Rehabilitation and Demolition of Infrastructure	Air Quality	Demolition and the removal of infrastructure may result in fugitive dust emissions. Nuisance dust and possible health implications from exposure to airborne particulate matter	▪ Apply wetting agents, dust suppressant or binders on the exposed areas (including excavated material and roads); ▪ Enforce vehicle speed limits on site; ▪ Keep the area of disturbance to a minimum at all times; ▪ Minimise the drop heights when loading and unloading material onto trucks; ▪ Dismantling of infrastructure should be done in phases; and ▪ Implement routine maintenance, vegetation (and if required secondary-vegetation).	▪ NEM:AQA; ▪ National Ambient Air Quality Standards	Decommissioning
Decommissioning	Removal of infrastructure and surface rehabilitation	Noise	Noise will emanate from the machinery and vehicles undertaking the decommissioning and rehabilitation activities.	▪ Restrict decommissioning activities to daylight hours (06:00 – 18:00); ▪ Regularly service decommissioning related machines and vehicles to ensure noise suppression mechanisms are effective e.g. installed exhaust mufflers; ▪ Regulate speed limits on access roads; and ▪ Switch off equipment when not in use.	▪ SANS 10103	Decommissioning
Decommissioning	Closure of the Mine	Socio-economic	Job Losses and Negative Effects on the Local Economy	▪ Develop a detailed Social Closure Plan at least 5 years prior to decommissioning, that includes a retrenchment plan for Project staff as well as a communication strategy that will keep employees and surrounding communities informed about closure timing and management strategies; ▪ Develop and implement the required Human Resource systems to provide references for employees; ▪ Ensure that employment contracts release employees from non-compete clauses following the closure of the Project; ▪ Design community development initiatives that will be sustainable beyond the life of the Project and independent of mining operations; ▪ Increase opportunities for ABET, portable skills training, and mining skills-related skills development during the Operational Phase; and	▪ NEMA	Decommissioning

Phase	Activity	Aspect	Impacts	Mitigation Measures	Compliance with standards	Time frame for implementation
				▪ Proactively assess and manage the social and economic impacts on individuals, regions and economies where retrenchment and/or closure of the Project are certain.		

5 Item 1(e): Impact Management Outcomes

Table 5-1 explains the measures to rehabilitate the environment affected by the undertaking of any listed activity.

Table 5-1: Impacts to be mitigated in their respective phases

<table>
<tr><th>Activity</th><th>Impacts</th><th>Aspect</th><th>Phase</th><th>Mitigation Measures</th><th>Standard to be achieved</th></tr>
<tr><td>Site clearance for construction work disturbs soils, exposure to erosion by wind and water and stockpiling</td><td>Soil loss by wind and water erosion from cleared land surfaces, and incorrect stockpiling</td><td>Soil, land use and land capability</td><td>Construction</td><td rowspan="3">▪ Areas where stripping occurs must be clearly demarcated to ensure only those areas are affected;
▪ Topsoil must be stripped to a depth of 300mm and stockpiled to a maximum height of 4 m;
▪ The subsoil of 0.4 – 1.2 m will then be stripped and stockpiled separately for deep soils;
▪ A Topsoil Management Plan (TMP) must be prepared to demonstrate how topsoil will be preserved in a condition as near as possible to its pre-mining condition in order to allow successful mine rehabilitation;
▪ Vehicles must be prohibited from driving over stockpiles;
▪ Runoff must be controlled and managed by use of effective stormwater management measures;
▪ Re-fuelling must take place on bunded impervious surfaces to prevent seepage of hydrocarbons into the soil;
▪ Establishment of effective vegetation around constructed infrastructure for adequate soil protection from wind and water erosion;
▪ If any erosion occurs, corrective actions must be taken to minimise any further erosion from taking place at regular intervals or after high rainfall events;
▪ Restriction of vehicle movement over sensitive areas to reduce compaction;
▪ Minimise unnecessary removal of the natural vegetation cover outside the development footprint;
▪ All vehicles and machines must be parked within hard park areas and must be checked daily for fluid leaks;
▪ Place drip trays where there are vehicles or machinery leaks occurring;
▪ Fuel, grease and oil spills should be remediated using commercially available emergency clean up kits;
▪ For major spills (>5L), if soils are contaminated, they must be stripped and disposed of at a licensed waste disposal site; and
▪ Any contractors on site must ensure that all employees are aware of the procedure for dealing with spills and leaks and undergo training on site.</td><td rowspan="3">▪ NEMA
▪ CARA.</td></tr>
<tr><td>Movement of vehicles and machinery and general handling of hydrocarbons may result in spillages of hydrocarbons such as oils, fuels and grease</td><td>Soil contamination by hydrocarbon spillages and leakages</td><td>Soil, land use and land capability</td><td>Construction</td></tr>
<tr><td>Movement of heavy machinery</td><td>Soil compaction resulting from the movement of heavy machinery within the Project Area or on stockpiles</td><td>Soil, land use and land capability</td><td>Construction</td></tr>
<tr><td>Site Clearance within vegetated areas</td><td>Loss of high sensitivity vegetation type and landscape (Hyparrhenia – Themeda Grassland, Sandstone Ridges, Riparian areas)</td><td>Fauna and Flora</td><td>Construction</td><td>▪ Except where critical to the project development and where absolutely necessary and by offset, the Primary grassland, Riparian areas and Sandstone ridges should be excluded from the mine plan to prevent deterioration of these areas;
▪ All Primary grassland and Sandstone ridges must be managed as sensitive landscapes and designated as no- go areas except for the exclusion above.;
▪ The footprint of disturbance area should be kept as small as possible and only the access roads which will follow current roads and tracks should be used to reach the site for clearing and vehicles should not be allowed to traverse natural areas or leave the demarcated road; and
▪ An alien and invasive plant species management programme must be in place during the construction phase. In this regard, special mention is made of A. mearnsii, which is the dominant alien invasive tree species observed in the watercourses at the time of the assessment. Existing AIP's within the project area will be eradicated as well as the disturbed site is monitored quarterly for at least the life of the project and a minimum of two years post closure to ensure that alien invasion does not take place;</td><td rowspan="2">▪ NEM: BA;
▪ NEMA
▪ NEM: PAA (as amended);
▪ NFA;
▪ MPNCA; and
▪ CARA</td></tr>
<tr><td>Site Clearance within vegetated areas</td><td>Loss of habitat of moderate to low sensitivity (AIP vegetation types)</td><td>Fauna and Flora</td><td>Construction</td><td>▪ The footprint area should be kept as small as possible and only the access roads swhich will follow existing roads and tracks should be used to reach the site for clearing and vehicles should not be allowed to traverse natural areas or leave the demarcated road;
▪ An AIP management plan must be implemented, whereby existing AIP's within the mine infrastructure areas are eradicated as well monitoring the disturbed site is monitored quarterly for at least two years to ensure that alien invasion does not take place.</td></tr>
</table>

Activity	Impacts	Aspect	Phase	Mitigation Measures	Standard to be achieved

Site clearing, including the removal of vegetation and disturbance of soils	Construction and development activities within a greenfield site are likely to result in negative impacts to functioning freshwater resources and the catchment. This is realised through the resultant habitat fragmentation, spreading of alien and invasive species, soil disturbance and/or compaction, increased incidence of erosion, sedimentation from erosion, potential water quality deterioration, and disturbance to avifauna and other fauna utilising the freshwater resources thus resulting in an overall loss of biodiversity	Wetlands	Construction	▪ Environmental Practitioner to be present during vegetation clearing to prevent unnecessary clearing of extensive areas not part of the direct footprint area;
				▪ Clearly marked buffer zones must be established, which are defined as regions of natural vegetation between watercourses/wetlands and developments or activities (WRC, 2015). This is a key management action that should take place by revising proposed infrastructure locations in line with the sensitivity mapping;
				▪ Limit vegetation removal and construction activities to the infrastructure footprint area only, where removed or damaged vegetation areas should be revegetated as soon as possible;
				▪ An alien and invasive plant species management programme must be in place during the construction phase. In this regard, special mention is made of *A. mearnsii*, which is the dominant alien invasive tree species observed in the watercourses at the time of the assessment;
				▪ Bare land surfaces downstream of construction activities must be vegetated to limit erosion from surface runoff associated with infrastructure areas. Actively re-vegetate disturbed areas immediately after construction;
				▪ Ensure a soil management programme is implemented and maintained to minimise erosion and sedimentation;
				▪ If destruction of wetlands is unavoidable disturbance must be minimised and suitably rehabilitated;
				▪ Ensure no incision and canalisation of the wetland features takes place;
				▪ Erosion berms must be installed on roadways and downstream of the discard dump to prevent gully formation and siltation of the freshwater resources. The following points should serve to guide the placement of erosion berms:
				  ▪ Where the track has a slope of less than 2%, berms every 50m should be installed;
				  ▪ Where the track slopes between 2% and 10%, berms every 25m should be installed;
				  ▪ Where the track slopes between 10%-15%, berms every 20m should be installed; and
				  ▪ Where the track has a slope greater than 15%, berms every 10m should be installed.
				▪ All erosion within the construction footprint should be remedied immediately and included as part of an ongoing rehabilitation plan;
				▪ Limit personnel within the buffer areas for all freshwater features identified and such personnel can only enter as and when necessary;
				▪ All areas of increased ecological sensitivity should be designated as "No-Go" areas and be off limits to all unauthorised vehicles and personnel;
				▪ No crossing of the wetland features and their associated buffers should take place (excluding the access road, powerline and water pipleline) and the substrate conditions of the wetlands and downstream stream connectivity must be maintained;
				▪ At areas where road crossings have been designed, these roads should cross wetland or river features at the narrowest point and at a 90-degree angle with suitable drainage designed into the relevant bridge/culvert crossing;
				▪ No material will be dumped or stockpiled within any rivers, tributaries or drainage lines in the vicinity of the proposed footprint area.
				▪ Environmentally friendly barrier systems, such as silt nets or, in severe cases, use of trenches, downstream from construction sites to limit erosion and possibly trap contaminated runoff from construction;
				▪ Stormwater must be diverted from construction activities and managed in such a manner to disperse runoff and prevent the concentration of stormwater flow;
				▪ Water used at construction sites should be utilised in such a manner that it is kept on site and not allowed to run freely into nearby watercourses (i.e. installation of clean and dirty water separation systems);
				▪ Construction during high rainfall periods (usually November to March) should be avoided to decrease surface runoff in areas of vegetation removal and disturbed soils in an attempt to limit erosion and sedimentation into wetlands and instream aquatic systems;
				▪ The clean and dirty water separation systems must be some of the first infrastructures installed on site and care must be taken to ensure that contamination of the receiving environment as a result of mining activities is minimised as far as possible;
				▪ No vehicles or heavy machinery may be allowed to drive indiscriminately within any wetland areas and their associated buffer zones. All vehicles must remain on demarcated roads and within the construction footprint and access roads;
				▪ All vehicles must be regularly inspected for leaks;
				▪ Re-fuelling must take place on a concrete lined or bunded surface area away from wetlands to prevent ingress of hydrocarbons into the topsoil;
					▪ NWA;
					▪ NEM:BA;
					▪ NEMA

Construction of mine related infrastructure including the plant area, the infrastructure area, the ROM pad, the PCD, the discard dump, the explosives delivery bay, the northern underground access point, and	Fragmentation of the freshwater resources as a result of road crossings. Loss of freshwater resource habitat (soils and vegetation) due to both direct and indirect impacts. These impacts may result in	Wetlands	Construction		

Activity	Impacts	Aspect	Phase	Mitigation Measures	Standard to be achieved
access and haul roads.	complete loss of wetland ecosystems or part thereof. Although some of these freshwater resources are not in pristine condition, they are providing significant ecological services at the local and catchment scale			▪ Construction chemicals, such as paints and hydrocarbons, should be used in an environmentally safe manner with correct storage as per each chemical's specific storage descriptions; ▪ All spills should be immediately cleaned up and treated accordingly; ▪ Appropriate sanitary facilities must be provided for the duration of the construction activities and all waste must be removed to an appropriate waste facility, and ▪ Wetland monitoring must be carried out quarterly during the construction phase by a wetland specialist to ensure no unnecessary impact to the freshwater resources occur; and if so, a solution must be put in place as soon as possible.	
Site clearance and construction of proposed infrastructure	Land and vegetation manipulation/clearing for infrastructure in proximity to the Southern Tributary and within non-perennial drainage lines.	Aquatics	Construction	▪ Mitigation measures detailed for the site and vegetation clearing impact should be applied to areas leading up to the watercourse crossing points. However, the infrastructure construction over a watercourse needs additional attention due to the proximity of the activity to aquatic ecosystems. Essentially, the watercourse is going to be directly affected unless a "suspension" approach is adopted (e.g. suspending the infrastructure, allowing only contact with the banks of the watercourse of concern). This is recommended where applicable but will most likely only be a viable option for pipelines that cross watercourses, if any. Larger constructions over watercourses, more specifically the proposed road constructions and associated culverts (if any), are of focus. ▪ The design as well as the physical construction of roads should not alter the natural hydrology and connectivity of the watercourses in any way (i.e. damming or creating barriers). Any infrastructure proposed to be in contact with the substrate/channel bottom should allow for the free flow of water and material. If hard surfaces are going to be used as foundation or if culverts are going to be installed, their base should not be noticeable above the natural channel bottom to maintain connectivity. Biannual aquatics monitoring of the crossing points should also form part of the management actions to ensure correct flow occurs through the crossing point, especially during the wet season.	▪ NWA
Physical construction of infrastructure over natural aquatic ecosystems	Vegetation removal for site access and potential hydrological disturbance of associated watercourses	Aquatics	Construction		
Site preparation including vegetation clearance and excavations, leading to exposure of soils	Sedimentation and siltation of nearby watercourses	Surface water	Construction	▪ Clearing of vegetation must be limited to the development footprint, and the use of any existing access roads must be prioritised so as to minimise creation of new ones; ▪ If possible, construction activities must be prioritised to the dry months of the year to limit mobilisation of sediments, dust generation and hazardous substances from construction vehicles used during site clearing; ▪ Dust suppression with water on the haul roads and cleared areas must be undertaken to limit dust; ▪ Avoid placement of any infrastructure within the 100-year floodlines or 100 m buffer from watercourses, whichever is greater; ▪ Hydrocarbon and hazardous waste storage facilities must be appropriately bunded to ensure that leakages can be contained. Spill kits should be in place and construction workers should be trained in the use of spill kits, to contain and immediately clean up any potential leakages or spills; ▪ Vehicles should regularly be maintained as per the developed maintenance program. This should also be inspected daily before use to ensure there are no leakages underneath ▪ Drip trays must be used to capture any oil leakages. Servicing of vehicles and machinery should be undertaken at designated hard park areas. Any used oil should be disposed of by accredited contractors;	▪ NEMA; ▪ NEM:WA; ▪ NWA; ▪ GN R 704; ▪ GN R 718; and ▪ DWA BPGs, 2008
Construction and installation of infrastructural facilities including administration offices, ablutions, storerooms, workshops, pollution control dams, processing plant, roads, pipelines etc.	Increase of impermeable surfaces, subsequently increasing runoff and potential flooding	Surface water	Construction		
Handling of hydrocarbons and other chemicals; Loading, hauling and transportation of product coal.	Surface water contamination leading to deterioration of water quality	Surface water	Construction		

