mineral resources

Department:
Mineral Resources
REPUBLIC OF SOUTH AFRICA

Draft Environmental Impact Assessment
And
Environmental Management Plan

for Listed Activities Associated with the Canyon Resources (Pty) Ltd, Proposed Palmietkuilen Mining Project near Springs, Gauteng

DMR Reference Number: GP 30/5/1/2/2(10047)MR

SUBMITTED FOR ENVIRONMENTAL AUTHORISATIONS IN TERMS OF THE NATIONAL ENVIRONMENTAL MANAGEMENT ACT, 1998 (ACT NO. 107 OF 2008) (NEMA) AND THE NATIONAL ENVIRONMENTAL MANAGEMENT: WASTE ACT, 2008 (ACT NO. 59 OF 2008) (NEM:WA) IN RESPECT OF LISTED ACTIVITIES THAT HAVE BEEN TRIGGERED BY APPLICATIONS IN TERMS OF THE MINERAL AND PETROLEUM RESOURCES DEVELOPMENT ACT, 2002 (ACT NO. 28 of 2008) AS AMENDED (MPRDA).

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File Reference Number SAMRAD:	GP 30/5/1/2/2(10047)MR

DIGBY WELLS
ENVIRONMENTAL

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 Canyon Resources (Pty) Ltd Proposed Palmietkuilen Mining Project near Springs, Gauteng**
Project Code:	**CNC4065**

Name	**Responsibility**	**Signature**	**Date**
Anita Gutu	Report compiler		January 2017
Stephanie Aken	Project Manager and 1st Review		February 2017
Mellerson Pillay	EXCO Review		February 2017

Public Review Period: 31 March 2017 – 03 May 2017

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

Pandospan (Pty) Ltd (Pandospan) concluded a contract with Anglo Operations Limited (AOL) in support of the acquisition of a Prospecting Right for coal (DMR Ref. No. GP 30/5/1/1/2 (201/10026) PR). Pandospan forms part of the Canyon Group of Companies for which Canyon Coal functions as the operational division. The enviro-legal applications for the Project will be managed by Pandospan on behalf of AOL, the Project applicant.

Canyon Coal is planning the development of a new opencast coal mining operation located near Springs within the Gauteng Province to be known as the Proposed Palmietkuilen Mining Project (the Project). A coal processing plant and associated infrastructure will also be constructed. The Project is a greenfields development planned on Portions 1, 2, 4, 9, 13 and 19 of the Farm Palmietkuilen 241 IR.

Coal mining will be undertaken by conventional truck and shovel operations. The Run-of-mine (ROM) coal will be processed at the proposed plant on site and sold to local and export markets.

In terms of the requirements of the Minerals and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002), (MPRDA) as amended, a Mining Right Application (MRA) must be submitted to the Department of Mineral Resources (DMR) for the proposed project. In support of the MRA, an Environmental Impact Assessment (EIA) process must be undertaken in accordance with the EIA Regulations, 2014 (promulgated in terms of the National Environmental Management Act, 1998 (Act No. 107 of 1998), as amended (NEMA). The EIA process will include the following applications:

- An Environmental Authorisation (EA) for listed activities as contained in Government Notice Regulations (GN R) GN R984 and R985);
- Waste Management Licence (WML) in terms of the National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008) (NEM: WA);
- Heritage Resources Management (HRM) Process in accordance with section 38(8) of the National Heritage Resources Act, 1999 (Act No. 25 of 1999) (NHRA); and
- An Integrated Water Use Licence Application (IWULA) in terms of the National Water Act, 1998 (Act No. 36 of 1998) (NWA) will also be made for water uses associated with the proposed project.

A MRA for the proposed Project was submitted to the DMR on 23 August 2016 to begin the process and in order to receive a reference number. An application for EA was subsequently lodged with the DMR. This EIA Report, which relates specifically to the Palmietkuilen Mining Right applied for, has been compiled in accordance with the MPRDA read together with the EIA Regulations, 2014.

Digby Wells Environmental (Digby Wells) has been appointed by Canyon Coal as the independent Environmental Assessment Practitioner (EAP) to conduct an EIA and the associated specialist studies for the proposed Project.

Project applicant

The particulars for the Project applicant are detailed in the table below.

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Project overview

The proposed Project involves the development of a new open pit coal mine and the associated supporting infrastructure. The coal resource will be mined using open pit methods due to the seemly depth of the coal reserve (between 12 and 60 m below the surface). Bench mining and strip mining techniques are proposed. Bench mining involves the development of an open pit through a series of benches at varying depths while strip mining involves the movement of overburden laterally to an adjacent empty pit where the mineral has already been extracted. The proposed project will include one open pit.

Topsoil and subsoil will be stripped using an excavator and will be stored in separate stockpile areas on the mining area. Drilling and blasting will be employed for the hard overburden or bedrock to expose the coal seams. Once blasted, the hard overburden will be excavated and stockpiled separately for rehabilitation purposes. The mined coal from the open pit will be transported via the haul roads and stored on the ROM stockpile area in the plant area. The coal will be fed into a crushing and washing plant with a conveyor after which the coal product will be temporarily stored at the product stockpile area before being transported to the Welgedacht Railway Siding for distribution or directly via truck to the relevant markets. A temporary discard dump containing one year's capacity will be constructed to store discard before being either rewashed or backfilled (preferred) into mined out areas.

The key infrastructure will include:

- Open pit mining;
- Processing Plant and Fuel Storage;
- Haul roads from pit to plant and from plant to mine access point, and various conveyor belts;
- Overburden dumps and ROM Stockpile Area;

- Discard disposal facility (slurry dam and discard dump);
- Pollution Control Dam (PCD), Stormwater Trenches and Sewage management systems; and
- Site Offices and Security Offices.

The current resource is estimated at 125.98 Mt. The life of mine for the Project is 53 years including a 2 year ramp-up period. Once the mine has been established a full production rate of 200 000 t / month will be maintained for 51 years.

Need and Desirability of the Project

The Integrated Environmental Management Guideline Series 9: Guideline on Need and Desirability was promulgated in terms of the Environmental Impact Assessment (EIA) Regulations, 2010 in Government Notice 891 of 2014. According to these guidelines, the consideration of “need and desirability” in EIA decision-making requires the consideration of the strategic context of the proposed Project along with the broader public interest and societal needs. The guidelines further state that the development must not exceed ecological limits and the proposed actions must be measured against the short-term and long-term public interest to promote justifiable social and economic development, essentially ensuring the simultaneous achievement of the triple bottom line.

The need and desirability of the proposed Project was therefore assessed in terms of its economic and social benefits while highlighting how the inevitable adverse environmental impacts will be addressed.

It is recognised that mining activities are an essential component of South Africa’s economic development. According to the Chamber of Mines of South Africa’s Integrated Annual Review (2015) the mining sector accounted for 7.7% of South Africa’s Gross Domestic Product (GDP) directly, and approximately 17% if direct, indirect and induced effects are included. Coal specifically is a national requirement to meet the demand for electricity supply. According to the Chamber of Mines (2015) coal provides 81% of the power generated within South Africa with imminent future expansions. South Africa is home to 3.5% of the world’s coal reserves thus it is likely that coal will continue to be utilised as a significant part of the energy mix. The National Development Plan 2030 (NDP) identifies the sufficient production of energy to support industry and providing access to poor households as an enabling milestone toward the reduction of inequality and elimination of income poverty by the year 2030 (National Planning Commission, 2011). It is therefore essential that sufficient coal resources are available to meet the demand required for electricity generation. The coal that would be produced through the proposed Project would be of suitable quality for use in local markets.

In addition to providing an essential resource for power generation in South Africa, the proposed project will have knock-on benefits. These include tax contributions, an overall improvement of the local socio-economic profile job creation and procurement.

The Lesedi Local Municipality and Wards affected by this Project experience unemployment rates between 11 % and 19 % and the Project could assist in alleviating some of this unemployment. It is anticipated that the proposed Project will likely employ a total of 320 permanent employees with preference given to Historically Disadvantaged South African (HDSA) candidates. The Social and Labour Plan (SLP) stipulates that the Applicant will search for employees within the directly affected wards. The Applicant will also provide skills development to employees thereby advancing the future employability of these individuals.

The project will inevitably result in adverse impacts to the environment. As part of the EIA process, specialist studies which relate to the physical, biological and socio-economic environmental aspects were undertaken. Sensitive environments have been identified as part of the baseline investigation which informed the impact assessment provided in Section 10.1 of this report. Mitigation and management measures have been provided for each potential impact to the direct environment as well as surrounding receptors and stipulated buffer zones will be implemented where necessary.

Purpose of this report

The purpose of the EIA process is to ensure that potential environmental and social impacts associated with 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.

Various specialist studies were undertaken during the Project evaluation to inform the EIA/EMP. These include:

- Soil, Land Use and Land Capabilities Assessment;
- Surface Water Assessment;
- Groundwater Assessment;
- Geochemistry Assessment;
- Fauna and Flora Assessment;
- Wetland Assessment;
- Aquatic Ecology Assessment;
- Air Quality Assessment;
- Noise Assessment;
- Visual Assessment;
- Blasting and Vibration Assessment;
- Cultural Heritage Assessment;
- Social Assessment;

- Economic Impact Assessment;
- Traffic Assessment; and
- Rehabilitation and Closure Assessment.

A summary of the baseline environment is presented in Section **Error! Reference source ot found.** (Part A). Various environmental monitoring plans are included in Section **Error! Reference source not found.** (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.

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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 (CRR) (Appendix B) and were used to refine the scope of specialist studies. The CRR will be updated after the next public review.

This draft EIA/EMP report will be submitted to the public for their input and comments for a period of 30 days. The commenting period is from the on 31 March 2017 and ends on 03 May 2017. The draft EIA/EMP is available for review at the locations listed below and is also available on the Digby Wells website (www.digbywells.com). Electronic copies (CDs) are available from the Digby Wells Public Participation Office.

- Bakerton Public Library;
- Delmas Public Library;
- Springs Public Library;
- Vischkuil Clinic (Endicott); and

- Digby Wells' website.

Community, public and focus group meetings will be held during this commenting period to present the draft EIA/EMP and obtain comments from the Interested and Affected Parties (I&APs). The draft EIA/EMP will be updated with all the comments received from the I&APs prior to submission to the DMR for consideration. Once the DMR has made a decision this will be communicated to all the registered I&APs.

Project alternatives

The alternatives considered for the Project include the infrastructure layout (including location of the boxcut and boxcut spoils and soil stockpiles), the method of mining, the transportation of coal off site, routing alternatives and the "No-Go" alternative. In terms of the location of the mine, alternative sites were not considered as the location of the mineral resource determines the location of a mining operation.

The wetlands present on site have been excluded from the pit and infrastructure areas as far as possible; however, five largely modified pans are still located on the area to be affected by the open pit. The layout has taken into consideration the location of other pans on site and has therefore been designed to utilise the least amount of surface area to accommodate mining-related infrastructure. The layout has also moved the mining footprint to ensure a buffer between the surrounding residential areas, Aston Lake and the Blesbokspruit.

The proposed alternatives for coal extraction consider underground versus open pit mining. The coal seams within the Project area are too shallow (between 12 and 60 m below the surface) to warrant underground mining and therefore open pit mining is the preferred alternative. Evidence of environmental degradation due to shallow underground mining is very visible in adjacent properties.

The alternatives that were considered during the EIA phase comprised the transportation of coal via road and/ or rail. Canyon Coal has an in principle lease agreement with Transnet Freight Rail for the use of Welgedacht Railway Siding which is linked to the surrounding rail networks. The transportation of coal product from site to the rail siding will be undertaken by trucks using the existing road network on site. The alternative is to use trucks to transport coal product directly to market or to use conveyors to transport coal product to the siding. The preferred alternative is to use the rail siding. The benefit of utilising the existing siding will, inter alia, reduce the number of coal trucks on the roads in the surrounding area.

Routing alternatives were considered for linear infrastructure, namely the powerline and road route. In addition to the use of diesel generators at the Project site, AOL intends to either construct an 10 MVA substation within the Mining Right Ares at the northern office complex to secure power supply for the operation of the proposed mine or obtain power from the existing Ukufisa Substation located west of the Mining Right area. Three options were considered for the powerline route which took into consideration existing servitudes as well as sensitive environmental features along the routes. The preferred powerline route traverses through portions of the wetland as well as a portion of an existing road servitude.

Four existing road options were considered for hauling operations from the mine to the Welgedacht rail siding. The route will be used by 34-ton trucks, thus the capacity and traffic along the road was considered. The preferred road option does not traverse through a residential area and has sufficient capacity for additional traffic from the mine development.

Baseline Environment

The table below provides a brief summary of the baseline environment as determined during the specialist studies.

Aspect	Baseline Summary
Soil, Land Use and Land Capabilities	The Project area is dominated by Hutton and Clovelly soil forms with portions of Westleigh, Kroonstad, Mispah, Katspruit, Arcadia and Glencoe soils. The land capability is dominated by the Class II (Intensive cultivation), followed by Class III (Moderate cultivation) and Class v (Wet zones). The most dominant land use within the project area is cultivated areas followed by grasslands, shrubland and woodlands. The fertility status of the soils is generally considered moderate to high. The site had low soil pH and there is a need to add lime to remedy soil acidity. All of the soil samples collected on the site show the profile of Ca>Mg>K>>Na concentrations as expected. Soils had low organic carbon levels. The Cation Exchange Capacity (CEC) of the soils was moderate to high and soils are capable of retaining mineral elements. The soil can be described as texturally variable, containing a mixture of sandy clay loam, loamy sand and sandy loam. The dominant soils, the Hutton and Clovelly forms have high agricultural potential, Westleigh has low potential and Arcadia has a low potential in its wetland setting but this can be moderate to high under suitable management.
Fauna and Flora	The Project area is located within the threatened ecosystems: Blesbokspruit Highvled Grassland. According to the Gauteng C-Plan the wetlands throughout the Project area is regarded as Important Areas, with a small patch of Irreplaceable habitat being present in the south according to the Gauteng C-Plan. The results of the field investigations confirm that the irreplaceable areas are intact natural systems and should be conserved, and if disturbed off sets will be required.
Surface Water	The proposed Project is within the Aston Lake catchment, surrounded by wetlands and drained by the the Dwars-in-die-wegvlei and the Verdrietlaagte stream on either sides. The Lake discharge flows into the Blesbokspruit. The Project Area is situated within the Vaal Water Management Area (WMA 5), within quaternary catchments C21E and it falls within the Sedibeng District Municipality and borders of the Mpumalanga Province. The identified infrastructure areas amount to approximately 10.72

	km^2. The percentage loss in Mean Annual Runoff (MAR) for the C21E quaternary catchment due to the project will amount to approximately 1.7% of the total MAR. The Infrastructure is approximately 3.1% of total catchment area for the Aston Lake (344 km^2) and this would imply a loss of only 3.1 % catchment runoff are to the Aston Lake. The water quality results indicated the following: ■ pH exceeded the South African Water Quality Guidelines (SWQG) Agriculture: Irrigation limit in all samples, which has high possibility of affecting yield, decreasing marketable products for farmers but is within the range for other limits; ■ Turbidity exceeded SWQG Agriculture: Domestic Use limit and the SANS 241-2015 drinking water quality standards in all samples; ■ One sampling point has elevated levels of EC, Ca, Mg, Na, Cl, Total Hardness and Turbidity beyond the SWQG: Domestic Use limit. Cl found in this sample also exceeds SWQG: Agriculture (Irrigation) Limit. The elevated levels of salts could be attributed to the concentration of these elements due to evaporation in the dry season; ■ The water quality at Aston Lake had elevated Al and Fe exceeding SWQG Domestic Use, Turbidity exceeding beyond both SANS 241-2015 drinking water quality standards and SWQG: Domestic Use limit with SS exceeding SWQG: Agriculture (Irrigation) Limit; and ■ When benchmarked against the Blesbokspruit Water Quality Objectives (WQO), the pH at Aston Lake and SW01 as well as the Aluminium at Aston Lake exceed the limits. The Aluminium levels in Aston Lake can be attributed to the slightly elevated pH levels as Aluminium levels in dissolved state increase at higher and lower pH than 5.5 - 9.0 (WHO, 2003) Aluminium naturally occurs in waters in very low concentrations. Higher concentrations derived from mining waste may negatively affect aquatic communities. Aluminium is toxic to fish in acidic, unbuffered waters starting at a concentration of 0.1 mg/L. The results of the flood elevations are that none of the infrastructure proposed in the immediate future is within the determined Dwars-in-die-wegvlei floodlines except the proposed haul road which crosses the floodlines. It is important to note that the floodlines methodology used is conservative and considered a worst case scenario given up to the 1:50 and 1:100 year flood peak.

Groundwater	Groundwater use in the immediate vicinity of the Palmietkuilen project area include domestic and drinking water supply. Ten groundwater samples were collected during the hydrocensus and analysed by SANAS accredited laboratory in Pretoria (Aquatico). Water levels were found to be generally shallow ranging between 1 mbgl and 16.27 mbgl (from boreholes that are not used). The groundwater flow direction follows the surface topography. Therefore, groundwater will flow from highest to lowest elevation, in the direction of surface water drainage. Groundwater generally flows towards the nearby wetland and Aston lake. Only three boreholes intersected fractures yielding above 0.5 l\s and the rest were below 0.5l\. The hydraulic conductivity in the aquifers intersected during the drilling is low ranging between 0.007 m\d and 0.154 m\d and could act as retarding factor when contaminant flow arises. The water quality is generally good and suitable for drinking and well within the South African National Standards for drinking water with the exception of borehole WNBH1, SCBH01 and SCCBH1 with elevated nitres.
Wetland	The proposed Mining Right Area is characterised by multiple wetland systems, totalling 1,550.4 ha of the 3 422ha. There are two major valley bottom systems, which flow into the Blesbokspruit Ramsar Wetland approximately 6.5km South West of the proposed Project infrastructure. The one system has a large dam and this is referred to as Aston Lake. The remainder of the area is characterised by extensive hillslope seeps that drain into the valley bottom wetlands and pan wetlands at the tops of the hills. The wetlands have been largely transformed by agricultural activities, compromising the natural ecological functioning and biodiversity maintenance role of these wetlands. However, the wetlands and landscape will play an important ecological role as they are tributaries to the Blesbokspruit Ramsar Wetland of International Importance and the Marievale Bird Sanctuary. Additionally, most of the project area is mapped as Ecological Support Areas according to the provincial conservation plan whilst some wetlands are Critical Biodiversity Areas. The wetlands are providing important hydrological services such as flood attenuation, streamflow regulation during low flow periods and water quality improvement. The wetlands are important for the provision of the crops and for the cattle raised on the properties. Furthermore, these wetlands are an important water source for the land owners and surrounding communities. Due to the significant extent of hillslope seep wetlands, which indicate perched groundwater, the wetlands will also play an important role in catchment water recharge.

Aquatic Ecology	In order to determine the baseline ecological status of rivers associated with the proposed Project, two river reaches of the C21E quaternary catchment were assessed on a bi-annual basis. Applying standard River Ecosystem Monitoring Programme techniques the Present Ecological Status (PES) of the river reaches was determined. The results of the assessment derived an overall PES class of largely/seriously modified (class D/E). This class was derived due to the existing habitat impacts within the catchment area. The central cause of the poor ecological status was found to be associated with various agricultural practices which have resulted in habitat modification of the assessed river reaches.
Air Quality	Dust deposition data were available from a network of monitoring setup by the mine. However PM_{10}, $PM_{2.5}$ and gaseous pollutants data were not available to assess background scenario. For the dust deposition data, deposition rates measured showed that the area occasionally experiences level higher than the residential and non-residential limits. As such, contributions from the mine may result in exceedances of the regulatory limits in the area.
Noise	The baseline ambient day and night time soundscape ranges between 44 dBA and 54 dBA and mainly typical of rural districts with intermittent road traffic. Based on the daytime results from the noise measurements it is noted that the LAeq levels predominantly measured above the SANS guideline for the maximum allowable outdoor daytime rating level for ambient noise in rural districts (45 dBA), with the background noise levels (LA90) measuring below the daytime rating level guideline for rural districts (45 dBA). Based on the night time results from the noise measurements it is noted that the LAeq levels predominantly measured above the SANS guideline for the maximum allowable outdoor night time rating level for ambient noise in suburban districts (40 dBA) as well as rural districts (35 dBA), with the background noise levels (LA90) ranging from below to similar to the night time rating level guideline for suburban districts (40 dBA).
Visual	Theoretical and practical viewshed models were created for the Project. These viewshed models are based on the topography only and do not take the screening effect of vegetation into account. The viewshed models show the areas from which the Project may potentially be visible. The theoretical viewshed model was refined to daytime and night time practical viewshed models with a buffer of 10 km around the proposed infrastructure and divided into areas that are likely to experience different categories of visual exposure. Due to the nature of the receiving environment it is unlikely that the proposed infrastructure and associated night time lighting will be noticeable

	beyond this 10 km buffer. The practical viewshed models cover an area of approximately 275.79 km². The potential visual receptors identified within the daytime and night time practical viewshed areas include residents of the towns and settlements within 10 km of the proposed infrastructure (Daggafontein, Eloff, Endicott, Largo, Strubenvale, Sundra, Vischkuil and Welgedacht), residents of the surrounding farms and small holdings (2 022 receptor points), road users of the N17 national route, the R29, R42 and R555 regional roads, secondary roads and farm roads and visitors to the Blesbokspruit Ramsar Site and Important Bird Area (IBA) and the Marievale Nature Reserve and Bird Sanctuary.
Cultural Heritage	The cultural heritage assessment considered the cultural landscape identified, the distribution of known heritage resources, the designated CS and the potential of heritage resources to be impacted upon by project related activities. Within the local Project area, a total of 158 heritage resources were identified ranging from the (Late Farming Community) LFC through to historical period. Of these, seven occur within the site-specific study area. The identified historical built environment resources were determined to have a negligible Cultural Significance (CS) designation and were excluded from the impact assessment. Two gravesites, BGG-001 and BGG-002 are situated within the development footprint and will be directly impact upon by project related activities. The construction phase of the Project presents the greatest likelihood for direct negative impacts on the burial grounds BGG-001 and BGG-002 to manifest. Based on the location of these resources, the identified direct impacts include the destruction of the burial grounds and graves.
Social	The Project area is situated within Sedibeng District Municipality (SDM), which comprise three local municipalities (LMs); Midvaal, Emfuleni and Lesedi. The Mining Right Area is located entirely within Ward 12 of Lesedi Local Municipality (LLM) and directly borders Ward 7 of the Victor Khanye LM (VKLM), located in the Nkangala District Municipality (Mpumalanga Province) and Ward 75 and 76 of the Ekurhuleni Metropolitan Municipality (EMM). Human settlements closest to the site include Aston Lake and Prosperity (directly adjacent), Endicott and Vischkuil (2km south), Sundra (2.5km north), Welgedacht (3km north-west) and Springs (4km east). Agricultural activities within the Project area comprise irrigated and dry-land commercial maize and soya farming operations. Farmlands are under the ownership of privately owned companies and generally produce for the local market within Gauteng and Mpumalanga. Farmland is either used by owners or leased out on an annual basis to other farmers who will cultivate the land and/or

	use it to graze livestock. Farms provide permanent employment for a number of permanent employees, which include unskilled farm labour and semi-skilled managerial staff. Farming operations are solely dependent on ground and surface water as well as extensive support infrastructure, which include pivoted irrigation systems, warehouses, workshops, farm office and worker accommodation, etc. The age distribution of the surveyed population indicates a relatively old population with only 17% of household members being younger than 10 years, and an average age of almost 30 years. The population's gender ratio indicates that females and males are equally distributed. The average household size (calculated by dividing the total number of household members recorded during the survey by the number of surveyed households) is between four and five members. It is relatively uncommon for extended family members to share the same household. In addition to permanent household members several homesteads also offer accommodation to tenants. Just more than a quarter of households (27%) rent out rooms to tenants, with the average number of tenants per affected household being between two and three persons. The survey recorded a total of 30 tenants. School attendance is relatively high amongst those of school going age (6-18 years), with most children (83%) attending primary school. Attendance varies considerably between boys (94%) and girls (69%), with attendance amongst girls being 25% lower.
Economic	The economic baseline revealed that the LLM is a relatively small economy and makes a minor contribution towards the economies of the Sedibeng DM and Gauteng Province, although the economy has shown above average growth in the past few years mainly due to the growing tertiary industries. In addition, the primary sector has a negligible impact on employment and GDP in the local economy of Lesedi. Lastly, the municipality is dominated by low-income earners. The planned mining project should improve these economic shortcomings. Providing employment to the local labour will have a major impact on the employment creation, skills development, household earnings and local economy activity. The assessment of the current economic state in LLM, the profile of the zone of influence, and the project itself revealed that the proposed mining activity will create numerous positive impacts and will likely stimulate the local economy. The stimulation of the national economy will occur as a result of the investment into the mine and proceeding increase in production. The subsequent benefits are employment creation, a rise in consumption levels, new business sales, and a contribution to GDP.
Traffic	The existing road network surrounding the Project area includes

	the following roads: ■ Road R29 (also referred to as Ermelo Road) is a single lane road running in an east-west direction to the south of the Project site. The road links Springs and surrounding area with areas such as Delmas. Road R29 falls under the jurisdiction of the Gauteng Provincial Administration; ■ Road D1133 is a single lane surfaced road for a distance of approximately 950m (measured from the R29/D1133 intersection. The remaining section of the road has a gravel surface. Road D1133 falls under the jurisdiction of the Gauteng Provincial Administration; ■ The road serving Aston Lake is a surfaced road to the west of the Project site. The road falls under the jurisdiction of the Ekurhuleni Municipality; ■ Road D1255 is a gravel road serving only the farming community abutting the road to the north of the Project site. Road D1255 falls under the jurisdiction of the Gauteng Provincial Administration; ■ Milner Street is a single lane road running in a north-southern direction. The road services the Welgedacht residential area, as well as the rail siding located to the north-west of the applicant site. The road falls under the jurisdiction of the Ekurhuleni Municipality; and ■ Welgedacht Road/Main Road runs in a west to northern direction. The road links the study area with Springs to the south and the N12 in the north. The road is a single lane road with road widening at the intersection with Milner Street. The Welgedacht Road/Main Road & Milner Street is signalised. Welgedacht Road/Main Road falls under the jurisdiction of the Gauteng Provincial Administration. It is anticipated that the mine staff and contractors as well as deliveries will access the mine Weltevreden/Main Road & Milner Street intersection along Road D1255. While hauling operations outside of the mine will operate between the main access proposed on Road D1125 and the Welgedacht Railway Siding (route located to the north-west of the site) as this proposed route will not take the hauling trucks through any residential area. The haul road has an unsurfaced section, which from a traffic engineering viewpoint has sufficient capacity to accommodate the additional development traffic, as well as a surfaced more narrow section in the eastbound direction. The route will be used by 393 x 34-ton interlink truck trip per day. However, a registered professional engineer will have to determine whether the structural strength of the pavement layers is sufficient to accommodate the

	truck traffic.

Impact Assessment Summary

The EIA/EMP report, the associated specialist studies and the PPP have been undertaken and completed in line with the legislative requirements discussed in Section **Error! eference source not found.** (Part A) of this report. A quantitative impact rating methodology was applied to determine the significance of the expected impacts pre-mitigation and post-mitigation. Table A, Table B and Table C provide a summary of the key impacts (of moderate and major significance only) expected during the various phases of the project. Section **Error! Reference source not found.** (Part A) of this report lists and assesses all the potential impacts, together with the associated mitigation measures.

Table A: Summary of the **Key** Impacts during the Construction Phase

Aspects Affected	Potential Site Specific Impact	Prior to Mitigation Significance	Post-Mitigation Significance
Soil, Land Use and Land Capability	Loss of topsoil as a resource and soil compaction from heavy machinery and vehicles during site clearance	Moderate (negative)	Minor (negative)
	Loss of land capability	Major (negative)	Major (negative)
Flora and Fauna	Loss of *Eragrostis* – dominated Grassland	Moderate (negative)	Minor (negative)
	Loss of Riparian areas, Wetlands and Pans	Moderate (negative)	Minor (negative)
Surface water	Alteration in surface water drainage patterns and a reduction in the amount of water reaching the Aston Lake and reduced flow to Blesbokspruit	Moderate (negative)	Minor (negative)
Wetlands	Loss of wetland habitat (soils and vegetation) totalling 53.3 ha for infrastructure and 201.9 ha associated with the open pit area.	Major (negative)	Major (negative)
Noise	Noise emanating from the machinery and vehicles operating during the construction activities	Moderate (negative)	Negligible (negative)
Heritage	Direct impact to burial grounds and graves	Moderate (negative)	Negligible (negative)
Visual	The Project area will become noticeable to nearby receptors as it will contrast the surrounding areas.	Moderate (negative)	Minor (negative)
	The surface infrastructure will change the sense of place of the Project area from an agricultural sense of	Moderate (negative)	Minor (negative)

	place to an industrial / mining sense of place. Construction area lighting at night will have a negative visual impact on the receiving environment. The construction area lighting will be visible from a distance of up to 10 km and will draw attention to the Project area.		
Social	Displacement as a result of site clearance	Major (negative)	Moderate (negative)
	Influx of job seekers in area creating a social disruption	Moderate (negative)	Minor (negative)
	Nuisance impacts on surrounding land users (mainly noise, blasting, dust etc.)	Moderate (negative)	Minor (negative)
	Inherent risk on community health and safety	Moderate (negative)	Negligible (negative)
Macro-Economic	Increase in Production (economic activity, job taxes etc.)	Moderate (positive)	Moderate (positive)
	Impact on Agricultural Production due to Sterilisation of Productive Agricultural Land	Major (negative)	Moderate (negative)

Table B: Summary of the **Key** Impacts during the Operational Phase

Aspects Affected	**Potential Site Specific Impact**	**Prior to Mitigation Significance**	**Post-Mitigation Significance**
Soil, Land Use and Land Capability	Topsoil losses can occur during the operational phase as a result of rainwater runoff and wind erosion from roads and soil stockpiles.	Moderate (negative)	Minor (negative)
	When topsoil is removed from the open pit, land capability is reduced to nothing. The land use will be change from intensive cultivation to mining.	Major (negative)	Moderate (negative)
Surface Water	Development and operation of surface infrastructure resulting in water contamination leading to deterioration of water quality	Moderate (negative)	Minor (negative)
Groundwater	Reduction of groundwater quantity as a result of mine dewatering	Moderate (negative)	Moderate (negative)
Wetlands	Operational activities will be occurring within an ecologically sensitive catchment and thus the handling, stockpiling and transport of the coal will have some impacts to the wetlands, particularly with respect to the haul road that crosses the NFEPA Rank 1 wetland, upstream of Aston Lake. Movement of coal	Moderate (negative)	Minor (negative)

	openly through the environment will have some deposition of coal fines that will negatively impact the surrounding environment, particularly water quality.		
	Perforation of rock and groundwater reserves leading to severe hydrological and geomorphological impacts to wetlands and catchment due to draw down cone.	Major (negative)	Major (negative)
Aquatic Ecology	Runoff from the dirty water areas reporting into the Aston Lake and the unnamed streams flowing to it resulting in water contamination or the deterioration of the water quality.	Moderate (negative)	Moderate (negative)
	Reduction of catchment yield as dirty water runoff within the mine will be contained in the PCD. Groundwater loss and flow from the pit will also contribute toward baseflow reduction.	Moderate (negative)	Moderate (negative)
	Reduction in air quality due to gaseous emissions	Moderate (negative)	Negligible (negative)
	Loading, Hauling and Stockpiling of ROM Coal and Overburden will result in result in fugitive emissions and reduction in air quality	Moderate (negative)	Minor (negative)
Noise	Noise will emanate from the machinery and vehicles operating during the operational activities	Moderate (negative)	Minor (negative)
Visual	As the Project area is stripped it will become noticeable to nearby receptors as it will contrast the surrounding area.	Moderate (negative)	Minor (negative)
	Removal of overburden (including drilling and blasting of hard overburden) will have a negative visual impact on the receiving environment. Drilling and blasting will result in noise and dust thereby attracting attention to the Project area. Dust from blasting will have a negative visual impact. The open pit will dramatically contrast the surrounding agricultural area as it will result in a scar on the landscape.	Moderate (negative)	Moderate (negative)
	Stockpiling of overburden (including topsoil, soft overburden and hard overburden) will have a negative visual impact on the receiving environment. Dust from the stockpiles will also have a negative visual impact. The impact of the stockpiles will occur for the life of the Project. This impact will be reversed when the material from the stockpiles is used to backfill the open pit (soft overburden and hard overburden) and rehabilitate the Project area (topsoil) during the decommissioning and closure phase.	Moderate (negative)	Moderate (negative)

	Plant area lighting at night will have a negative visual impact on the receiving environment. The plant area lighting will be visible from a distance of up to 10 km and will draw attention to the Project area. This will also have a negative impact on the sense of place.	Moderate (negative)	Moderate (negative)
	Drilling and blasting of coal will have a negative visual impact on the receiving environment. Drilling and blasting will result in noise and dust thereby attracting attention to the Project area. Dust from blasting will have a negative visual impact. The open pit will dramatically contrast the surrounding agricultural area as it will result in a scar on the landscape. Once coal is removed from the open pit there will be insufficient material to backfill the open pit completely and a void will remain. This will result in a permanent and irreversible negative visual impact on the receiving environment.	Major (negative)	Moderate (negative)
	Disposal of discard from the washing plant on the discard dump will have a negative visual impact on the receiving environment that will occur for the life of the Project.	Moderate (negative)	Moderate (negative)
Blast and Vibrations	Ground vibration at surrounding houses	Moderate (negative)	Negligible (negative)
	Fly Rock impact on houses	Moderate (negative)	Negligible (negative)
	Fly Rock impact on roads	Moderate (negative)	Negligible (negative)
Heritage	Direct impact to burial grounds and graves during years 40 – 45 of the LoM	Major (negative)	Moderate (negative)
-Economic	Impact on Production	Moderate (positive)	Moderate (positive)
	Impact on GDP	Moderate (positive)	Moderate (positive)
	Impact on Employment	Moderate (positive)	Moderate (positive)
	Impact on Skills Development	Moderate (positive)	Moderate (positive)
	Impact on Household Income	Moderate (positive)	Moderate (positive)
	Impact on Government Revenue	Moderate (positive)	Moderate (positive)

Table C: Summary of the **Key** Impacts during the Decommissioning and Post Closure Phase

Aspects Affected	Potential Impact	Prior to Mitigation Significance	Post-Mitigation Significance
Soil, Land Use and Land Capability	Decommissioning and rehabilitation of the infrastructure and open pit areas could cause erosion and compaction if rehabilitation is not done correctly. Heavy machinery driving continuously over rehabilitated areas may result in compaction which could impact on plant rooting depth which then would have an impact to vegetation establishment.	Moderate (negative)	Minor (negative)
	Backfilling of soil material layers will impact on land capability and land use. Infrastructure area will be rehabilitated and the land capability may be restoring to pre-mining land capability.	Moderate (negative)	Minor (negative)
	Rehabilitation of infrastructure footprint areas	Moderate (positive)	Moderate (positive)
	Post-mining water decant is predicted to occur once the final void has been rehabilitated and groundwater levels are allowed to return back to natural level. It is anticipated that this decant will be acid forming (acid mine draining, AMD).	Major (negative)	Moderate (negative)
	Post-mining decant of groundwater will have negative impacts on the downstream water quality	Major (negative)	Minor (negative)
Groundwater	Groundwater Contamination after closure	Moderate (negative)	Minor (negative)
	Mine decanting and contamination of surface water bodies	Moderate (negative)	Negligible (negative)
Wetlands	Post-mining water decant is predicted to occur once the final void has been rehabilitated and groundwater levels are allowed to return back to natural level. It is anticipated that this decant will be acid forming (acid mine draining, AMD).	Major (negative)	Moderate (negative)
Aquatic Ecology	Post-mining decant of groundwater will have negative impacts on the downstream water quality	Major (negative)	Minor (negative)
Social	Dependency on mine for sustaining local economy	Moderate	Minor

		(negative)	(negative)

Conclusions and recommendations

Various specialist studies were undertaken during the EIA Phase of the Project with the objective of identifying and weighing anticipated impacts and risks associated with the activities. The findings of the impact assessment have shown that the Project will have some major adverse impacts on the receiving environment. This mainly pertains to the loss of wetland habitat for the creation of the open pit, significant alterations of the two subcatchments of Aston Lake and the subsequent amount of water reporting to Aston Lake as well as increased sedimentation of surface water resources which may also impact aquatic biota, reduction in catchment yields, nuisance noise, dust and visual impacts, displacement of households located in the proposed open pit footprint as well as an irreversible impact to the land use and the overall land capability. Where possible, mitigation and management measures, no-go areas, as well as further recommendations have been provided by specialist which in reducing the significance of impacts to minor or negligible significance. Monitoring plans, which should be implemented throughout the life of the mine, have also been provided to ensure that adverse impacts are realised and continuous improvements are developed.

If the proposed Project is authorised some positive social and economic impacts will be realised at local, regional and national level. Nationally, the Project will contribute coal requirement to meet the demand for electricity supply as well as knock-on benefits such as tax contributions. At regional and local level, the Project has the potential to improve local socio-economic profiles through job creation, development of SMMEs and skills development.

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Part A: Scope of Assessment and Environmental Impact Assessment Report

1 Introduction

Pandospan (Pty) Ltd (Pandospan) concluded a contract with Anglo Operations Limited (AOL) in support of the acquisition of a Prospecting Right for coal (DMR Ref. No. GP 30/5/1/1/2 (201/10026) PR). Pandospan forms part of the Canyon Group of Companies for which Canyon Coal functions as the operational division. The enviro-legal applications for the Project will be managed by Pandospan on behalf of AOL, the Project applicant.

Canyon Coal is planning the development of a new opencast coal mining operation located near Springs within the Gauteng Province to be known as the Palmietkuilen Mining Project. A coal processing plant and associated infrastructure will also be constructed. The Project is a greenfields development planned on Portions 1, 2, 4, 9, 13 and 19 of the Farm Palmietkuilen 241 IR.

Coal mining will be undertaken by conventional truck and shovel operations. The Run-of-mine (ROM) coal will be processed at the proposed plant on site and sold to local and export markets. The key infrastructure will include:

- Open pit mining;
- Processing Plant and Fuel Storage;
- Haul roads from pit to plant and from plant to mine access point, and various conveyor belts;
- Various overburden dumps and ROM Stockpile Area;
- Discard disposal facilities (slurry dam and discard dump);
- Pollution Control Dam (PCD), Stormwater Trenches and Sewage management systems; and
- Site Offices and Security Offices.

2 Item 3: Project applicant

Name of Applicant:	Anglo Operations Limited
Tel no:	011 638 3589
Fax no:	011 638 4608
Postal Address:	PO Box 62179, Marshlltown, 2017
Physical Address:	55 Marshall Street, Johannesburg, 2001
File Reference Number SAMRAD:	GP 30/5/1/2/2(10047)MR

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

Digby Wells has been appointed by the Applicant as the independent Environmental Assessment Practitioner (EAP) to conduct the EIA/EMP in accordance with National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA) as well as the Public Participation Process (PPP). Digby Wells is a South African company with international expertise that offers innovative and comprehensive environmental and social solutions, with specific focus on the mining and energy industries. The details of the EAP undertaking the EIA process are provided in Table 2-1 below.

Table 2-1: Contact details of the EAP

Name of Practitioner:	Stephanie Aken
Telephone:	011 789 9495
Fax:	011 069 6801
Email:	stephanie.aken@digbywells.com

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

2.2.1 The qualifications of the EAP

Ms Aken holds the following degrees/diplomas:

- BSc Zoology and Entomology, Rhodes University, 2003;
- BSc Hons, Rhodes University, 2004; and
- Post-grad diploma in Environmental Science, Wits University, 2014.

The EAP's Certificates and CV are attached as Appendix A.

2.2.2 Summary of the EAP's past experience

Ms Aken has eight years' experience as an Environmental Consultant and has participated in various projects for different commodities. Her involvement has ranged from project manager to undertaking various specialist studies, including public consultation, from initiation to the final authorisation of projects. She has gained experience on IFC and World Bank projects as well as dealing with local legislation in South Africa and other African countries.

Currently she is in the Environmental and Legal Services Department at Digby Wells, which handles various environmental licencing and permitting processes in the Mining and Energy sector, which are undertaken concurrently for the life of the Projects. These processes include Mining Rights, Waste and Water licences as well as Environmental and Social Impact Assessment (ESIA) authorisations.

Ms Aken was also seconded to Xstrata Coal for 12 months to assist the Environmental Manager in the legal permitting and auditing processes as well as managing the consultants on their greenfield projects.

3 Item 3(b): Description of the property

The Mining Right Area covers an area of approximately 3 422 ha, of this area approximately 1 300 ha is the total infrastructure area (the Project Area). The Project boundary is located entirely within the Sedibeng District Municipality. The northern Project boundary lies on the Mpumalanga and Gauteng provincial boundary, and the western boundary also lies on the boundary between the Ekurhuleni District Municipality and the Sedibeng District Municipality. The Project borders the Ekurhuleni Metropolitan Municipality (Gauteng) and the Nkangala District Municipality and the Victor Khanye Local Municipality (Mpumalanga).

The coordinates of the centre point of the Project area are 26° 15' 07.073" S and 28° 33' 39.643" E. Several tributaries of the Blesbokspruit run through the Project area and one of these tributaries includes the Dwars-in-die-wegvlei and Aston Lake. The Project area and surrounds are interspersed with streams, wetlands and pans. The R29 regional road runs through the Largo settlement and the south-western part of the Project area. The N12 and N17 national routes are situated approximately 6.8 km north and 260 m south of the Project area respectively. The R42 regional road is situated approximately 1.1 km east, the R51 is situated approximately 6.5 km west and the R555 is situated approximately 3.8 km north of the Project area. The details of the properties directly affected by the proposed Project are contained in Table 3-1.

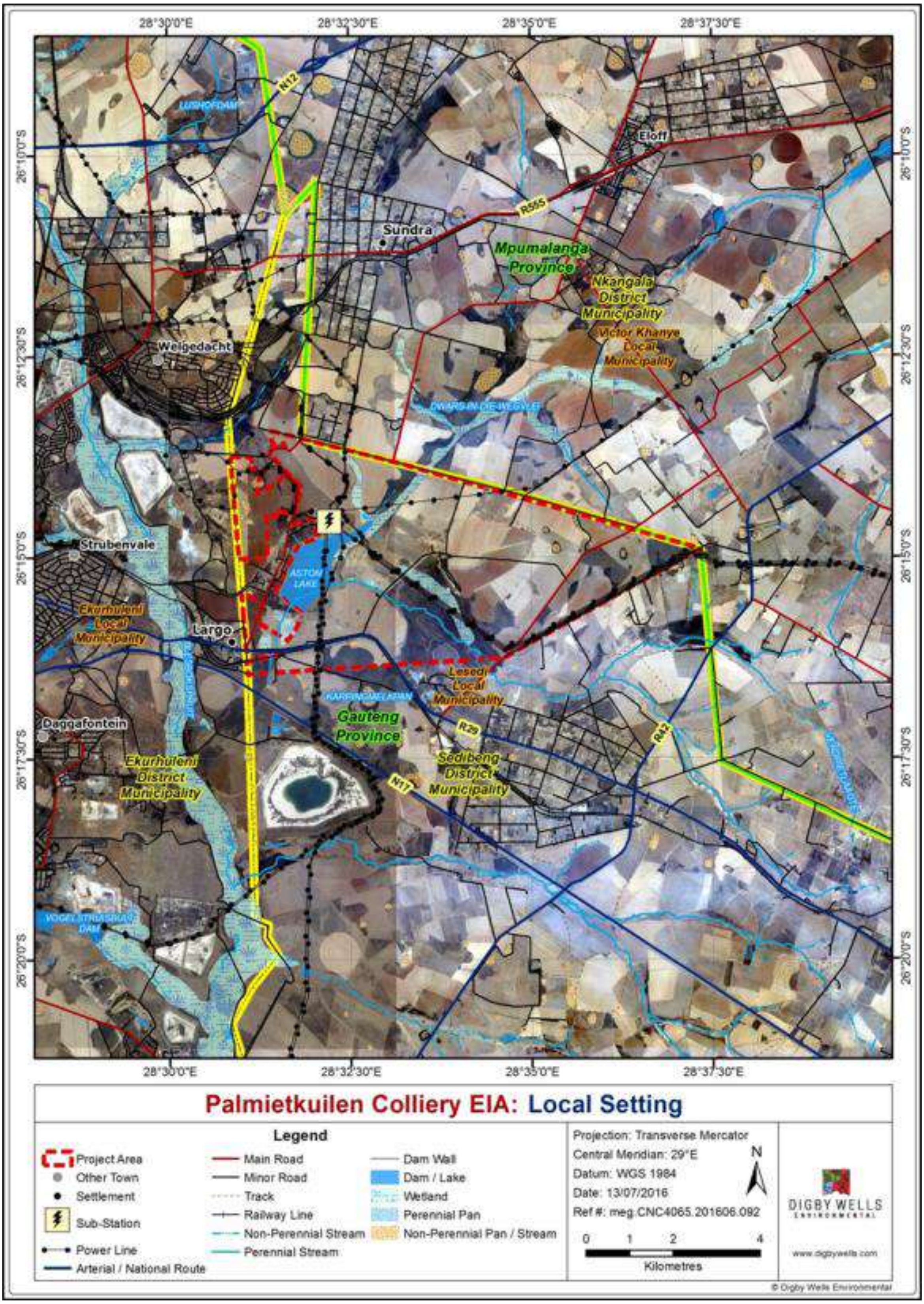
Table 3-1: Property Details

Farm Name:	Portion 1 of Farm Palmietkuilen 241 IR Portion 2 of Farm Palmietkuilen 241 IR Portion 4 of Farm Palmietkuilen 241 IR Portion 9 of Farm Palmietkuilen 241 IR Portion 13 of Farm Palmietkuilen 241 IR Portion 19 of Farm Palmietkuilen 241 IR
Application Area (Ha):	3 422 ha
Magisterial District:	Sedibeng District Municipality
Distance and direction from nearest town:	Approximately 9 km east of Springs
21 digit Surveyor General Code for each farm portion:	T0IR00000000024100001 T0IR00000000024100002 T0IR00000000024100004

	T0IR00000000024100009 T0IR00000000024100013 T0IR00000000024100019

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

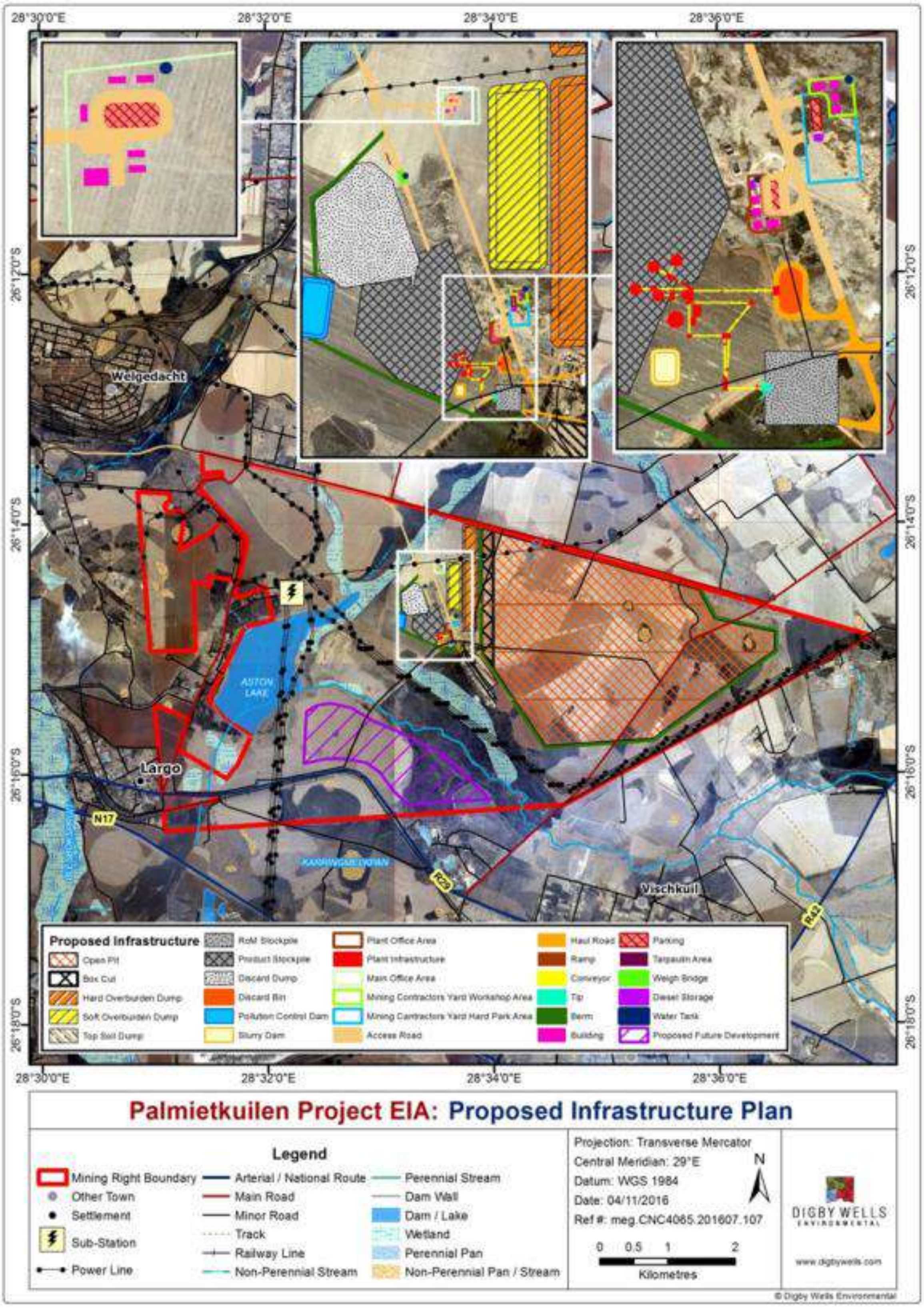
An A3 Locality Map is provided in Plan 1 below.



Plan 1: Project Locality Map

5 Item 3(d) of Appendix 3: Description of the scope of the proposed overall activity

An Infrastructure Layout Plan is provided below as Plan 2.



Plan 2: Proposed Infrastructure Plan

5.1 Item 3(d)(i): Listed and specified activities

Together with the EIA Regulations, 2014[1], the Minister published the following Regulations in terms of Sections 24 and 24D of the NEMA:

- **Regulation GN R. 983 – Listing Notice 1**: This listing notice provides a list of various activities which require environmental authorisation and must follow the Basic Assessment process as described in Regulation 19 and Regulation 20 of the NEMA EIA Regulations;
- **Regulation GN R. 984 – Listing Notice 2**: This listing notice provides a list of various activities which require environmental authorisation and must follow an EIA process as described in Regulation 21 to Regulation 24 of the NEMA EIA Regulations; and
- **Regulation GN R. 985 – Listing Notice 3**: This notice provides a list of various environmental activities which have been identified by provincial governmental bodies. The undertaking of such activities within the stipulated provincial boundaries will require environmental authorisation and the Basic Assessment process as described in Regulation 19 and Regulation 20 of the NEMA EIA Regulations will need to be followed.

In addition, the National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008) (NEM:WA) sets out the law regulating the management of waste. The list of waste management activities under GN R921 of 29 November 2013 identifies activities under Category A, B and C. These activities include:

- **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 (WML);
- **Category B** describes waste management activities requiring an Environmental Impact Assessment process to be conducted in accordance with the EIA Regulations, 2014, supporting a waste management licence application; and
- **Category C** 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 Listed Activities applicable to the proposed prospecting activities in terms of NEMA and NEM:WA are outlined in Table 5-1 below.

[1] Published in GN R982 of 4 December 2014.

Table 5-1: Listed and Specified Activities for the Project

Name of Activity	Aerial extent of the activity	Listed Activity	Applicable Listing Notice
Listing Notice 1			
Water pipelines. *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.*	Final lengths of pipelines are still to be confirmed in the final design phase.	X – 9 (i) and /or (ii)	GN R 983 under NEMA
Process water, waste water, return water pipelines *The development and related operation of infrastructure exceeding 1000 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 bulk transportation of sewage, effluent, process water, wastewater, return water, industrial discharge or slimes inside a road reserve; or*	Final lengths of pipelines are still to be confirmed in the final design phase.	X – 10 (i) or (ii)	GN R 983 under NEMA

Name of Activity	Aerial extent of the activity	Listed Activity	Applicable Listing Notice
(b) where such development will occur within an urban area.			
Development of open pit and stockpiles- *The development of-* *infrastructure or structures with a physical footprint of 100 square metres or more;* *where such development occurs-* *(a) within a watercourse;* *(b) in front of a development setback; or* *(c) if no development setback exists, within 32 metres of a watercourse, measured from the edge of a watercourse*	Approximately 1, 300 ha, namely: ▪ Open Pit 875 ha ▪ Hard Overburden Dump (HOD) 33 ha ▪ Soft Overburden Dump (SOD)16 ha ▪ Top Soil 9 ha ▪ Run of Mine (ROM) 1 ha ▪ Product Stockpile 18 ha ▪ Discard Dump 14 ha The above areas are total for the infrastructure, not those within wetland / water course areas	X – 12 (xii)	GN R 983 under NEMA
Pollution control dam *The development of facilities or infrastructure for the off-stream storage of water, including dams and reservoirs, with a*	3 ha	X –13	GN R 983 under NEMA

Name of Activity	Aerial extent of the activity	Listed Activity	Applicable Listing Notice
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.			
Mining through wetlands / pans *The infilling or depositing of any material of more than 5 cubic metres into, or the dredging, excavation, removal or moving of soil, sand, shells, shell grit, pebbles or rock of more than 5 cubic metres from-* *(i) a watercourse;* *(ii) the seashore; or* *(iii) the littoral active zone, an estuary or a distance of 100 metres inland of the high-water* *mark of the sea or an estuary, whichever distance is the greater but excluding where such infilling, depositing , dredging, excavation, removal or moving-* *(a) will occur behind a development setback;* *(b) is for maintenance purposes undertaken in accordance with a maintenance management plan; or* *(c) falls within the ambit of activity 21 in this Notice, in which case that activity applies.*	255 ha	X – 19	GN R 983 under NEMA
Roads on site *The development of-* *(ii) a road with a reserve wider than 13,5 meters, or where no*	Combined length and width: ■ Access Roads:	X –24 (ii)	GN R 983 under NEMA

Name of Activity	Aerial extent of the activity	Listed Activity	Applicable Listing Notice
reserve exists where the road is wider than 8 metres; but excluding- *(a) roads which are identified and included in activity 27 in Listing Notice 2 of 2014; or* *(b) roads where the entire road falls within an urban area.*	▪ Length 9 km ▪ Width 10 m ■ Haul Roads: ▪ Length 3 km ▪ Width 10 m ■ Ramps: ▪ Length 10 km ▪ Width 20 m		
Listing Notice 2			
Diesel storage, explosives magazine *The development of facilities or infrastructure, for the storage, or storage and handling of a dangerous good, where such storage occurs in containers with a combined capacity of more than 500 cubic metres.*	Diesel storage - 0.01 ha	X – 4	GN R 984 under NEMA
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.*	-	X – 6	GN R 984 under NEMA
Site establishment and vegetation removal.	1238 ha	X –15	GN R 984 under NEMA

Name of Activity	Aerial extent of the activity	Listed Activity	Applicable Listing Notice
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*.			
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 associated infrastructure, structures and earthworks, directly related to the extraction of a mineral resource, including activities for which an exemption has been issued in terms of section 106 of the Mineral and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002).	3422 ha	X – 17	GN R 984 under NEMA
Waste Activities			
Slurry dam *The storage of hazardous waste in lagoons excluding storage of effluent, wastewater or sewage.*	0,2 ha	Category B 4 (1)	GN R 921 under NEM:WA
The construction of a facility for a waste management activity listed in Category B of this Schedule	-	Category B 4 (10)	GN R 921 under NEM:WA
The establishment or reclamation of a residue stockpile or residue deposit resulting from activities which require a mining	Discard Dump - 14 ha Discard Bin - 0.2 ha	Category B 4 (11)	GN R 921 under NEM:WA

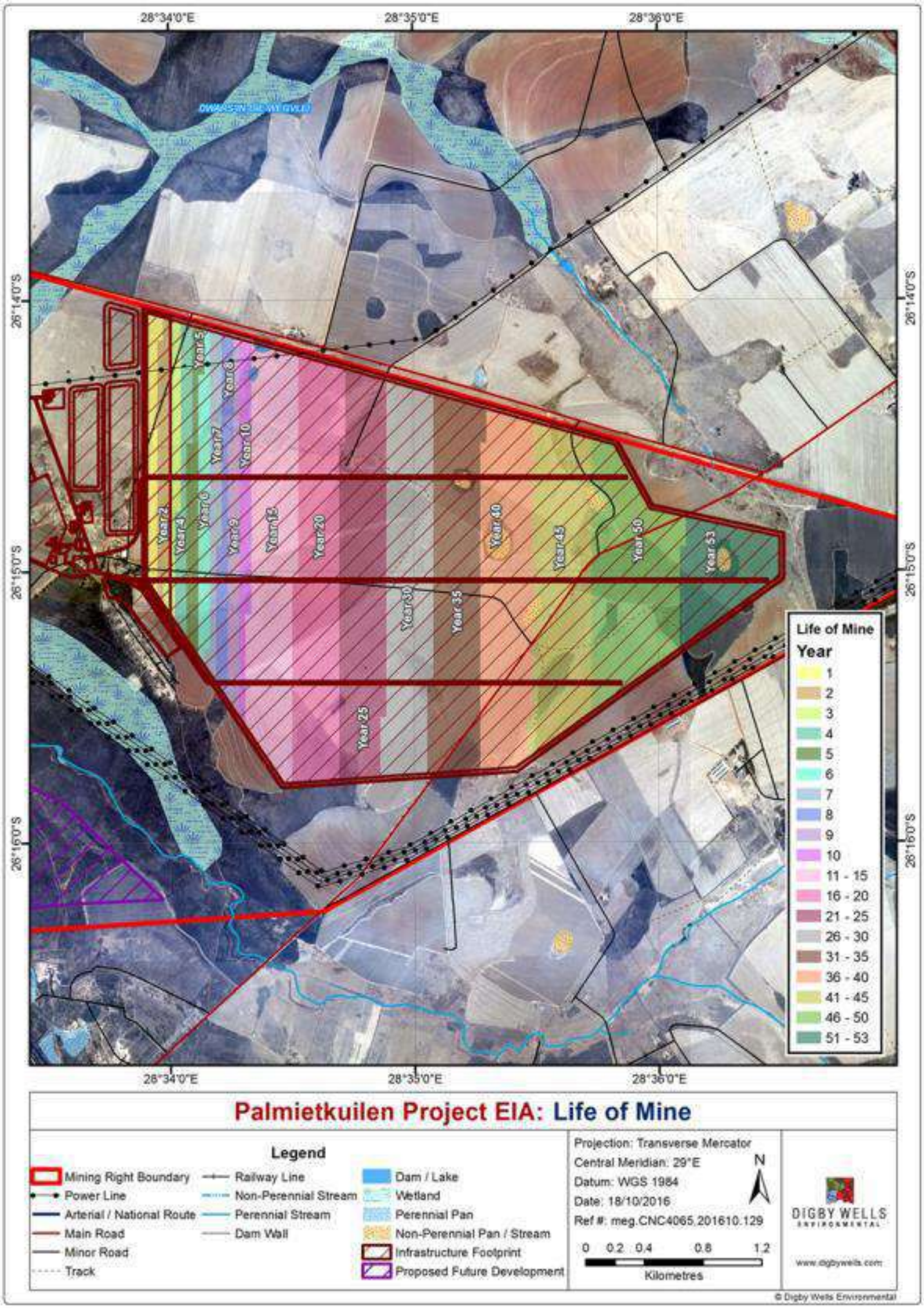
Name of Activity	Aerial extent of the activity	Listed Activity	Applicable Listing Notice
right, exploration right or production right in terms of the Mineral and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002).	HOD 33 ha		

5.2 Item 3(d)(ii): Description of the activities to be undertaken

The proposed Project involves the development of a new open pit coal mine and the associated supporting infrastructure. The raw coal, once extracted, will be transported to a processing plant for crushing, screening and washing. The coal product will either be transported via haul roads from the product stockpile area to the existing Welgedacht Railway Siding for distribution by rail or directly to prospective clients by road. The subsections below present a description of the proposed Project including an analysis of the geological conditions, mining method and associated infrastructure.

5.2.1 Mineral Resource and Life of Mine

The current resource is estimated at 125.98 Mt. The life of mine for the Project is 53 years including a 2 year ramp-up period. Once the mine has been established a full production rate of 200 000 t / month will be maintained for 51 years. The progression of the mining operation is depicted in the Life of Mine (LOM) plan, Plan 3 below.



Plan 3: Life of Mine Plan

5.2.2 Mining Method

The coal resource will be mined using open pit methods due to the seem depth of the coal reserve (between 12 and 60 m below the surface). Bench mining and strip mining techniques are proposed. Bench mining involves the development of an open pit through a series of benches at varying depths while strip mining involves the movement of overburden laterally to an adjacent empty pit where the mineral has already been extracted. The proposed project will include one open pit.

Topsoil and subsoil will be stripped using an excavator and will be stored in separate stockpile areas on the mining area. Drilling and blasting will be employed for the hard overburden or bedrock to expose the coal seams. Once blasted, the hard overburden will be excavated and stockpiled separately for rehabilitation purposes. The mined coal from the open pit will be transported via the haul roads and stored on the ROM stockpile area. The coal will be fed into a crushing and washing plant with a conveyor after which the coal product will be temporarily stored at the product stockpile area before being transported to the Welgedacht siding for distribution or directly via truck to the relevant markets. A temporary discard dump containing one year’s capacity will be constructed to store discard before being either rewashed or backfilled (preferred) into mined out areas.

The proposed mine would require additional infrastructure and services to support the proposed mining operation, as shown in Plan 2 above. The supporting infrastructure associated with the proposed Project is discussed below.

5.2.1 Stockpile Areas

Topsoil, subsoil and overburden material will be excavated and stored on site for use during rehabilitation. The mined coal will also need to be temporarily stored on a ROM stockpile and a product stockpile area.

5.2.2 Process Plant

5.2.2.1 Screening and Crushing

The ROM will be fed into the process plant by means of a feeder bin at the ROM pad. The feeding capacity of the plant will be 400 tons/hour. Coal will be manually fed into the bin by means of a Front-End Loader. The first stage of the process plant is to screen the coal into various particle sizes. This is done by the use of a 1.5 x 2.5 m primary vibrating grizzly screen fitted with 80 mm bar spacing. The coal fraction of 250 x 80 mm fraction will be discharged into a primary double roll crusher, which will reduce the oversize fraction to 90 mm in size. The primary crusher product will re-join the grizzly undersize fraction which feeds into a secondary 1.8 x 6.0 m double deck screen fitted with 60 and 50 mm bar spacing. The oversize (+75 mm) fraction will be fed to a secondary double roll crusher, the crushed product will be returned to the primary screen feed conveyor belt, in a closed crushing circuit.

5.2.2.2 Coal Washing and Processing

The eventual crushed and screened undersize fraction (-75mm) will be fed to the cyclone, drum and spiral sections of the wash plant which will then be deposited onto a product stockpile. The washing section will operate during mining hours.

The slurry from the thickener underflow will report to the filter press and make up 12% to 15% of the plant feed. The Dense Media Separation (DMS) plant will be capable of a 95 % organic efficiency with a product yield of 60 %. The remaining 25 % to 28 % solid discard will be placed in the opencast voids.

The plant will produce a product suitable for local and export markets.

5.2.2.3 Product Storage

The coal product will be stored on a product stockpile. The product stockpile conveyor belt will be fitted with a level probe to avoid over filling the stockpile and a mass meter for process accounting purposes.