Activity	Impacts	Aspect	Phase	Mitigation Measures	Standard to be achieved
Fuel storage, construction vehicles causing potential groundwater contamination	Storage of fuel and the usage of construction vehicles on-site could cause spillages of hydrocarbons. These spillages may seep into the underlying aquifers, causing contamination of groundwater with hydrocarbons.	Groundwater	Construction	▪ Regular service of vehicles in designated repair bays as per the developed maintenance program; and ▪ Refuelling of vehicles only in designated areas with correct liners and surfaces	▪ NWA ▪ NEM:WA
Mine access dewatering causing groundwater level drawdown	During construction of the adit into the underground mine, small scale dewatering associated with the construction could lead to local drawdown of groundwater levels in the vicinity of the adit.	Groundwater	Construction	▪ Keep the box cut construction time as short as possible; and ▪ Keep the extents and depth of the box cuts as small as possible	
The current proposed infrastructure design layout suggests that the Project will directly impact only STE-005	Indirect impact on burial grounds and graves	Heritage	Construction	▪ Dagsoom must develop and implement a CMP to prevent the degradation of the fabric of the burial grounds and graves through the Project lifecycle and preserve the CS of the heritage resources. ▪ Dagsoom must also develop and implement an Access Protocol to allow individuals access to the burial grounds and graves. This Access Protocol can be developed considering the relevant safety and security measures of the mine, the requirements of the Mine Health and Safety Act, 1996 (Act No. 29 of 1996) (MHSA) and the needs of the community. ▪ Information regarding the Access Protocol must be made publicly available and can be developed as part of the CMP.	▪ NHRA
Site Clearing, Excavation / Transport, Tipping and Spreading of Materials	Nuisance and reduction in ambient air quality	Air Quality	Construction	▪ Develop a traffic management plan for site to enforce a speed limit; ▪ Apply wetting agents, dust suppressant or binders on exposed areas (including excavated stockpiled material and on dirt roads); ▪ Enforce adherence to set vehicle speed limits; ▪ Conduct activities judiciously during windy days (≥5.4 m/s); and ▪ Minimise the drop heights when loading, offloading and tipping material.	▪ NEM:AQA; ▪ National Ambient Air Quality Standards
Blasting the adit	Ground vibration impact on community houses and heritage resources	Blasting	Construction	▪ Specific blast design to be done, shorter blast holes, smaller diameter blast hole, using electronic initiation instead of shock tube systems to obtain single hole firing. ▪ Monitor ground vibration and air blast from blasting operations	▪ MHSA; ▪ MPRDA ▪ Explosives Act, 2003 (Act No. 15 of 2003) ▪ USBM
	Air blast impact on community houses	Blasting	Construction	▪ Specific blast design to be done, shorter blast holes, smaller diameter blast hole, use of specific stemming materials to manage air blast, increased stemming lengths to reduce air blast effect. Used of specific stemming to manage fly rock - crushed aggregate of specific size. Re-design with increased stemming lengths ▪ Monitor ground vibration and air blast from blasting operations	
	Fly rock impact on community houses	Blasting	Construction	▪ Specific blast design to be done, shorter blast holes, smaller diameter blast hole, use of specific stemming materials to manage air blast, increased stemming lengths to reduce air blast effect. ▪ Monitor fly rock situation using video camera	
Site clearing, and the construction of infrastructure will result in the generation of noise.	Noise will emanate from the machinery, and vehicles during the site preparation, haul road construction as well as processing plant construction activities and may	Noise	Construction	▪ Restrict construction activities to daylight hours (06:00 – 18:00 ▪ Vehicles to be serviced as per their design requirements to ensure noise suppression mechanisms are effective e.g. installed exhaust mufflers; ▪ Regulate vehicle speeds on the access and haul roads; and ▪ Switch off equipment when not in use during the working hours.	▪ SANS 10103

Activity	**Impacts**	**Aspect**	Phase	**Mitigation Measures**	**Standard to be achieved**
	exceed the South African standard SANS 10103[2]				
Recruitment / Appointment of Construction Workforce	Employment creation during construction	Socio-economic	Construction	▪ Develop and implement an abbreviated Stakeholder Engagement Plan (SEP), inclusive of a communications plan and grievance mechanism, as well as the appointment of community liaison personnel; ▪ Undertake a skills survey of the communities located in the primary and secondary study areas, allowing residents to register their interest and particular skills for upcoming employment and skills training opportunities; ▪ Use the results of the skills survey to develop a skills register to inform the Skills Development Plan to maximize employment opportunities for residents in the primary and secondary study areas; ▪ Provide skills training prior to and during the Construction Phase to improve local employability during both Construction and Operational Phases; ▪ Explore the possibility of expanding job opportunities beyond mining-related work to also include hiring contract workers to assist with community development projects; ▪ Comply with minimum wage requirements for unskilled labour and all other requirements, including gender equity, of the Employment Equity Act[8] to ensure maximum benefits accrue to workers; ▪ Monitor Dagsoom and its subcontractors in terms of the commitments stipulated in Dagsoom's Social and Labour Plan (SLP) on an annual basis through external auditors; ▪ Ensure that local communities understand the Project's employment requirements in terms of skills and type of employment, by communicating relevant aspects of the SLP and its overarching objectives at community forums in the primary and secondary study areas; and ▪ Prepare for the Operational Phase by updating the Project's local labour database to include local community members employed during the Construction Phase.	▪ NEMA
Soil chemical pollution	Soil Contamination from Hydrocarbon waste (lubricants, explosives and fuels)	Soil, land use and land capability	Operational	▪ Soil pollution monitoring should be conducted at selected locations on the project site to detect any extreme levels of pollutants; ▪ Any spillages of hydrocarbons or sewage effluent from the treatment plant or ablution facilities should be cleaned-up immediately and the contaminated soils removed for disposal of at accredited disposal sites; ▪ A Topsoil Management Plan (TMP) must be prepared to demonstrate how topsoil will be preserved in a condition as near as possible to its pre-mining condition in order to allow successful mine rehabilitation; ▪ Long term stockpiles should be revegetated to minimise loss of soil quality. This will minimise weed infestation, maintain soil organic matter levels, maintain soil structure and microbial activity and maximise the vegetative cover of the stockpile; ▪ Topsoil stripping should be scheduled for the dry season, where possible; and ▪ All long-term topsoil material stockpiles should be located outside the active mine path and away from drainage lines.	▪ NEMA ▪ CARA.
During the stripping and stockpiling process there may be some unexpected changes in the depth and the nature of the soil.	Deterioration of Topsoil Quality from in Topsoil Stockpiles	Soil, land use and land capability	Operational		
Underground mining of coal and the operation of the rock dumps, soils, ROM, discard dump.	Potential for road kills, injuring or poaching and faunal disturbance	Fauna and Flora	Operational	▪ Erect signage with speed limits. ▪ Restrict vehicle movement to daylight hours. ▪ Additional surveys should be conducted to determine the presence of Grass Owl and Serval on site. If these species are present, a management plan should be implemented. ▪ Concurrent rehabilitation should take place.	▪ NEM: BA; ▪ NEMA ▪ NEM: PAA (as amended); ▪ NFA; ▪ MPNCA; and ▪ CARA
Operation of powerlines that could cause bird fatalities through collisions and electrocutions.	Collisions and electrocutions	Fauna and Flora	Operational	▪ Install Bird Diverters ▪ Utilise best practice with pylon construction and type.	

[8] The Employment Equity Amendment Act 47 of 2013, Government Gazette, RSA, Volume 583, 16 January 2014, Cape Town.

<table>
<tr><th>Activity</th><th>Impacts</th><th>Aspect</th><th>Phase</th><th>Mitigation Measures</th><th>Standard to be achieved</th></tr>
<tr><td>Operational underground mining activities, including excavation and dewatering</td><td>Operational activities of the proposed underground mining activities have the potential to result in impacts to the water quality of the groundwater, local and downstream resources as well as the potential loss of water supply from the groundwater aquifer. Dewatering activities are likely to result in the loss of water supply to the wetlands, with special mention of the lower lying wetlands such as CVB4, and moisture stress to the surrounding wetland areas.</td><td>Wetlands</td><td>Operational</td><td rowspan="3">The following management actions are recommended to guide the effective management of stormwater and water generated on site:
Channelled water should not be dispersed in a concentrated manner. Baffles should be incorporated into artificial drainage lines/channels around the surface infrastructure to decrease the kinetic energy of water as it flows into the natural environment;
Bare surfaces downstream from the developments where silt traps are not an option should be vegetated in order to attempt to limit erosion and runoff that might be carrying contaminants;
All erosion noted within the operational footprint should be remedied immediately and included as part of an ongoing rehabilitation plan;
Ensure that no incision and canalisation of the wetland features present takes place;
Erosion berms should be installed on roadways and downstream of stockpiles and the discard dump to prevent gully formation and siltation of the freshwater resources. The following points should serve to guide the placement of erosion berms:
Where the track has a slope of less than 2%, berms every 50m should be installed;
Where the track slopes between 2% and 10%, berms every 25m should be installed;
Where the track slopes between 10%-15%, berms every 20m should be installed; and
Where the track has a slope greater than 15%, berms every 10m should be installed;
Quarterly monitoring of all wetland areas affected as a result of infrastructure developments, including linear infrastructures such as roads watercourses should be carried out by a suitably qualified wetland ecologist in order to determine localities of areas subjected to erosion and increased runoff; where after, new mitigation actions should be implemented as per the specialist's recommendations.
The following management and mitigation measures should be put in place to minimise the impact of the underground operational activities:
During the operational phase of the project the Storm Water Management Plan (SWMP) contained in the Surface Water Report should already be implemented. This should consider all wetlands and other watercourses associated with the new developments/infrastructure which should divert stormwater away from the surface infrastructure and back into natural watercourses to maintain catchment yield as far as possible. The SWMP should also convey stormwater to silt traps where needed in order to limit erosion and the subsequent increase of suspended solids in downstream watercourses;
If possible, clean water removed as part of the dewatering activities should be released downgradient of the operational areas to ensure water supply to the lower lying wetlands is maintained.
The following management and mitigation measures should be put in place to ensure impacts to the wetland ecology of the area as a result of (and in specific areas that could be effected by the operation) the general operational activities is reduced:
Environmental Practitioner to be present during operational phase to prevent any additional clearing of extensive areas or vegetation or dumping of waste rock and/or coal in areas not part of the direct footprint area.
The edge of the non-directly impacted freshwater resources, and at least a 100m buffer or 1:100 floodline buffer, should be clearly demarcated in the field with wooden stakes painted white as no-go zones that will last for the duration of the operational phase.
All areas of increased ecological sensitivity should be designated as "No-Go" areas and be off limits to all unauthorised vehicles and personnel;
Freshwater resource monitoring must be carried out during the operational phase by a wetland specialist to ensure no unnecessary impact to the freshwater resources present; and if so that a remedy is put in place as soon as possible.
Ensure soil management programme is implemented and maintained to minimise erosion and sedimentation;
Implement and maintain alien vegetation management programme;
If it is absolutely unavoidable that any of the wetland areas present will be affected, disturbance must be minimised and suitably rehabilitated;
No material is to be dumped or stockpiled within any rivers, tributaries or drainage lines;
No vehicles or heavy machinery may be allowed to drive indiscriminately within any wetland areas or their buffer areas. All vehicles must remain on demarcated roads and within the operational footprint;
All vehicles must be regularly inspected for leaks;</td><td rowspan="3">NWA;
NEM:BA;
NEMA</td></tr>
<tr><td>Uncontrolled runoff of stormwater or water generated from the mining operations from or through the surface infrastructure</td><td>Water quality and habitat deterioration of watercourses receiving unnatural/contaminated runoff</td><td>Wetlands</td><td>Operational</td></tr>
<tr><td>Operational underground mining activities, including excavation and dewatering</td><td>Operational activities of the proposed underground mining activities have the potential to result in impacts to the water quality of the groundwater, local and downstream resources as well as the potential loss of water supply from the groundwater aquifer. Dewatering activities are likely to result in the loss of water supply to the wetlands, with special mention of the lower lying wetlands such as CVB4, and moisture stress to the</td><td>Wetlands</td><td>Operational</td></tr>
</table>