5.2.3 Water Supply and Management

5.2.3.1 Water Supply

Possible water sources for use in mining operations include the existing Aston Lake, owned by the Schoeman Boerdery as well as available or new boreholes. These water sources are still to be confirmed by undertaking the relevant feasibility studies and will form part of the WUL process. Pipes and pumps will be installed to pump water from these resources directly to the process plant. It is estimated that approximately 0.3 m^3 of water is required per ton of coal. Process water will be managed and re-used throughout the operations of the Project via clean and dirty water separation system, which shall include separate drains.

5.2.3.2 Water Management

Storm water management and drainage planning are critical for the management of water and waste at mining sites. As a best practise for a mining entity in South Africa, a Storm Water Management Plan (SWMP) needs to be developed under the guidance of the Department of Water and Sanitation (DWS) Best Practice Guidelines (BPG) (DWS, 2006) focusing on storm water management (BPG: G1).

A negative impact on the baseline water quality by the proposed mining operation will likely affect local aquatic ecosystems within the Blesbokspruit or the Aston Lake feeder streams, and the local community who use the water for drinking, washing, irrigating or livestock watering. In addition to the above, storm water may pose a risk of flooding to the proposed development, if not managed correctly. The aim of this SWMP is to mitigate negative water related impacts by fulfilling the requirements of the NWA and more particularly GN 704.

The following definitions from GN 704 are appropriate to the classification of catchments and design of SWMP for the proposed Project:

- **Clean water system:** includes any dam, other forms of impoundment, canal, works, pipeline and any other structure or facility constructed for the retention or conveyance of unpolluted (clean) water;
- **Dam:** includes any settling dam, slurry dam, evaporation dam, catchment or barrier dam and any other form of impoundment used for the storage of unpolluted water or water containing waste (i.e. dirty water);
- **Dirty area:** means any area at a mine or activity which causes, has caused or is likely to cause pollution of a water resource; and
- **Dirty water system:** This includes any dirty water diversions bunds, channels, pipelines, dirty water dams or other forms of impoundment, and any other structure or facility constructed for the retention or conveyance of water containing waste (i.e. dirty water).

5.2.3.3 Waste Water Dams

Waste water dams will be constructed in the form of a slurry dam and PCD. The purpose of the slurry dam is to collect and separate water from its dissolved constituents. A slurry dam will be constructed adjacent to the processing plant. The purpose of the PCD is to store process water and dirty stormwater for re-use in the plant and for dust suppression. The dams will be designed as per requirements of DWS.

5.2.4 Power Supply

The Project will obtain power from an existing Eskom distribution power lines. AOL are proposing to construct an 10 MVA substation within the Mining Right Ares at the northern office complex to connect to existing power line to secure power for the operation of the proposed mine. The required power requirements would need to be confirmed with Eskom.

Electricity will also be generated by means of diesel generator sets for lighting and pumping of water. AOL is also currently investigating the feasibility of using onsite solar power generation as a backup system. The maximum power requirements for the mine will be 5 MVA.

5.2.5 Waste Management

The proposed mining and related activities will result in the generation of coal discard as well as non-mineralised waste. Waste management should be done in accordance with the requirements set out in NEM:WA and the Mineral and Petroleum Resource Development Act, 2002 (Act No. 28 of 2002) (MPRDA).

5.2.5.1 Coal Discard

The proposed mining will result in the generation of two mineralised waste streams, namely solid coal discard from the mining operations and slurry waste which will be generated during coal washing and processing.

AOL intends to backfill the open pit using waste rock material generated during mining operations. The solid coal discard, therefore, will be temporarily stored on a discard dump and discard bin before being taken to the open pit for final disposal. A slurry dam will be constructed to store all slurry waste generated.

5.2.5.2 Non-mineralised Waste

Non-mineralised waste in the form of general and hazardous waste will be produced from various activities associated with the Project. Table 5-2 provides a preliminary list of potential wastes that may be generated at the Project site.

Table 5-2: Hazardous and General Waste Generated on Site

Hazardous Waste	General Waste
▪ Hydrocarbon contaminated waste (e.g. rags, filters, oil drums); ▪ Fluorescent tubes, batteries, printer cartridges and acids; ▪ Aerosols and chemical waste; ▪ Contaminated soil; ▪ Asbestos; ▪ Sewage Waste; ▪ Medical Waste ▪ Contaminated Protective Personal Equipment (PPE); ▪ Polychlorinated biphenyls (PCBs); ▪ Pesticide-, herbicide-, insecticide- and fertilizer waste; and ▪ Paint and cleaning liquids include leftover paint, paint contaminated containers.	▪ Scrap Metal; ▪ Waste Tyres and rubber – generated from vehicles, machinery and the conveyer belt; ▪ Non –contaminated plastic, timber, food waste, canteen waste, cardboard; ▪ Cement; ▪ Waste paper; ▪ Grey water from human consumption; ▪ Non-compactable waste includes ash, wood, used sand, general garden refuse such as trees and branches; and ▪ Cable.

A proposed sewage treatment package plant is proposed as part of the Project to manage sewage waste. Other wastes including materials and chemicals from maintenance activities and daily operation of the proposed mine will also be generated. All hazardous wastes will be stored and handled appropriately prior to being disposed of by a licensed hazardous waste disposal contractor. General domestic wastes will be managed in accordance with the requirements of the district municipality.

5.2.6 Access and Site Roads

The Project site is bordered by an unnamed road to the north that also serves as the boundary between the Gauteng and Mpumalanga Provinces. The R29 serves as a partial southern boundary. There are various farm roads present on the proposed project area that can used to navigate the site.

Access to the site will be from the R29 onto an unnamed farm road heading north. AOL intend on using the surrounding road network to haul coal to the existing WelgedachtRailway Siding.

An existing public gravel road transgressing the site in a SW – NE direction would need to be re-aligned as it currently runs through the proposed open pit area.

A Traffic Impact Assessment (TIA) appended to this report as Appendix P was undertaken by Mariteng Consulting Engineers (Pty) Ltd in support of the EIA to determine the traffic characteristics of the area. It is anticipated that the mine personnel and contractors will access the mine from Road D1133, via Road R29 (located to the south-west of the mine). Thirty-four (34) ton interlink trucks (57 tons when loaded) will be used to transport coal from the site to Welgedacht Railway Siding (route located to the north-west of the site). Hauling operations will operate between the main access proposed on Road D1125 and the Welgedacht Railway Siding, located to the north-west of the site as the proposed route will not take the hauling trucks through any residential area or using the main mine entrance.

The TIA also assessed the anticipated total trip generation of mine personnel and hauling traffic associates with the proposed Project. Table 5-3 outlines the anticipated peak hour trips.

Table 5-3: Expected Weekday Morning and Afternoon Peak Hour Trips

Description	Morning Peak Hour (06:30 – 07:30)			Afternoon Peak Hour (16:00 – 17:00)		
	IN	OUT	TOTAL	IN	OUT	TOTAL
Private Vehicles	16	16	32	16	16	32
Public Transport	2	2	4	2	2	4
Sub Total 1 : Mine Personnel	18	18	36	18	18	36
Sub Total 2: Hauling Traffic	12	13	25	12	13	25
Total	30	31	61	30	31	61

5.2.7 Rail Siding

Coal product will be transported via road to the Welgedacht Railway Siding from where the coal product will be distributed to the intended local and export markets. Coal has an agreement to lease the running of the Welgedacht Railway Siding.

5.2.8 Workshop Area

A workshop and office area is proposed which will also include a contractor’s yard where machinery and equipment can be maintained and repaired. It is likely that this area will include offices, a laboratory, wash bays and storage facilities. These buildings are proposed to be approximately 3 m in height.

5.2.9 Hazardous Substance Storage

Diesel storage tanks are proposed to be located in close proximity to the workshop area. This facility will be adequately bunded and have the necessary control systems in place to manage the potential risks of fire and /or explosion.

5.2.10 Vehicles and Equipment

The following vehicles and machinery will be used for the construction and operation of the proposed mine:

- Excavators;
- Dozers to move material;
- Load Haul Dump (LHD);
- Front End Loaders;
- 34 ton interlink haul trucks;
- Mine passenger vehicles;
- Graders for road maintenance;
- Water Bowsers for dust suppression;
- Generators for lighting and water pumping: and
- 2 ton Light Duty Vehicles (LDV).

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 local legislation and policies, plans, guidelines as well as any other applicable development planning frameworks and tools.

Table 6-1: Relevant National Legislation

Applicable legislation and guidelines used to compile the report	Reference where applied	How does this development comply with and respond to the policy and legislative context
The Constitution of the Republic of South Africa, 1996 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.*	The EIA process is being undertaken to determine the impacts associated with the project. As part of the EIA process, mitigation measures and monitoring plans are recommended to ensure that any potential impacts are managed to acceptable levels to support the rights as enshrined in the Constitution.	An Application for Environmental Authorisation (EA) for the proposed project was submitted to the Department of Mineral Resources (DMR), Gauteng Regional Office in Johannesburg on 04 August 2016 detailing the proposed activities. A Scoping Report was compiled and submitted to the DMR on 16 September 2016 which detailed the biophysical and social environments which will be affected. An EIA phase has been undertaken where the impacts associated with the proposed activities as well as measures to mitigate, manage and monitor the impacts have been determined.
National Environmental Management Act, 1998 (Act No 107 of 1998) and EIA Regulations (December 2014) 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.* 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.	This EIA Report is informed by the requirements of the NEMA and Regulations thereunder.	An Application for EA for the proposed project was submitted to the Department of Mineral Resources (DMR), Gauteng Regional Office in Johannesburg on 04 August 2016 detailing the proposed activities. A Scoping Report was compiled and submitted to the DMR on 16 September 2016 which detailed the biophysical and social environments which will be affected. An EIA phase has been undertaken where the impacts associated with the proposed activities as well as measures to mitigate, manage and monitor the impacts have been determined.
Mineral and Petroleum Resource Development Act. 2002 (Act No. 28 of 2002) The MPRDA sets out the requirements relating to the development of the	A Mining Right Application (MRA) for the proposed Project was submitted to the DMR on 23 August 2016. An application for EA was subsequently lodged with the DMR. This EIA Report, which relates specifically to the Palmietkuilen Mining Right applied for, has been compiled in accordance with the MPRDA	AOL has submitted a Mining Right Application, together with the SLP, to mine coal on the Palmietkuilen premises. The EIA process will be undertaken to meet the requirements of the MPRDA read with the EIA Regulations, 2014. Financial Provisioning and Closure Costs will be included

Applicable legislation and guidelines used to compile the report	Reference where applied	How does this development comply with and respond to the policy and legislative context
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.	read together with the EIA Regulations, 2014.	in the EIA.
<u>National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008)</u> 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: <u>Category A</u> 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; <u>Category B</u> 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 <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.	The listed activities which are triggered under the NEM: WA have been identified and provided in Table 5-1. Category B activities were identified, therefore a full EIA process is required the proposed Project. The triggered waste management activities have been applied for as part of the Environmental Application to the DMR who is the relevant Competent Authority.	A WML has been applied for due to the nature of mining activities. AOL has applied for a Waste Licence. The associated waste activities are recorded in Table 5-1.
<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:	An Integrated Water Use Licence Application (IWULA) and an associated Integrated Water and Waste Management Plan (IWWMP) are required in terms of Section 21 of the NWA for the Project. The IWULA and IWWMP will be compiled and submitted to the DWS as the decision-making authority. 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;	An IWULA will be submitted to the DWS for the triggered water uses under Section 21 of the NWA.

Applicable legislation and guidelines used to compile the report	Reference where applied	How does this development comply with and respond to the policy and legislative context
■ 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.	■ 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.	
<u>National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004) (NEM:BA)</u> 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 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).	As part of this proposed Project, biological assessments namely a flora and fauna; wetlands; and aquatic assessment have been undertaken to determine the current status of the environment and to determine any potential ecological sensitivity to be avoided and/or mitigated. There are currently no applications submitted in terms of NEM: BA for the proposed project. This has been confirmed by the flora, fauna, wetlands and aquatic specialist.	The Project footprint is located in amongst or near to sensitive areas, including: ■ The Moist Grasslands priority area and is 500 m east of the Bushveld-Bankenveld priority area; ■ The Blesbokspruit Highveld Grassland threatened ecosystem occurs in the project Site and surrounds; ■ The vegetation includes Andesite Mountain Bushveld, Eastern Highveld Grassland, Eastern Temperate Freshwater Wetlands and Soweto Highveld Grassland; ■ According to the Gauteng Conservation Plan the project area includes Ecological Support Areas, Important Areas and Irreplaceable Areas; ■ According to the SANBI mining and biodiversity guideline the wetland areas fall within the Highest Biodiversity Importance class with the Highest Risk for Mining and the majority of the remaining areas have Moderate Biodiversity Importance with a Moderate Risk for Mining; ■ There are numerous National Freshwater Ecosystem Priority Areas (NFEPA) wetlands within the project area (rivers and pans); ■ The Aston Lake and River within the Site are part of the Blesbokspruit IBA. The Devon Grasslands IBA is located 9.5 km south-east of the project area; and ■ The Blesbokspruit Ramsar Site and the Marievale Nature Reserve are less than 1 km west of the project area however, approximately 6.5km from the proposed infrastructure. The Nicolaas Private Nature Reserve is located 13.6 km south-south-east of the project area and the Voortrekker Private Nature Reserve is located 15.2 km south of

Applicable legislation and guidelines used to compile the report	Reference where applied	How does this development comply with and respond to the policy and legislative context
		the project area. The biological assessments detail the areas within the Project area which are of ecological importance. The findings of the biodiversity assessments in the form of the impacts and the proposed mitigation measures undertaken for the proposed project area detailed in this report.
National Environmental Management: Protected Areas Act, Act No. 57 of 2003) To provide for the protection and conservation of the ecologically viable areas representative of South Africa's biological diversity and its natural landscapes and seascapes; for the establishment of a national register of all national, provincial and local protected areas; for the management of those areas in accordance with national norms and standards; for intergovernmental co-operation and public consultation in matters concerning protected areas; and for the matters in connection therewith.	Officially protected areas, either Provincially or Nationally that occur close to a project site could be impacted by the proposed project.	A Fauna and Flora Impact Assessment has been undertaken to determine whether any protected areas are located within the project site. There is currently no formal protection status for the Ramsar site other than the Marievale Nature Reserve, which was proclaimed a nature reserve under this Act.
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 will be undertaken as part of the EIA Phase to determine the baseline conditions prior to the implementation and potential subsequent impacts.	The Project's activities will set out to abide by the NEM:AQA and standards set out in the NAAQS. The required mitigation is included in the Environmental Management Plan (EMP) as part of this EIA.
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 NEM:AQA. In the published National Dust Control Regulations, terms like target, action and alert thresholds were 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.	An Air Quality Impact Assessment will be undertaken as part of the EIA Phase to determine the baseline conditions prior to the implementation and potential subsequent impacts.	The Project's activities will set out to abide by the NEM:AQA and standards set out in the NAAQS. The required mitigation is included in the EMP as part of this EIA.
National Noise Control Regulations, R.154 of 1992 (the Noise Regulations) promulgated in terms of Section 25 of the Environmental	A Noise Impact Assessment, including modelling, and a Blast and Vibration Assessment were undertaken to identify potential noise impacts of the	The proposed project activities will be set out to abide by the National Noise-Control Regulations and standards set out in the South African National

Applicable legislation and guidelines used to compile the report	Reference where applied	How does this development comply with and respond to the policy and legislative context
Conservation Act, 1989 (Act 73 of 1989) 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.	proposed activities.	Standard (SANS) 10103:2008. The noise impacts associated with the proposed activities have been determined and mitigation and monitoring measures were proposed to minimise the impacts during the LOM.
The National Heritage Resources Act, 1999 (Act No. 25 of 1999) (NHRA) 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. 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).	A Notice of Intent to Develop (NID) was submitted, as part of the Scoping phase, to the Mpumalanga Provincial Heritage Resources Authority (PHRA-M) and the SAHRA. Furthermore, a Heritage Impact Assessment (HIA) has been undertaken and will be submitted as part of the EIA phase to the PHRA-G and the SAHRA.	A Heritage Resource Management process was undertaken to identify all heritage resources that may be impacted on to provide feasible management and mitigation measures. The results of the HRM process will be submitted to SAHRA and PHRA-G for adjudication in terms of Section 38 of NHRA.
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.	Rehabilitation, decommissioning and the mine closure plan, including the financial provision estimate, were assessed during the EIA Phase.
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	An EMP, based on the identified potential impacts of the proposed activities, is in Part B of this document.	An EMP, based on the identified potential impacts of the proposed activities, is in Part B of this document.

Applicable legislation and guidelines used to compile the report	Reference where applied	How does this development comply with and respond to the policy and legislative context
be reviewed annually. R527 provides specific principles for mine closure including safety and health, residual and latent environmental impacts etc.		

Table 6-2: Relevant Provincial Legislation

Applicable legislation and guidelines used to compile the report	Reference where applied	How does this development comply with and respond to the policy and legislative context
Gauteng Resources Heritage Bill, 2013 To provide for the conservation, protection and management of both the physical and the living or intangible heritage resources of Gauteng Province; to empower civil society to nurture and convert their heritage resources that they may be bequeathed to future generations; to set out principles for governing heritage resources throughout the Province; to introduce an integrated system for the identification, assessment and management of the heritage resources of the Province; to establish a Council to administer heritage conservation in the Province; to determine the objects, powers, duties and functions of the Council; to determine the manner in which the Council is to be managed, governed, staffed and financed; to establish Heritage Forums within a Municipal jurisdiction to assist the Council in facilitating and ensuring the involvement of local communities in the administration and conservation of heritage in the Province; and to provide for matters connected therewith.	There are two graveyards located within the proposed location of the open pit. The HIA took this Bill into consideration for the management of these graveyards.	There are two graveyards located within the proposed location of the open pit. The HIA took this Bill into consideration for the management of these graveyards.

Table 6-3: Local By-Laws and Guidelines

Applicable legislation and guidelines used to compile the report	Reference where applied	How does this development comply with and respond to the policy and legislative context
Ekurhuleni Integrated Development Plan (IDP) 2013/16 An IDP is a municipal-level planning document that aims to provide a developmental framework for regional and local government, in which municipalities must provide leadership, management, budgeting, and direction in the provision of services and infrastructure. The IDP serves to guide developmental planning and community development. Municipal IDPs highlight local needs and priorities that could be considered by the Project.	The IDP will be taken into consideration during the development of the Project.	The IDP will be taken into consideration during the development of the Project.
Spatial Development Framework (SDF) A SDF an integral part of the IDP and is a spatial planning policy that aims to inform the determination of development proposals and applications. The SDF serves to stimulate debate and consider emerging development, investment and economic trends within the District Municipality.	The Gauteng SDF has been reviewed and taken into consideration for this Project.	The Gauteng SDF has been reviewed and taken into consideration for this Project.
The Wetland Convention (Ramsar Convention) The so-called Ramsar Convention (signed in Ramsar, Iran in 1971) is the intergovernmental treaty that provides the framework for the conservation and wise use of wetlands and their resources.	The Blesbokspruit is a registered Ramsar site.	The Blesbokspruit Ramsar Status was considered in the Project site sensitivity analysis and rating.
DWS[2] 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 will be designed for a 50 year, 24 hour rainfall event.	Floodline delineations of 1:50 and 1: 100 year rainfall events were undertaken to understand the risk of flooding to the proposed mine infrastructure, and in accordance with GN 704 regulations.
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	An IWULA and an associated IWWMP are required in terms of Section 21 of the NWA. The IWULA and IWWMP will be compiled and submitted to the DWS as the decision making authority. The EIA as part of the MRA will assess potential impacts on surface water and groundwater resources as a result of the Project.	An IWULA and an associated IWWMP are required in terms of Section 21 of the NWA. The IWULA and IWWMP will be compiled and submitted to the DWS as the decision making authority. The EIA as part of the MRA will assess potential impacts on surface water and groundwater resources as a result of the Project.

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

Applicable legislation and guidelines used to compile the report	Reference where applied	How does this development comply with and respond to the policy and legislative context
and to determine the extent of possible future impacts on the groundwater resources.		

7 Item 3(f): Need and desirability of the proposed activities

The Integrated Environmental Management Guideline Series 9: Guideline on Need and Desirability was promulgated in terms of the Environmental Impact Assessment (EIA) Regulations, 2010 in Government Notice 891 of 2014. According to these guidelines, the consideration of "need and desirability" in EIA decision-making requires the consideration of the strategic context of the proposed Project along with the broader public interest and societal needs. The guidelines further state that the development must not exceed ecological limits and the proposed actions must be measured against the short-term and long-term public interest to promote justifiable social and economic development, essentially ensuring the simultaneous achievement of the triple bottom line.

The need and desirability of the proposed Project was therefore assessed in terms of its economic and social benefits while highlighting how the inevitable adverse environmental impacts will be addressed.

7.1 Economic Consideration

It is recognised that mining activities are an essential component of South Africa's economic development. According to the Chamber of Mines of South Africa's Integrated Annual Review (2015) the mining sector accounted for 7.7% of South Africa's Gross Domestic Product (GDP) directly, and approximately 17% if direct, indirect and induced effects are included.

Coal specifically is a national requirement to meet the demand for electricity supply. According to the Chamber of Mines (2015) coal provides 81% of the power generated within South Africa with imminent future expansions. South Africa is home to 3.5% of the world's coal reserves thus it is likely that coal will continue to be utilised as a significant part of the energy mix. The National Development Plan 2030 (NDP) identifies the sufficient production of energy to support industry and providing access to poor households as an enabling milestone toward the reduction of inequality and elimination of income poverty by the year 2030 (National Planning Commission, 2011). It is therefore essential that sufficient coal resources are available to meet the demand required for electricity generation. The coal that would be produced through the proposed Project would be of suitable quality for use in local markets, thereby assisting with the alleviation of the shortage of supply.

In addition to providing an essential resource for power generation in South Africa, the proposed project will have knock-on benefits. These include tax contributions, an overall improvement of the local socio-economic profile job creation and procurement. The revenue generated by the mine will translate into R430.6 million (2016 prices) of value added annually and R19.9 billion (2016 prices) of GDP over the lifespan of the Project. Assuming that the direct impact on GDP, i.e. R164.2 million, to be created on an annual basis will be registered within the municipal boundaries, it can be suggested that the Palmietkuilen Mining Project operations will expand the current Lesedi Local Municipality GDP economy by 2.3%, while the mining sector's GDP increase by about 70% (Urban-Econ, 2016).

7.2 Social Consideration

The Lesedi Local Municipality and Wards affected by this project experience unemployment rates between 11 % and 19 % and the Project could assist in alleviating some of these unemployment rates. It is anticipated that the proposed Project will likely employ a total of 320 permanent employees with preference given to Historically Disadvantaged South African (HDSA) candidates. The SLP stipulates that the Applicant (AOL) will search for employees within the directly affected wards. The Applicant will also provide skills development to employees thereby advancing the future employability of these individuals.

Further to this, a Skills Development Plan will be formulated and implemented for the proposed Project. This plan will aim to that all employees obtain a minimum educational level equivalent to ABET Level 4 and provide a conducive environment for employees to develop and pursue clear career paths within the organisation as a whole. 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.

7.3 Environmental Consideration

The project will inevitably result in adverse impact to the environment. As part of the EIA process, specialist studies which relate to the physical, biological and socio-economic environmental aspects were undertaken. Sensitive environments have been identified as part of the baseline investigation which informed the impact assessment provided in Section 13 of this report.

Mitigation and management measures have been provided for each potential impact to the direct environment as well as surrounding receptors and stipulated buffer zones will be implemented where necessary.

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. An initial sensitivity analysis was undertaken to determine sensitive features that needed to be considered within the proposed Project site. Theses sensitivities informed the proposed mine layout and areas of high sensitivities were avoided as far as possible.

The location of the pit has excluded two pans on site; however, at least five largely modified pans will be removed as a result of open pit mining. The Aston Lake which is located within the proposed mine boundary has also been excluded from the mining area.

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;
- No-go alternative – the proposed project/activity does not proceed, implying that the current situation or status quo remains.

8.1.1 Design and Layout of the Project

The wetlands present on site have been excluded from the pit and infrastructure areas as far as possible; however, five largely modified pans are still located on the area to be affected by the open pit. The layout has taken into consideration the location of other pans on site and has therefore been designed to utilise the least amount of surface area to accommodate mining-related infrastructure. The layout has also moved the mining footprint and the initial boxcut to ensure a buffer between the surrounding residential areas, Aston Lake and the Blesbokspruit.

8.1.2 Mining Method Alternatives

The proposed alternatives for coal extraction consider underground versus open pit mining. The coal seams within the Project area are too shallow (between 12 and 60 m below the surface) to warrant underground mining and therefore open pit mining is the preferred alternative.

8.1.3 Transportation of Coal

The alternatives that were considered during the EIA phase comprised the transportation of coal via road and/ or rail. Canyon Coal has an agreement to lease the running of the

Welgedacht Railway Siding which is linked to the surrounding rail networks. The transportation of coal product from site to the rail siding will be undertaken by trucks using the existing road network on site. The alternative is to use trucks to transport coal product directly to market or to use conveyors to transport coal product to the siding. The preferred alternative is to use the rail siding. The benefit of utilising the existing siding will, inter alia, reduce the number of coal trucks on the roads in the surrounding area.

8.1.4 Routing Alternatives

Routing alternatives were considered for linear infrastructure, namely the powerline and road route. These alternatives and preferred option for each are discussed and illustrated on below.

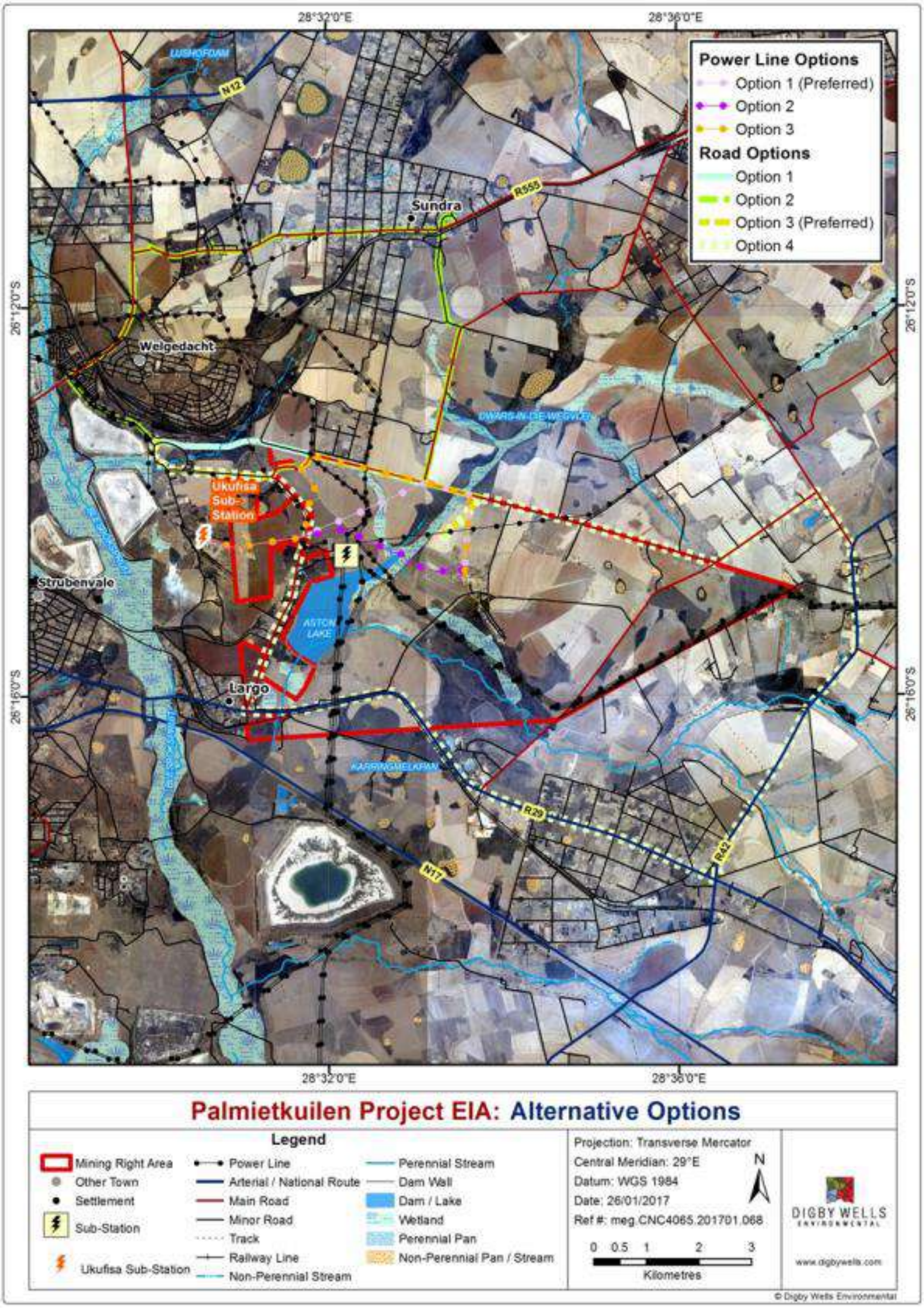
8.1.4.1 Powerline Routing Alternative (between Ukufisa Substation and Project Site)

In addition to the use of diesel generators at the Project site, AOL intends to construct an 10MVA substation within the Mining Right area at the northern office complex to secure power supply for the operation of the proposed mine or obtain power from the existing Ukufisa Substation located west of the Mining Right area. Three options were considered for the powerline route (below) which took into consideration existing servitudes as well as sensitive environmental features along the routes. Three options were considered for the powerline routing:

- Option 1 was considered as the route would mainly run along existing powerline and road servitudes, however, this option is the longest route of the options and traverses through a portion of wetland. This option is not considered to be feasible for this Project;
- Option 2, along shorter than Option 1 and Option 3, traverses through the largest portion of the wetland which may result in adverse environmental impacts to the wetland. This option is not considered to be feasible for this Project; and
- Option 3, which traverses through marginally smaller portions of the wetland as well as a portion of an existing road servitude, has therefore been deemed the preferred alternative and is included in this application.

8.1.4.2 Road Routing Alternatives (between Welgedacht Rail Siding and the Project Site)

Four existing road options were considered (Plan 4) for hauling operations from the mine to the Welgedacht rail siding. The route will be used by 34-ton trucks, thus the capacity and traffic along the road was considered. The TIA deemed Option 3 the preferred option as the road has sufficient capacity to accommodate 34 ton trucks. Furthermore, Option 3 does not traverse through a residential area therefore the road also has sufficient capacity for additional traffic from the mine development.



Plan 4: Routing Alternatives Considered

8.1.5 The "No-Go" Alternative

The no-go alternative entails maintaining the status quo. The current land use is primarily maize farming and small-scale cattle farming. The no-mining option will result in the continuation of such land use.

Although economically viable, the continuation of agriculture would not provide the level of medium term economic growth to the area that mining would offer. These economic benefits include an increase in employment at the local level, contribution to the national economy in taxes and royalties and an injection into the local economy through the procurement of goods and services at the regional level. Furthermore, the justification for the project, including the provision of coal product to existing power stations to secure South Africa's power supply, would not be met. In addition, the no-go alternative would also result in lost foreign revenues from the planned export coal product.

The no-go alternative also means that all potential negative impacts associated with the proposed mine and its associated infrastructure would not occur. The impacts which have been identified include direct impacts to the wetland resources in the area. According to the NFEPA delineations, the project area is dominated by the valley floor floodplain wetland associated with Aston Lake, which drains into the Blesbokspruit River Ramsar[3] Wetland and Marievale Nature Reserve. Within the Project boundary, the Gauteng Conservation Plan (known as the Gauteng C-Plan) identifies ecological sensitive areas classified as Irreplaceable, Important, and Support Areas, all indicating the overall sensitivity of the Project site. However, the Mining and Biodiversity Guideline (SANBI, 2013) has classified the majority of the proposed mining area as having a Moderate Biodiversity Importance within the eastern side of the proposed pit location, with areas of High Biodiversity Importance to the west of the proposed location of the open pit. The extent of the impacts were assessed and are provided in Section 11 of this report.

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.

[3] The Convention on Wetlands, called the Ramsar Convention, is an intergovernmental treaty that provides the framework for national action and international cooperation for the conservation and wise use of wetlands and their resources.

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:

- 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; and
- Telephonic and one-on-one consultations with landowners and land occupiers were done to identify additional I&APs.

Stakeholders for the proposed project were grouped into the following categories:

- **Government:** National, Provincial, District and Local authorities;
- **Landowners:** Directly affected and surrounding landowners;
- **Land occupiers:** Directly affected and surrounding land occupiers;
- **Communities:** Surrounding communities;
- **Non-Governmental Organisations (NGOs):** Environmental and social organisations;
- **Agriculture:** associations or organisations focussed on agricultural activities; and
- **Business:** small and medium enterprises and formal organisations.

A stakeholder database was compiled and updated throughout the PPP with new stakeholders (refer to Appendix B). 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
Portion 1 of the farm Palmietkuilen IR	Transnet (Pty) Ltd
Portion 4 and13 of the farm Palmietkuilen IR	Eskom Holdings
Portion 2 and19 of the farm Palmietkuilen IR	Palmietkuilen (Pty) Ltd

9.2 Consultation with Stakeholders during the Scoping Phase

Telephonic discussions were undertaken with stakeholders throughout the Scoping phase to inform them about meetings to be held and also to obtain comments. These discussions were predominantly on an ad-hoc basis via telephone and mostly with landowners, community leaders and councillors.

The intention of the varied stakeholder meetings was to solicit detailed stakeholder comments from specific sectors of society, provide Project details and explain the EIA and PPP. Having various stakeholder 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 stakeholder meetings.

Comments raised by stakeholders have been captured in the Comment and Response Report (CRR) (see Appendix B). The comments received were closely considered and addressed, where applicable, by the project team in order to ensure the scope for specialist studies undertaken during the Impact Assessment Phase were clearly defined. Responses have been provided to stakeholder comments and included in the CRR throughout the PPP (see Appendix B). The PowerPoint presentations utilised as part of the various stakeholder meetings are appended hereto as Appendix B.

Below are the various stakeholder meetings held (further details are available in Table 9-2 below).

9.2.1 Landowner One-on-One Meetings

Directly affected and the majority of the adjacent landowners were consulted by means of one-on-one meetings during which project details were provided, discussions were held to obtain comments and to identify additional landowners. This was undertaken during announcement of the project with only the BID being available to stakeholders as a reference to the project. A map was also used as part of the discussions in order to provide landowners with a reference to locality and recognisable landmarks. Key comments from landowners included, but isn't limited to the following:

- Confirmation of project timelines and infrastructure locations;
- Process associated with land acquisition;
- Impact on water quality and availability;
- Impact of blasting and dust; and
- Influx of people causing safety concerns.

9.2.2 Community Meeting

A community meeting was held at the end the Scoping Phase with the Schoeman Umbila Boerdery Community. The intention of the meeting was to provide details of the project and to understand key concerns from the Umbila Community. This meeting was attended by representative/s from community and members of the community. The formal presentation and printed maps used at the Scoping Phase Public Meeting were presented. Key comments from attendees included, but isn't limited to the following:

- Any plans for relocation of the people living in the area;
- Jobs for the local community during the operation of the mine;
- Health hazards during mining;
- Any specific skills or qualifications required to work for the mine; and
- The grave location plan.

9.2.3 Public Meeting

A public meeting was arranged for all stakeholders who are affected by or interested in the project. The intention of the meeting was to share project details, address comments already received from community leaders where possible, and to obtain further comments. Attendance was from some Residents in the area resulted in informal discussions taking place. Comments received were similar to what was received at the community meeting/s.

In **Error! Reference source not found.**, more details are provided on the PP activities ndertaken thus far during the Scoping phase, together with referencing materials appended.

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 B 1** Stakeholder database
Distribution of announcement letter and Background Information Document (BID)	BID, announcement letter with Registration and Comment Form was emailed and posted to stakeholders on Thursday, **11 August 2016**.	**Appendix B 2** Public Participation Materials
Placing of newspaper advertisement	An English advert was placed in the Springs Advertiser on Thursday, **18 August 2016**.	**Appendix B 2** Public Participation Materials
Putting up of site notices	English site notices were put up at the proposed project site, local libraries, municipal offices and frequently visited shops or recreational venues on Wednesday, **10 August 2016**: ▪ Bakerton Public Library; ▪ Heidelburg Public Library; ▪ Springs Public Library; ▪ On road side of R555 Road; ▪ On road side of R29 Road (at a Chicken Farm); ▪ Aston Lake; and ▪ Various locations bordering the site.	**Appendix B 2** Public Participation Materials

Activity	Details	Reference in Report
Announcement of Draft Scoping Report	Announcement of availability of the Scoping Report was emailed and posted to stakeholders together with the formal project announcement on Thursday, **11 August 2016**. Copies of the Scoping Report were made available at: ▪ Bakerton Public Library; ▪ Heidelberg Public Library; and ▪ Springs Public Library; The Draft Scoping Report was also made available on www.digbywells.com (under Public Documents) and at the various Stakeholder Meetings. *(Comment period: 12 August – 10 September 2016)*	**Appendix B 3** Progress Materials
Meetings with stakeholders	A letter to invite stakeholders to the Public Meeting was sent to the complete stakeholder database on Tuesday, 12 August 2016. The following stakeholder meetings were conducted: ▪ Various landowners were also consulted on a one-on-one basis during **September and October 2016**; ▪ Public Meeting: Wednesday, **24 August 2016** at the Stable Inn in Springs , 12:00 – 14:00; and ▪ Community Meeting: Sunday, **20 November 2016** at the Schoeman Umbila Boerdery Community Church, 09:00 – 11:00.	**Appendix B 3** Progress Materials **Appendix B 4** Comment and Response Report
Announcement of the Final Scoping Report	Final Scoping Report was submitted to Department of Mineral Resources on **16 September 2016**. A notification for availability of the Final Scoping Report was emailed and posted to stakeholders on **16 October 2016**. Copies of the Final Scoping Report have been made available at: ▪ Bakerton Public Library; ▪ Heidelberg Public Library; and ▪ Springs Public Library; The Final Scoping Report was made available on 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 B** Comment and Response Report

9.3 Consultation with Stakeholders during the EIA phase

During the Impact Assessment Phase the following main PP activities are envisaged to be undertaken:

- Provide feedback on the findings of the specialist studies conducted and mitigation measures proposed by means of consultation with I&APs;
- Making the relevant environmental reports available for public comment;
- Consultation with I&APs;
- Provide opportunity for I&APs to comment on specialist findings, impacts assessments and recommendations;
- Verify that comments raised by I&APs have been accurately recorded; and
- Inform specialists and the proponent of IA&P comments.

9.3.1 Public Participation Impact Assessment Phase Activities

Table 9-3 provides more detail about the PP activities undertaken during the Impact Assessment phase, together with referencing materials appended.

Table 9-3: Public Participation Impact Assessment Phase Activities

Impact Assessment Phase	
Announcement of Draft EIA/EMP Reports	Announcement of availability of the Draft EIA/EMP Reports will be emailed and posted to stakeholders on Thursday, 30 March 2017. Similar to the Scoping Report, copies of the Draft EIA/EMP Reports will be available at: ▪ Bakerton Public Library; ▪ Heidelberg Public Library; ▪ Springs Public Library; ▪ Delmas Public Library; and ▪ Vischkuil Clinic (Endicott). The Draft EIA/EMP Reports will also be available on www.digbywells.com (under Public Documents) and at the various stakeholder meetings. *(Comment period: 31 March 2017 – 03 May 2017)*
Focus Group Meetings	It is anticipated that Focus Group Meetings will be held. Stakeholders will be informed of the various meetings via email and telephonic discussions. Additional methods of informing stakeholders of the meetings such as placing notices will be considered and implemented.

Impact Assessment Phase	
Meetings with stakeholders	Meetings will be held with all stakeholders, and specifically so communities, following the release of the Draft EIA for public review. The following dates and venues are proposed: ▪ Focus Group Meetings with surrounding communities Tuesday, 22 April 2017, the venue and time of the meeting will be confirmed; and ▪ Public Meeting: Tuesday, 23 April 2017, the venue and time of the meeting will be confirmed.
Obtaining comments from stakeholders	Comments, issues of concern and suggestions received from stakeholders will be captured in the final CRR.
Announcement of the Final EIA/EMP Report	Notification for availability of the Final EIA/EMP Report will be emailed and posted to stakeholders. SMS notification will also be sent to stakeholders. Copies of the reports will be made available Digby Wells Website www.digbywells.com under Public Documents. *(Comment period: 31 March 2017 – 03 May 2017)*

9.4 Item 3(g)(iii): Summary of issues raised by I&APs

Views provided by I&APs throughout the PPP thus far have been captured in the CRR and also includes responses provided (please refer to Appendix B). As mentioned above, comments and issues of concern that are raised following the public review period of this Draft EIA will be captured and responded to in an updated CRR. Table 9-4 below provides a categorised summary of the key issues raised to date.

Table 9-4: Summary of Comments Received

Category	Comments
Water	▪ Negative impact to the Blesbokspruit; ▪ Negative impacts to borehole water (groundwater); ▪ Municipal water is not readily available to all residents; ▪ Potential negative impacts to the Aston Lake; and ▪ Concerns regarding water compensation to surrounding residents.
Socio-economic	▪ Displacement of residents within the mine boundary; and ▪ Job creation should not be at the expense of the environment.
Health and Safety	▪ New people being brought into the area could result in theft / crime; and ▪ Concerns regarding asthma and air pollution-related diseases.
Land Value / Ownership	▪ Mining will deteriorate the property values in the area; and ▪ Negative impact to surrounding businesses.
Agriculture	▪ Loss of agricultural land in and around the mine boundary; and

	▪ The project site will destroy good agricultural land.
Air quality	▪ Dust emissions.
Heritage	▪ Graves located within the proposed open pit area will need to be relocated.
Ecology	▪ Wetland destruction within the mine boundary.
Blasting	▪ Concerns of blasting on surrounding structures and the proposed communication streams and compensation from the applicant.
Roads and Transport	▪ Haul trucks affecting the surrounding road network.
Environmental Impact Assessment	▪ Scepticism surrounding the legislated NEMA EIA Process; and ▪ Authorities must consider the regional cumulative impact of another mining operation in the area.
Public Participation	▪ Some residents want the public meetings to be held closer to the project area. ▪ General dissatisfaction surrounding communication between the applicant and I&APs.
Need and Desirability for the Project	▪ The majority of I&AP comments received are opposed to the Project.

10 Item 3(g)(iv): The environmental attributes associated with the development footprint alternatives

A number of specialist studies were undertaken during the EIA phase for the proposed project, as shown in Table 10-1 below.

Table 10-1: Specialist Reports and Associated Appendices

Specialist Study	Appendix
Soil, Land Use and Land Capability Assessment	Appendix C
Surface Water Assessment	Appendix D
Groundwater Assessment	Appendix E
Flora and Fauna Assessment	Appendix F
Wetland Assessment	Appendix G
Aquatic Ecology Assessment	Appendix H
Air Quality Assessment	Appendix I

Noise Assessment	Appendix J
Visual Assessment	Appendix K
Blast and Vibration Assessment	Appendix L
Cultural Heritage Assessment	Appendix M
Social Assessment	Appendix N
-Economic Assessment	Appendix O
Traffic and Transport Assessment	Appendix P
Rehabilitation Plan (incl. Closure Cost Assessment)	Appendix Q

The section below provides 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 Type of environment affected by the proposed activity

10.1.1 Regional Geology

The Project area is underlain primarily by sedimentary strata (quartzite and shale) associated with the Witwatersrand Supergroup, and younger sediments (dolomite, quartzite and shale) associated with the older strata of the Transvaal Supergroup. The region is dominated by a cover of Karoo sandstone, conglomerate, dolerite sills and shale, with minor coal seams.

The Project site is located within the Eastern Basin. The Eastern Basin is characterised by northwest-striking folds, with two prominent anticlinal structures namely the Nigel Anticline and Springs Monocline.

10.1.2 Regional Climate

Meteorological data was utilised to assess the baseline environment. The following parameters were assessed (utilising data from 2011- 2013): wind direction, wind speed, rainfall, temperature, relative humidity and these are discussed below.

10.1.2.1 Temperature

Three-year average maximum, mean and minimum temperatures for the Project area are given in Table 10-2. The average daily maximum temperatures range from 18°C in July to 30°C in January, October and November with daily minimum ranging from -1°C in July and August to 12°C in January. Annual mean temperature is 26°C.

Table 10-2: Average Monthly Temperature for Springs Modelled Data, 01 January 2011 – 31 December 2013

Temp(°C)	J	F	M	A	M	J	J	A	S	O	N	D	Annual Average
Monthly Max.	30	29	27	25	24	19	18	23	25	30	30	29	26
Monthly Min.	12	11	10	4	1	-2	-1	-1	1	4	6	10	5
Monthly Mean	20	17	19	13	11	3	8	10	14	17	19	20	14

10.1.2.2 Relative Humidity

The annual maximum, minimum and average relative humidity is given as 70.2 %, 65.8 % and 68.6 %, respectively. The monthly minimums, maximums and averages are indicated in Table 10-3.

Table 10-3: Average Monthly Relative Humidity for Springs modelled data, 01 January 2011 – 31 December 2013

Relative Humidity (%)	J	F	M	A	M	J	J	A	S	O	N	D	Annual Average
Monthly Max.	71	68	67	75	73	76	77	71	72	69	60	64	70
Monthly Min.	68	66	66	67	70	73	68	68	67	60	58	61	66
Monthly Ave.	70	70	73	71	71	75	72	70	69	65	59	62	69

10.1.2.3 Precipitation

The annual total rainfall maximum and average rainfall for the three year period are 1,044 mm and 677 mm respectively. The highest total monthly precipitation of 221 mm was observed in January. This is shown in Table 10-4.

Table 10-4: Monthly Precipitation (max) for Springs Modelled Data, 01 January 2011 – 31 December 2013

Precipitation (mm)	J	F	M	A	M	J	J	A	S	O	N	D	Annual Total
Total Monthly Rainfall (Max).	221	102	81	63	22	28	5	24	59	142	100	175	1044
Average Total Monthly	168	69	22	38	11	14	3	13	34	89	99	170	677

rainfall													

10.1.3 Soil, Land Use and Land Capability

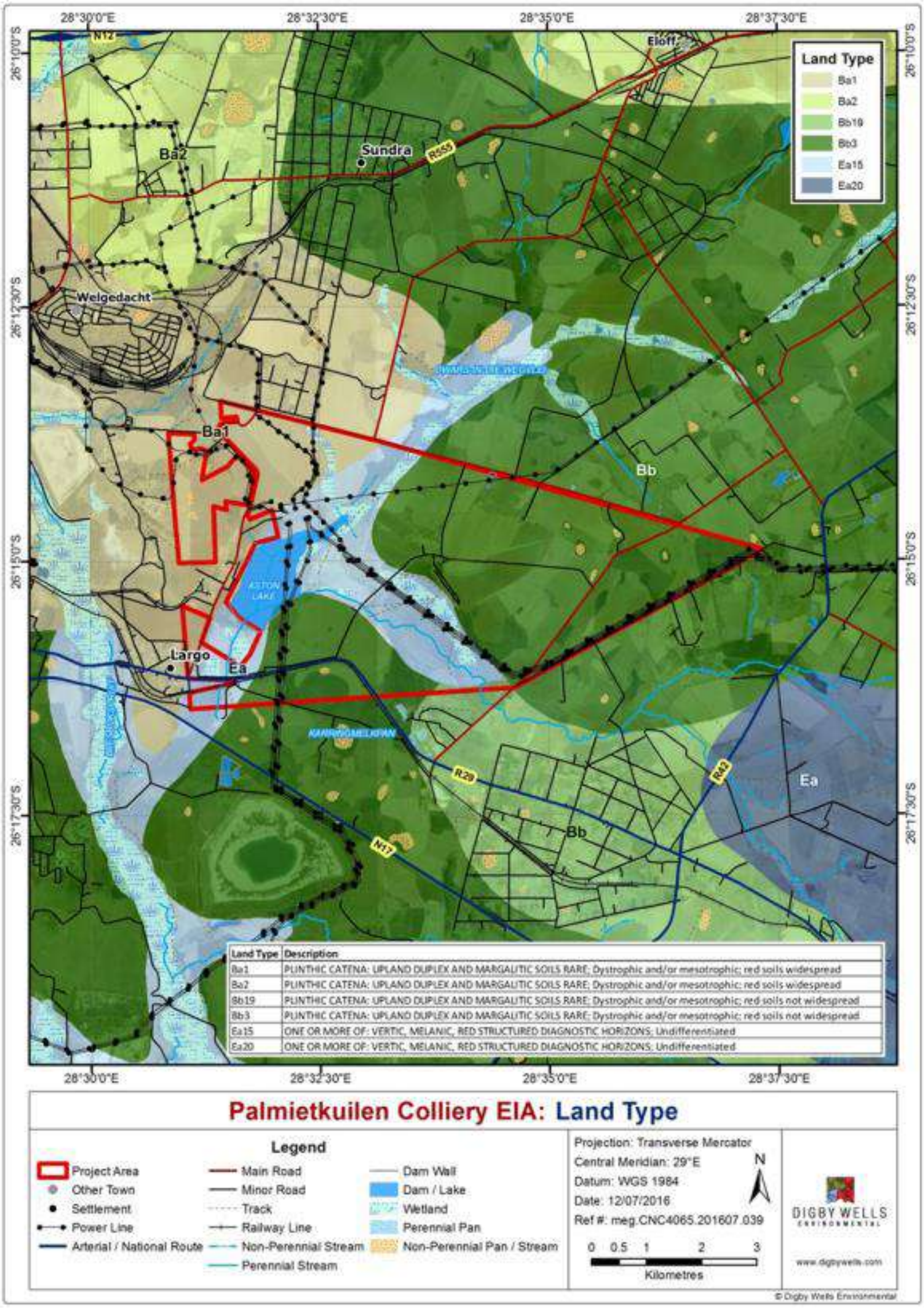
The Soil, Land Use and Land Capability Assessment undertaken during the EIA Phase is appended to this report as Appendix C. The land type data gathered during the scoping phase suggested that the dominant land types on site were Ba1, Bb3 and Ea15 (Table 10-5 below). The field survey confirmed these findings with the dominant soil forms in the area of the open pit and infrastructure. The Mining Right Area is dominated by the presence of soils highly suited to agriculture such as Hutton and Clovelly which represent 56% of the project site as shown in Plan 5. The remainder of the Project area consists of soils with low agricultural potential and wetland soils.

10.1.3.1 Land Type Data and Soil Forms

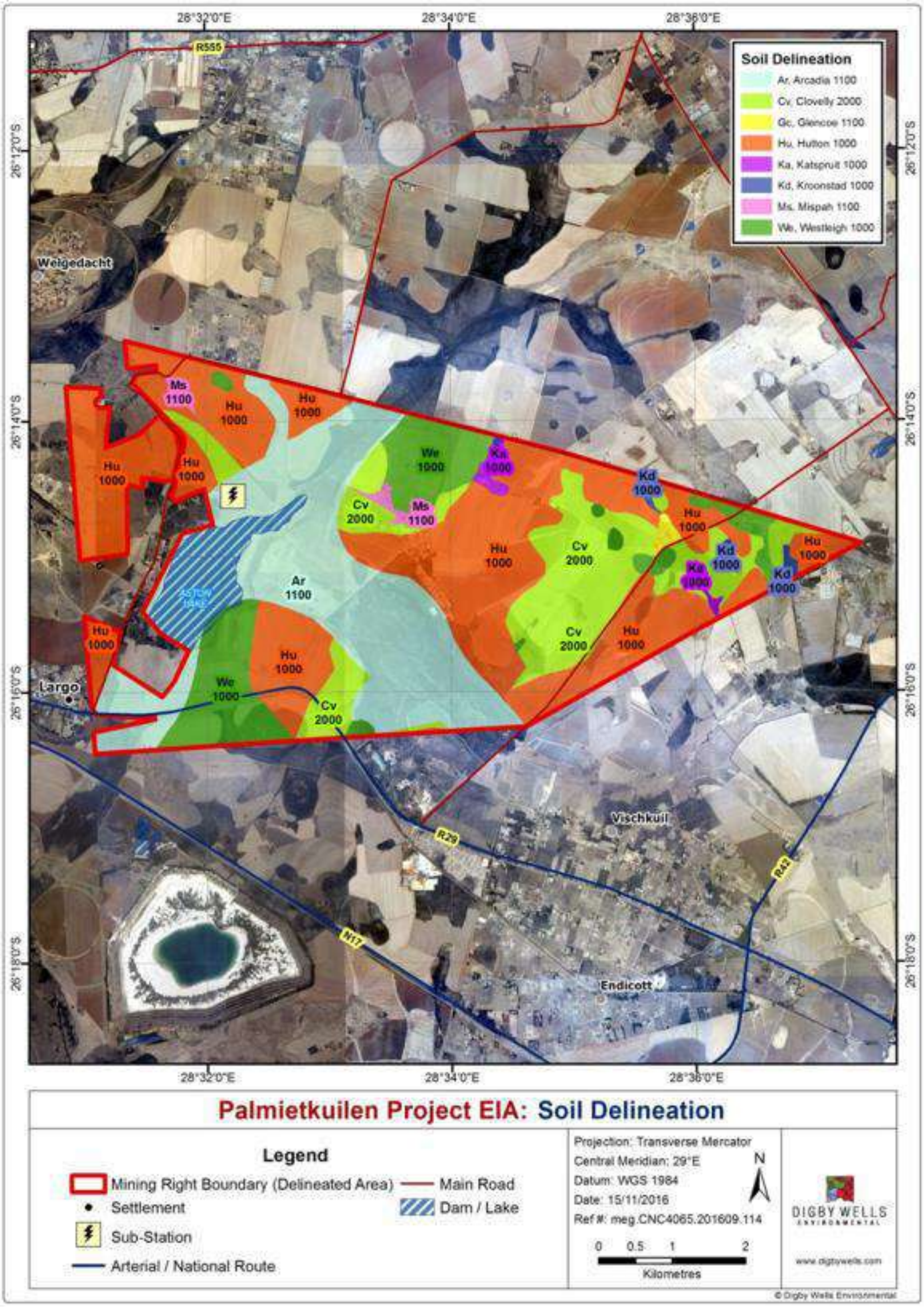
The dominant land types and soil forms identified at the Project site as well as their key characteristics are provided Table 10-5 below. This is also illustrated in respect of the Project site in Plan 5 and Plan 6 respectively. Further detail pertaining to the soil forms is provided in the Soil, Land Use and Land Capability Assessment appended as Appendix C.

Table 10-5: Dominant Land Types and Soil Forms

Land Type	Soil Forms	Geology	Characteristics
Ba1	Hutton; Mispah and Clovelly.	Shale, sandstone, slate, quartzite and lava of the Witwatersrand Supergroup	Dominated by moderately deep to deep well drained soils. Mispah has a high erosion hazard and a shallow rooting depth.
Bb3	Hutton; Mispah; Westleigh; Kroonstad, Katspruit, Glencoe and Clovelly	Shale, sandstone, clay, conglomerate and limestone of the Ecca Group, shale and tillite of the Dwyka Formation, dolerite and dolomite	This land type is dominated by moderately deep to deep well drained soils with plinthic character at depth on the higher lying areas.
Ea15	Arcadia and (probably) Rensburg forms	Alluvium, dolerite, sandstone and shale of the Ecca Group	Consists of soil with significant accumulation of smectitic (swelling) clay (vertic horizon).



Plan 5: The Land Type Map for the Palmietkuilen Colliery EIA (Land Type Survey Staff, 1976-2006)



Plan 6: Soil Map for the Palmietkuilen Project EIA

10.1.3.2 Land Capability

Land capability is determined by a combination of soil, terrain and climate features. The dominant land capability classes in the Project area are Class II (Intensive cultivation, 57%), followed by Class III (Moderate cultivation, 15%) and Class V (Wet zones, 28%), as depicted in Plan 7 below. Arable land capability covers 72% of the area while non-arable covers 28%. The land capability where the proposed open mining and infrastructure is to be constructed will be reduced from highly arable to non-arable. The sections below list in detail the limitations used to define the three classes.

10.1.3.2.1 Class II: Arable

Class II land capability coincides with the Hutton and Clovelly soils. These soils are well drained, easily managed and have high agricultural potential. Land in Class II has some limitations that reduce the choice of plants or require moderate conservation practices. It may be used for cultivated crops, but with less latitude in the choice of crops or management practices than Class I. The limitations are few and the practices are easy to apply. Limitations may include, singly or in combination, the effects of:

- Gentle slopes;
- Moderate susceptibility to wind and water erosion;
- Less than ideal soil depth;
- Somewhat unfavourable soil structure and workability;
- Slight to moderate salinity or sodicity easily corrected but likely to recur;
- Occasional damaging flooding;
- Wetness correctable by drainage but existing permanently as a moderate limitation; and
- Slight climatic limitations on soil use and management.

Limitations may cause special soil-conserving cropping systems, soil conservation practices, water-control devices or tillage methods to be required when used for cultivated crops.

10.1.3.2.2 Class III: Arable

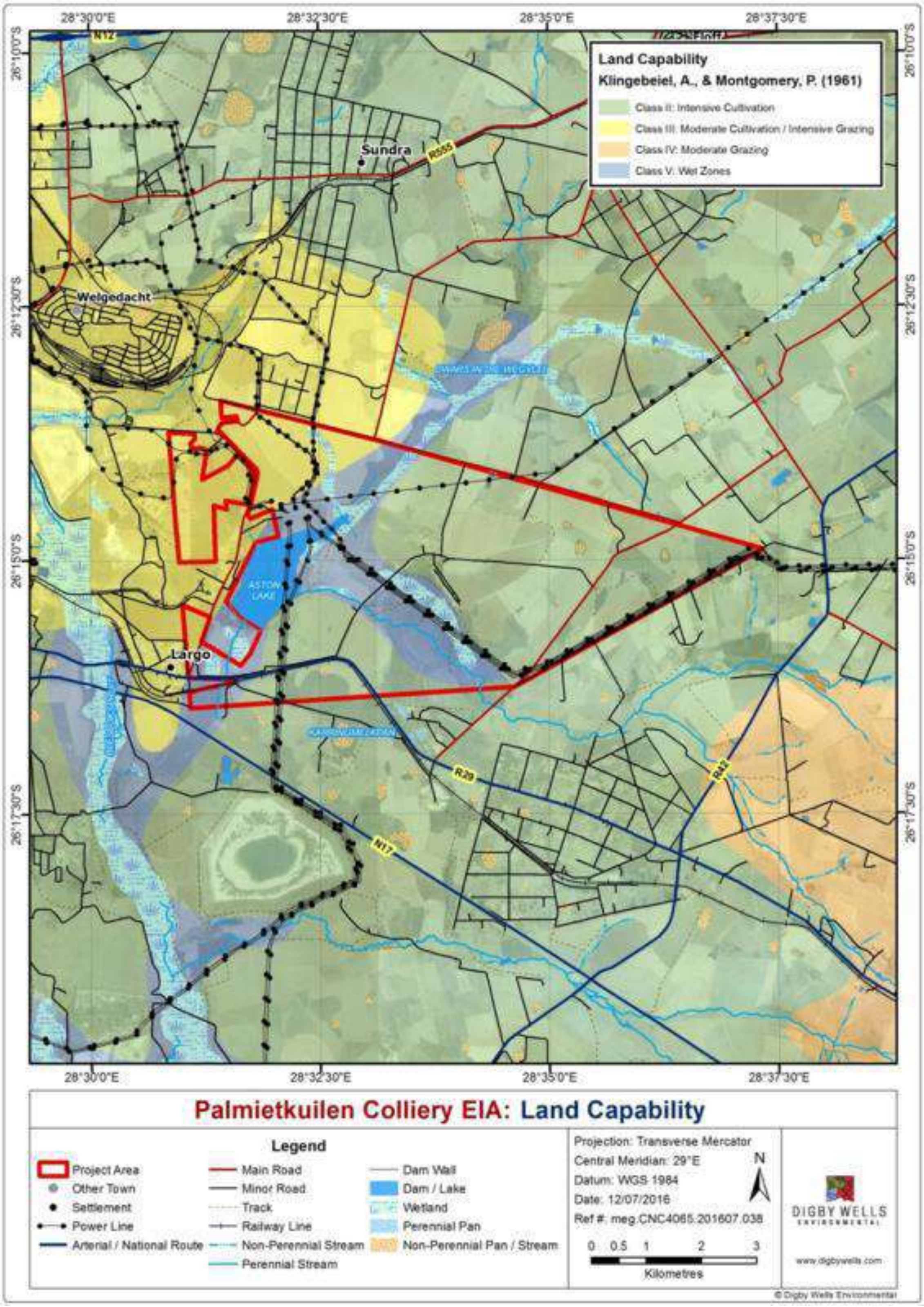
Land in Class III has more severe limitations that reduce the choice of plants or require special conservation practices or both. Land may be used for cultivated crops, but has more restrictions than Class II. When used for cultivated crops, the conservation practices are usually more difficult to apply and to maintain. The number of practical alternatives for average farmers is less than that for soils in Class II. Limitations restrict, singly or in combination, the amount of clean cultivation, time of planting, tillage, harvesting and choice of crops. Limitations may result from the effects of one or more of the following:

- Moderately steep slopes;
- High susceptibility to water or wind erosion or severe adverse effects of past erosion;

- Frequent flooding accompanied by some crop damage;
- Very slow permeability of the subsoil;
- Wetness or some continuing waterlogging after drainage;
- Shallow soil depth to bedrock, hardpan, fragipan or clay-pan that limits the rooting zone and water storage;
- Low water-holding capacity;
- Low fertility not easily corrected;
- Moderate salinity or sodicity; and
- Moderate climatic limitations.

10.1.3.2.3 Class V: Grazing

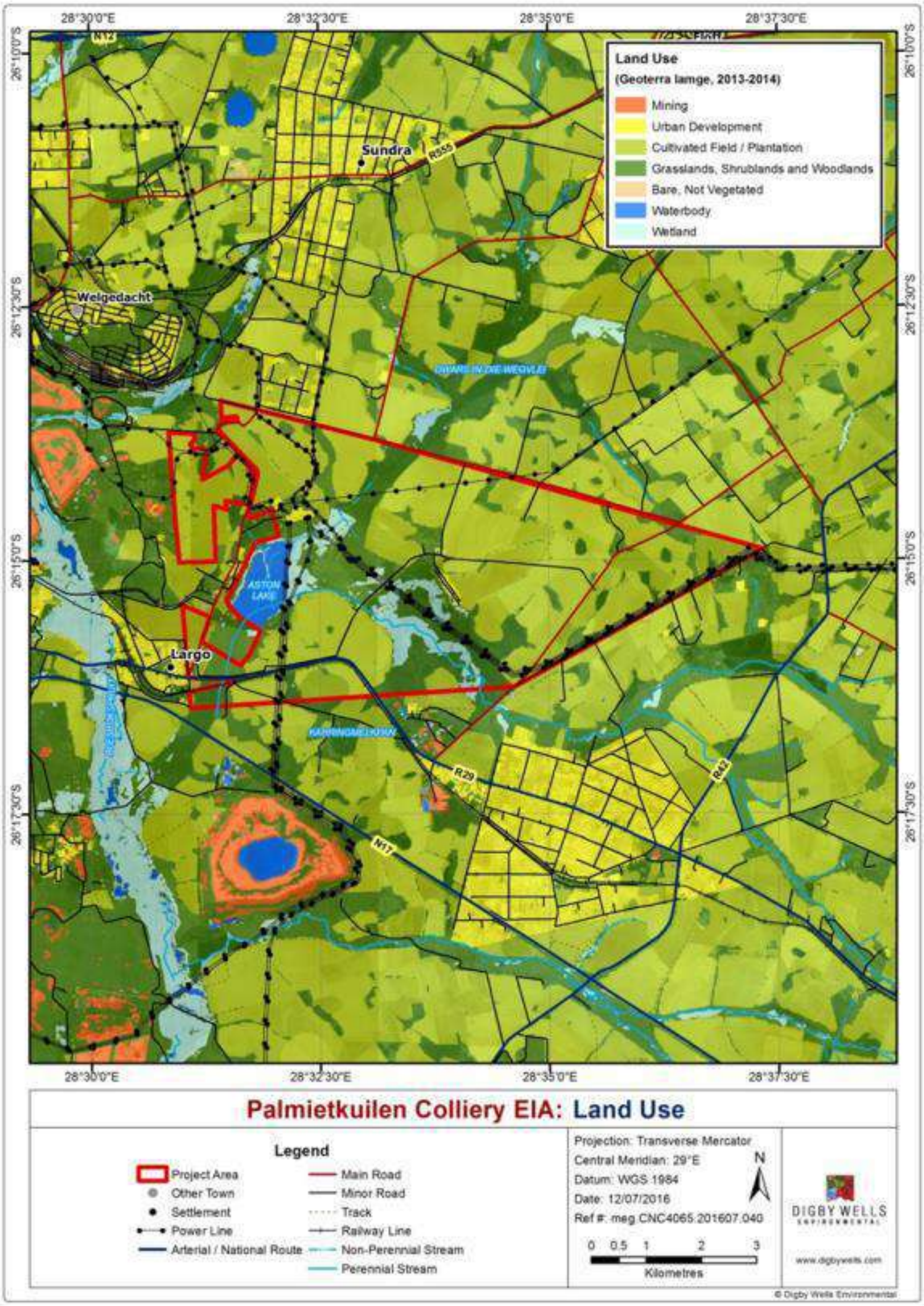
Class V land capability coincides with the Arcadia soils. Although these soils are deeper, they have high clay content and shrink/swell properties, making them very difficult to manage from an agricultural perspective. Land in Class V has little or no erosion hazard but has other limitations impractical to ameliorate which limit its use largely to grazing or wildlife. Limitations restrict the kind of plants that can be grown and prevent normal tillage of cultivated crops.