Activity	Impacts	Aspect	Phase	Mitigation Measures	Standard to be achieved
	surrounding wetland areas.			▪ Re-fuelling must take place on a sealed surface area away from wetlands to prevent ingress of hydrocarbons into topsoil; ▪ All spills should be immediately cleaned up and treated accordingly; and ▪ Appropriate sanitary facilities must be provided for the duration of the operational phase and all waste must be removed to an appropriate waste facility.	
Uncontrolled runoff of stormwater or water generated from the mining operations from or through the surface infrastructure	Water quality and habitat deterioration of watercourses receiving unnatural/contaminated runoff	Wetlands	Operational		
Loading, hauling and stockpiling	These activities have the potential to result in an increased potential for soil compaction, erosion, sedimentation, loss of water quality, habitat and biodiversity	Wetlands	Operational		
Use and maintenance of haul roads for the transportation of coal and waste rock	Fragmentation of the freshwater resources as a result of road crossings, contamination of freshwater resources and impacts to water quality as a result of spills, compaction of soils, loss of habitat and biodiversity. Increased potential for sheet runoff from paved/cleared surfaces and increased potential for erosion	Wetlands	Operational		
Uncontrolled runoff of stormwater or water generated from the mining operations from or through the surface infrastructure	Water quality and habitat deterioration of watercourses receiving unnatural/ contaminated runoff	Aquatics	Operational	▪ During the Operational Phase of the Project a SWMP should already be implemented. This should consider all drainage lines associated with the new developments/infrastructure which should divert stormwater away from the surface infrastructure and back into natural watercourses. The SWMP should also convey stormwater to silt traps where needed in order to limit erosion and an increase of suspended solids in downstream watercourses; ▪ Channelled water should not be dispersed in a concentrated manner. Baffles should be incorporated into artificial drainage lines/channels around the surface infrastructure to decrease the kinetic energy of water as it flows into the natural environment; ▪ Bare surfaces downstream from the developments where silt traps are not an option should be vegetated in order to attempt to limit erosion and runoff that might be carrying contaminants; ▪ Careful monitoring of the areas where dust suppression is proposed should be undertaken regularly. Areas concentrating water runoff should be addressed and not allowed to flow freely into associated watercourses; and ▪ Monitoring of infrastructure over watercourses should be done by an aquatic specialist in order to determine localities of areas subjected to erosion and increased runoff where after new mitigation actions should be implemented as per the specialist's recommendations	▪ NWA
Runoff from the dirty water areas or catchments (coal stockpile areas, mine processing plant, workshops etc.)	Surface water contamination by runoff from dirty water areas	Surface water	Operational	▪ Infrastructure development must be limited to the demarcated footprint to minimize the dirty runoff generating catchments within the project area. ▪ As per the SWMP, clean water runoff from the upstream catchment of the mine should be diverted around the site into the natural environment, this will minimize the runoff that will potentially be contaminated by mine waste	▪ NEMA; ▪ NEM:WA; ▪ NWA; ▪ GN R 704; ▪ GN R 718; and

Activity	Impacts	Aspect	Phase	Mitigation Measures	Standard to be achieved
Hydrocarbons and chemicals spillages and leakages from equipment, moving haulage trucks and machinery	Surface water Contamination from hydrocarbon and chemical spillages and leakages	Surface water	Operational	▪ All the runoff captured on the stormwater dam and RWD should be re-used in the mine processes to avoid sourcing water from external sources. ▪ Should the contaminated water stored water be more than the storage capacities and discharge is considered, this water should be treated to acceptable water quality prior to discharge into the natural environment. In this case, acceptable water quality should at least be benchmarked with the baseline surface water quality of the surrounding streams	▪ DWA BPGs, 2008
Containment of dirty runoff in the PCDs	Reduction of catchment runoff yield	Surface water	Operational		
Mine dewatering causing a decrease in groundwater reserves	Due to active mine dewatering required to ensure dry working conditions in the underground mine, certain groundwater volumes will be extracted from the underground void, limiting the groundwater resource.	Groundwater	Operational	▪ Mining should progress as swiftly as possible to reduce the period of active dewatering; ▪ The mining-related surface infrastructure area extent should be kept to a minimum ▪ Underground mining can only take place in the areas associated with this application ▪ Dewatering of the underground mine should stop as soon as the mining activities cease ▪ Dewatering volumes should be monitored frequently throughout the LoM to note deviations from the predicted inflows as soon as possible	▪ NWA ▪ NEM:WA
Mine dewatering causing lowering of groundwater levels	Active mine dewatering will be required to ensure dry working conditions in the underground void. The dewatering will cause ground levels to be drawn down in the vicinity of the mining area.	Groundwater	Operational	▪ Mining should progress as swiftly as possible to reduce the period of active dewatering ▪ The mining area extent should be kept to a minimum ▪ Dewatering of the underground mine should stop as soon as the mining activities cease ▪ Groundwater levels surrounding the mine void should be monitored on a regular basis throughout the LoM to verify the extent of the cone of drawdown	
AMD formation in the underground void and discard dump causing groundwater contamination	Due to AMD forming within the underground void and in the discard dump, potential groundwater contamination with sulphate and a lower pH could occur, which would have an impact on the groundwater quality.	Groundwater	Operational	▪ Groundwater abstraction should continue for the LoM to maintain a cone of drawdown ▪ Biannual aquatic monitoring of groundwater quality in the area surrounding the mine void should continue throughout the LoM ▪ Groundwater levels surrounding the mine void should be monitored on a quarterly basis throughout the LoM to verify the extent of the cone of drawdown.	
Material Handing, Hauling of Ore and Discard Waste, Crushing and Screening, Wind Erosion, and Generator Sets	Nuisance and potential health effects from exposure to fine particulate matter, gases and volatile	Air Quality	Operational	▪ Apply wetting agents, dust suppressant or binders on the dirt roads; ▪ Construct surfaces of haul roads from lateritic soils if possible and avoid fine/colloidal (e.g. clays and silts) materials; ▪ Vegetate exposed areas as soon as practicably possible; ▪ Enclose the crusher, screens, transfer and discharge points and conveyors; ▪ The area of disturbance shall be kept to a minimum at all times and no unnecessary stripping must occur, especially on windy days (wind speed ≥ 5.4 m/s); ▪ Set maximum vehicle speed limits on site and enforce these limits; ▪ Ensure generators are operated at optimal conditions; and ▪ Minimise the drop heights when loading and unloading material onto trucks and at tipping points.	▪ NEM:AQA; ▪ National Ambient Air Quality Standards

Activity	**Impacts**	**Aspect**	Phase	**Mitigation Measures**	**Standard to be achieved**
Drill and blast underground	Ground vibration impact on community houses	Blasting	Operational	▪ No mitigation required	▪ MHSA; ▪ MPRDA ▪ Explosives Act, 2003 (Act No. 15 of 2003)
Mining and Processing of Ore	Noise will emanate from the crusher, screening and washer plants and hauling of coal. However, the noise levels will not exceed the SANS 10103 guidelines in the immediate environment of the mining operation boundaries.	Noise	Operational	▪ Vehicles are to be serviced to the design requirements to ensure noise suppression mechanisms are effective e.g. installed exhaust mufflers; ▪ Switch off equipment when not in use; ▪ Regulate the speed of vehicles traveling on access and haul roads.	▪ SANS 10103
Recruitment / appointment of Operational Phase workforce	Employment Creation during Operation	Socio-economic	Operational	▪ Continue enforcement of SLP commitments for giving preference for employment to suitably qualified members of local communities; ▪ Monitor the contractors and sub-contractors on an annual basis through an external auditor to ensure their compliance with SLP commitments; and ▪ Ensure the skills development initiatives proposed in the SLP are targeted at as many local community members as possible, thereby improving skills training beneficiaries' chances at employment on the Project. ▪ Use the Project database, developed during the Construction Phase, listing local community members who were employed during the Construction Phase to select locals for employment in the Operational Phase.	▪ NEMA
Operational Activity Impacts on the Local Economy	Growth of the local economy	Socio-economic	Operational	▪ Continue implementation of the measures recommended to enhance local employment, skills development, community development, and multiplier effects on the local economy for the Construction Phase; ▪ Set targets to progressively increase local and regional procurement over the life of the Project; and ▪ Incorporate SMME capacity development programmes into future iterations of the SLP to enable local suppliers to take maximum advantage of procurement opportunities during the Operational Phase.	
Demolition of infrastructure and rehabilitation of affected areas	Disturbance of soils and subsequent erosion by wind and water	Soil, land use and land capability	Decommissioning	▪ Implement land rehabilitation measures; ▪ Compacted areas are to be ripped to loosen the soil and vegetation cover re-instated; ▪ Inventory of hazardous waste materials stored on site should be compiled and arrange complete removal; ▪ Monitor decant of AMD and implement management measures which include in-situ passive treatment or neutralisation and electrolytic treatment using a Water Treatment Plant (WTP) to get purified water for discharge to the natural environment or for other beneficial uses. ▪ Seal the shaft by placing concrete plugs; ▪ Underground materials should be disconnected prior to removal; ▪ Ensure effective stormwater management designs are in place to ensure no run-off or pooling occurs; ▪ Conduct soil contamination assessment to assess if any remediation is required prior to future land use development; ▪ Only designated access routes are to be used to reduce any unnecessary compaction; and ▪ The backfilled, reprofiled landscape should be top soiled and revegetated to allow free drainage close to the pre-mining conditions.	▪ NEMA ▪ CARA.
Reaction of sulphide compounds in extracted coal residues with water and oxygen	Contamination from Acid Mine Drainage	Soil, land use and land capability	Decommissioning		
Dismantling and removal of infrastructure	Demolition could induce habitat loss and continual pressure by the operations on the ecosystem can lead to pressure on the populations of threatened species or could lead to direct loss of individuals. Alien plant invasion may take place due to soil disturbance.	Fauna and Flora	Decommissioning	▪ An alien plant species management plan for the affected areas should be implemented for two years after rehabilitation is completed. ▪ All emergent alien plant species should be removed before they reach a seed-bearing or flowering maturity. ▪ Ensure that the controls of noise, dust, waste generation, vehicle speed limits, food waste disposal, hazardous waste disposal, human interaction with the ecology are monitored regularity and controls to prevent adverse conditions arising from the activities which are likely to affect fauna and flora are updated and implemented. ▪ Ensure continuous environmental awareness training takes place.	▪ NEM: BA; ▪ NEMA ▪ NEM: PAA (as amended); ▪ NFA; ▪ MPNCA; and ▪ CARA

Activity	Impacts	Aspect	Phase	Mitigation Measures	Standard to be achieved
Activity and Interaction: Rehabilitation of infrastructure footprint areas	Restoration of vegetation and habitat types.	Fauna and Flora	Decommissioning	▪ An alien plant species management plan should be implemented for two years. ▪ All emergent alien plant species should be removed before they reach a seed-bearing or flowering maturity. ▪ At least five species should be used for rehabilitation and only species that are native to the area and stipulated in the Rehabilitation and Closure Plan (Digby Wells, 2019) should be utilised.	
Rehabilitation of site and dismantling of infrastructure	Erosion onset, sedimentation and establishment of alien plants	Wetlands	Decommissioning	▪ High rainfall periods should be avoided during decommissioning; ▪ Stormwater must be diverted from decommissioning activities; ▪ Stored mine-affected water should be treated before decommissioning of any mine-related water retention areas, such as PCDs; ▪ In the areas that could be affected by mining activities tThe edge of the non-directly impacted freshwater resources, and at least a 100m buffer or 1:100 floodline buffer, should be clearly demarcated in the field with wooden stakes painted white as no-go zones that will last for the duration of the decommissioning phase; ▪ All areas of increased ecological sensitivity should be designated as “No-Go” areas and be off limits to all unauthorised vehicles and personnel; ▪ Actively re-vegetate disturbed areas as well as decommissioned footprint areas as part of the decommissioning process; ▪ Implement and maintain an alien vegetation management programme for the duration of the decommissioning phase and into closure; ▪ No material should be dumped within any wetlands or watercourses; ▪ No vehicles or heavy machinery should be allowed to drive indiscriminately within any wetland areas or their buffer areas. All vehicles must remain on demarcated roads; ▪ All vehicles must be regularly inspected for leaks; ▪ Re-fuelling must take place on a sealed surface area away from wetlands to prevent ingress of hydrocarbons into the topsoil; ▪ All spills should be immediately cleaned up and treated accordingly; ▪ Appropriate sanitary facilities must be provided for the duration of the decommissioning phase and all waste must be removed to an appropriate waste facility; and ▪ Wetland monitoring must be carried out during the decommissioning phase to ensure no unnecessary impact to wetlands takes place.	▪ NWA; ▪ NEM:BA; ▪ NEMA
Physical removal of surface infrastructure and rehabilitation activities near and within drainage lines	Water quality and habitat deterioration of watercourses in contact with heavy machinery and receiving runoff from surface workings	Aquatics	Decommissioning	▪ High rainfall periods should be avoided during decommissioning; ▪ Removed or damaged vegetation areas should be revegetated; ▪ Stormwater must be diverted from decommissioning activities; ▪ Water used during decommissioning should be kept onsite and not be allowed to freely flow into nearby watercourses; ▪ Stored mine-affected water should be treated before decommissioning of any mine-related water retention areas, such as PCDs; ▪ Land reprofiling should be done during the dry season to allow for attempts to restore the morphology of the drainage lines prior to rainfall/flow events; and ▪ Ensure the revegetation activities use appropriate indigenous plant species.	▪ NWA
Demolition of mine infrastructure (PCDs, workshops, haul roads, processing plant etc.) Disturbance of soils and erosion by overland flow	Sedimentation and siltation of nearby watercourses and deterioration of water quality	Surface water	Decommissioning	▪ Disturbance of soils during infrastructure demolition should be restricted to relevant footprint areas; and ▪ Movement of demolition machinery and vehicles should be restricted to designated access roads to minimise the extent of soil disturbance.	▪ NEMA; ▪ NEM:WA; ▪ NWA; ▪ GN R 704; ▪ GN R 718; and ▪ DWA BPGs, 2008
Rehabilitation of disturbed sites close to pre-mining conditions	Restoration of pre-mining streamflow regime in nearby watercourses	Surface water	Decommissioning		
Rehabilitation and Demolition of Infrastructure	Demolition and the removal of infrastructure may result in fugitive dust emissions. Nuisance dust and possible health implications from exposure to	Air Quality	Decommissioning	▪ Apply wetting agents, dust suppressant or binders on the exposed areas (including excavated material and roads); ▪ Enforce vehicle speed limits on site; ▪ Keep the area of disturbance to a minimum at all times; ▪ Minimise the drop heights when loading and unloading material onto trucks; ▪ Dismantling of infrastructure should be done in phases; and ▪ Implement routine maintenance, vegetation (and if required secondary-vegetation).	▪