Plan 7: The Land Capability Map for the Project Area (Land Type Survey Staff, 1976 – 2006)

10.1.3.3 Land Use

The most dominant land use as shown in Plan 8 is cultivated areas which occupy 63% of the project site followed by grazing which occupies 37 % including wetlands and water body. This reflects that the area has been developed for agriculture over years. The main impact on land use will be the change from crop production to mining. The cumulative impact on land use will be converting into open cast mining and infrastructure areas resulting in loss of agricultural land in that area for the mining life (<50 years). After mining, however, it is anticipated that land can be restored. Surrounding land use can be broadly defined as arable land under cultivation on commercial farms.



Plan 8: The Land Use Map for the Project Area

10.1.3.4 Soil Chemical and Physical Characteristics

The results of soil analysis are presented in Table 10-6 and as a basis for interpreting this data, local soil fertility guidelines are presented in Table 10-7.

Table 10-6: Soil Physico-Chemical Results

Land Ref	Soil Form	pH (KCl)	P(Bray1)	K	Na	Ca	Mg	CEC	S	C	Clay	Sand	Silt	Texture
			mg/kg					cmol/kg	mg/kg	%				
WP068	Ms1100	4.4	17	166	9	473	104	37	10	0.6	13	71	16	Loamy Sand
WP072A	Hu1000	4.4	58	95	7	344	80	27	23	0.6	13	81	6	Loamy Sand
WP073B	Hu1000	5.2	3	38	9	432	103	25	20	0.7	19	72	9	Loamy Sand
WP074A	Cv2000	5.7	9	85	9	689	158	32	12	0.5	27	70	3	Sandy Clay Loam
WP074B	Cv2000	6.1	4	52	10	853	184	33	18	0.4	23	61	16	Sandy Clay Loam
WP082A	Hu1000	4.3	84	94	6	260	74	20	9	0.7	11	81	8	Loamy Sand
WP082B	Hu1000	4.2	16	64	7	190	57	18	15	0.6	13	77	10	Loamy Sand
WP084A	We1000	4.5	10	89	12	543	136	32	10	0.6	13	69	18	Sandy Loam
WP084B	We1000	5.2	1	61	45	719	321	39	34	0.5	27	56	17	Sandy Clay Loam
WP103A	Hu1000	4.9	39	197	10	595	144	32	16	0.4	23	62	15	Sandy Clay Loam
WP103B	Hu1000	5.4	6	66	8	634	145	26	18	0.5	31	54	15	Sandy Clay Loam
WP117A	Cv2000	5.5	12	106	7	572	100	28	10	0.7	13	74	13	Sandy Loam
WP117B	Cv2000	5.4	3	49	8	770	119	33	14	0.6	27	61	12	Sandy Clay Loam
WP120A	Cv2000	4.8	20	242	22	758	264	39	17	0.7	23	59	18	Sandy Clay Loam
WP120B	Cv2000	4.6	3	189	95	1147	451	40	44	0.6	37	43	20	Clay Loam
WP127A	Kd1000	5.5	16	236	10	684	135	33	14	0.6	15	68	17	Sandy Loam
WP127B	Kd1000	6.0	8	241	9	708	179	38	15	0.6	19	65	16	Sandy Loam
WP134A	Hu1000	4.9	14	212	16	706	149	37	12	0.4	17	69	14	Sandy Loam
WP138A	Ar1100	5.2	2	309	149	5135	1811	44	63	2.5	55	20	25	Clay

Table 10-7: Soil Fertility Guidelines (Fertiliser Association of South Africa, 2003)

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

In general the acidity level of the soils is slight to moderate, with only a few samples having a pH near the threshold of 4.5 (measured in KCl) indicative of a likely response to lime application. On most of the soils a positive crop response to lime application would not be expected. This is confirmed by the Ca and Mg status which in all but one or two soils (WP082A and B with pH of 4.2-4.3) is satisfactory in relation to the norms in

Table 10-7. Phosphorus availability is variable but shows evidence of past fertilizer application on many of the soils and potassium status is relatively high in the great majority of the soils. The light texture and low organic carbon status of all the soils besides the Arcadia (WP138A, last row of Table 10-6) have adverse implications for rehabilitation because compaction problems are potentially severe, as has been widely found in open cast coal mining areas of the Highveld. By contrast, the Arcadia soil is considerably better endowed with base cations, organic carbon, clay, and cation exchange capacity. The low available P status of the Arcadia sample reflects a probable history of no cropping on this wetland soil. Because of the high nutrient status and well buffered pH, soils such as Arcadia with a vertic horizon are potentially very suitable for rehabilitation work. Although the black clay is potentially difficult to work because of unfavourable consistence, it has the advantage of a self-mulching habit meaning that clods will "weather" to a fine crumb structure due to shrinking and swelling with changes in water content. Furthermore, the shrink-swell behaviour could potentially have a favourable effect in counteracting mechanical compaction caused by heavy machinery employed for rehabilitation. Vertic soils can be used successfully for crop and pasture production if managed judiciously (Fey *et al*, 2010).

10.1.3.5 Agricultural Potential

Among the dominant soils in Table 10-8, the Hutton and Clovelly forms have high agricultural potential, Westleigh has low potential and Arcadia has a low potential in its wetland setting but this can be moderate to high under suitable management.

Table 10-8: Agricultural potential for soils

Soil Form	Depth	Hectares	Agricultural Potential
Hutton	0 – 1.2	1382	High
Clovelly	0 – 1.2	575	High
Glencoe	0 – 0.5	12	Low to moderate
Kroonstad	0 – 0.5	18	Low to moderate
Mispah	0 – 0.3	20	Very Low
Arcadia	0 – 0.4	1025	Low*
Katspruit	0 – 0.4	28	Very low*
Westleigh	0 – 0.4	413	Low

* Potential rated low in a wetland context but can be high with suitable management.

10.1.3.5.1 Dryland Crop Production

The largest part of the Project area is currently used for crop production. Soils of Hutton and Clovelly are highly suitable for crop production and according to the Department of Agriculture in co-operation with ARC-Grain Crops Institute; 350 to 450 mm of rain per annum is required for successful maize production. The project area is therefore suitable for rain-fed maize production with its average annual rainfall of 677 mm (Digby Wells Environmental, 2016). The Glencoe and Mispah soil are considered more suitable for grazing. Soils of Katspruit and Arcadia have wetland land capability and are not suitable for crop production except possibly if landscaping during rehabilitation allows suitable drainage and water management in which case these soils can be very productive.

10.1.3.5.2 Irrigated Crop Production

The Project area has irrigation infrastructure including a large dam. Currently the Hutton, Clovelly and Glencoe soils are suitable for irrigated crop production.

10.1.4 Surface Water

The Surface Water Assessment undertaken during the EIA Phase is appended to this report as Appendix D. A site visit was conducted on 23 August 2016 to collect water samples from the selected points, The selection of water sampling locations aims at collection of samples upstream of the proposed mining activities, within the mining activities (mid-stream) and downstream of mining activities/infrastructure. The upstream site will indicate the inflow water quality into the proposed Project area which represents the water quality from all upstream activities not related to the proposed Project activities. The midstream points will indicate the immediate mine site’s point and diffuse sources of water quality pollution, whilst the downstream points will detect how far reaching the water quality impacts are, and is most cases can prove the water course’s self-cleaning capability through dilution or biological activities.

The surface water points locations are summarised below in Table 10-9.

Table 10-9: Surface Water Sampling Points

Point Name	Latitude*	Longitude*	Description
AECSW06	-26.269461	28.523228	Downstream monitoring point : downstream of Aston Lake on unnamed Stream
SW1	-26.274339	28.572975	Upstream on Verdrietlaagte a feeder stream to the Aston Lake
SW2	-26.231863	28.55844	Upstream sampling point on the Dwars-in-die-wegvlei was found dry
Aston Lake	-26.253233	28.527422	Located within the Lake downstream of infrastructure area

*Geographic Coordinate System WGS84 Datum

Sampling photos taken of the sampling locations are represented on Figure 10-1.

SW1

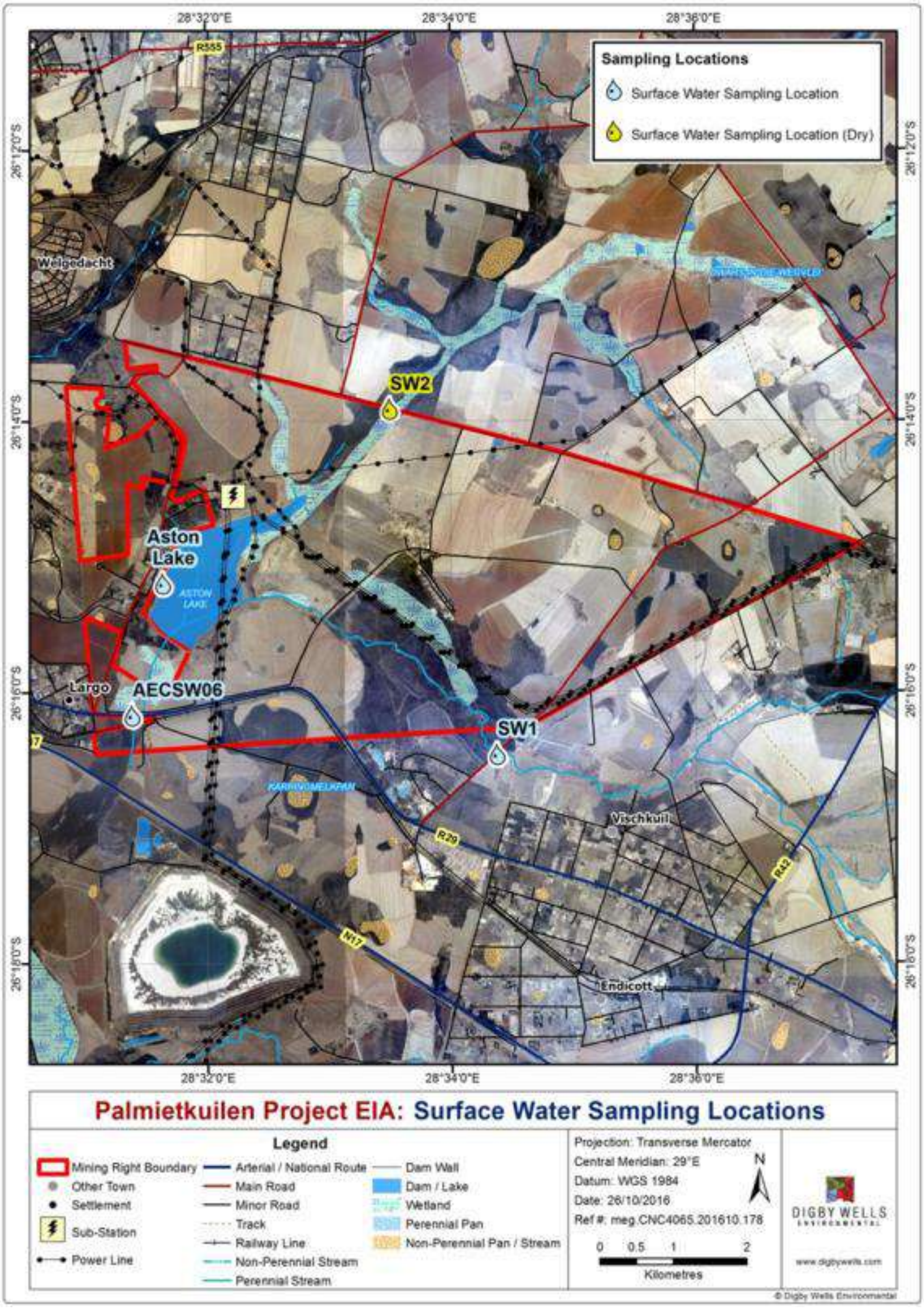
SW2

AECSW06

Aston Lake

Figure 10-1: Sampling Location Pictures

The location of the three sampling sites relative to the project area is indicated in Plan 9.



Plan 9: Surface Water Sampling Locations

10.1.4.1 Regional Hydrology

South Africa is divided into 9 Water Management Areas (WMAs) which have been published in the Government gazette number 40279 of 19/09/16 (Notice no 1056, DWS, 2016), managed by their own water boards. Each of the WMAs is made up of quaternary catchments which relate to the drainage regions of South Africa, ranging from A to X (excluding O). These drainage regions are subdivided into four known divisions based on size.

The Project area is situated within the Vaal Water Management Area (WMA 5), within the C21E quaternary catchment (Plan 10).

10.1.4.2 Local Hydrology

The proposed Project site is within the Aston Lake catchment, surrounded by wetlands and drained by the Dwars-in-die-wegvlei and the Verdrietlaagte streams on either side. The Aston Lake discharge flows into the Blesbokspruit approximately 4 km from the dam's outlet and approximately 6.5 km from the nearest proposed Project infrastructure.

The Blesbokspruit is a perennial second-order stream which is a tributary of the Suikerbosrand River, and in turn flows into the Vaal River. The Blesbokspruit originates in the northern part of the catchment with perennial and non-perennial streams contributing to its flow; it is a NFEPA recognised wetland and is also a Ramsar site. Aston Lake is best known as a fishing destination thus giving is a local recreational importance.

10.1.4.3 Mean Annual Runoff

The C21E quaternary catchment has a net area of 629 km^2 and has a Mean Annual Runoff (MAR) of 18.02 million cubic metres (Mm^3). Runoff emanating from this quaternary catchment drains in a south-westerly direction towards the Blesbokspruit.

According to Government Notice 704 in Government Gazette 20119 (GN704) requirements pertaining to mine water use, all runoff emanating from dirty water areas such as mine infrastructures, operational areas and ROM stockpiles need to be contained within these areas, so as not to mix with the downstream clean water

As previously mentioned the proposed Project will include the establishment of an open pit coal mine as well as supporting surface infrastructure including a crushing, screening and washing plant, conveyors, PCD dams and offices. The identified infrastructure areas amount to approximately 10.72 km^2. The percentage loss in MAR for the C21E quaternary catchment due to the project is approximately 1.7% of the total MAR. The Infrastructure is approximately 3.1% of total catchment area for the Aston Lake (344 km^2) and this would imply a loss of 3.1% catchment runoff area to the Aston Lake.

The surface water attributes of the C21E quaternary catchment are summarised in Table 10-10. This includes the Mean Annual Precipitation (MAP), MAR, and Mean Annual Evaporation (MAE) as obtained from the Water Resources of South Africa 2012 Study (WR2012).

Table 10-10 : Summary of the Surface Water Attributes of the C21D Quaternary Catchment

Quaternary Catchment	Total Area (km^2)	MAR (Mm^3*	Infrastructure Area (km^2)	Percentage decrease in MAR (%)	Loss in MAR (Mm^3)*
C21E	629	18.02	10.72	1.70	0.307

10.1.4.3.1 Storm Rainfall Depths

The closest weather stations to the Project area defined are presented in Table 10-11. The data was used to estimate the 24-hour design rainfall using the Design Rainfall Estimation (DRE) in South Africa (Smithers and Schulze, 2003).

Table 10-11 : Summary of the Closest Rainfall Stations

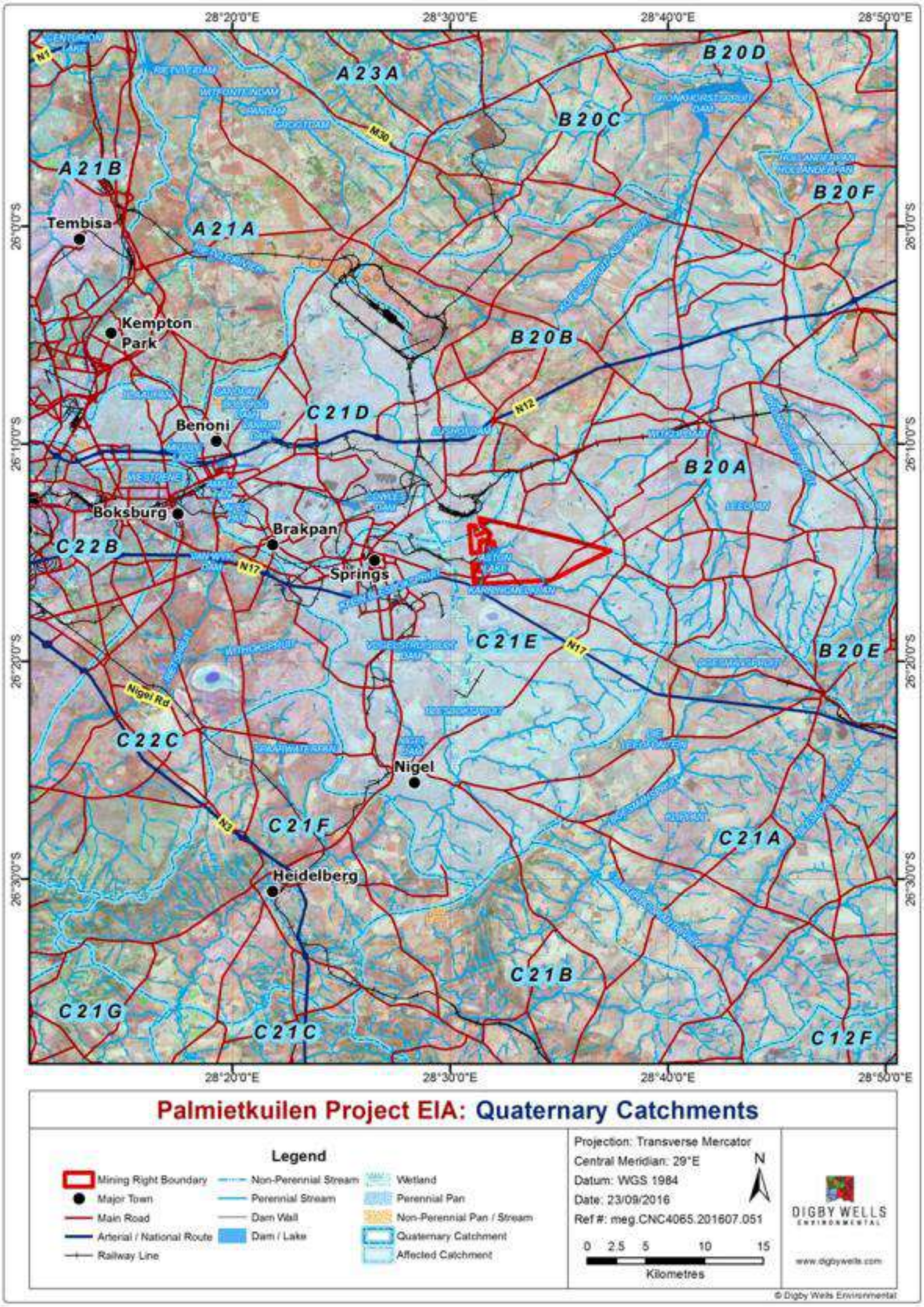
Station Name	SAWS Number	Distance from Project Centre (km)	Record Length (years)	Lat (°) (')	Long (°) (')	MAP (mm)	Altitude (m)
STRYDPAN	0477224_W	5.4	46	26° 14'	28° 37'	683	1603
DROOGEFONTEIN	0477191_W	6.5	61	26° 11'	28° 36'	664	1617
RIETFONTEIN	0476737_W	10.2	48	26° 18'	28° 30'	702	1580
SPRINGS-OLYMPIA PARK	0476766_W	16.3	80	26° 15'	28° 25'	711	1622
SPRINGS (RWB)	0476736_W	16.6	96	26° 16'	28° 25'	709	1610
DELMAS (POL)	0477309_W	16.6	92	26° 8'	28° 41'	661	1555

Table 10-12 presents the estimated rainfall depths for a 24-hour rainfall event for various return periods based on a weighted average for the stations mentioned in Table 10-11.

Table 10-12 : Estimated 24 Hour Design Rainfall Depth

Design rainfall return period (yrs)	1:2	1:5	1:10	1:20	1:50	1:100	1:200
24 Hr design peak rainfall (mm)	62.5	86.3	104.3	123.4	151.4	174.8	200.6

The quaternary catchment and local setting are illustrated in Plan 10 below and Plan 1 above.



Plan 10: Quaternary Catchments of the Study Area

10.1.4.4 Catchment Water Uses

The Water Authorisation Registration and Management System (WARMS) (DWS, 2013) database pertaining to surface water use was consulted on the 20 July 2016. The surface water uses determined for quaternary catchment C21E included industrial use (urban and non-urban), irrigation, watering livestock and mining. This information is summarised in Table 10-13.

Table 10-13: Summary of Surface Water Uses for Quaternary Catchment C21E

Quaternary Catchment	Registered Water Use	No. of Registered Users	Registered Volumes (m^3/year)	Sources of Water Used
C21E	Agriculture: Irrigation	17	5,568,809	Dam, Borehole, River/Stream
C21E	Agriculture: Watering livestock	2	60,225	Borehole
C21E	Mining	2	960,000	Scheme and River/Stream
C21E	Industry (Urban)	4	104,441	Boreholes and Scheme
C21E	Industry (Non-Urban)	4	71,896	Borehole and River/Stream

There are 29 registered water users in this quaternary catchment sharing 6 765 371 m^3 of water per year with agriculture (irrigation) being the highest water user sector. These water uses were confirmed during the site visit conducted by a surface water specialist for water sampling.

10.1.4.5 Water Quality

Surface water samples were submitted to Aquatico Laboratory (Pty) Ltd, a South African National Accreditation System (SANAS) accredited laboratory, in Pretoria for analyses of physical and chemical water quality parameters. Based on the site survey water use around the project area is predominantly for irrigation, livestock watering and domestic water use (with most farmers having their own water treatment plants). For that reason the results were benchmarked against the South African Water Quality Guidelines for Agricultural Use: Irrigation (DWAF, 1996) and South African Water Quality Guidelines for Agricultural Use: Domestic Use.

The water quality data was also benchmarked against the Blesbokspruit catchment water quality objectives (WQO) as the Project area is located within the catchment and there are no standards in the Aston Lake. Water quality results have also been benchmarked against the South African National Standards (SANS) 241-1:2015 drinking water standards. SANS 241 specifies the quality of acceptable drinking water, defined in terms of microbiological, physical, aesthetic and chemical determinants. Water that complies with SANS 241 is deemed to present an acceptable quality for human consumption (this implies an average consumption of 2 L of water per day for 70 years by a person that weighs 60 kg). The results of the surface water quality analysis are presented in Table 10-14 and Table 10-15.

Table 10-14: Water Quality Results Benchmarked against the SANS 241-1:2015 and South African Water Quality Guidelines: Irrigation and Domestic Use Guidelines

Sample ID		pH-Value at 25° C	Conductivity at 25° C in mS/m	Total Dissolved Solids	Calcium as Ca	Magnesium as Mg	Sodium as Na	Potassium as K	Chlorides as Cl	Sulphate as SO_4	Nitrate NO_3 as N	Fluoride as F	Aluminium as Al	Iron as Fe	Free and Saline Ammonia as N	Total Hardness	Turbidity	Orthophosphate as P	Suspended Solids as SS	Total Alkalinity as $CaCO_3$
SANS 241:2015 Limits	(Aesthetic)	-	≤ 170	≤ 1 200	-	-	≤ 200		≤ 300	≤ 250	-	-	-	≤ 300	≤ 1.5	-	≤ 5	-	-	-
	Operational	≥ 5 to ≤ 9.7	-	-	-	-	-	-	-	-	-	-	≤ 300	-	-	-	≤ 1	-	-	-
	Chronic Health	-	-	-	-	-	-	-	-	-	-	≤ 1.5	-	≤ 2000	-	-		-		
	Acute Health	-	-	-	-	-	-	-	-	≤ 500	≤ 11	-	-	-	-	-	-	-	-	-
SWQG: Domestic Use (Target water quality range)	Target Water Quality Range	6.0 – 9.0	-	0 - 450	0 - 32	0 - 30	0 - 100	0 - 50	0 - 100	0 - 200	-	0 - 1.0	0 - 0.15	0 - 0.1	0 - 1.0	50 - 100	0 - 1	-	-	-
South Africa Water Quality Guidelines: Agriculture Irrigation	Target Water Quality Range	6.5 - 8.4	-	40	-	-	70	-	100	-	-	2.0	5.0	5.0	-	-	-	-	50	-
AECSW06	26/08/2016 00:00	8.5	26	146	30	13	9	11	8	51	0.313	0.386	BDL	BDL	0.077	127	15	0.05	11	92
SW01	26/08/2016 00:00	8.8	119	692	80	52	127	33	178	109	0.272	0.348	BDL	BDL	0.091	414	28	0.10	42	300
Aston Lake	26/08/2016 00:00	8.6	30	222	19	12	35	12	21	29	0.298	0.565	0.744	0.429	0.065	97	222	0.08	204	119

N:B:

BDL = Below Detection Limit; and

(-) = No Specified Guidelines Value

Manganese as Mn ; Co Cadmium as Cd; Cobalt as Co ; Total Chromium as Cr; Copper as Cu; Nickel as Ni ; Lead as Pb; and Zinc as Zn have been excluded as they were all BDL

Table 10-15 : Water Quality Results Benchmarked against the Blesbokspruit Catchment Water Quality Objectives

Sample ID		Nitrate NO_3 as N	Chlorides as Cl	Sulphate as SO_4	Calcium as Ca	Magnesium as Mg	Sodium as Na	Potassium as K	Iron as Fe	Conductivity at 25° C in mS/m	pH-Value at 25° C	Aluminium as Al	Free and Saline Ammonia as N	Fluoride as F
Water Quality Guidelines for the Blesboksspruit Catchment														
Ideal Catchment Background		<0.5	<80	<150	NS	<8	<70	NS	<0.1	<45	6.5 - 8.5	NS	<0.1	<0.19
(Acceptable Management Target)		0.5 - 3.0	80 - 150	150 - 300	NS	8 - 30	70 - 100	NS	0.1 - 0.5	45-70	NS	< 0.3	0.1 - 1.5	0.19 - 0.70
(Tolerable Interim Target)		3.0 - 6.0	150 - 200	300 - 500	NS	30 - 70	100 - 150	NS	0.5 - 1.0	70-120	NS	0.3 - 0.5	1.5 - 5.0	0.70 - 1.00
(Unacceptable)		> 6.0	> 200	> 500	NS	> 70	> 150	NS	> 1.0	>120	<6.5 >8.5	> 0.5	> 5.0	> 1.00
AECSW06	26/08/2016 00:00	0.31	7.7	50.8	29.9	12.6	9.3	10.80	BDL	26.0	8.47	BDL	0.08	0.39
SW01	26/08/2016 00:00	0.27	178.0	109.0	79.9	52.1	127.0	32.90	BDL	119.0	8.75	BDL	0.09	0.35
Aston Lake	26/08/2016 00:00	0.30	20.8	28.6	19.1	12.1	34.9	12.30	0.43	30.0	8.56	0.74	0.07	0.57

N:B:

BDL = Below Detection Limit; and

(NS) = No Specified Guidelines Value

Manganese as Mn has been excluded as they were all BDL

10.1.4.5.1 Water Quality Results

Recent water quality results presented in Table 10-14 and Table 10-15 can be summarised as follows:

- pH exceeded the South African Water Quality Guidelines (SWQG) Agriculture: Irrigation limit in all samples, which has high possibility of affecting yield, decreasing marketable products for farmers but is within the range for other limits. The pH exceedance can be attributed to the natural geology, high concentration salts and/ or bases;
- Turbidity exceeded SWQG Agriculture: Domestic Use limit and the SANS 241-2015 drinking water quality standards in all samples;
- SW01 has elevated levels of EC, Ca, Mg, Na, Cl, Total Hardness and Turbidity beyond the SWQG: Domestic Use limit. Cl found in this sample also exceeds SWQG: Agriculture (Irrigation) Limit. The elevated levels of salts could be attributed to the concentration of these elements due to evaporation in the dry season.;
- The water quality at Aston Lake had elevated Al and Fe exceeding SWQG Domestic Use, Turbidity exceeding beyond both SANS 241-2015 drinking water quality standards and SWQG: Domestic Use limit with SS exceeding SWQG: Agriculture (Irrigation) Limit; and
- When benchmarked against the Blesbokspruit WQO, the pH at Aston Lake and SW01 as well as the Aluminium at Aston Lake exceeds the limits. The Aluminium levels in Aston Lake can be attributed to the slightly elevated pH levels as Aluminium levels in dissolved state increase at higher and lower pH than 5.5-9.0 (WHO, 2003) Aluminium naturally occurs in waters in very low concentrations.

The water samples collected should be considered to be a representative of a low flow period water quality where the constituents are more concentrated resulting in higher salt concentrations. During project operational phase, water quality monitoring should be undertaken as prescribed in the proposed monitoring plan most preferably monthly to establish an extensive water quality records database.

10.1.4.6 Floodline Determination

To understand the risk of flooding to the proposed mine infrastructure, and in accordance with GN 704 regulations, where it is stated that infrastructure should not be placed within the 1:100 year floodline, or a horizontal distance of 100 m from a watercourse (whichever is greater), it is necessary to determine the 1:100 year floodlines. Streams and drainage lines within close proximity to surface infrastructure areas were modelled. A key component of the floodlines delineation is the mapping of the flood extent of the Aston Lake and the Dwars-in-die-wegvlei and the Verdrietlaagte streams feeding the lake. The floodlines will be based on a 1:50 and 1: 100 year rainfall events.

10.1.4.6.1 Model Inputs

Catchment Characteristics

A summary of the catchment characteristics for the Aston Lake Inflow Rivers is provided in Table 10-16.

Table 10-16: Catchment Characteristics

Catchment	Catchment Area (km^2)	Length of Longest Course (km)	Height Difference (the 10-85- method) m	Average Rainfall (mm)
C1	62	9.7	22	691
C2	69	16	39	691
C3	13	2.9	2.28	691

Percentage Slope for the catchments used to determine the catchments runoff coefficients is the slopes less than 3% and 3-10%. In terms of the catchments souls characteristic also used in peak flow determination, all catchments bare considers 100% semi permeable.

These inputs are applied in the modelling using Standard Design Flood (SDF) and Alternative rational (AR) methods in the Utilities Programme for Drainage (UPD)

Flood Peak Calculations

The output from the UPD software for the 3 catchments is provided in detail in the Surface Water Assessment, Appendix D. A summary of the peak flows calculated is depicted in Table 10-17.

Table 10-17: Predicted Peak Flow (m^3/s) based on the UPD Model

Catchment	1:50 (m^3/s)	1:100 (m^3/s)	Tc hours	River channel Average slope m/m	Combined C(runoff coefficient)
C1	233	290	3.56	0.003	0.36
C2	196	244	5.09	0.003	0.36
C3	73	91	2.1	0.001	0.31
Aston Lake C12 + C2)	298	362	5.55	0.00253	0.37

10.1.4.6.2 Hydraulic Structures

One of the key objectives of the site visit, undertaken on 23 August 2016, was to determine the existence of any hydraulic structures. A spillway was identified at the Aston Lake as a necessary hydraulic structure. A spillway serves as a control on the flow through the lake. This implies a controlled release downstream thus also controlling the flood levels downstream. The measurements of the spillway were undertaken for the flood routing in the lake to be undertaken. The spillway is located on the south eastern corner of the lake crest similar to the spillway depicted in Figure 10-2.

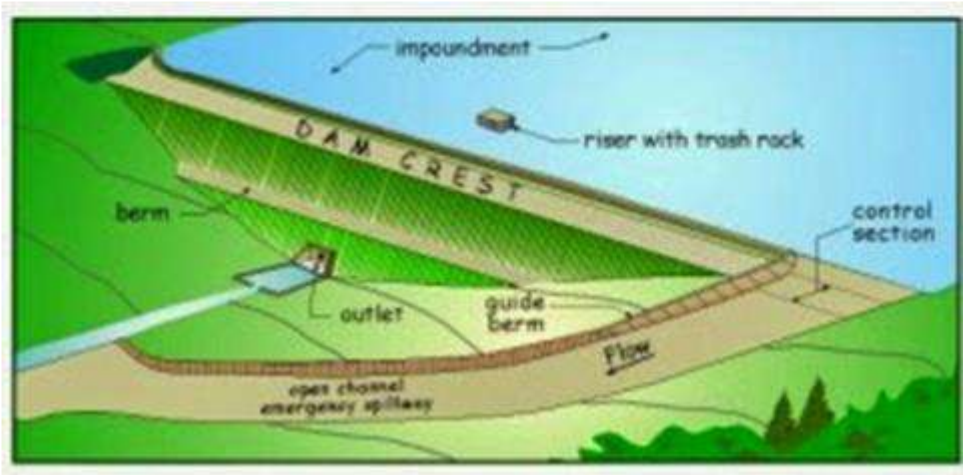


Figure 10-2: Example of Spillway Location similar to that of Aston Lake

(Source: http://www.strukts.com)

The measurements taken on the southern bank at the spillway are depicted in

Figure 10-3 below:

Figure 10-3: Measurement taken at the Aston Lake

Where:

- A is 100 m;
- B is 25 m;
- C is 20 m;
- D is 335 m; and
- E is 350 m.

A to E make up the crest of the Lake;

A depicts the spillway of the Lake used in the routing.

The lake properties were that were determined for input into the level pool reservoir routing procedure are detailed below in Table 10-18.

Table 10-18: Summary of Aston Lake Characteristics

Input	Unit	Value
1:50 peak flow	m^3/s	298
1:100 peak flow	m^3/s	362
Slope		0.00253
Tc	hours	5.55
Lake surface area	km^2	1.6578
Spillway L	m	100
Spillway H	m	1.15
Total L of Dam wall / Crest	m	830
Lake Capacity	m^3	3 500 000

The Aston Lake capacity is estimated from the Area of the Lake and an average depth of at least 2 m on average. This will need to be verified if any bathymetric data is made available.

10.1.4.6.3 Results

The results of the flood elevations in HEC-RAS output table are presented in the Surface Water Assessment, Appendix D.

As can be seen in Plan 11, none of the infrastructure proposed in the immediate future is within the determined Dwars-in-die-wegvlei floodlines.

The flood height on the Aston Lake will range between 1.07 and 1.12 m above the dam water level for the 1:50 and 1:100 year flood peaks respectively indicates. It is important to note that the floodlines delineation methodology used is conservative and considered a worst case scenario given up to a 1:100 year flood peak. The 1:50 and 1:100 year floodlines are indicated on Plan 11 below.

Plan 11: The 1:50 and 1:100 Year Floodlines

10.1.4.7 Sensitivity Analysis and No-Go Areas

The Surface Water Assessment included floodlines delineation as part of the assessment. Floodlines delineation was done to understand the risk of flooding on the proposed mine infrastructure, and in accordance with GN 704 regulations, where it is states that infrastructure should not be placed within the floodlines, or a horizontal distance of 100 m from a watercourse (whichever is greater).

The 1:50 and 1:100 year floodlines were delineated for the streams and drainage lines within close proximity to infrastructure areas. This is considered as a very sensitive area and no infrastructure with potential to impact water resources should be placed within the delineated floodlines. This is with the exception of the proposed access road, approximately 372 m and 386 m of this road falls within the 1:50 and 1:200 year floodline respectively.

The perennial streams, dams and pans with the potential to be impacted on by the proposed mining activities have been classified as highly sensitive whilst the non-perennial and perennial streams, dams and pans that are not likely to be impacted on have classified as moderately sensitive.

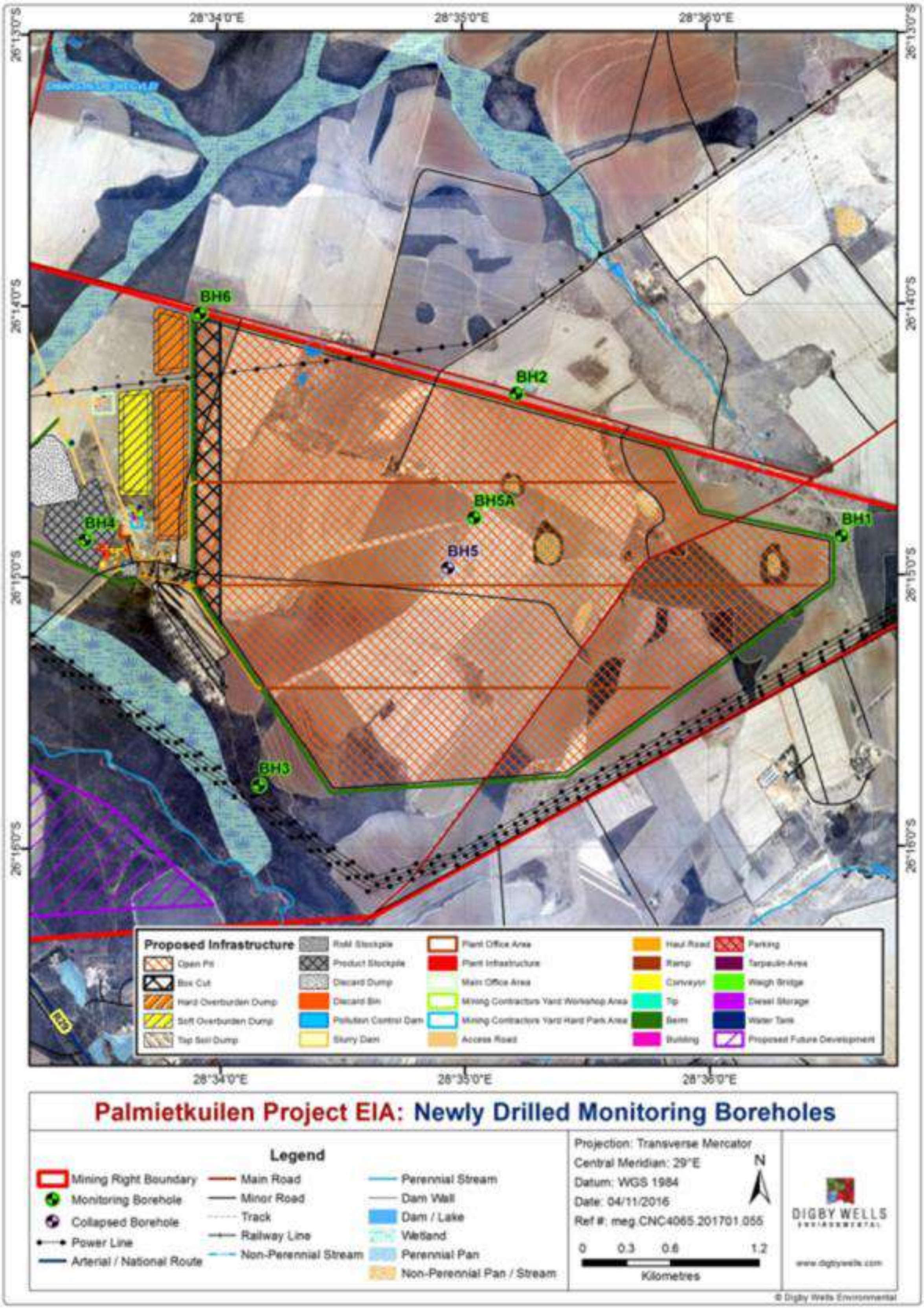
10.1.5 Groundwater

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

- **Desktop Study** - involved a review of available hydrogeological and geological data. Available data was selected and stored into a WISH database;
- **Ground Geophyics** - aeromagnetic maps of the project area were interpreted for possible subsurface geological contacts and structures such as dykes. Two ground survey geophysical methods were used during this study, the electromagnetic (EM) and magnetic methods. Four lines were surveyed and marked in the field using a handheld GPS for reference and targeting purposes. Station spacing was set at ten m to ensure that possible vertical to sub-vertical features could be detected.
- **Borehole Drilling** – a percussion drilling programme was initiated to provide an indication of the groundwater hydraulic properties (i.e. aquifer permeability and storage characteristics) of the study area and to be able to monitor contamination and plume migration around the pit area. The boreholes were sited downstream and upstream of the pit and with one borehole in the middle of the pit (Plan 12).
- **Aquifer Testing** - Five of the new boreholes were either pump or slug tested to calculate the hydraulic permeability and storativity values presenting the aquifer hydro-dynamics underlying the investigation areas. Digby Wells subcontracted Boegman boreholes testing to conduct the aquifer tests in January 2017
- **Numerical Modelling** - The numerical model for the project area was constructed using Processing MODFLOW Pro, a pre- and post- processing package for

MODFLOW and MT3DMS. MODFLOW and MT3DMS use 3D finite difference discretization and flow codes to solve the governing equations. MODFLOW and MT3DMS is a widely used simulation code, which is well documented.

Further detail pertaining to the methodology utilised is provided in the Groundwater Assessment report, Appendix E.



Plan 12: Newly Drilled Monitoring Boreholes

Based on the South African Aquifer Classification System (Parsons, 1995), the intergranular and fractured aquifer underlying Palmietkuilen project area is classified as a Minor Aquifer System, with distinct zones that can be classified as Major Aquifer Systems towards northeast and southeast of the project boundary. Although these aquifers seldom produce large quantities of water, they are important both for local supplies and in supplying base flow to rivers.

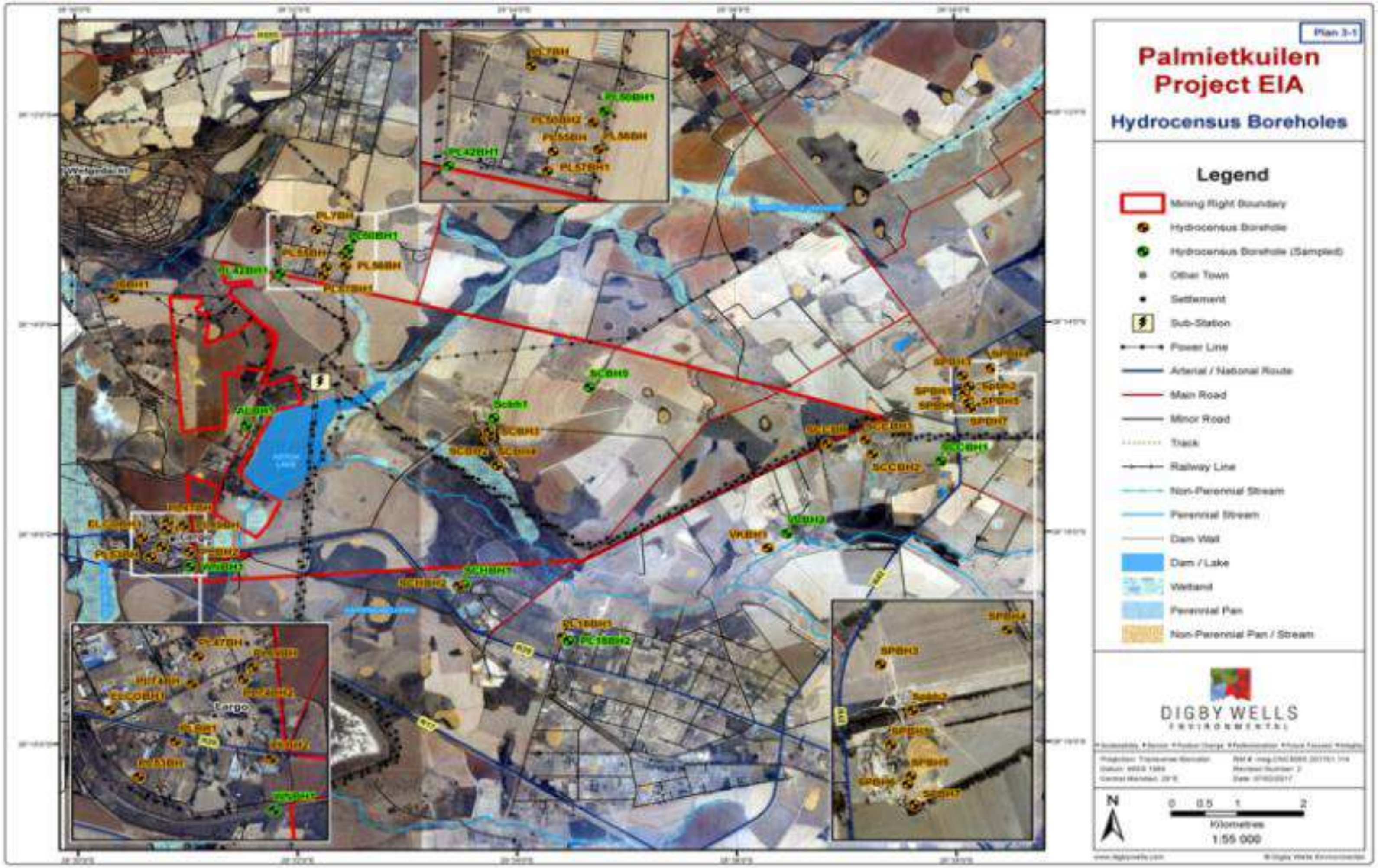
The groundwater environment comprises a karst aquifer associated with two outliers of the Malmani Subgroup dolomite, and various fractured rock aquifers associated with the Black Reef Formation strata and older basement rocks of the Central Rand and West Rand Groups.

10.1.5.1 Groundwater Usage

A total of 42 boreholes were recorded during hydrocensus and 6 new drilled boreholes, of these:

- 8 (16.6%) are used for drinking only;
- 16 (33.3%) are used for drinking and livestock watering;
- 7 (14.5%) are used as groundwater monitoring points; and
- The remaining 17 (35.4%) are unused.

The detailed information obtained during the hydrocensus is provided in the Groundwater Assessment Report, Appendix E. The hydrocensus borehole locations are displayed in Plan 13 below.



Plan 13: Hydrocensus Boreholes location

The main groundwater uses in the vicinity of the proposed Project area are domestic and agricultural. Dwars-in-die-Wegvlei' wetland/stream is likely to be a gaining and losing stream flow depending on the season. A lowering of the groundwater level could result in a total local reduction of inflow to the wetland impacting its functionality. Furthermore, contaminated surface and groundwater is likely to impact on the Dwars-in-die-Wegvlei water quality. If the stream is gaining stream flow after mine closure then potential pollution (ARD) emanating from the mine activities may impact on its quality. During wet seasons surface water from the stream flows towards Aston Lake which is used for recreational activities. If substandard quality migrates into the lake drainage line, the dam may be at risk of water quality deterioration.

10.1.5.2 Baseline Groundwater Quality

To gain a better understanding of the groundwater qualities around the proposed Project area, 10 groundwater samples were collected during the hydrocensus and analysed by SANAS accredited laboratory in Pretoria (Aquatico).

The water quality assessment is based on a once off analysis conducted by Digby Wells during the hydrocensus task conducted between 23 August 2016 and 26 August 2016. The laboratory certificate of the water quality is presented in the Groundwater Assessment Report.

A summary of the results are presented in Table 10-19 referenced against the South African Bureau of Standards (SABS) (SANS 241:2015) guidelines for drinking water quality since the mine WUL was not available during the task.

Based on the laboratory analysis, the following observations could be made regarding to the compliance with SANS 241:2015 drinking water quality standards:

- A total of 7 boreholes namely: SCHBH1, SCBH05, ALBH01, VLBH2, PL18BH2, PL42BH and PL50BH were found to be within the recommended SANS 241:2015 drinking guideline values. Based on the tested parameters, the water of only these 7 boreholes is considered to be safe for human consumption.
- Groundwater samples from boreholes SCCBH1, WNBH1 and SCBH01 were found to be exceeding the acceptable acute health level of NO_3 concentrations when benchmarked against the SANS 241:2015. Anthropogenic sources are the ones that most often cause the amount of nitrate to rise. The elevated nitrogen concentrating from the mentioned boreholes could be resulting from the actions of farmers' fertilisation.
- Concentration of Total Dissolved Solids (TDS) and electric conductivity (EC) of the sample from WNBH1 was found to be exceeding the maximum allowed aesthetic limits as set by SANS 241:2015. WNBH1 is located south-west of the proposed open pit area. The elevated TDS and EC concentrations at the boreholes are attributed to it being downgradient of the Grootvlei Gold Mine Shaft.

Table 10-19: Water quality results compared to SANS 241:2015

Sample Date	Sample ID	Total Dissolved Solids	Nitrate NO_3 as N	Chlorides as Cl	Total Alkalinity as $CaCO_3$	Sulphate as SO_4	Calcium as Ca	Magnesium as Mg	Sodium as Na	Potassium as K	Iron as Fe	Manganese as Mn	Conductivity at 25° C in mS/m	pH-Value at 25° C	Aluminium as Al	Free and Saline Ammonia as N	Fluoride as F
	Aesthetic	1200	No limit	No limit	No limit	250	No limit	No limit	200	No limit	0.3	0.1	170	No limit	No limit	6.6	No limit
	Operational	No limit	No limit	No limit	No limit	No limit	No limit	No limit	No limit	No limit	No limit	No limit	No limit	5 to 9,7	0.3	No limit	No limit
	Chronic health	No limit	No limit	300	No limit	No limit	No limit	No limit	No limit	No limit	2	0.4	No limit	No limit	No limit	No limit	1.5
	Acute health	No limit	11	No limit	No limit	500	No limit	No limit	No limit	No limit	No limit	No limit	No limit	No limit	No limit	No limit	No limit
26/08/2016	SCHBH1	245.00	5.68	10.80	180.00	9.37	46.10	21.70	15.70	5.83	0.00	0.00	33.70	8.67	0.00	0.15	-0.26
23/08/2016	SCBH05	207.00	2.09	18.80	138.00	13.40	31.40	14.70	22.60	12.50	0.02	0.00	27.20	8.37	0.00	0.07	0.27
25/08/2016	SCCBH1	345.00	11.80	23.10	196.00	28.50	64.30	24.70	24.70	7.63	0.00	0.00	46.20	8.73	0.00	0.12	-0.26
23/08/2016	ALBH01	282.00	2.41	22.20	171.00	40.30	47.60	22.40	25.60	8.03	0.00	0.00	39.20	8.73	0.00	0.19	-0.26
23/08/2016	VLBH2	380.00	4.82	40.50	225.00	38.90	59.80	25.00	54.90	1.99	0.00	0.00	51.90	8.67	0.00	0.26	0.33
24/08/2016	WNBH1	1446.00	21.80	327.00	227.00	425.00	195.00	102.00	153.00	9.50	0.00	0.00	213.00	8.46	0.00	0.19	0.52
26/08/2016	PL18BH2	104.00	1.07	9.49	73.80	4.25	21.70	6.75	9.15	2.47	0.00	0.00	15.70	8.46	0.00	0.29	-0.26
26/08/2016	PL42BH	273.00	10.40	12.20	185.00	3.30	52.10	24.50	11.40	9.81	0.00	0.00	38.80	8.69	0.00	0.10	-0.26
26/08/2016	PL50BH	338.00	1.06	30.40	228.00	32.00	31.70	19.20	75.80	4.24	0.00	0.00	47.20	8.78	0.00	0.21	0.35
23/08/2016	SCBH01	236.00	24.30	22.30	29.70	21.30	24.90	16.90	18.50	6.53	0.00	0.00	29.60	8.12	0.00	0.13	-0.26

10.1.5.2.1 Diagnostic Plots

A Piper diagram (Figure 10-4) was created using the WISH program to characterise the groundwater in the area. A Piper diagram is utilized to characterise water types in a graphical manner and to distinguish between specific water types in the area. The Piper diagram is quartered to simplify this process. The water samples can be grouped into the left, bottom, right and upper quarters. The position of the water sample on the plot is based on the ratio of the various constituents measured in equivalence and is not an indication of the absolute water quality or the suitability thereof for domestic consumption.

The left quarter is characterised by freshly recharged water and is dominated by calcium-magnesium-bicarbonate. The right quarter is associated with stagnant or slow moving groundwater and is dominated by sodium chloride. The bottom quarter is typical of dynamic groundwater flow and is dominated by sodium bicarbonate and the top quarter typically shows contamination by mining activities and is dominated by sulphate.

Groundwater quality results from boreholes ALBH01, VLBH2, SCBH05, PL18BH2, SCCBH1, SCHBH1 and PL42BH plot in the left quarter which is an indication of fresh recharge water that is dominated by calcium-magnesium-bicarbonate. Samples collected at borehole PL50BH plot at the bottom quarter indicating dynamic groundwater flow that is dominated by sodium bicarbonate. The remaining samples (WNBH1 and SCBH01) plot in the top quadrant, indicative of dynamic groundwater flow that is dominated by sulphate water.

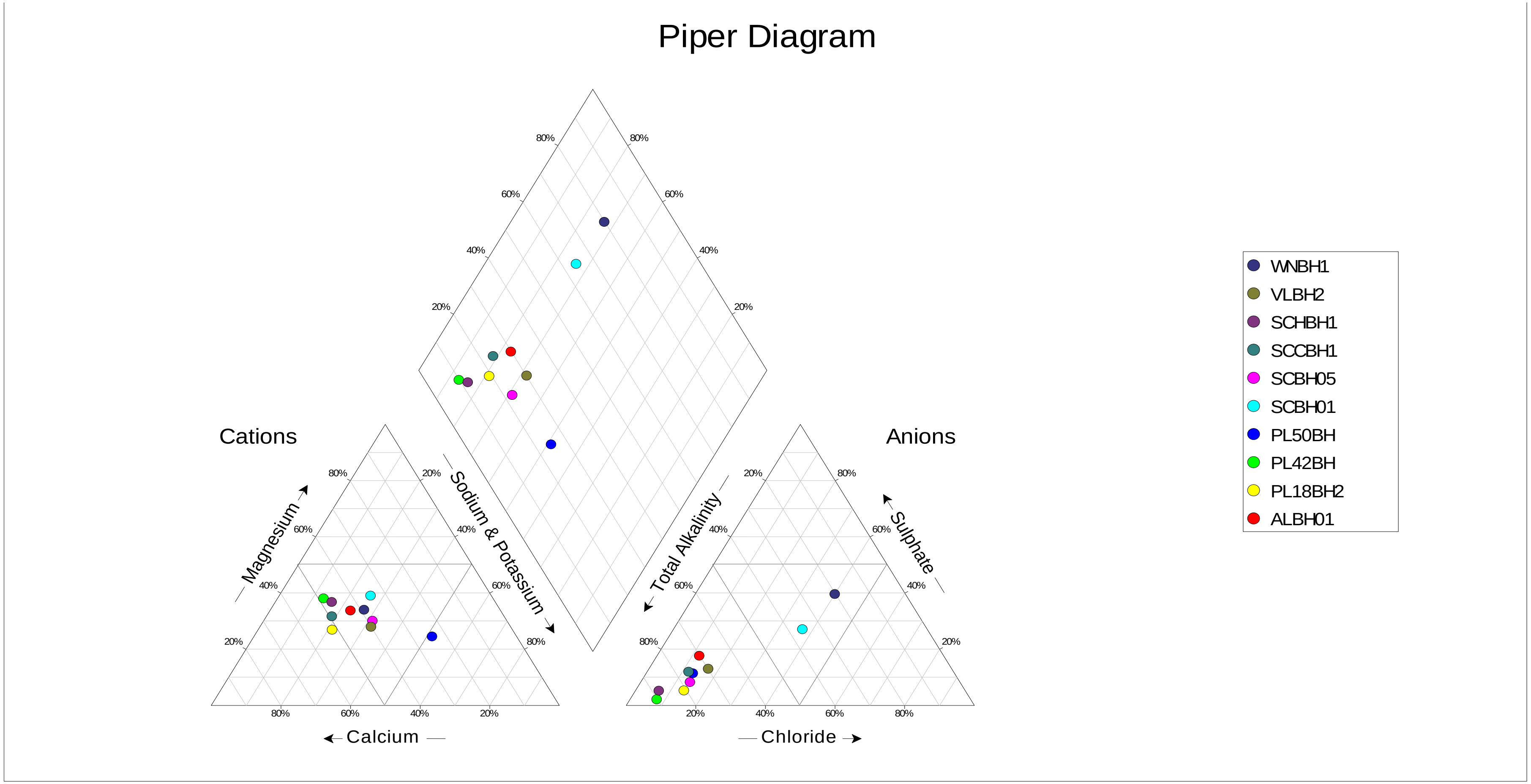


Figure 10-4: Piper diagram of the baseline water chemistry

10.1.5.3 Water Level and Flow Direction

The baseline water levels measured during the hydrocensus and the new drilled boreholes are shown provided in detail in the Groundwater Assessment Report, Appendix E. The groundwater level ranges between 1 m and 73.51 m below ground level (mbgl). The relatively large water level variation in a relatively short distance indicates groundwater abstraction points, as identified during the hydrocensus, or possibly from different aquifers.

A comparison of the water level elevation with topography shows a good correlation of 92.64% (Figure 10-5). Only boreholes with static water level measurements were used to plot this figure. The boreholes that are currently in use and their water level is lowered from its natural position were not included.

Plan 14 confirms that groundwater elevation mimics the topography and flows towards the Aston Lake and Dwars-in-die-Wegvlei wetland/stream.

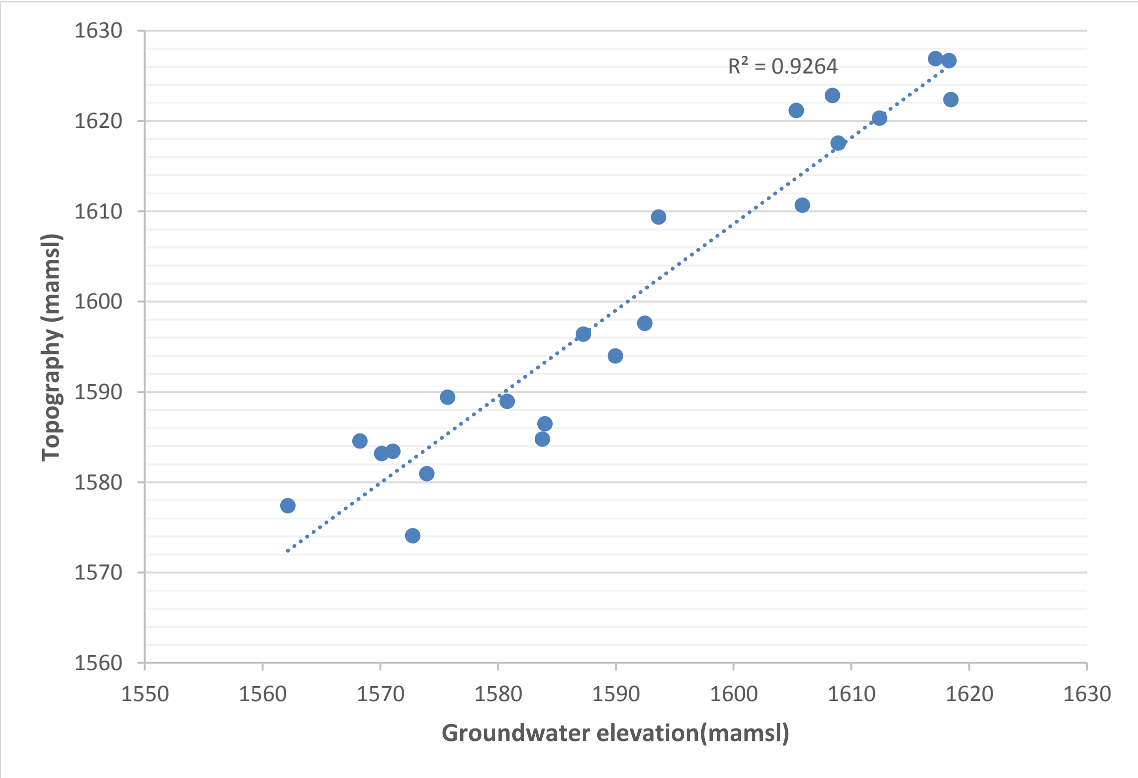
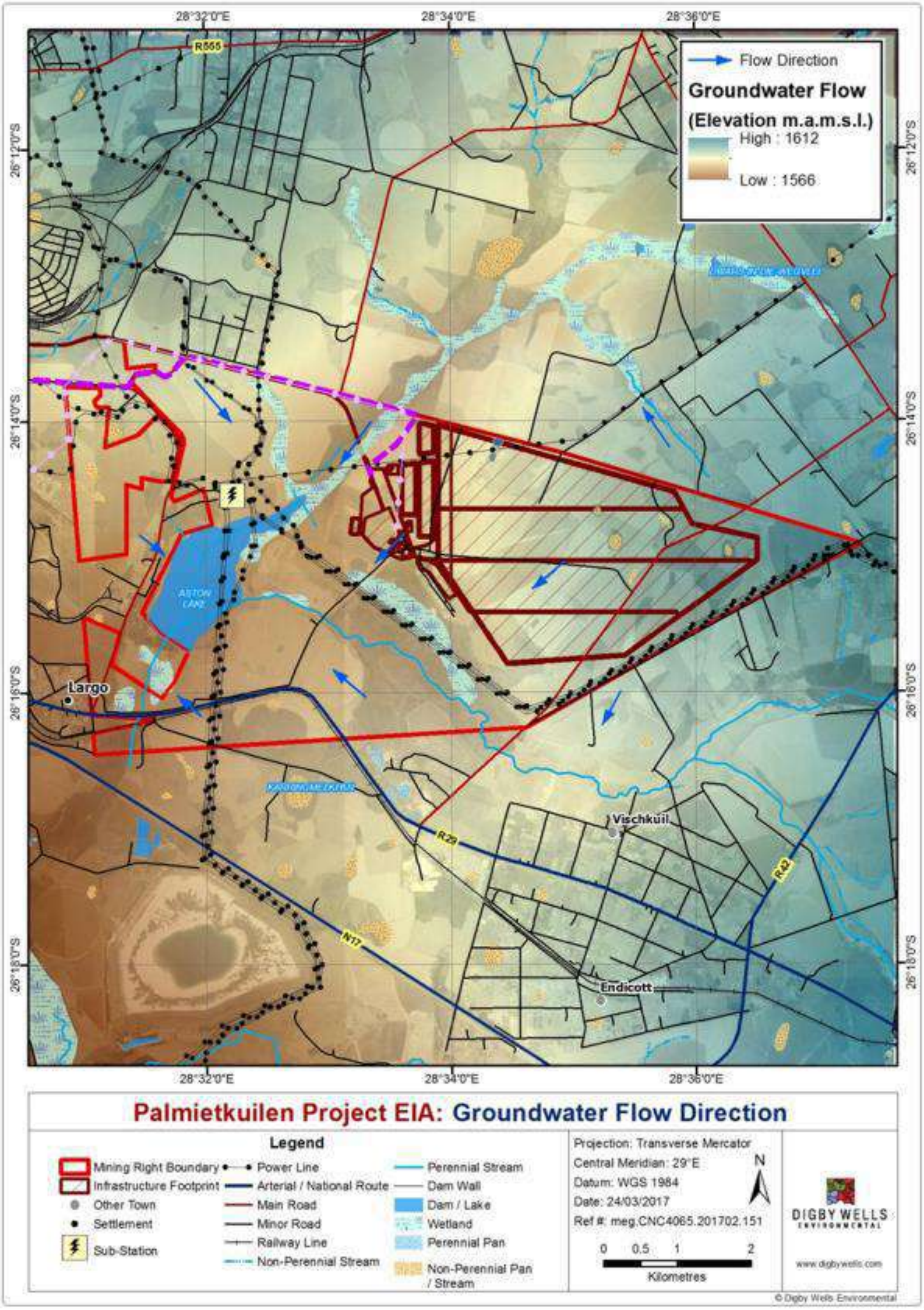


Figure 10-5: Correlation between topography and groundwater level



Plan 14: Groundwater Flow Direction

10.1.5.4 Drilling Results

As mentioned above, a percussion drilling programme was initiated to provide an indication of the groundwater hydraulic properties (i.e. aquifer permeability and storage characteristics) of the Project area. The boreholes were drilled at various depths below surface with the shallowest being 40 m and the deepest being 110 m.