Activity	**Impacts**	**Aspect**	Phase	**Mitigation Measures**	**Standard to be achieved**
	airborne particulate matter				
Removal of infrastructure and surface rehabilitation	Noise will emanate from the machinery and vehicles undertaking the decommissioning and rehabilitation activities.	Noise	Decommissioning	▪ Restrict decommissioning activities to daylight hours (06:00 – 18:00); ▪ Regularly service decommissioning related machines and vehicles to ensure noise suppression mechanisms are effective e.g. installed exhaust mufflers; ▪ Regulate speed limits on access roads; and ▪ Switch off equipment when not in use.	▪ SANS 10103
Closure of the Mine	Job Losses and Negative Effects on the Local Economy	Socio-economic	Decommissioning	▪ Develop a detailed Social Closure Plan at least 5 years prior to decommissioning, that includes a retrenchment plan for Project staff as well as a communication strategy that will keep employees and surrounding communities informed about closure timing and management strategies; ▪ Develop and implement the required Human Resource systems to provide references for employees; ▪ Ensure that employment contracts release employees from non-compete clauses following the closure of the Project; ▪ Design community development initiatives that will be sustainable beyond the life of the Project and independent of mining operations; ▪ Increase opportunities for ABET, portable skills training, and mining skills-related skills development during the Operational Phase; and ▪ Proactively assess and manage the social and economic impacts on individuals, regions and economies where retrenchment and/or closure of the Project are certain.	▪ NEMA

6 Item 1(f): Impact Management Actions

A description of impact management outcomes of the EMP is outlined in Table 6-1.

Table 6-1: Objectives and outcomes of the EMP

Phase	Activity	Aspect	Impacts	Mitigation Measures	Standard to be achieved
Construction	Site clearance for construction work disturbs soils, exposure to erosion by wind and water and stockpiling	Soil, land use and land capability	Soil loss by wind and water erosion from cleared land surfaces, and incorrect stockpiling	▪ Areas where stripping occurs must be clearly demarcated to ensure only those areas are affected; ▪ Topsoil must be stripped to a depth of 300mm and stockpiled to a maximum height of 4 m; ▪ The subsoil of 0.4 – 1.2 m will then be stripped and stockpiled separately for deep soils; ▪ A Topsoil Management Plan (TMP) must be prepared to demonstrate how topsoil will be preserved in a condition as near as possible to its pre-mining condition in order to allow successful mine rehabilitation; ▪ Vehicles must be prohibited from driving over stockpiles; ▪ Runoff must be controlled and managed by use of effective stormwater management measures; ▪ Re-fuelling must take place on bunded impervious surfaces to prevent seepage of hydrocarbons into the soil; ▪ Establishment of effective vegetation around constructed infrastructure for adequate soil protection from wind and water erosion; ▪ If any erosion occurs, corrective actions must be taken to minimise any further erosion from taking place at regular intervals or after high rainfall events; ▪ Restriction of vehicle movement over sensitive areas to reduce compaction; ▪ Minimise unnecessary removal of the natural vegetation cover outside the development footprint; ▪ All vehicles and machines must be parked within hard park areas and must be checked daily for fluid leaks; ▪ Place drip trays where there are vehicles or machinery leaks occurring; ▪ Fuel, grease and oil spills should be remediated using commercially available emergency clean up kits; ▪ For major spills (>5L), if soils are contaminated, they must be stripped and disposed of at a licensed waste disposal site; and ▪ Any contractors on site must ensure that all employees are aware of the procedure for dealing with spills and leaks and undergo training on site.	▪ NEMA ▪ CARA.
Construction	Movement of vehicles and machinery and general handling of hydrocarbons may result in spillages of hydrocarbons such as oils, fuels and grease	Soil, land use and land capability	Soil contamination by hydrocarbon spillages and leakages		
Construction	Movement of heavy machinery	Soil, land use and land capability	Soil compaction resulting from the movement of heavy machinery within the Project Area or on stockpiles		
Construction	Site Clearance within vegetated areas	Fauna and Flora	Loss of high sensitivity vegetation type and landscape (*Hyparrhenia – Themeda* Grassland, Sandstone Ridges, Riparian areas)	▪ Except where critical to the project development and where absolutely necessary and by offset, the Primary grassland, Riparian areas and Sandstone ridges should be excluded from the mine plan to prevent deterioration of these areas; ▪ All Primary grassland and Sandstone ridges must be managed as sensitive landscapes and designated as no- go areas; ▪ The footprint of disturbance area should be kept as small as possible and only the access roads (which will follow existing roads and tracks where possible) should be used to reach the site for clearing and vehicles should not be allowed to traverse natural areas or leave the demarcated road; and ▪ An alien and invasive plant species management programme must be in place during the construction phase. In this regard, special mention is made of *A. mearnsii*, which is the dominant alien invasive tree species observed in the watercourses at the time of the assessment. Existing AIP's within the areas demarcated for infrastructure will be eradicated. The disturbed site will be	▪ NEM: BA; ▪ NEMA ▪ NEM: PAA (as amended); ▪ NFA; ▪ MPNCA; and ▪ CARA

Phase	Activity	Aspect	Impacts	Mitigation Measures	Standard to be achieved
				monitored quarterly for at least the life of the project and a minimum of two years post closure to ensure that alien invasion does not take place;	
Construction	Site Clearance within vegetated areas	Fauna and Flora	Loss of habitat of moderate to low sensitivity (AIP vegetation types)	▪ The footprint area should be kept as small as possible and only access roads (which will follow existing roads and tracks) should be used to reach the site for clearing and vehicles should not be allowed to traverse natural areas or leave the demarcated road; ▪ An AIP management plan must be implemented, whereby existing AIP's within the areas demarcated for infrastructure will be eradicated. The disturbed site will be monitored quarterly for at least two years to ensure that alien invasion does not take place.	

Construction	Site clearing, including the removal of vegetation and disturbance of soils	Wetlands	Construction and development activities within a greenfield site are likely to result in negative impacts to functioning freshwater resources and the catchment. This is realised through the resultant habitat fragmentation, spreading of alien and invasive species, soil disturbance and/or compaction, increased incidence of erosion, sedimentation from erosion, potential water quality deterioration, and disturbance to avifauna and other fauna utilising the freshwater resources thus resulting in an overall loss of biodiversity	▪ Environmental Practitioner to be present during vegetation clearing to prevent unnecessary clearing of extensive areas not part of the direct footprint area;
				▪ Clearly marked buffer zones must be established, which are defined as regions of natural vegetation between watercourses/wetlands and developments or activities (WRC, 2015). This is a key management action that should take place by revising proposed infrastructure locations in line with the sensitivity mapping;
				▪ Limit vegetation removal and construction activities to the infrastructure footprint area only, where removed or damaged vegetation areas should be revegetated as soon as possible;
				▪ An alien and invasive plant species management programme must be in place during the construction phase. In this regard, special mention is made of *A. mearnsii*, which is the dominant alien invasive tree species observed in the watercourses at the time of the assessment;
				▪ Bare land surfaces downstream of construction activities must be vegetated to limit erosion from surface runoff associated with infrastructure areas. Actively re-vegetate disturbed areas immediately after construction;
				▪ Ensure a soil management programme is implemented and maintained to minimise erosion and sedimentation;
				▪ If destruction of wetlands is unavoidable disturbance must be minimised and suitably rehabilitated;
				▪ Ensure no incision and canalisation of the wetland features takes place;
				▪ Erosion berms must be installed on roadways and downstream of the discard dump to prevent gully formation and siltation of the freshwater resources. The following points should serve to guide the placement of erosion berms:
				  ▪ Where the track has a slope of less than 2%, berms every 50m should be installed;
				  ▪ Where the track slopes between 2% and 10%, berms every 25m should be installed;
				  ▪ Where the track slopes between 10%-15%, berms every 20m should be installed; and
				  ▪ Where the track has a slope greater than 15%, berms every 10m should be installed.
				▪ All erosion within the construction footprint should be remedied immediately and included as part of an ongoing rehabilitation plan;
				▪ Limit personnel within the buffer areas for all freshwater features identified and such personnel can only enter as and when necessary;
				▪ All areas of increased ecological sensitivity should be designated as "No-Go" areas and be off limits to all unauthorised vehicles and personnel;
				▪ No crossing of the wetland features and their associated buffers should take place (excluding the access road, powerline and water pipleline) and the substrate
					▪ NWA;
					▪ NEM:BA;
					▪ NEMA

Phase	Activity	Aspect	Impacts	Mitigation Measures	Standard to be achieved
Construction	Construction of mine related infrastructure including the plant area, the infrastructure area, the ROM pad, the PCD, the discard dump, the explosives delivery bay, the northern underground access point, and access and haul roads.	Wetlands	Fragmentation of the freshwater resources as a result of road crossings. Loss of freshwater resource habitat (soils and vegetation) due to both direct and indirect impacts. These impacts may result in complete loss of wetland ecosystems or part thereof. Although some of these freshwater resources are not in pristine condition, they are providing significant ecological services at the local and catchment scale	conditions of the wetlands and downstream stream connectivity must be maintained; ▪ At areas where road crossings have been designed, these roads should cross wetland or river features at the narrowest point and at a 90-degree angle with suitable drainage designed into the relevant bridge/culvert crossing; ▪ No material will be dumped or stockpiled within any rivers, tributaries or drainage lines in the vicinity of the proposed footprint area. ▪ Environmentally friendly barrier systems, such as silt nets or, in severe cases, use of trenches, downstream from construction sites to limit erosion and possibly trap contaminated runoff from construction; ▪ Stormwater must be diverted from construction activities and managed in such a manner to disperse runoff and prevent the concentration of stormwater flow; ▪ Water used at construction sites should be utilised in such a manner that it is kept on site and not allowed to run freely into nearby watercourses (i.e. installation of clean and dirty water separation systems); ▪ Construction during high rainfall periods (usually November to March) should be avoided to decrease surface runoff in areas of vegetation removal and disturbed soils in an attempt to limit erosion and sedimentation into wetlands and instream aquatic systems; ▪ The clean and dirty water separation systems must be some of the first infrastructures installed on site and care must be taken to ensure that contamination of the receiving environment as a result of mining activities is minimised as far as possible; ▪ No vehicles or heavy machinery may be allowed to drive indiscriminately within any wetland areas and their associated buffer zones. All vehicles must remain on demarcated roads and within the construction footprint and access roads; ▪ All vehicles must be regularly inspected for leaks; ▪ Re-fuelling must take place on a concrete lined or bunded surface area away from wetlands to prevent ingress of hydrocarbons into the topsoil; ▪ Construction chemicals, such as paints and hydrocarbons, should be used in an environmentally safe manner with correct storage as per each chemical's specific storage descriptions; ▪ All spills should be immediately cleaned up and treated accordingly; ▪ Appropriate sanitary facilities must be provided for the duration of the construction activities and all waste must be removed to an appropriate waste facility, and ▪ Wetland monitoring must be carried out quarterly during the construction phase by a wetland specialist to ensure no unnecessary impact to the freshwater resources occur; and if so, a solution must be put in place as soon as possible.	
Construction	Site clearance and construction of proposed infrastructure	Aquatics	Land and vegetation manipulation/clearing for infrastructure in proximity to the Southern Tributary and within non-perennial drainage lines.	▪ Mitigation measures detailed for the site and vegetation clearing impact should be applied to areas leading up to the watercourse crossing points. However, the infrastructure construction over a watercourse needs additional attention due to the proximity of the activity to aquatic ecosystems. Essentially, the watercourse is going to be directly affected unless a "suspension" approach is adopted (e.g. suspending the infrastructure, allowing only contact with the banks of the watercourse of concern). This is recommended where applicable but will most likely only be a viable option for pipelines that cross watercourses, if any. Larger constructions over watercourses, more specifically the proposed road constructions and associated culverts (if any), are of focus.	▪ NWA