The drilling programme was undertaken by Diabor Geotechnical & Exploration Drilling between 29 November 2016 and 12 December 2016. During the drilling programme a total of 460 m of drilling was advanced. The rotary air-percussion drilling method was used to enable hard rock formations to be penetrated using a hammer drill bit, forced through the rock by compressed air. Borehole finishing included the installation of steel casing, steel lockable cap, black and white marker pole and borehole development.

Six 165 mm diameter boreholes were drilled, developed and installed under the supervision of Digby Wells (the positions of the boreholes is shown in Plan 12 above). During the drilling supervision the following information were recorded:

- Site identification details (coordinates);
- Colour and drilling chip size at 1 m intervals;
- Vertical geology succession and degree of weathering;
- Depth of drilling and borehole construction; and
- Depth of water strikes, individual water strike yield, final / accumulative blow yield and rest water level after completion.

A summary of the borehole localities and decision record details are given in Table 10-20.

Table 10-20: Borehole Locality Results

Borehole	Longitude	Latitude	Comment
BH1	-26.248	28.60959	BH1 drilled on the high magnetic area, also ground geophysics done
BH2	-26.2387	28.58661	BH2 drilled on the high magnetic area, both ground and aeromagnetic show the anomaly
BH3	-26.2634	28.5683	BH3 drilled on the moderate magnetic field as confirmed by the aeromagnetic data. Borehole also placed on a possible structure.
BH4	-26.2481	28.55198	BH4 drilled on the low magnetic field to confirm the rock permeability of the lower field.
BH5	-26.2497	28.58318	BH5 drilled on the moderate magnetic area at the centre of the pit to characterise the permeability of the rocks.

Borehole	Longitude	Latitude	Comment
BH5A	-26.246392	28.584051	BH5A drilled on the moderate magnetic area at the centre of the pit to characterise the permeability of the rocks
BH6	-26.2336	28.56512	BH6 drilled on the high magnetic area next to the proposed topsoil stockpile.

The following observations and conclusions were derived from the drilling programme.

10.1.5.4.1 Borehole BH1

BH1 was drilled on the east side of the mine pit to a final depth of 60 m with the geology of the area consisting mainly of clay. Seepage was encountered at 30 m and 41 m below surface. The borehole was not developed as it did not have enough water at the end of drilling. The static water level for the borehole was measured as 4.28 mbgl.

10.1.5.4.2 Borehole BH2

Borehole BH2 was drilled at the project boundary, along the northern side of the proposed open pit area and the lithology of the area consist mainly of Sandstone.

Seepage was encountered at 5 m and a water bearing structure was encountered 31 m below surface at the interface between clay and sandstone. The borehole was developed for 30 minutes at the end of drilling and the final borehole yield was measured to be 1.04 litres per second (L/s). The static water level for the borehole was measured as 4.81 mbgl.

10.1.5.4.3 Borehole BH3

Borehole BH3 was drilled south west of the proposed open pit area to a final depth of 70 m. Seepage was encountered at 11 m below surface and a water bearing structure was encountered 24 m below surface at the interface between clay and sandstone. The borehole was developed for 30 minutes at the end of drilling and the final borehole yield was measured to be 5 litres per second (L/s). The static water level for the borehole was measured as 1.25 mbgl.

10.1.5.4.4 Borehole BH4

BH4 was drilled west of the proposed open pit area to a final depth of 60 m below the surface and the geology intersected during the drilling of BH4 was recorded as Mudstone being the dominating rock type in that area.

Seepage was encountered at 44 m below surface. The borehole was not developed as it did not have enough water at the end of drilling. The static water level for the borehole was measured as 18.64 mbgl.

10.1.5.4.5 Borehole BH5A

BH5A was drilled in the middle of the proposed open pit area to a final depth of 70 m and the borehole lithology was recorded.

Seepage was encountered at 22 m below surface and a water bearing structure was encountered 38 m below surface where the sandstone was completely weathered. The borehole was developed for 30 minutes at the end of drilling and the final borehole yield was measured to be 2.5 litres per second (L/s). The static water level for the borehole was measured as 7.88 mbgl.

10.1.5.4.6 Borehole BH6

Borehole Bh6 was drilled North-west of the proposed open pit area to a final depth of 50 m below the surface.

Seepage was encountered at 20 m and 27 m below surface. The borehole was not developed as it did not have enough water at the end of drilling. The static water level for the borehole was measured as 2.59 mbgl.

10.1.5.5 Aquifer Systems

Five of the new boreholes were either pump or slug tested to calculate the hydraulic permeability and storativity values presenting the aquifer hydro-dynamics underlying the investigation areas. Digby Wells subcontracted Boegman boreholes testing to conduct the aquifer tests in January 2017.

Three of the newly drilled boreholes (BH2, BH3 and BH5A) yielded more than 0.2 L/s during the percussion drilling. BH2 and BH3 were pump tested and BH5A was found to be blocked above the water strike position at the depth of 25 m, therefore it was not tested.

The remaining three boreholes (BH1, BH4 and BH6) were slug tested as their blow yield was less than 0.2 L/s. The test was conducted by instantaneously adding 60 L of water to the boreholes. The water level response was then measured and recorded automatically using electronic water level logging devices. The recovery rate was measured for 2 hours after the addition of the slug or until a 90% recovery was achieved. Borehole BH5 was not tested as it collapsed during the drilling.

Summary of the test results are indicated on Table 10-21 below.

10.1.5.5.1 Shallow unconfined aquifer

A shallow unconfined aquifer occurs within the soil and weathered bedrock zone. This unconfined aquifer is formed as a result of the weathering of the top section of the geological sequence. The water will then seep horizontally in a downgradient direction on this contact zone. This layer is sometimes referred to as “a”.

10.1.5.5.2 Fractured Karoo aquifer

The second aquifer system is an intergranular and fractured, semi-confined Karoo type aquifer of Ecca (shale/sandstone/tillite) origins occurring between 20 and 40 mbgl. Groundwater is confined to joints and fractures and flow in the matrix rock and usually has very low hydraulic conductivity and low yields. However, high yields do occasionally occur especially where dolerite intrusions (of Karoo age) have resulted in significant fracturing of the host rock. Of all un-weathered sediments in the fractured aquifer, the coal seam often has the highest hydraulic conductivity (Ngululu Resources, 1998).

Slug tests were performed on three of the low yield (seepage) boreholes to determine the aquifer parameters of this upper aquifer zone. The slug test data was interpreted using the Bouwer and Rice method (Bouwer and Rice, 1976) and the software package Flow FC_Excel for the determination of aquifer parameters in fractured rock environments.

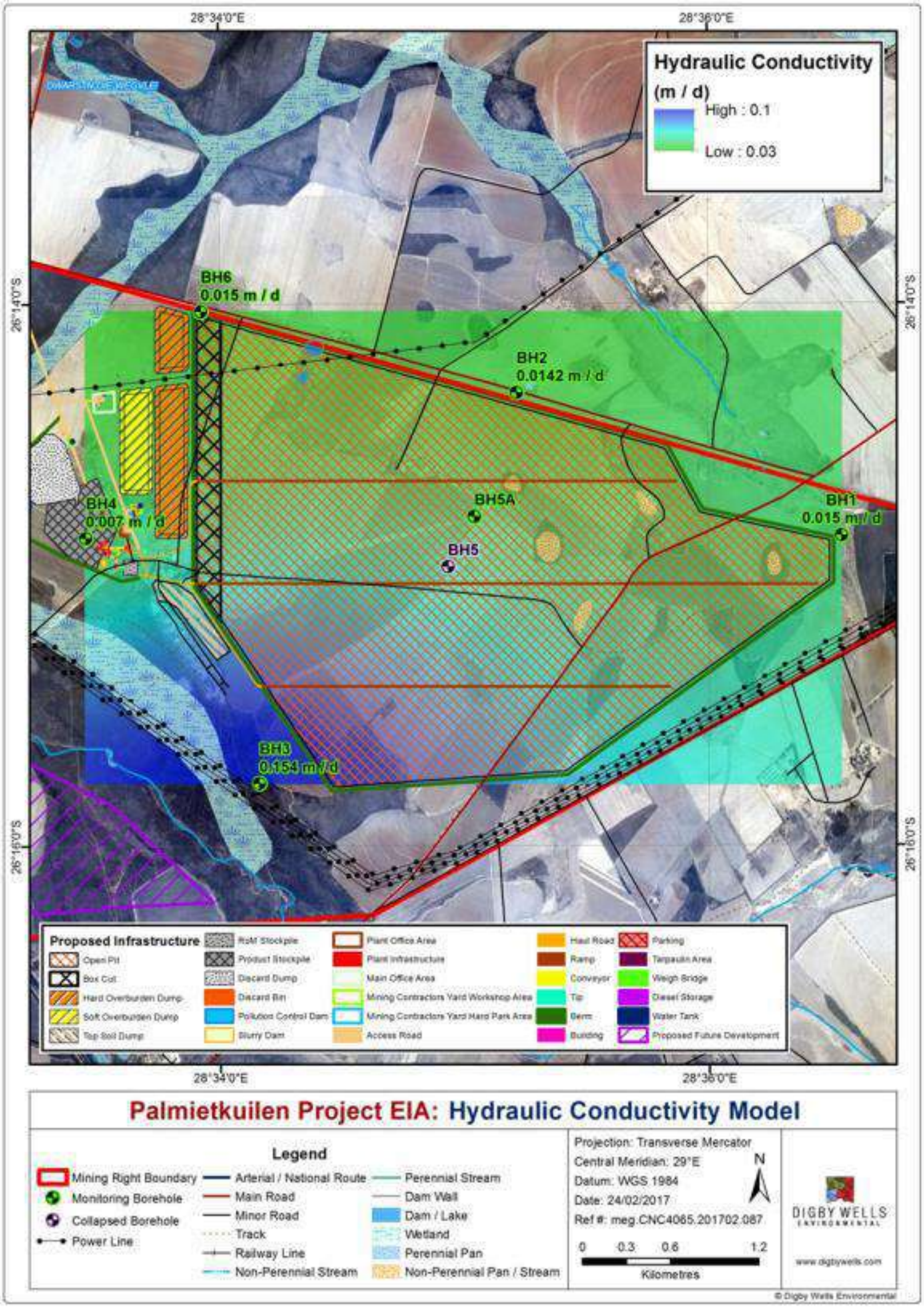
The transmissivities were calculated using the Thesis with Jacob correction method. Average values for hydraulic conductivity and transmissivity were calculated to be 0.04104 m/d and 2.44462 m^2 /d.

The fractured rock aquifer is considered to be a more reliable source of groundwater compared to the shallow weathered zone aquifer. The yield from this borehole BH2 and BH3 would be sufficient to supply drinking, sanitation and irrigation (small scale) water for a household.

The hydraulic parameters are summarised in Table 10-21 and displayed in Plan 15. Based on the aquifer test results interpretation, the area marked in green shows a high hydraulic conductivity that ranges between 0.014 m\d and 0.154 m\d. This may mean that the aquifers in that area are more vulnerable to contamination than the area that is less permeable. The light blue coloured area shows aquifers with low hydraulic conductivity ranging between 0.007 m\d and 0.015 m\d.

Table 10-21: Summary of Aquifer test results

Bore ID	Test Method and period hours	Blow Out Yield, Q (L/s)	Tested Yield, Q (L/s)	FC-Method Transitivity(m^2/d)		Aquifer test pro method		
				Early time	Late Time	T(m^2/d)	K(m/d)	Storativity (Estimate)
BH1	Slug	Seepage	60L Slug	-	-	0.126	0.0150	-
BH4	Slug	Seepage	60L Slug	-	-	0.0151	0.007	-
BH6	Slug	Seepage	60L Slug	-	-	0.122	0.015	-
BH2	Constant test	0.75	0.75	1	1.5	1.36	0.0142	0.00772
BH3	Constant test	5	4.4	8.6	7	10.6	0.154	0.215



Plan 15: Hydraulic Conductivity

10.1.5.6 Groundwater Numerical Modelling

Numerical groundwater modelling can be considered to be one of the most reliable methods of anticipating and quantifying the likely impacts on the groundwater regime. During model setup, the conceptual model was translated into a numerical model. This stage entails selecting the model domain, defining the model boundary conditions, discretizing the data spatially and over time, defining the initial conditions, selecting the aquifer type, and preparing the model input data. The above conditions together with the input data were used to simulate the groundwater flow in the model domain for pre-mining steady state conditions.

10.1.5.6.1 Model Domain

The definition of the numerical model domain was set up considering the surface infrastructure and natural groundwater flow boundaries. The model is a simplified representation of site conditions constructed with as much accuracy as possible in order to achieve the highest level of confidence.

The project area is located within the C21E quaternary catchment, in an area of high topography compared to the majority of the local surrounding area. The model boundaries are determined by consideration of groundwater divides and sub-catchments located far enough not to influence natural or induced groundwater flows within the area of interest.

The model domain is irregularly shaped with dimensions of 19 km by 16 km. A rectangular mesh was generated over the model domain, consisting of 374 rows and 315 columns. The mesh size of the model is 50 m longitudinally and transversely.

10.1.5.6.2 Model Calibration

The model was calibrated by manually adjusting recharge, aquifer properties and drain conductance (used to simulate rivers) within an acceptable range, according to the available data and field investigation results. This is done to establish a good correlation between the groundwater levels calculated by the model and those observed on site.

The calibrated model yielded a 99% correlation between the observed groundwater levels and calculated groundwater levels (Figure 10-6 and Figure 10-7).

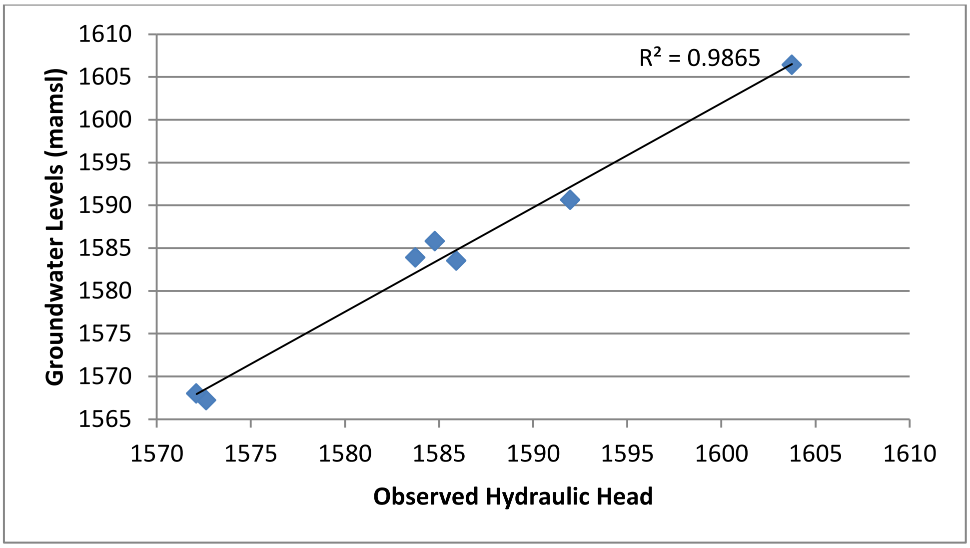


Figure 10-6: Groundwater level correlation

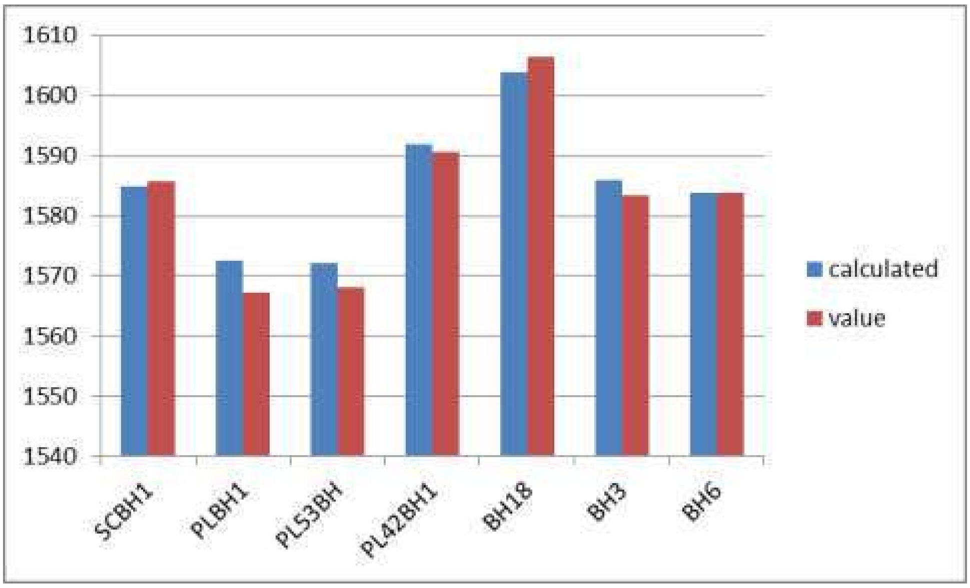


Figure 10-7: Groundwater level comparison

The results of the Groundwater Numerical Model are presented in 11.1.4 below.

10.1.6 Flora and Fauna

The Flora and Fauna Assessment undertaken during the EIA Phase is appended to this report as Appendix F.

10.1.6.1 Regional Vegetation

The project area falls within the Andesite Mountain Bushveld, Soweto Highveld Grassland and Eastern Highveld Grassland as described by Mucina and Rutherford (2006) in the Grassland Biome (Table 10-22). The term ‘grassland’ creates the impression that the biome consists only of grass species. In fact, it is a complex ecosystem, including rivers and wetlands, where only one in six plant species are grasses.

Thirty percent of the biome has been irreversibly transformed and only 1,9% is formally conserved. As a result, the National Biodiversity Strategy and Action Plan has identified the grasslands biome as one of the spatial priorities for conservation action (SANBI, 2016). The important biodiversity contained within the grasslands, which underpins life, is being eroded to such an extent that human wellbeing is threatened. Common and characteristic plant species of the Eastern Highveld and Soweto Highveld Grasslands are listed in Table 10-22 and Table 10-23 with Andesite Mountain Bushveld in

Table **10-24**, and their distribution relative to the project area is found in Plan 16.

Table 10-22: Common and Characteristic Plant Species of the Eastern Highveld Grassland

Plant form	Species (names based on taxonomic names as in 2006)
Graminoids (grasses and sedges)	*Heteropogon contortus, Aristida aequigluims, A. congesta , A. junciformis subsp. Galpini, Brachiaria serrata, Cynodon dactylon, Digitaria monodactyla, D. tricholaenoides, Elionurus muticus, Eragrostis chloromelas, E. curvula, E. plana, E. racemosa, E. sclerantha, Heteropogon contortus, Loudetia simplex, Microchloa caffra, Monocymbium cereiiforme, Setaria sphacelata, Sporobolus africanus, S. pectinatus, Themeda triandra, Trachypogon spicatus, Tristachya leucothrix, T. rhmanni, Alloteropsis semialata subsp. eckloniana, Andrpogon appendiculatus, A. schirensi, Bewsia biflora, Ctenuim concinnum, Diheteropogon amplectens, Eragrostis capensis, E. dummiflua, E. patentissima, Harpochloa falx, Panicum natalense, Rendlia altera, Schizachyruim sanguineum, Setaria nigrirostris, Urelytrum agropyroides*
Herbs	*Berkheya setifera, Haplocarpha scaposa, Euryops gifillani, Justicia anagalloides, Acalyha angusta, Cahmaecrista mimosoides, Dicoma anomala, E. transvalensis subsp. setilobus, Helichrysum aureonitens, H. caespititium, H. callicomum, H. oreophilum, H. caespititium, H. oerophilum, H. rugulosum, Ipomoea crassipes, Pentanisia prunelloides subsp. latifolia, Selago densiflora, Senecio coronatus, Hilliardiella oligocephala, Wahlenbergia undulata*
Geophytic herbs	*Gladiolus crassifolius, Haemanthus humilis subsp. hirsutus, Hypoxis rigidulua var. pilosissima, Ledebouria ovatifolia*
Succulent herb	*Aloe ecklonis*
Low shrubs	*Anthospermum rigidum subsp. pumilum, Seriphium plumosa*

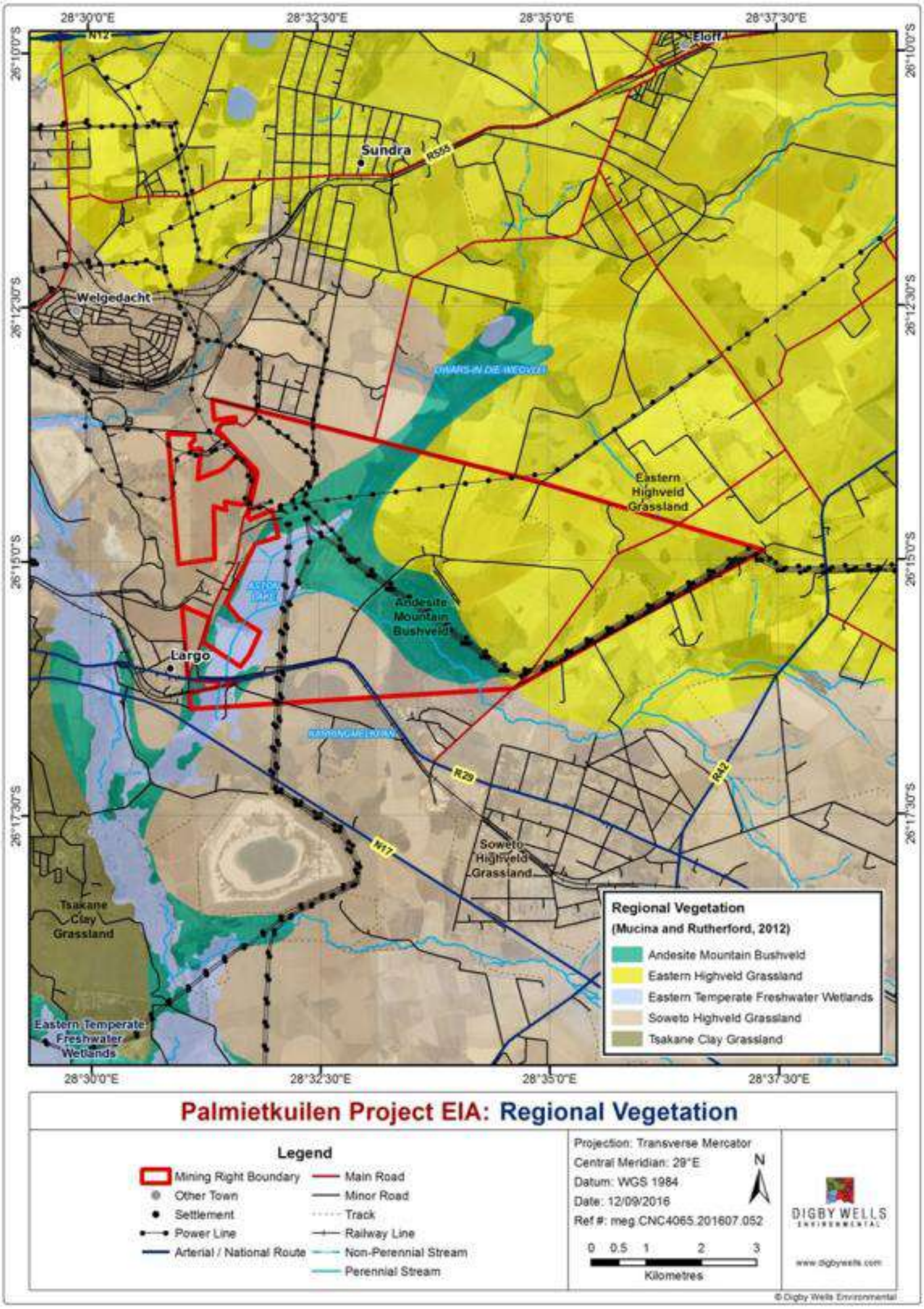
Table 10-23: Common and Characteristic Plant Species of the Soweto Highveld Grassland

Plant Forms	Species (names based on taxonomic names as in 2006)
Graminoids (grasses)	*Andropogon appendiculatus, Brachiaria serrata, Cymbopogon pospischillii, Cynodon dactylon, Elionurus muticus, Eragrostis capensis, E. chloromelas, E.curvula, E. plana, E. planiculmis, E. racemosa, Heteropogon contortus,Hyparrhenia hirta, Setaria nigrirostris, S. sphacelata, Themeda triandra, Tristachya leucothrix, Andropogon schirensis, Aristida adscensionis, A. bipartita, A. congesta, A. junciformis subsp. galpinii, Cymbopogon caesius, Digitaria diagonalis, Diheteropogon amplectens, Eragrostis micrantha, E. superba, Harpochloa falx, Microchloa caffra, Paspalum dilatatum*
Herbs	*Hermannia depressa, Acalypha angustata, Berkheya setifera, Dicoma anomala, Euryops gilfillanii, Geigeria aspera var. aspera, Graderia subintergra, Haplocarpha scaposa, Helichrysum miconiifolium, H. nudifolium var. nudifolium, H. rugulosum, Hibuscus pusillus, Justicia anagalloides, Lippia scaberrima, Rhynchosia effusa, Schistostephium crataegifolium, Selago densiflora, Senecio coronatus, Hilliardiella oligocephala, Wahlenbergia undulata*
Geophytic herbs	*Haemanthus humilis subsp. hirsutus, Haemanthus montanus*
Herbaceuos climber	*Rhynchosia totta*
Low shrubs	*Anthospermum hispidulum, A. rigidum subsp. pumilum, Berkheya annectens, Felicia muricata, Ziziphus zeyheriana*

Table 10-24: Common and Characteristic species of the Andesite Mountain Bushveld

Plant Forms	Species (names based on taxonomic names as in 2006)
Graminoids (grasses)	*Eragrostis curvula*, *Hyparrhenia hirta*, *Setaria sphacelata*, *Themeda triandra*, *Cymbopogon pospischilii*, *Digitaria eriantha* subsp. *eriantha*, *Elionurus muticus*, *Eragrostis racemosa*, *E. superba*, *Panicum maximum*.
Herbs	*Commelina africana*, *Vernonia galpinii*, *V. oligocephala*. Succulent Herb: *Aloe greatheadii* var. *davyana*
Woody Climber	*Rhoicissus tridentata*
Tall Shrubs	*Asparagus laricinus*, *Euclea crispa* subsp. *crispa*, *Rhus pyroides* var. *pyroides*, *Diospyros lycioides* subsp. *lycioides*, *Gymnosporia polyacantha*, *Lippia javanica*, *Rhamnus prinoides*

Small Trees	*Acacia caffra*, *A. karroo*, *Celtis africana*, *Protea caffra*, *Zanthoxylum capense*, *Ziziphus mucronata*
Low shrubs	*Asparagus suaveolens*, *Rhus rigida* var. *margaretae*, *Teucrium trifidum*. Soft Shrub: *Isoglossa grantii*



Plan 16: Vegetation types (Mucina and Rutherford, 2006)

10.1.6.2 Project Area Flora

The majority of the Project area (1 740 ha or 50.3%) had undergone transformation due to cultivation for maize and soy beans. Livestock were also observed throughout most of the site and evidence of overgrazing was recorded in grassland areas; showing a dominance of increaser species and some erosion. Despite these impacts, areas that were left intact showed a moderate diversity of grasses and some forbs, particularly members of the Asteraceae family and the *Helichrysum* genus.

A total of 90 plant species of 266 listed (recorded by SANBI in the relevant grid in the past) in the regional list were recorded on site (please refer to a detailed listed in the Flora and Fauna Assessment appended as Appendix F). However, more plant species may occur that are not recorded and identified by SANBI and therefore not on the PRECIS List. The disturbed areas included former cultivated fields that had been colonised by alien plants and pioneer species. The primary land uses and vegetation habitats identified on site are listed in

Table **10-25**.

Acacia Name Change

The International Code of Botanical Nomenclature, the official botanical names authority, made a decision in July 2005 to reserve the name *Acacia* for Australian species only. Both Africa and Australia had been sharing the genus name for two distinctly different groups of species and a final call had become a necessity. The *Acacia* name change has been a matter of dispute for over a decade but it is important to note that the change is now official. The reasons for voting *Acacia* as an Australian type were numerous, primarily owing to the fact that over 1000 *Acacia*'s (many that are endemic) are to be found in Australia, making up the largest genus in the country. In addition, the *Acacia* has significant cultural and traditional value as a symbol in the Australian coat of arms. A taxonomic revision of African *Acacia*'s is underway and all species will be renamed into either *Vachellia* or *Senegalia*. The *Acacia* name is maintained for the purpose of this report.