Phase	Activity	Aspect	Impacts	Mitigation Measures	Standard to be achieved
Construction	Physical construction of infrastructure over natural aquatic ecosystems	Aquatics	Vegetation removal for site access and potential hydrological disturbance of associated watercourses	▪ The design as well as the physical construction of roads should not alter the natural hydrology and connectivity of the watercourses in any way (i.e. damming or creating barriers). Any infrastructure proposed to be in contact with the substrate/channel bottom should allow for the free flow of water and material. If hard surfaces are going to be used as foundation or if culverts are going to be installed, their base should not be noticeable above the natural channel bottom to maintain connectivity. Biannual aquatics monitoring of the crossing points should also form part of the management actions to ensure correct flow occurs through the crossing point, especially during the wet season.	
Construction	Site preparation including vegetation clearance and excavations, leading to exposure of soils	Surface water	Sedimentation and siltation of nearby watercourses	▪ Clearing of vegetation must be limited to the development footprint, and the use of any existing access roads must be prioritised so as to minimise creation of new ones; ▪ If possible, construction activities must be prioritised to the dry months of the year to limit mobilisation of sediments, dust generation and hazardous substances from construction vehicles used during site clearing; ▪ Dust suppression with water on the haul roads and cleared areas must be undertaken to limit dust; ▪ Avoid placement of any infrastructure within the 100-year floodlines or 100 m buffer from watercourses, whichever is greater; ▪ Hydrocarbon and hazardous waste storage facilities must be appropriately bunded to ensure that leakages can be contained. Spill kits should be in place and construction workers should be trained in the use of spill kits, to contain and immediately clean up any potential leakages or spills; ▪ Vehicles should regularly be maintained as per the developed maintenance program. This should also be inspected daily before use to ensure there are no leakages underneath ▪ Drip trays must be used to capture any oil leakages. Servicing of vehicles and machinery should be undertaken at designated hard park areas. Any used oil should be disposed of by accredited contractors;	▪ NEMA; ▪ NEM:WA; ▪ NWA; ▪ GN R 704; ▪ GN R 718; and ▪ DWA BPGs, 2008
Construction	Construction and installation of infrastructural facilities including administration offices, ablutions, storerooms, workshops, pollution control dams, processing plant, roads, pipelines etc.	Surface water	Increase of impermeable surfaces, subsequently increasing runoff and potential flooding		
Construction	Handling of hydrocarbons and other chemicals; Loading, hauling and transportation of product coal.	Surface water	Surface water contamination leading to deterioration of water quality		
Construction	Fuel storage, construction vehicles causing potential groundwater contamination	Groundwater	Storage of fuel and the usage of construction vehicles on-site could cause spillages of hydrocarbons. These spillages may seep into the underlying aquifers, causing contamination of groundwater with hydrocarbons.	▪ Regular service of vehicles in designated repair bays as per the developed maintenance program; and ▪ Refuelling of vehicles only in designated areas with correct liners and surfaces	▪ NWA ▪ NEM:WA
Construction	Mine access dewatering causing groundwater level drawdown	Groundwater	During construction of the adit into the underground mine, small scale dewatering associated with the construction could lead to local drawdown of groundwater levels in the vicinity of the adit.	▪ Keep the box cut construction time as short as possible; and ▪ Keep the extents and depth of the box cuts as small as possible	
Construction	The current proposed infrastructure design layout suggests that the Project will directly impact only STE-005	Heritage	Indirect impact on burial grounds and graves	▪ Dagsoom must develop and implement a CMP to prevent the degradation of the fabric of the burial grounds and graves through the Project lifecycle and preserve the CS of the heritage resources.	▪ NHRA

Phase	Activity	Aspect	Impacts	Mitigation Measures	Standard to be achieved
				▪ Dagsoom must also develop and implement an Access Protocol to allow individuals access to the burial grounds and graves. This Access Protocol can be developed considering the relevant safety and security measures of the mine, the requirements of the Mine Health and Safety Act, 1996 (Act No. 29 of 1996) (MHSA) and the needs of the community. ▪ Information regarding the Access Protocol must be made publicly available and can be developed as part of the CMP.	
Construction	Site Clearing, Excavation / Transport, Tipping and Spreading of Materials	Air Quality	Nuisance and reduction in ambient air quality	▪ Develop a traffic management plan for site to enforce a speed limit; ▪ Apply wetting agents, dust suppressant or binders on exposed areas (including excavated stockpiled material and on dirt roads); ▪ Enforce adherence to set vehicle speed limits; ▪ Conduct activities judiciously during windy days (≥5.4 m/s); and ▪ Minimise the drop heights when loading, offloading and tipping material.	▪ NEM:AQA; ▪ National Ambient Air Quality Standards
Construction	Blasting the adit	Blasting	Ground vibration impact on community houses and heritage resources	▪ Specific blast design to be done, shorter blast holes, smaller diameter blast hole, using electronic initiation instead of shock tube systems to obtain single hole firing. ▪ Monitor ground vibration and air blast from blasting operations	▪ MHSA; ▪ MPRDA ▪ Explosives Act, 2003 (Act No. 15 of 2003) ▪ USBM
Construction		Blasting	Air blast impact on community houses	▪ Specific blast design to be done, shorter blast holes, smaller diameter blast hole, use of specific stemming materials to manage air blast, increased stemming lengths to reduce air blast effect. Used of specific stemming to manage fly rock - crushed aggregate of specific size. Re-design with increased stemming lengths ▪ Monitor ground vibration and air blast from blasting operations	
Construction		Blasting	Fly rock impact on community houses	▪ Specific blast design to be done, shorter blast holes, smaller diameter blast hole, use of specific stemming materials to manage air blast, increased stemming lengths to reduce air blast effect. ▪ Monitor fly rock situation using video camera	
Construction	Site clearing, and the construction of infrastructure will result in the generation of noise.	Noise	Noise will emanate from the machinery, and vehicles during the site preparation, haul road construction as well as processing plant construction activities and may exceed the South African standard SANS 10103 [2]	▪ Restrict construction activities to daylight hours (06:00 – 18:00 ▪ Vehicles to be serviced as per their design requirements to ensure noise suppression mechanisms are effective e.g. installed exhaust mufflers; ▪ Regulate vehicle speeds on the access and haul roads; and ▪ Switch off equipment when not in use during the working hours.	▪ SANS 10103
Construction	Recruitment / Appointment of Construction Workforce	Socio-economic	Employment creation during construction	▪ Develop and implement an abbreviated Stakeholder Engagement Plan (SEP), inclusive of a communications plan and grievance mechanism, as well as the appointment of community liaison personnel; ▪ Undertake a skills survey of the communities located in the primary and secondary study areas, allowing residents to register their interest and particular skills for upcoming employment and skills training opportunities; ▪ Use the results of the skills survey to develop a skills register to inform the Skills Development Plan to maximize employment opportunities for residents in the primary and secondary study areas; ▪ Provide skills training prior to and during the Construction Phase to improve local employability during both Construction and Operational Phases; ▪ Explore the possibility of expanding job opportunities beyond mining-related work to also include hiring contract workers to assist with community development projects;	▪ NEMA

Phase	Activity	Aspect	Impacts	Mitigation Measures	Standard to be achieved
				▪ Comply with minimum wage requirements for unskilled labour and all other requirements, including gender equity, of the Employment Equity Act[9] to ensure maximum benefits accrue to workers; ▪ Monitor Dagsoom and its subcontractors in terms of the commitments stipulated in Dagsoom's Social and Labour Plan (SLP) on an annual basis through external auditors; ▪ Ensure that local communities understand the Project's employment requirements in terms of skills and type of employment, by communicating relevant aspects of the SLP and its overarching objectives at community forums in the primary and secondary study areas; and ▪ Prepare for the Operational Phase by updating the Project's local labour database to include local community members employed during the Construction Phase.	
Operational	Soil chemical pollution	Soil, land use and land capability	Soil Contamination from Hydrocarbon waste (lubricants, explosives and fuels)	▪ Soil pollution monitoring should be conducted at selected locations on the project site to detect any extreme levels of pollutants; ▪ Any spillages of hydrocarbons or sewage effluent from the treatment plant or ablution facilities should be cleaned-up immediately and the contaminated soils removed fordiposal of at accredited disposal sites; ▪ A Topsoil Management Plan (TMP) must be prepared to demonstrate how topsoil will be preserved in a condition as near as possible to its pre-mining condition in order to allow successful mine rehabilitation; ▪ Long term stockpiles should be revegetated to minimise loss of soil quality. This will minimise weed infestation, maintain soil organic matter levels, maintain soil structure and microbial activity and maximise the vegetative cover of the stockpile; ▪ Topsoil stripping should be scheduled for the dry season, where possible; and ▪ All long-term topsoil material stockpiles should be located outside the active mine path and away from drainage lines.	▪ NEMA ▪ CARA
Operational	During the stripping and stockpiling process there may be some unexpected changes in the depth and the nature of the soil.	Soil, land use and land capability	Deterioration of Topsoil Quality from in Topsoil Stockpiles		
Operational	Underground mining of coal and the operation of the rock dumps, soils, ROM, discard dump.	Fauna and Flora	Potential for road kills, injuring or poaching and faunal disturbance	▪ Erect signage with speed limits. ▪ Restrict vehicle movement to daylight hours. ▪ Additional surveys should be conducted to determine the presence of Grass Owl and Serval on site. If these species are present, a management plan should be implemented. ▪ Concurrent rehabilitation should take place.	▪ NEM: BA; ▪ NEMA ▪ NEM: PAA (as amended); ▪ NFA; ▪ MPNCA; and ▪ CARA
Operational	Operation of powerlines that could cause bird fatalities through collisions and electrocutions.	Fauna and Flora	Collisions and electrocutions	▪ Install Bird Diverters ▪ Utilise best practice with pylon construction and type.	

[9] The Employment Equity Amendment Act 47 of 2013, Government Gazette, RSA, Volume 583, 16 January 2014, Cape Town.

Phase	Activity	Aspect	Impacts	Mitigation Measures	Standard to be achieved

Operational	Operational underground mining activities, including excavation and dewatering	Wetlands	Operational activities of the proposed underground mining activities have the potential to result in impacts to the water quality of the groundwater, local and downstream resources as well as the potential loss of water supply from the groundwater aquifer. Dewatering activities are likely to result in the loss of water supply to the wetlands, with special mention of the lower lying wetlands such as CVB4, and moisture stress to the surrounding wetland areas.	The following management actions are recommended to guide the effective management of stormwater and water generated on site:
				▪ Channelled water should not be dispersed in a concentrated manner. Baffles should be incorporated into artificial drainage lines/channels around the surface infrastructure to decrease the kinetic energy of water as it flows into the natural environment;
				▪ Bare surfaces downstream from the developments where silt traps are not an option should be vegetated in order to attempt to limit erosion and runoff that might be carrying contaminants;
				▪ All erosion noted within the operational footprint should be remedied immediately and included as part of an ongoing rehabilitation plan;
				▪ Ensure that no incision and canalisation of the wetland features present takes place;
				▪ Erosion berms should be installed on roadways and downstream of stockpiles and the discard dump to prevent gully formation and siltation of the freshwater resources. The following points should serve to guide the placement of erosion berms:
				  ▪ Where the track has a slope of less than 2%, berms every 50m should be installed;
				  ▪ Where the track slopes between 2% and 10%, berms every 25m should be installed;
				  ▪ Where the track slopes between 10%-15%, berms every 20m should be installed; and
				  ▪ Where the track has a slope greater than 15%, berms every 10m should be installed;
				▪ Quarterly monitoring of all wetland areas affected as a result of infrastructure developments, including linear infrastructures such as roads watercourses should be carried out by a suitably qualified wetland ecologist in order to determine localities of areas subjected to erosion and increased runoff; where after, new mitigation actions should be implemented as per the specialist's recommendations.
				The following management and mitigation measures should be put in place to minimise the impact of the underground operational activities:
				▪ During the operational phase of the project the Storm Water Management Plan (SWMP) contained in the Surface Water Report should already be implemented. This should consider all wetlands and other watercourses associated with the new developments/infrastructure which should divert stormwater away from the surface infrastructure and back into natural watercourses to maintain catchment yield as far as possible. The SWMP should also convey stormwater to silt traps where needed in order to limit erosion and the subsequent increase of suspended solids in downstream watercourses;
				▪ If possible, clean water removed as part of the dewatering activities should be released downgradient of the operational areas to ensure water supply to the lower lying wetlands is maintained.
				The following management and mitigation measures should be put in place to ensure impacts to the wetland ecology of the area as a result of (and in specific areas that could be effected by the operation) the general operational activities is reduced:
				▪ Environmental Practitioner to be present during operational phase to prevent any additional clearing of extensive areas or vegetation or dumping of waste rock and/or coal in areas not part of the direct footprint area.
					▪ NWA;
					▪ NEM:BA;
					▪ NEMA

Operational	Uncontrolled runoff of stormwater or water generated from the mining operations from or through the surface infrastructure	Wetlands	Water quality and habitat deterioration of watercourses receiving unnatural/contaminated runoff		
Operational	Operational underground mining activities, including excavation and dewatering	Wetlands	Operational activities of the proposed underground mining activities have the potential to result in impacts to the water quality of the groundwater, local and downstream resources as well as the potential loss of water supply from the groundwater aquifer. Dewatering activities are likely to result in the loss of water supply to the wetlands, with special mention of the lower lying wetlands such as CVB4, and moisture stress to the surrounding wetland areas.		
Operational	Uncontrolled runoff of stormwater or water generated from the mining operations from or through the surface infrastructure	Wetlands	Water quality and habitat deterioration of watercourses receiving		

Phase	Activity	Aspect	Impacts	Mitigation Measures	Standard to be achieved
			unnatural/contaminated runoff	▪ The edge of the non-directly impacted freshwater resources, and at least a 100m buffer or 1:100 floodline buffer, should be clearly demarcated in the field with wooden stakes painted white as no-go zones that will last for the duration of the operational phase. ▪ All areas of increased ecological sensitivity should be designated as “No-Go” areas and be off limits to all unauthorised vehicles and personnel; ▪ Freshwater resource monitoring must be carried out during the operational phase by a wetland specialist to ensure no unnecessary impact to the freshwater resources present; and if so that a remedy is put in place as soon as possible. ▪ Ensure soil management programme is implemented and maintained to minimise erosion and sedimentation; ▪ Implement and maintain alien vegetation management programme; ▪ If it is absolutely unavoidable that any of the wetland areas present will be affected, disturbance must be minimised and suitably rehabilitated; ▪ No material is to be dumped or stockpiled within any rivers, tributaries or drainage lines; ▪ No vehicles or heavy machinery may be allowed to drive indiscriminately within any wetland areas or their buffer areas. All vehicles must remain on demarcated roads and within the operational footprint; ▪ All vehicles must be regularly inspected for leaks; ▪ Re-fuelling must take place on a sealed surface area away from wetlands to prevent ingress of hydrocarbons into topsoil; ▪ All spills should be immediately cleaned up and treated accordingly; and ▪ Appropriate sanitary facilities must be provided for the duration of the operational phase and all waste must be removed to an appropriate waste facility.	
Operational	Loading, hauling and stockpiling	Wetlands	These activities have the potential to result in an increased potential for soil compaction, erosion, sedimentation, loss of water quality, habitat and biodiversity		
Operational	Use and maintenance of haul roads for the transportation of coal and waste rock	Wetlands	Fragmentation of the freshwater resources as a result of road crossings, contamination of freshwater resources and impacts to water quality as a result of spills, compaction of soils, loss of habitat and biodiversity. Increased potential for sheet runoff from paved/cleared surfaces and increased potential for erosion		
Operational	Uncontrolled runoff of stormwater or water generated from the mining operations from or through the surface infrastructure	Aquatics	Water quality and habitat deterioration of watercourses receiving unnatural/ contaminated runoff	▪ During the Operational Phase of the Project a SWMP should already be implemented. This should consider all drainage lines associated with the new developments/infrastructure which should divert stormwater away from the surface infrastructure and back into natural watercourses. The SWMP should also convey stormwater to silt traps where needed in order to limit erosion and an increase of suspended solids in downstream watercourses; ▪ Channelled water should not be dispersed in a concentrated manner. Baffles should be incorporated into artificial drainage lines/channels around the surface infrastructure to decrease the kinetic energy of water as it flows into the natural environment; ▪ Bare surfaces downstream from the developments where silt traps are not an option should be vegetated in order to attempt to limit erosion and runoff that might be carrying contaminants; ▪ Careful monitoring of the areas where dust suppression is proposed should be undertaken regularly. Areas concentrating water runoff should be addressed and not allowed to flow freely into associated watercourses; and ▪ Monitoring of infrastructure over watercourses should be done by an aquatic specialist in order to determine localities of areas subjected to erosion and increased runoff where after new mitigation actions should be implemented as per the specialist’s recommendations	▪ NWA
Operational	Runoff from the dirty water areas or catchments (coal stockpile areas, mine processing plant, workshops etc.)	Surface water	Surface water contamination by runoff from dirty water areas	▪ Infrastructure development must be limited to the demarcated footprint to minimize the dirty runoff generating catchments within the project area.	▪ NEMA; ▪ NEM:WA; ▪ NWA;

Phase	Activity	Aspect	Impacts	Mitigation Measures	Standard to be achieved
Operational	Hydrocarbons and chemicals spillages and leakages from equipment, moving haulage trucks and machinery	Surface water	Surface water Contamination from hydrocarbon and chemical spillages and leakages	▪ As per the SWMP, clean water runoff from the upstream catchment of the mine should be diverted around the site into the natural environment, this will minimize the runoff that will potentially be contaminated by mine waste ▪ All the runoff captured on the stormwater dam and RWD should be re-used in the mine processes to avoid sourcing water from external sources. ▪ Should the contaminated water stored water be more than the storage capacities and discharge is considered, this water should be treated to acceptable water quality prior to discharge into the natural environment. In this case, acceptable water quality should at least be benchmarked with the baseline surface water quality of the surrounding streams	▪ GN R 704; ▪ GN R 718; and ▪ DWA BPGs, 2008
Operational	Containment of dirty runoff in the PCDs	Surface water	Reduction of catchment runoff yield		
Operational	Mine dewatering causing a decrease in groundwater reserves	Groundwater	Due to active mine dewatering required to ensure dry working conditions in the underground mine, certain groundwater volumes will be extracted from the underground void, limiting the groundwater resource.	▪ Mining should progress as swiftly as possible to reduce the period of active dewatering; ▪ The mining-related surface infrastructure area extent should be kept to a minimum ▪ Underground mining can only take place in the areas associated with this application ▪ Dewatering of the underground mine should stop as soon as the mining activities cease ▪ Dewatering volumes should be monitored frequently throughout the LoM to note deviations from the predicted inflows as soon as possible	▪ NWA ▪ NEM:WA
Operational	Mine dewatering causing lowering of groundwater levels	Groundwater	Active mine dewatering will be required to ensure dry working conditions in the underground void. The dewatering will cause ground levels to be drawn down in the vicinity of the mining area.	▪ Mining should progress as swiftly as possible to reduce the period of active dewatering ▪ The mining area extent should be kept to a minimum ▪ Dewatering of the underground mine should stop as soon as the mining activities cease ▪ Groundwater levels surrounding the mine void should be monitored on a regular basis throughout the LoM to verify the extent of the cone of drawdown	
Operational	AMD formation in the underground void and discard dump causing groundwater contamination	Groundwater	Due to AMD forming within the underground void and in the discard dump, potential groundwater contamination with sulphate and a lower pH could occur, which would have an impact on the groundwater quality.	▪ Groundwater abstraction should continue for the LoM to maintain a cone of drawdown ▪ Biannual aquatic monitoring of groundwater quality in the area surrounding the mine void should continue throughout the LoM ▪ Groundwater levels surrounding the mine void should be monitored on a quarterly basis throughout the LoM to verify the extent of the cone of drawdown.	
Operational	Material Handing, Hauling of Ore and Discard Waste, Crushing and Screening, Wind Erosion, and Generator Sets	Air Quality	Nuisance and potential health effects from exposure to fine particulate matter, gases and volatile	▪ Apply wetting agents, dust suppressant or binders on the dirt roads; ▪ Construct surfaces of haul roads from lateritic soils if possible and avoid fine/colloidal (e.g. clays and silts) materials; ▪ Vegetate exposed areas as soon as practicably possible; ▪ Enclose the crusher, screens, transfer and discharge points and conveyors; ▪ The area of disturbance shall be kept to a minimum at all times and no unnecessary stripping must occur, especially on windy days (wind speed ≥ 5.4 m/s); ▪ Set maximum vehicle speed limits on site and enforce these limits; ▪ Ensure generators are operated at optimal conditions; and ▪ Minimise the drop heights when loading and unloading material onto trucks and at tipping points.	▪ NEM:AQA; ▪ National Ambient Air Quality Standards

Phase	Activity	Aspect	Impacts	Mitigation Measures	Standard to be achieved
Operational	Drill and blast underground	Blasting	Ground vibration impact on community houses	▪ No mitigation required	▪ MHSA; ▪ MPRDA ▪ Explosives Act, 2003 (Act No. 15 of 2003)
Operational	Mining and Processing of Ore	Noise	Noise will emanate from the crusher, screening and washer plants and hauling of coal. However, the noise levels will not exceed the SANS 10103 guidelines in the immediate environment of the mining operation boundaries.	▪ Vehicles are to be serviced to the design requirements to ensure noise suppression mechanisms are effective e.g. installed exhaust mufflers; ▪ Switch off equipment when not in use; ▪ Regulate the speed of vehicles traveling on access and haul roads.	▪ SANS 10103
Operational	Recruitment / appointment of Operational Phase workforce	Socio-economic	Employment Creation during Operation	▪ Continue enforcement of SLP commitments for giving preference for employment to suitably qualified members of local communities; ▪ Monitor the contractors and sub-contractors on an annual basis through an external auditor to ensure their compliance with SLP commitments; and ▪ Ensure the skills development initiatives proposed in the SLP are targeted at as many local community members as possible, thereby improving skills training beneficiaries' chances at employment on the Project. ▪ Use the Project database, developed during the Construction Phase, listing local community members who were employed during the Construction Phase to select locals for employment in the Operational Phase.	▪ NEMA
Operational	Operational Activity Impacts on the Local Economy	Socio-economic	Growth of the local economy	▪ Continue implementation of the measures recommended to enhance local employment, skills development, community development, and multiplier effects on the local economy for the Construction Phase; ▪ Set targets to progressively increase local and regional procurement over the life of the Project; and ▪ Incorporate SMME capacity development programmes into future iterations of the SLP to enable local suppliers to take maximum advantage of procurement opportunities during the Operational Phase.	
Decommissioning	Demolition of infrastructure and rehabilitation of affected areas	Soil, land use and land capability	Disturbance of soils and subsequent erosion by wind and water	▪ Implement land rehabilitation measures; ▪ Compacted areas are to be ripped to loosen the soil and vegetation cover re-instated; ▪ Inventory of hazardous waste materials stored on site should be compiled and arrange complete removal; ▪ Monitor decant of AMD and implement management measures which include in-situ passive treatment or neutralisation and electrolytic treatment using a Water Treatment Plant (WTP) to get purified water for discharge to the natural environment or for other beneficial uses. ▪ Seal the shaft by placing concrete plugs; ▪ Underground materials should be disconnected prior to removal; ▪ Ensure effective stormwater management designs are in place to ensure no run-off or pooling occurs; ▪ Conduct soil contamination assessment to assess if any remediation is required prior to future land use development; ▪ Only designated access routes are to be used to reduce any unnecessary compaction; and ▪ The backfilled, reprofiled landscape should be top soiled and revegetated to allow free drainage close to the pre-mining conditions. ▪	▪ NEMA ▪ CARA
Decommissioning	Reaction of sulphide compounds in extracted coal residues with water and oxygen	Soil, land use and land capability	Contamination from Acid Mine Drainage		
Decommissioning	Dismantling and removal of infrastructure	Fauna and Flora	Demolition could induce habitat loss and continual pressure by the operations on the ecosystem can lead to pressure on the	▪ An alien plant species management plan for the affected areas should be implemented for two years after rehabilitation is completed. ▪ All emergent alien plant species should be removed before they reach a seed-bearing or flowering maturity. ▪ Ensure that the controls of noise, dust, waste generation, vehicle speed limits, food waste disposal, hazardous waste disposal, human interaction with the ecology are	▪ NEM: BA; ▪ NEMA ▪ NEM: PAA (as amended); ▪ NFA;

Phase	Activity	Aspect	Impacts	Mitigation Measures	Standard to be achieved
			populations of threatened species or could lead to direct loss of individuals. Alien plant invasion may take place due to soil disturbance.	monitored regularity and controls to prevent adverse conditions arising from the activities which are likely to affect fauna and flora are updated and implemented. ▪ Ensure continuous environmental awareness training takes place.	▪ MPNCA; and ▪ CARA
Decommissioning	Activity and Interaction: Rehabilitation of infrastructure footprint areas	Fauna and Flora	Restoration of vegetation and habitat types.	▪ An alien plant species management plan for the affected areas should be implemented for two years. ▪ All emergent alien plant species should be removed before they reach a seed-bearing or flowering maturity. ▪ At least five species should be used for rehabilitation and only species that are native to the area and stipulated in the Rehabilitation and Closure Plan (Digby Wells, 2019) should be utilised.	
Decommissioning	Rehabilitation of site and dismantling of infrastructure	Wetlands	Erosion onset, sedimentation and establishment of alien plants	▪ High rainfall periods should be avoided during decommissioning; ▪ Stormwater must be diverted from decommissioning activities; ▪ Stored mine-affected water should be treated before decommissioning of any mine-related water retention areas, such as PCDs; ▪ In the areas that could be affected by mining activities tThe edge of the non-directly impacted freshwater resources, and at least a 100m buffer or 1:100 floodline buffer, should be clearly demarcated in the field with wooden stakes painted white as no-go zones that will last for the duration of the decommissioning phase; ▪ All areas of increased ecological sensitivity should be designated as “No-Go” areas and be off limits to all unauthorised vehicles and personnel; ▪ Actively re-vegetate disturbed areas as well as decommissioned footprint areas as part of the decommissioning process; ▪ Implement and maintain an alien vegetation management programme for the duration of the decommissioning phase and into closure; ▪ No material should be dumped within any wetlands or watercourses; ▪ No vehicles or heavy machinery should be allowed to drive indiscriminately within any wetland areas or their buffer areas. All vehicles must remain on demarcated roads; ▪ All vehicles must be regularly inspected for leaks; ▪ Re-fuelling must take place on a sealed surface area away from wetlands to prevent ingress of hydrocarbons into the topsoil; ▪ All spills should be immediately cleaned up and treated accordingly; ▪ Appropriate sanitary facilities must be provided for the duration of the decommissioning phase and all waste must be removed to an appropriate waste facility; and ▪ Wetland monitoring must be carried out during the decommissioning phase to ensure no unnecessary impact to wetlands takes place.	▪ NWA; ▪ NEM:BA; ▪ NEMA
Decommissioning	Physical removal of surface infrastructure and rehabilitation activities near and within drainage lines	Aquatics	Water quality and habitat deterioration of watercourses in contact with heavy machinery and receiving runoff from surface workings	▪ High rainfall periods should be avoided during decommissioning; ▪ Removed or damaged vegetation areas should be revegetated; ▪ Stormwater must be diverted from decommissioning activities; ▪ Water used during decommissioning should be kept onsite and not be allowed to freely flow into nearby watercourses; ▪ Stored mine-affected water should be treated before decommissioning of any mine-related water retention areas, such as PCDs; ▪ Land reprofiling should be done during the dry season to allow for attempts to restore the morphology of the drainage lines prior to rainfall/flow events; and ▪ Ensure the revegetation activities use appropriate indigenous plant species.	▪ NWA
Decommissioning	Demolition of mine infrastructure (PCDs, workshops, haul roads, processing plant etc.) Disturbance of soils and erosion by overland flow	Surface water	Sedimentation and siltation of nearby watercourses and deterioration of water quality	▪ Disturbance of soils during infrastructure demolition should be restricted to relevant footprint areas; and ▪ Movement of demolition machinery and vehicles should be restricted to designated access roads to minimise the extent of soil disturbance.	▪ NEMA; ▪ NEM:WA; ▪ NWA; ▪ GN R 704; ▪ GN R 718; and ▪ DWA BPGs, 2008
Decommissioning	Rehabilitation of disturbed sites close to pre-mining conditions	Surface water	Restoration of pre-mining streamflow regime in nearby watercourses		

Phase	Activity	Aspect	Impacts	Mitigation Measures	Standard to be achieved
Decommissioning	Rehabilitation and Demolition of Infrastructure	Air Quality	Demolition and the removal of infrastructure may result in fugitive dust emissions. Nuisance dust and possible health implications from exposure to airborne particulate matter	▪ Apply wetting agents, dust suppressant or binders on the exposed areas (including excavated material and roads); ▪ Enforce vehicle speed limits on site; ▪ Keep the area of disturbance to a minimum at all times; ▪ Minimise the drop heights when loading and unloading material onto trucks; ▪ Dismantling of infrastructure should be done in phases; and ▪ Implement routine maintenance, vegetation (and if required secondary-vegetation).	▪ NEM:AQA; ▪ National Ambient Air Quality Standards
Decommissioning	Removal of infrastructure and surface rehabilitation	Noise	Noise will emanate from the machinery and vehicles undertaking the decommissioning and rehabilitation activities.	▪ Restrict decommissioning activities to daylight hours (06:00 – 18:00); ▪ Regularly service decommissioning related machines and vehicles to ensure noise suppression mechanisms are effective e.g. installed exhaust mufflers; ▪ Regulate speed limits on access roads; and ▪ Switch off equipment when not in use.	▪ SANS 10103
Decommissioning	Closure of the Mine	Socio-economic	Job Losses and Negative Effects on the Local Economy	▪ Develop a detailed Social Closure Plan at least 5 years prior to decommissioning, that includes a retrenchment plan for Project staff as well as a communication strategy that will keep employees and surrounding communities informed about closure timing and management strategies; ▪ Develop and implement the required Human Resource systems to provide references for employees; ▪ Ensure that employment contracts release employees from non-compete clauses following the closure of the Project; ▪ Design community development initiatives that will be sustainable beyond the life of the Project and independent of mining operations; ▪ Increase opportunities for ABET, portable skills training, and mining skills-related skills development during the Operational Phase; and ▪ Proactively assess and manage the social and economic impacts on individuals, regions and economies where retrenchment and/or closure of the Project are certain.	▪ NEMA

7 Financial Provision

To complete the Financial Provision Assessment there are a number of tasks which were undertaken. These tasks are explained separately below

7.1 Item (i)(1): Determination of the amount of Financial Provision

7.1.1 Item (i)(1)(a): Describe the closure objectives and the extent to which they have been aligned to the baseline environment described under Regulation 22 (2) (d) as described in 2.4 herein

Closure and rehabilitation is a continuous series of activities that begin with planning prior to the Project's design and construction, and end with achievement of long-term site stability and establishing a self-sustaining ecosystem. Not only will the implementation of this concept result in a more satisfactory environmental conclusion, but it will also reduce the financial burden of closure and rehabilitation. The following points outline the main objectives for rehabilitation and closure:

- Make all areas safe for both humans and animals;
- Make all areas stable and sustainable;
- Follow a process of closure that is progressive and integrated into the short- and long-term plans, and that will assess the closure impacts proactively at regular intervals throughout project life;
- Maintain and monitor all rehabilitated areas following re-vegetation and, if this monitoring shows that the objectives have been met, make an application for closure;
- Comply with local, district and national regulatory requirements; and
- Follow a comprehensive consultation and communication process with all stakeholders.

Rehabilitation and closure objectives have been tailored to the project at hand. This Rehabilitation, Decommissioning and Mine Closure Plan aims to assist Dagsoom in carrying out successful rehabilitation for the Project. The specific closure objectives identified for Twyfelaar further within this report.

7.1.2 Item (i)(1)(b): Confirm specifically that the environmental objectives in relation to closure have been consulted with landowner and interested and affected parties

A Public Participation Process has been undertaken during May and June 2019. I&APs were consulted, all comments, concerns raised and received during the commenting period were addressed and included in this report in Section 9.3 of Part A. There were no concerns raised regarding the financial provisions.

7.1.3 Item (i)(1)(c): Provide a rehabilitation plan that describes and shows the scale and aerial extent of the main mining activities, including the anticipated mining area at the time of closure

This report should inform how the mine infrastructure is either handed over legally or removed from site. During the operational phase it is recommended that an assessment be undertaken of the infrastructure to determine if some of the infrastructure can remain in situ and be utilised post closure.

The rehabilitation actions for infrastructure are briefly discusses in the Table 7-1 below and separated into phases, a more detailed Rehabilitation and Closure report is appended as Appendix P in this report.

Table 7-1: Rehabilitation Actions and Plans

Phases	Rehabilitation Actions
Construction	Land preparation during the construction phase for the intended infrastructure is discussed below: ▪ Planning should minimise the area to be occupied by infrastructure; ▪ Care should be taken around sensitive landscapes e.g. wetlands/pans/riverine areas to ensure that impacts to them are none to minimal; ▪ Construction crews should restrict their activities to planned demarcated areas; ▪ Prior to construction, the construction footprint must be comprehensively surveyed to identify all important species (such as Red Data Plants and Species of Special Concern); ▪ During vegetation removal, the removal of trees should be avoided where possible; ▪ If it is necessary to remove protected trees, permits will be required; ▪ The soil must be stockpiled.
Operational	During the operational phase: ▪ Ensure crews restrict their activities to planned areas to reduce soil compaction and erosion must be reduced; ▪ Pollution must be controlled at the proposed project site through the following mitigations discussed in this report as Appendix P; ▪ Monitor the conveyor and all facilities for any spillages/leaks or accidental discharges; and ▪ Alien invasive species must be removed (for more information, see Appendix P of this report).

Phases	Rehabilitation Actions
Decommissioning	It has been assumed that infrastructure with a beneficial use will be transferred to a suitable third party and will not be decommissioned and is thus excluded from the decommissioning phase, however it is recommended that an assessment be conducted for such and that if infrastructure is handed over, that third-party agreements are put into place.

7.1.4 Item (i)(1)(d): Explain why it can be confirmed that the rehabilitation plan is compatible with the closure objectives

The Rehabilitation Plan has been compiled in support of the primary closure objectives which are to remove unwanted infrastructure and rehabilitate the land to a suitable mixed end land use which provides a safe and stable environment for surrounding receptors.

7.1.5 Item (i)(1)(e): Calculate and state the quantum of the financial provision required to manage and rehabilitate the environment in accordance with the applicable guideline

The financial provision estimate was calculated based on a third-party model (Digby Wells Model). The estimated financial provision required for the rehabilitation and closure of the Proposed Twyfelaar Mine is **R 11,901,761.67** (excl. VAT). The financial provision estimates associated with the proposed operations is included in Table 7-2 below.

Table 7-2: Dagsoom Twyfelaar Financial Provision Estimate

DIGBY WELLS ENVIRONMENTAL	Digby Wells Environmental Dagsoom Coal Mining, Twyfelaar, DAG5603
Area and Description	**Life of Mine**
Infrastructure and Rehabilitation	
Area 1: Eastern Underground Access	R0.00
Area 2: Northern Underground Access	R5,662,955.10
Area 3: Western Underground Access	R0.00
Area 4: Discard Dumps	R2,379,051.64
Sub-total	**R8,042,006.74**
Monitoring and Maintenance	
Monitoring Costs (Groundwater and Surface water)	R1,579,661.00
Monitoring Costs (Vegetation)	R74,858.02
Maintenance Costs (Vegetation)	R435,994.43
Sub-total	**R2,090,513.45**
Project Management (12%)	R965,040.81
Contingency (10%)	R804,200.67
GRAND TOTAL	**R11,901,761.67**

7.1.6 Item (i)(1)(f): Confirm that the financial provision will be provided as determined

Provided the Mining Right is approved, Dagsoom will provide for closure as per the legal requirements. A liability assessment will also need to be undertaken annually to ensure the financial provision is in line with the closure cost.

8 Monitoring compliance with and performance assessment

Dagsoom will be responsible for the implementation of all monitoring, mitigation and management measures, as well as compliance with the EMP. The recommended monitoring for the identified impacts is detailed below. The applicant will keep a record of all environmental monitoring taken on site. A summary of the environmental monitoring to be undertaken is included in Table 8-3**.**

8.1 Item 1(g): Monitoring of impact management actions

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. The monitoring programmes have been discussed below:

8.1.1 Soils, Land Use and Land Capability

Supervision of activities and soil resources monitoring are essential aspects of any land use change project. The following should be observed:

- The Mine Manager and the Environmental Practitioner (EP) should be responsible to determine effectiveness of erosion control structures;
- The Mine Manager and the EP should ensure soil contamination monitoring on site, especially where hydrocarbons are stored and applied; and
- Training of sub-contractors and all workers on the operational procedures and mitigation measures should be undertaken.

The following items should be monitored continuously:

- Soils:
- Erosion status;
- Compaction;
- Contamination; and
- Vegetation cover.

The following maintenance is required:

- Subsidence should be monitored annually;
- Repair any damage caused by erosion;
- If soil is polluted, treat the soil by means of *in-situ* remediation, if possible; and
- If *in-situ* treatment is not possible then the polluted soil must be classified according to the Minimum Requirements for the Handling, Classification and Disposal of Hazardous Material and disposed of at an appropriate, permitted or licensed disposal facility.

8.1.2 Fauna and Flora

The following aspects were identified in the Flora and Fauna report that require monitoring:

- Ensuring sustainable populations of both fauna and flora persist until closure; and
- Ensuring areas of confirmed bird mortality is adequately equipped with mitigation measures.

8.1.3 Wetlands

The WET-health and WET-Ecoservices tools should be used to re-evaluate PES and eco-services on a quarterly basis by a suitably qualified wetland specialist for the duration of the construction phase, and annually for the duration of the operational phase. Upon closure and decommissioning, annual monitoring should take place for another three years to ensure no emerging impacts are identified, which may need to be addressed.

8.1.4 Aquatic Biomonitoring

Aquatic monitoring to be undertaken on an annual basis during the wet season (November to March) by a qualified aquatic ecologist is indicated in Table 8-1 below.

Table 8-1: Biomonitoring Programme

Method and Aquatic Component of Focus	Details	Goal/Target
Water Quality: ▪ In-situ water testing focusing on temperature, pH, conductivity and oxygen content.	Water quality should be tested on a biannual basis at each monitoring site to determine the extent of change from baseline results.	No noticeable change from determined baseline water quality for each respective season
Habitat Quality: ▪ Instream and riparian habitat integrity; and ▪ Availability/suitability of macroinvertebrate habitat at each monitoring site.	▪ The application of the IHI should be done on a reach basis for the Southern Tributary and larger Sandspruit reach; ▪ The IHAS must be applied at each monitoring site prior to sampling.	▪ The ecological category determined for each assessed reach must be maintained; and ▪ The IHAS scores determined within this report should improve especially during wet season monitoring.
Macroinvertebrates: ▪ Macroinvertebrate assemblages must be assessed biannually.	This must be done through the application of the latest SASS5, incorporated with the application of the MIRAI as outlined in this Aquatic Study.	▪ The baseline SASS5 scores should not noticeably deteriorate; and ▪ Baseline Ecological Categories should not be allowed to drop in category for each assessed reach/site.
Fish: ▪ Fish assemblages must be assessed biannually	Sampling must be done utilising standard electroshocking techniques followed by the application of FRAI for applicable reaches.	The presence of the species *Enteromius anoplus* at all sites within the MRA. However, the main goal for the Project must be to conserve the identified sensitive and conservation

Method and Aquatic Component of Focus	Details	Goal/Target
		important species in the lower reaches of the Sandspruit: ▪ *C. emarginatus*; ▪ *C. anoterus*; and ▪ *A. uranoscopus*.

8.1.5 Surface water

All water quality results should be benchmarked with the South African Water Quality guidelines: (for domestic use, aquatic ecosystems, livestock watering and irrigation) and any other prescribed standards i.e. Water Use License, to determine the impacts of the proposed mining activities on the natural surface water resources (positive/negative). Refer to Table 8-2.

Table 8-2: Surface Water Monitoring Plan

Monitoring Element	Comment	Frequency	Responsibility
Water quality	Ensure water quality monitoring as per sampled and proposed monitoring locations. Parameters should include but not limited to pH; Electrical Conductivity; Sulphate; major cations (K, Ca, Mg & Na); trace metals (Al, Fe, Zn, Cu, Mn, Co, Se, Mo, Cd, Ni, Cr (VI), Pb, Hg & As); Anions (NO_3, NO_2, NH_4, Cl, F, PO_4); Total Dissolved Solids; Total Suspended solids. It is also recommended to monitor water quality within the mine water dams or water containment facilities to determine the concentration levels in case of an overflow or need for discharge.	Monthly monitoring during construction, operation, decommissioning and for at least three (3) years after closure, or until rehabilitation has reached a sustainable state with no further changes.	Environmental Officer

Monitoring Element	Comment	Frequency	Responsibility
Sedimentation	Inspect construction sites, sites where infrastructure is demolished and rehabilitated sites for traces of erosion to ensure no entrance of sediment occurs into nearby watercourses, especially after rainfall events. Temporary silt fences, soil stabilization blankets should be installed and maintained until vegetation is established.	After rainfall event, until the establishment of vegetation on all rehabilitated sites	Environmental Officer
Water quantity and water balance	Monitoring or measuring of all the water inflows into the mine, reticulation within the mine and the outflows from the mine. This can be achieved by installing automatic flow meters to ensure real time measurements of water.	In operational areas where automatic flow meters are in place, daily records need to be kept	Environmental Officer
Physical structures and Storm Water Management Plan (SWMP) performance	Personnel should have a walk around facilities to determine the facilities conditions and pick out any anomalies such as leaks or overflows and system malfunctions. Storm water channels, and existing mine dams are inspected for silting and blockages of inflows, pipelines for hydraulic integrity; monitor the overall SWMP performance.	Continuous process and yearly formal report	Environmental Officer

8.1.6 Groundwater

Groundwater monitoring should be conducted to assess the following:

- The impact of mine dewatering on the surrounding aquifers. This will be achieved through monitoring of groundwater levels in the monitoring boreholes. If private boreholes are identified within the zone of impact on groundwater levels, these will be included in the monitoring programme;

- Groundwater inflow into the mine void. This will be achieved through monitoring of groundwater levels in the monitoring boreholes as well as measuring water volumes pumped from the underground mine;
- Groundwater quality trends. This will be achieved through sampling of the groundwater in the boreholes at the prescribed frequency; and
- The rate of groundwater recovery and the potential for decant after mining ceases. This can be achieved through measuring groundwater levels in the underground mine workings. Stage curves will be drawn to assess the inflow into defunct workings.

8.1.7 Blasting

A monitoring programme for recording blasting operations is recommended. The following elements should be part of such a monitoring program:

- Ground vibration and air blast results;
- Blast Information summary;
- Meteorological information at time of the blast;
- Video Recording of the blast; and
- Fly rock observations.

Most of the above aspects do not require specific locations of monitoring. Ground vibration and air blast monitoring requires identified locations for monitoring. Monitoring of ground vibration and air blast is done to ensure that the generated levels of ground vibration and air blast comply with recommendations. Proposed positions were selected to indicate the nearest points of interest at which levels of ground vibration and air blast should be within the accepted norms and standards as proposed in this report. The monitoring of ground vibration will also qualify the expected ground vibration and air blast levels and assist in mitigating these aspects properly. This will also contribute to proper relationships with the neighbours.

One monitoring position was identified as possible location that will need to be considered (refer to Appendix K). Monitoring point / s can be re-defined with the first blast done and the monitoring programme defined.

8.2 Item 1(h): Monitoring and reporting frequency

Table 8-3, below, discusses the monitoring and reporting frequency in detail.

8.3 Item 1(i): Responsible persons

Table 8-3, below discusses the monitoring and reporting frequency in detail.

8.4 Item 1(j): Time period for implementing impact management actions

The roles and responsibilities associated with the monitoring programme are set out in Table 8-3, below.

8.5 Item 1(k): Mechanism for monitoring compliance

Table 8-3 sets out the method of monitoring, the implementation of the impact management actions, the frequency of monitoring the implementation of the impact management actions, an indication of the persons who will be responsible for the implementation of the impact management actions, the time periods within which the impact management actions must be implemented and the mechanism for monitoring compliance with the identified impact management actions

Table 8-3: Monitoring and management of environmental impacts

Source of Activity	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
All activities throughout the project	Fauna and Flora	Ensuring sustainable populations of both fauna and flora persist until closure	Terrestrial Ecologist	Every year, during the wet season
	Avifaunal	Ensuring areas of confirmed bird mortality is adequately equipped with mitigation measures.	Ornotholigist	Twice Yearly
	Rehabilitation	Rehabilitation success	Rehabilitation Specialist	Quarterly for 2 years after closure
	Soil disturbance	Alien plant monitoring	Qualified Botanist	Quarterly monitoring for two years
	Water quality	Ensure water quality monitoring as per sampled and proposed monitoring locations. Parameters should include but not limited to pH; Electrical Conductivity; Sulphate; major cations (K, Ca, Mg & Na); trace metals (Al, Fe, Zn, Cu, Mn, Co, Se, Mo, Cd, Ni, Cr (VI), Pb, Hg & As); Anions (NO_3, NO_2, NH_4, Cl, F, PO_4); Total Dissolved Solids; Total Suspended solids. It is also recommended to monitor water quality within the mine water dams or water containment facilities to determine the concentration levels in case of an overflow or need for discharge.	Environmental Officer	Monthly monitoring during construction, operation, decommissioning and for at least three (3) years after closure, or until rehabilitation has reached a sustainable state with no further changes.
	Sedimentation	Inspect construction sites, sites where infrastructure is demolished and rehabilitated sites for traces of erosion to ensure no entrance of sediment occurs into nearby watercourses, especially after rainfall events. Temporary silt fences, soil stabilization blankets should be installed and maintained until vegetation is established.	Environmental Officer	After rainfall event, until the establishment of vegetation on all rehabilitated sites.
	Water quantity and water balance	Monitoring or measuring of all the water inflows into the mine, reticulation within the mine and the outflows from the mine. This can be achieved by installing automatic flow meters to ensure real time measurements of water.	Environmental Officer	In operational areas where automatic flow meters are in place, daily records need to be kept
	All monitoring boreholes	Groundwater quality trends. This will be achieved through sampling of the groundwater in the boreholes at the prescribed frequency	Groundwater Specialist	Quarterly: sampling for water quality analysis
	Physical structures and Storm Water Management Plan (SWMP) performance	Personnel should have a walk around facilities to determine the facilities conditions and pick out any anomalies such as leaks or overflows and system malfunctions. Storm water channels, and existing mine dams are inspected for silting and blockages of inflows, pipelines for hydraulic integrity; monitor the overall SWMP performance.	Environmental Officer	Continuous process and yearly formal report

Source of Activity	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
	All monitoring boreholes	The rate of groundwater recovery and the potential for decant after mining ceases. This can be achieved through measuring groundwater levels in the underground mine workings. Stage curves will be drawn to assess the inflow into defunct workings.	Groundwater Specialist	Quarterly: measuring the depth of groundwater levels
	Rainfall	**Groundwater inflow into the mine void**. This will be achieved through monitoring of groundwater levels in the monitoring boreholes as well as measuring water volumes pumped from the underground mine.	Groundwater Specialist	Daily at the mine
	Heritage	Establish Project-specific Chance Find Procedures (CFPs) as a condition of authorisation.	Heritage Specialist	-

9 Item 1(l): Indicate the frequency of the submission of the performance assessment report

In accordance with the NEMA EIA Regulations (2014), as amended, an external independent Environmental Audit will be undertaken biennially (every second year). The Environmental Audit Report will be submitted to the DMR and other relevant authorities where required.

10 Item 1(m): Environmental Awareness Plan

10.1 Item 1(m)(1): Manner in which the applicant intends to inform his or her employees of any environmental risk which may result from their work

The purpose of an Environmental Awareness Plan is to outline the methodology that will be used to inform the mine's employees and contractors of any environmental risks which may result from their work and the manner in which the risks must be dealt with to avoid contamination or the degradation of the environment. The environmental awareness plan is primarily a tool to introduce and describe the requirements of the range of environmental and social plans for the proposed project during the life of the Project.

The environmental awareness plan ensures that training needs are identified, and appropriate training is provided. The environmental awareness plan should communicate:

- Importance of conformance with the environmental policy, procedures and other requirements of good environmental management;
- The significant environmental impacts and risks of an individual's work activities and the environmental benefits of improved performance;
- Individual's roles and responsibilities in achieving the aims and objectives of the environmental policy; and
- The potential consequences of not complying with environmental procedures.

The objective of this Environmental Awareness Plan is to:

- Inform employees and contractors of any environmental risks which may result from their work; and
- Inform employees and contractors of the manner in which the identified possible risks must be dealt with to prevent degradation of the environment.

In general, the purpose of implementing an Environmental Awareness Plan is to optimise the awareness of those partaking in the mining and related activities which have the potential to impact negatively on the environment and in doing so, promote the global goal of sustainable development.

The awareness training of employees, supervisors, sub-contractors, contractors and visitors will ensure that co-operation in terms of environmental management will occur. This will contribute to the successful implementation of the conditions set out in the EMPR and Environmental Authorisation, and thus to the environmental sustainability of the project. In addition, it will ensure the success of the proposed project regarding compliance with legislation and avoid possible future liabilities and legal action due to a lack of environmental awareness.

10.2 Item 1(m)(2): Manner in which risks will be dealt with in order to avoid pollution or the degradation of the environment

Methods for the internal communication between the various levels and functions of the organisation, and receiving, documenting and responding to relevant communication from I&APs must be established for the project.

Communication is a management responsibility. All line supervisors are responsible for effective communication within their own sections. Environmental risks will be dealt with through training and communication to ensure minimal degradation of the environment.

11 Item 1(n): Specific information required by the Competent Authority

The placement of infrastructure will need to be reconsidered to avoid the ecologically highly sensitive areas. The adit, ROM pad and conveyor cannot be moved, and will form part of an offset report. The remaining infrastructure must be replaced within the least sensitive delineated areas. With reference to the composite map shown in Figure 3-1 in Part B above, there is an area of significantly lower sensitivity south of the discard dump, amongst others, which can be considered for the remainder of the required mining infrastructure on Portions 1, 2 and 5 of the Farm Twyfelaar 298IT.

A Biodiversity off set report must be compiled in which the offset requirements and receiving area is identified, at this stage the removal of all AIP tree species and returning these areas to natural grasslands within the project are can be considered. The ecosystem processes patterns and services will possibly be enhanced with the removal of the AIP infestations from sensitive ecosystems such as wetlands, riparian areas all of which fall within the CBA's present on site and will increase the CBA percentage as defined by the Mpumalanga Conservation plan.

The EAP and Specialist team will be required to review the amended mine infrastructure layout and provided the opportunity to amend the respective impact assessments. The Applicant will amend the layout based on the outcomes of this impact assessment process. The full extent of the proposed Mining Right boundary has been assessed to establish the environmental baseline. Therefore, in some instances, the impacts may be reduced, but the directly affected communities, associated noise and dust impacts,

the Stormwater Management Plan will need to be reconsidered and associated assessment updated.

The financial provision for the environmental rehabilitation and closure requirements of mining operations is governed by NEMA, as amended, which provides in Section 24P that the holder of a mining right must make financial provision for rehabilitation of negative environmental impacts. The financial provision will be reviewed annually.

12 Item 2: Undertaking

The EAP herewith confirms: -

(e) the correctness of the information provided in the reports

(f) the inclusion of comments and inputs from stakeholders and I&APs ;

(g) the inclusion of inputs and recommendations from the specialist reports where relevant; and

(h) the acceptability of the project in relation to the finding of the assessment and level of mitigation proposed.

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Appendix A: EAP CV and Qualifications

Appendix B: Plans

Appendix C: Public Participation Materials

Appendix D: Soils, Land Capability and Land Use Assessment

Appendix E: Fauna and Flora Assessment

Appendix F: Wetlands Assessment

Appendix G: Aquatic Ecology Assessment

Appendix H: Surface Water Assessment

Appendix I: Groundwater Assessment

Appendix J: Heritage Assessment

Appendix K: Blasting Assessment

Appendix L: Air Quality Assessment

Appendix M: Noise Assessment

Appendix N: Traffic Assessment

Appendix O: Socio-economic Assessment

Appendix P: Rehabilitation and Closure Assessment