Table 10-25: Vegetation Habitats (and other Land Use) and Approximate Areas

Vegetation Unit	Area (ha)	Proportion of total project area (%)
Wetland	25	2.11
Pan	26	2.1
Cultivated	851	71
Eragrostis Dominated Grassland	280	23
Alien Vegetation	0.005	0.004
Developed	1.7	0.14
Total	1184	**100%**

10.1.6.2.1 Grassland

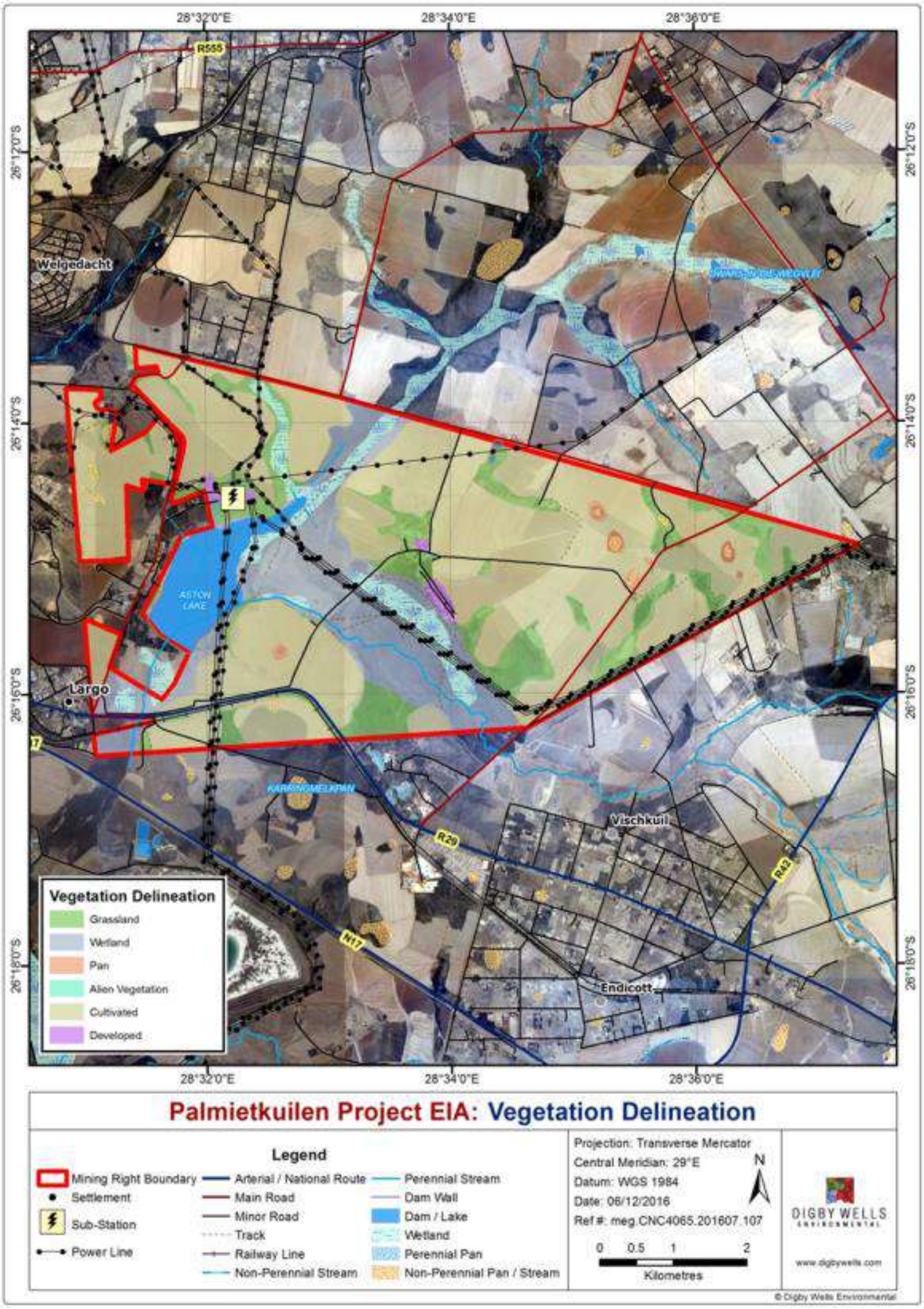
This *Eragrostis*-dominated Grassland covered the majority of the natural areas associated with the Project site and can further be subdivided into wetland and terrestrial habitats. The substrate of the wetland areas was composed of moist clays which formed the top of hillslope seeps. *Eragrostis gummiflua* (Gum Grass), unfavoured by cattle, was dominant and additional *Eragrostis* species were prevalent, including: *Eragrostis curvula* (Lovegrass), *Eragrostis racemosa* (Narrow Heart Love Grass) and *Eragrostis chloromelas* (Curly Leaf). Additional grass species included *Aristida congesta* subsp. *congesta* (Spreading Three-awn), *Hyparrhenia hirta* (Common Thatching Grass), *Themeda triandra* (Red Grass), *Agrostis lachnantha* (Bent Grass) and *Imperata cylindrica* (Cottonwool Grass) along hillslope seeps.

Common and characteristic forbs and succulents included: *Helichrysum oligocephala*, *Wahlenbergia* spp., and *Verbena brasiliensis* (Brazilian Vervain). Alien plant invasion was moderate in certain areas adjacent to cultivated fields and along roadsides, including species such as: *Datura stramonium* (Downy Thorn Apple), *Solanum sysimbriifolium* (Sticky Nightshade) and *Verbena brasiliensis* (Brazilian Vervain).

Figure 10-8: Examples of Riparian Habitat

Figure 10-9: Examples of the Landscape and Common Features of the Grassland during the dry season

The distribution of vegetation units is represented in Plan 17.



Plan 17: Vegetation delineation

10.1.6.2.2 Plant Species of Special Concern

The Project area falls within the Quarter Degree Squares (QDS); 2628BC and 2628BA. The Gauteng Province has been extensively surveyed from a botanical perspective and as a result, the South African database, known as PRECIS, adequately represents species diversity for this part of the country. For the expected species lists generated for the QDS in which the Project area occurs, 78 plant species have been recorded, three of which were allocated Red Data Status (one listed as Near-Threatened and one as Vulnerable), according the South African Red data list of Plants.

Based on desktop analysis, the vegetation consists of disturbed grassland, hydromorphic grassland (in wetland areas) and alien bush clumps. Alien species expected to make up the bush clumps include: *Eucalyptus, Phragmites* and *Pinus* species. Alien invasion is likely to be a potential concern for the Project area, owing to the historic, large-scale soil disturbance that has taken place in the surrounding area, mostly due to agricultural activities.

According to Lorraine Mills from Gauteng Department of Agriculture and Rural Development (GDARD) (personal communication), there are four Red/Orange List plant taxa that have been recorded in Red/Orange List plant taxa. These species are listed in Table 10-26, two Near Threatened and two Vulnerable species have also been recorded here in the past. *Crinum bulbispermum* and *Hypoxis hemerocallidea* were recorded during this wet season survey, these are designated as Declining according to the South African Red List of Plants.

Table 10-26: Expected Plant Species of Special Concern (SSC) for the QDS' in which the Project Area occurs

Family	Species	Threat Status
ASPHODELACEAE	*Kniphofia typhoides Codd*	Near threatened
MESEMBRYANTHEMACEAE	*Khadia beswickii (L.Bolus) N.E.Br.*	Vulnerable
AIZOACEAE	*Lithops lesliei subsp. lesliei*	Near threatened
AMARYLLIDACEAE	*Nerine gracillis*	Vulnerable

10.1.6.2.3 Alien Plant Species

Further to this, alien plant species have also been classified according to NEM:BA, as published in August 2014 (GN R599 in *GG* 37886 of 1 August 2014) into the following categories:

- Category 1a: Species requiring compulsory control;
- Category 1b: Invasive species controlled by an invasive species management programme;

- Category 2: Invasive species controlled by area, and;
- Category 3: Invasive species controlled by activity.

A total of 17 alien invader plant species (AIP) were recorded on site (Bromilow 2010) (Table 10-27); seven of these have been assigned alien invader plant categories according to Conservation of Agricultural Resources Act, 1983 (Act No. 43 of 1983) (CARA) and NEM:BA. These species have established due to disturbance of the soil, largely due to cultivation in the area, as well as trampling by livestock. Large alien bushclumps have been delineated in Plan 17.

Table 10-27: Alien Plant Species recorded on Site

Family	Species	Category (CARA/NEMBA)
Amaranthaceae	*Gomphrena celesioides*	No category
Amaranthaceae	*Guilleminea densa*	No category
Asteraceae	*Bidens pilosa*	No category
	Cirsium vulgare	1; 1b
	Conyza albida	No category
	Cosmos bippinatus	No category
	Tagetes minuta	No category
	Taraxacum offininale	No category
	Xanthium strumarium	1; 1b
Cactaceae	*Opuntia ficus-indica*	1; 1b
Fabaceae	*Acacia mearnsii*	2; 2
Myrtaceae	*Eucalyptus camuldulensis*	2; 1b
Poaceae	*Paspalum notatum*	No category
	Trichoneura grandiglumis	No category
Salicaceae	*Salix babylonica*	No category
Solanaceae	*Datura ferox*	1; 1b
	Solanum sp.	No category
	Solanum sysimbriifolium	1; 1b
Verbenaceae	*Verbena brasiliensis*	No category

10.1.6.3 Project Area Fauna

10.1.6.3.1 Mammals

Actual sightings, spoor, calls, dung and nesting sites, as well as active sampling by means of motion detection cameras and Sherman traps, were used to establish the presence of mammals on the proposed Project site. The evidence of dung and spoor suggests that animals were present in the area, although relatively few, were recorded during the surveys. Table 10-28 lists mammals that were recorded in the proposed Project area during this survey, this includes personal communication with farmers. The mammals recorded were found within a variety of the vegetation communities recorded on site.

Two of these species are regarded as species of special concern and include the Cape Clawless Otter (*Aonyx capensis)* and Serval (*Felis serval*). These two species are protected according to NEM:BA TOPS list. Examples of small mammal fauna identified on site are represented in **Error! Reference source not found.**. A detailed list of the expected mammal pecies for the site, based on the results of a desktop assessment is provided in the Flora and Fauna Assessment, Appendix F.

Table 10-28: Mammal Species Recorded

Scientific Name	English Name	IUCN (2016.2)	NEMBA TOPS List (2007)
Aonyx capensis	Cape Clawless Otter	Near Threatened	Not Listed
Hystrix africaeaustralis	Porcupine	Least Concern	Not Listed
Leptailurus serval	Serval**	Least Concern	Protected
Lepus saxatilis	Scrub Hare	Least Concern	Not Listed
Canis mesomelas	Black-backed Jackal	Not Listed	Not Listed
Cryptomys hottentotus	Common Mole Rat	Least Concern	Not Listed
Cynictis penicillata	Yellow Mongoose	Least Concern	Not Listed
Mastomys coucha	Multimammate Mouse	Least Concern	Not Listed
Potamochoerus larvatus	Bushpig**	Least Concern	Not Listed
Raphicerus campestris	Steenbok**	Least Concern	Protected
Rhabdomys pumilio	Striped Mouse	Least Concern	Not Listed
Sylvicapra grimmia	Common Duiker**	Least Concern	Not Listed
Tatera leucogaster	Bushveld Gerbil*	Least Concern	Not Listed

* - Recorded previously

** - Recorded via personal communication with landowner

10.1.6.3.2 Avifauna

A total of 89 species were identified during the dry season and the wet season survey (combined) (refer to the Flora and Fauna Assessment, Appendix F). It is generally accepted that vegetation structure, rather than the actual plant species, influences bird species distribution and abundance (in Harrison *et al.;* 1997). Therefore, the vegetation description below does not focus on lists of plant species, but rather on factors which are relevant to bird distribution.

The natural habitat of the Project areas consist predominantly of the Eastern Highveld Grassland vegetation type, which occurs on slightly to moderately undulating plains, including some low hills and pan depressions. The vegetation is short, dense grassland dominated by the usual highveld grass composition (*Aristida, Digitaria, Ergrostis, Themeda, Tristachya* etc.). Rainfall is strongly summer seasonal (average 726 mm), with very dry winters (Mucina & Rutherford 2012).

Wetland Areas

The wetlands within the property are an important habitat for common water birds such as: Redknobbed Coot *(Fulica cristata)*, Grey Heron *(Ardea cinerea),* Purple Heron *(Ardea purpurea),* Egyptian Goose *(Alopochen aegyptiacus),* Cape Shoveler *(Anas smithii),* Spurwinged Goose *(Plectropterus gambensis),* Yellowbilled Duck *(Anas undulata),* Cattle Egret *(Bubulcus ibis)* and Three banded Plover *(Charadrius tricollaris)* and the adjacent grasslands provide potential habitat (*Imperata* cylindrica) for the Vulnerable African Grass Owl *(Tyto capensis* (according to the national Red Data List).

During the site visits a number of typical Grassland species were observed. These areas also included the road infrastructure, farm boundary and isolated patches throughout the property and included species such as Redeyed Dove *(Streptopelia semitorquata)*, Laughing Dove *(Spilopelia senegalensis),* Cape Turtle Dove *(Streptopelia capicola),* Common Fiscal *(Lanius collaris),* Cape Sparrow *(Passer melanurus),* Neddicky *(Cisticola fulvicapilla),* Swainsons Spurfowl *(Pternistis swainsonii)*, Helmeted Guineafowl *(Numida meleagris),* Black Shouldered Kite *(Elanus axillaris)* and large numbers of exotic Feral Pigeons *(Columba livia domestica)*.

Transformed/Cultivation

The habitat in the Project area has been transformed through dryland cultivation, mostly maize. Areas of current cultivation are situated on the areas with the least gradient, but also on the hill slopes where the gradient is not too aggressive. The agricultural fields of the property harbour a number of typical highveld endemics. These included several widow, weaver and bishop species (within the wetter areas). A number of African Quailfinch's *(Ortygospiza fuscocrissa)* were observed within the fields – these species generally feed on the seeds of the wetter grass species and are renowned wetland indicators. African Pipit *(Anthus cinnamomeus)* and Cape Longclaw *(nyx capensis)* were observed throughout the property, although there is enough nesting habitat in the surrounding area for the more endangered lark species it is noted that the existing mining activities, increased traffic loads and earth movement have negatively impacted on the breeding of all lark and pipit species on the property. However, once rehabilitation is concluded this is usually not a permanent impact. The altitude of the proposed development and species type of the grassland suggests that the area could be home to some endemic and endangered lark and pipit species such as: Botha's Lark *(Spizocorys fringillaris).* These species, however were not observed during any of the surveys.

Alien Vegetation

Relatively small but prominent collection of alien invasive and exotic tree species is present the Project site. These tree species were either planted as windbreaks by local farmers, as is the case with *Pine* and *Eucalyptus spp.*, or they were transported to the area via waterways such as *Populus* spp. The alien vegetation habitat type is also present on the hill slopes of rolling hills and flat areas between these hills.

Examples of avifauna recorded on site are represented in **Error! Reference source not ound.**.

Table 10-29: Red Data Species Recorded in by SABAP2 QDS search that could potentially occur on the Project site

Common name	Taxon name	IUCN 2016-2	SA Red List	NEMBA
Crane, Blue	*Anthropoides paradiseus*	VU	VU	Protected
Grass-Owl, African	*Tyto capensis*	LC	VU	Protected
Kestrel, Lesser	*Falco naumanni*	LC	LC	Protected
Korhaan, White-bellied	*Eupodotis senegalensis*	LC	VU	Protected
Marsh-Harrier, African	*Circus ranivorus*	LC	EN	Protected
Secretarybird*	*Sagittarius serpentarius*	VU	VU	Protected
Stork, Black	*Ciconia nigra*	LC	VU	Protected
Stork, Yellow-billed	*Mycteria ibis*	LC	EN	Protected

*-Recorded

10.1.6.3.3 Herpetofauna

Three amphibians were encountered during this field survey by (Deulman *et al,* 1986), means of active searching, with three species encountered during previous surveys. The expected amphibian species for the area are included in the Flora and Fauna Assessment, Appendix F. All species identified on site are listed in Table 10-30. The species listed as encountered below were all encountered within the wetlands habitat types.

Table 10-30: Amphibian Species recorded in the Palmietkuilen Project Area

Scientific Name	English Name	IUCN (2016.2)	NEMBA TOPS List (2015)
Afrana angolensis	Common River Frog	-	-
Bufo gutturalis	Guttural Toad	-	-
Cacosternum boettgeri	Common Caco	-	-

Strongylopus fasciatus	Striped Stream Frog	-	-

No reptile species were encountered during the field survey. No IUCN protected species were encountered.

10.1.6.3.4 -Invertebrates

During the wet season survey, butterflies were recorded through sweep netting and opportunistic observations and photographed where possible. In the dry season, transects were walked along the roads, rehabilitated areas, exotic plantations and grassland areas to identify any scorpion or spider nests/burrows/webs. Butterflies are a good indication of the habitats available in a specific area (Woodhall, 2005). Although many species are eurytropes (able to use a wide range of habitats) and are widespread and common, South Africa has many stenotrope (specific habitat requirements with populations concentrated in a small area) species which may be very specialised (Woodhall, 2005). Butterflies are useful indicators as they are relatively easy to locate and catch, and to identify. It is for this reason that Lepidoptera were used as the primary focus for the invertebrate survey. Three butterfly species were observed within the proposed Project area, these included the, African Monarch *(Danaus chrysippus)*, Brown-veined White *(Belenois aurota),* Broad Bordered Grass Yellow *(Eurema brigitta).* All the species were located within grassland or the wetland areas. No butterfly species observed were considered to be Species of Special Concern. However according to SANBI, it is possible that the Near Threatened Marsh Sylph *(Metisella meninx)* can be located on the site. It is endemic to the wet vleis of highland grassland in northern KwaZulu-Natal, Mpumalanga, Gauteng, the northern part of Free State and the extreme east of the North West Province, they preferred *Leersia hexandra* dominatd grassland. It has become extinct in many areas close to Johannesburg due to building developments.

Paracinema tricolor, a locust species was encountered in the grasslands of the Project site, *Rhodometra sacraria* (Vestal) was found in the wetlands areas. *Spilostethus pandurus* or Seed Bug was found in the grassland areas and the Wolf spider (*Ctenus* spp.) was encountered by the pans to the north east of the project area (Figure 10-10).

Figure 10-10: Invertebrate species encountered, (A: *Paracinema tricolor,* B: *Rhodometra sacraria* (Vestel) C: *Spilostethus pandurus* (Seed bugs) D: *Ctenus spp* (Wolf Spider)

The diversity and density of the invertebrates was relatively high for the proposed development footprint area and surroundings, and this in general could assist in providing an indication of the health of the regional ecology. Although existing agricultural activities have modified the immediate area, there is sufficient habitat within the surrounding unaffected areas to sustain moderate populations of the typical highveld grassland species of fauna. It would however be recommended that the management of any encroachment of alien invasive plant species is strictly enforced in order to retain the preferred faunal species types that currently dominate across the grassland biome of Gauteng Province.

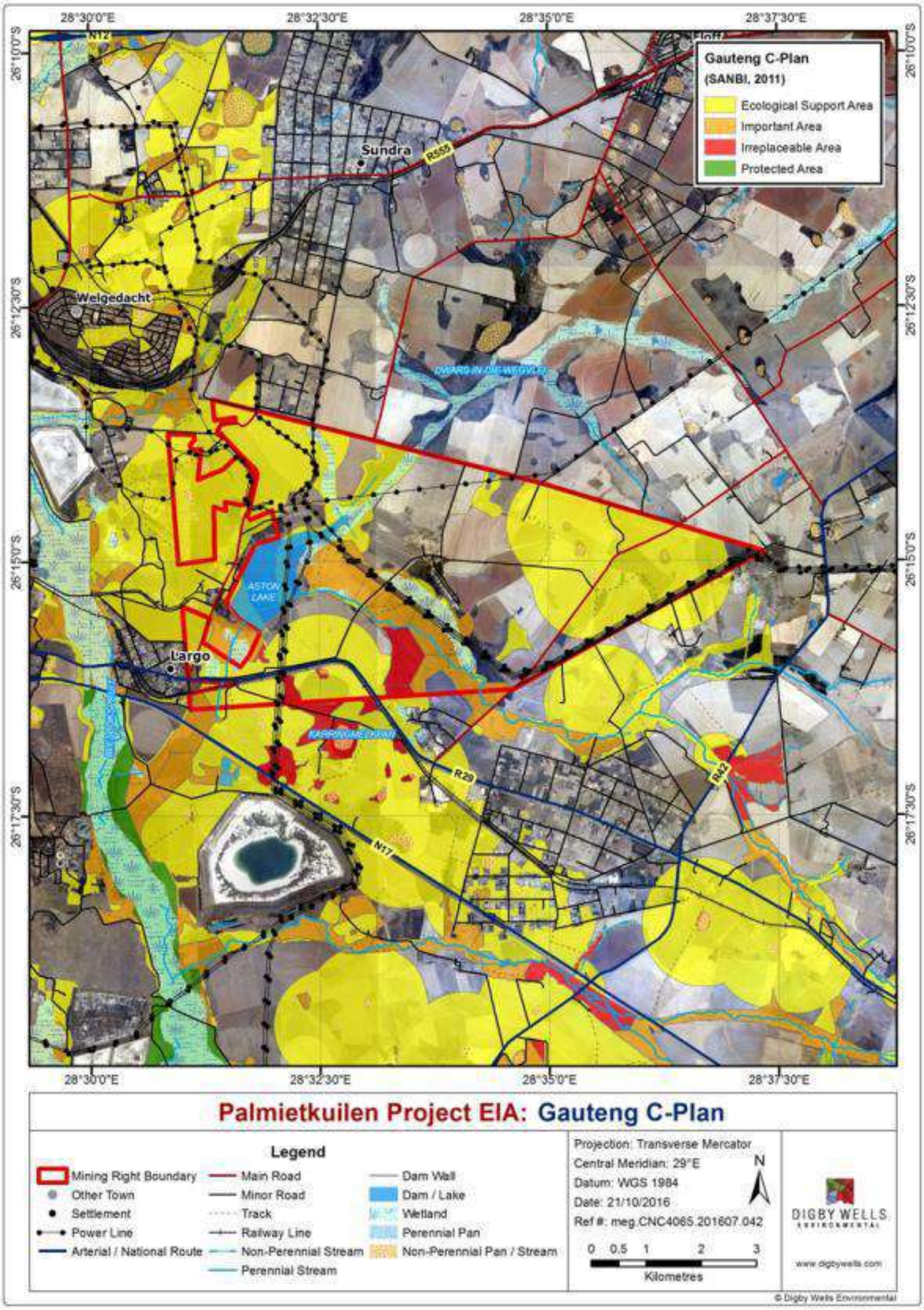
10.1.6.4 Sensitivity Analysis and No-go Areas

There are several assessments for South Africa as a whole, as well as on provincial levels that allow for detailed conservation planning as well as meeting biodiversity targets for the country's variety of ecosystems. These guides are essential to consult for development projects, and will form an important part of the sensitivity analysis.

Areas earmarked for conservation in the future, or that are essential to meet biodiversity and conservation targets should not be developed, and have a high sensitivity as they are necessary for overall ecological functioning. Further to this, details of the field investigation are used to determine the site-specific sensitivity.

10.1.6.4.1 Gauteng C-Plan (Conservation Plan)

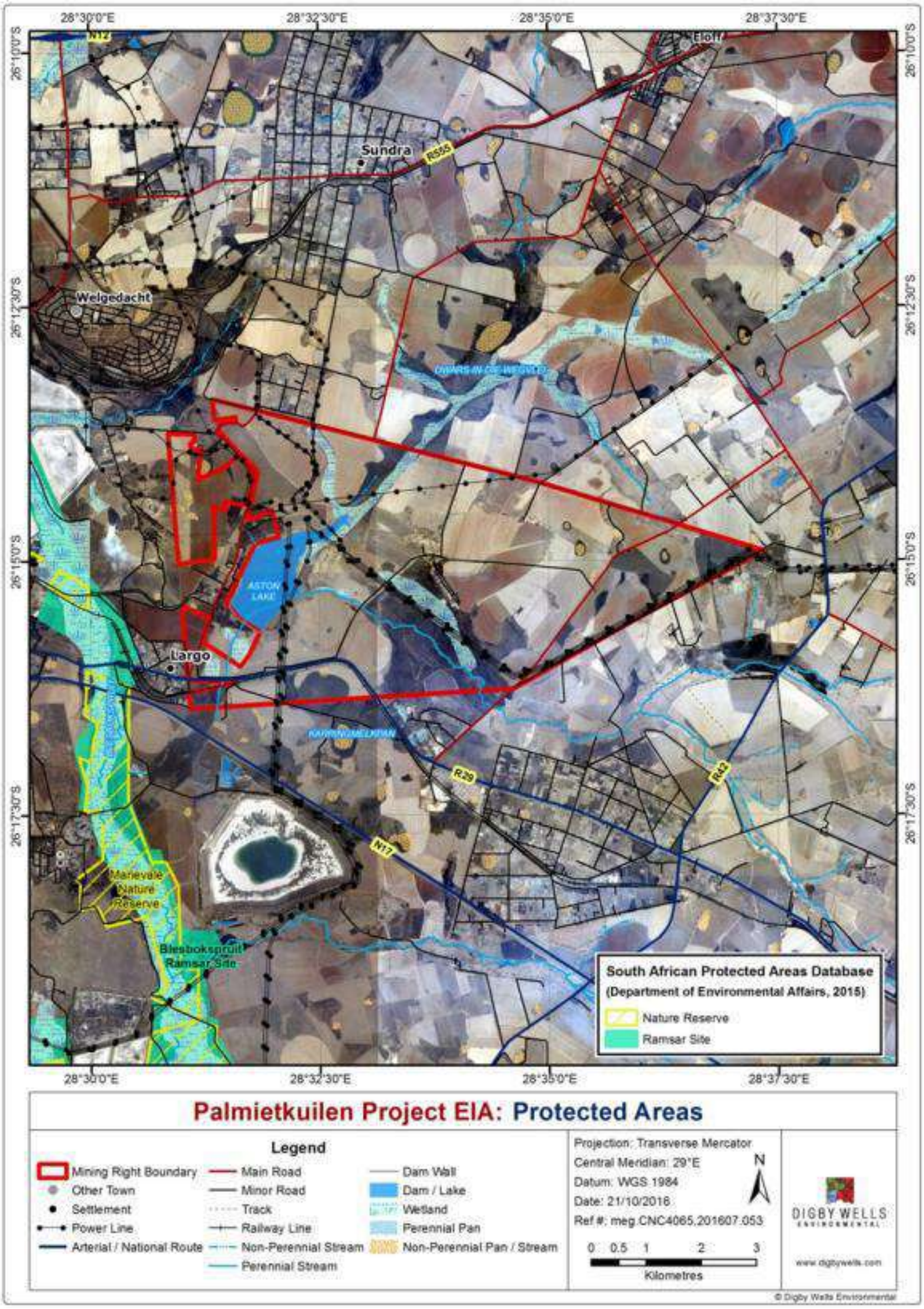
According to the Gauteng C-Plan the wetlands throughout the Project area are regarded as Important Areas, with a small patch of Irreplaceable habitat being present in the south, all of which forms part of the wetlands system present. Large parts of Ecological support areas are depicted on Plan 18.



Plan 18: Gauteng Biodiversity Conservation Plan (2014)

10.1.6.4.2 Protected Areas

Officially protected areas, either provincially or nationally, that occur within proximity to the project site could have consequences as far as impact on these areas are concerned. The Marievale Nature Reserve is less than 1 km west of the project boundary, this coincides with the Blesbokspruit Ramsar site. The protected areas within proximity to the project site are represented in Plan 19.



Plan 19: Protected Areas

10.1.6.4.3 Important Bird Areas (Birdlife SA, 2013)

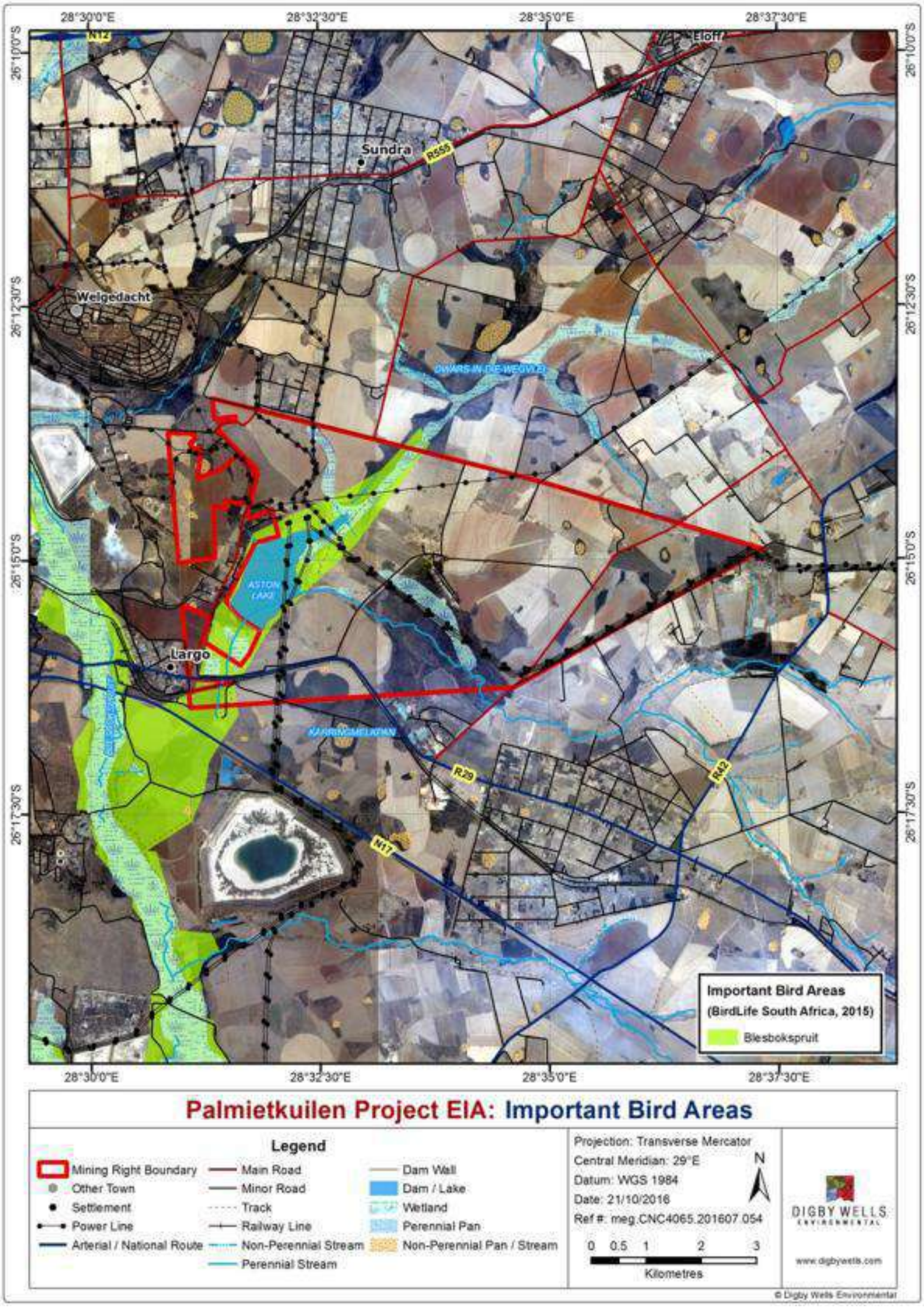
An Important Bird Area (IBA) is an area recognised as being globally important habitat for the conservation of bird populations. Currently there are about 10,000 IBAs worldwide. At present, South Africa has 124 IBA's, covering over 14 million hectares of habitat for our threatened, endemic and congregatory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

The proposed project area coincides with the Blesbokspruit IBA, (Plan 20). Located 15 km southeast of Springs, at an altitude of 1 585 mamsl, Blesbokspruit is a modified high-altitude wetland. The IBA includes the entire system, from the Springs Bird Sanctuary in the north to Marievale Bird Sanctuary in the south. Blesbokspruit is one of the Vaal River's larger tributaries and its catchment covers 1 000 km^2. The vlei holds much open water, often shallow, with extensive fringing vegetation and some relatively small patches of emergent vegetation.

The dominant marginal vegetation includes *Phragmites australis*, *Typha capensis*, *Juncus spp*. and *Cyperus spp*. Water levels in the spruit are artificially maintained by the input of mining, industrial and municipal effluents that are contained by embankments. The input of additional organic matter produces highly eutrophic conditions favoured by marginal vegetation, such as vast reedbeds, which provide a variety of reed and edge habitats (Birdlife, 2013).

At least 286 species, 78 of which are waterbirds, have been recorded in the reserve. Blesbokspruit, which in the past regularly supported more than 20 000 waterbirds, was designated a Ramsar wetland of international importance for waterfowl in 1986. The vlei used to support large numbers of Great Crested Grebe (*Podiceps cristatus)*, Yellow-billed Duck (*Anas undulate)* and Spur-winged Goose (*Plectropterus gambensis)* in the dry season when high water levels were artificially maintained at Blesbokspruit, and neighbouring wetlands dried up. Numbers of waterfowl at Blesbokspruit have decreased dramatically in the last 10 years, and no species has had numbers exceeding the 1% of the bio-geographical population estimate for over a decade (Birdlife, 2013).

The highly productive water used to provide food for large numbers of Lesser Flamingo (*Phoeniconaias minor)* and Greater Flamingo (*Phoenicopterus ruber*) however, these have disappeared in recent years. The system still supports locally important numbers of Goliath Heron (*Ardea goliath)*, Purple Heron (*Ardea purpurea)*, African Spoonbill (*Platalea alba)*, Glossy Ibis (*Plegadis falcinellus)*, Pied Avocet (*Recurvirostra avosetta)*, Red-knobbed Coot (*Fulica cristata)* and White-winged Tern (*Chlidonias leucopterus)*. The African Marsh Harrier (*Circus ranivorus)*, which has been displaced from much of the surrounding veld by intense industrialisation, urbanisation and habitat modification, used to have a strong population here; this too has dwindled over the last 5 years, and now it is only an occasional visitor (Birdlife, 2013).



Plan 20: Important Bird Area (IBA) (Birdlife SA, 2013)

10.1.6.4.4 Nationally Threatened Ecosystems

The list of nationally threatened ecosystems has been gazetted by the NEM:BA National list of ecosystems that are threatened and in need of protection and results in several implications in terms of development within these areas. Four basic principles were established for the identification of threatened ecosystems.

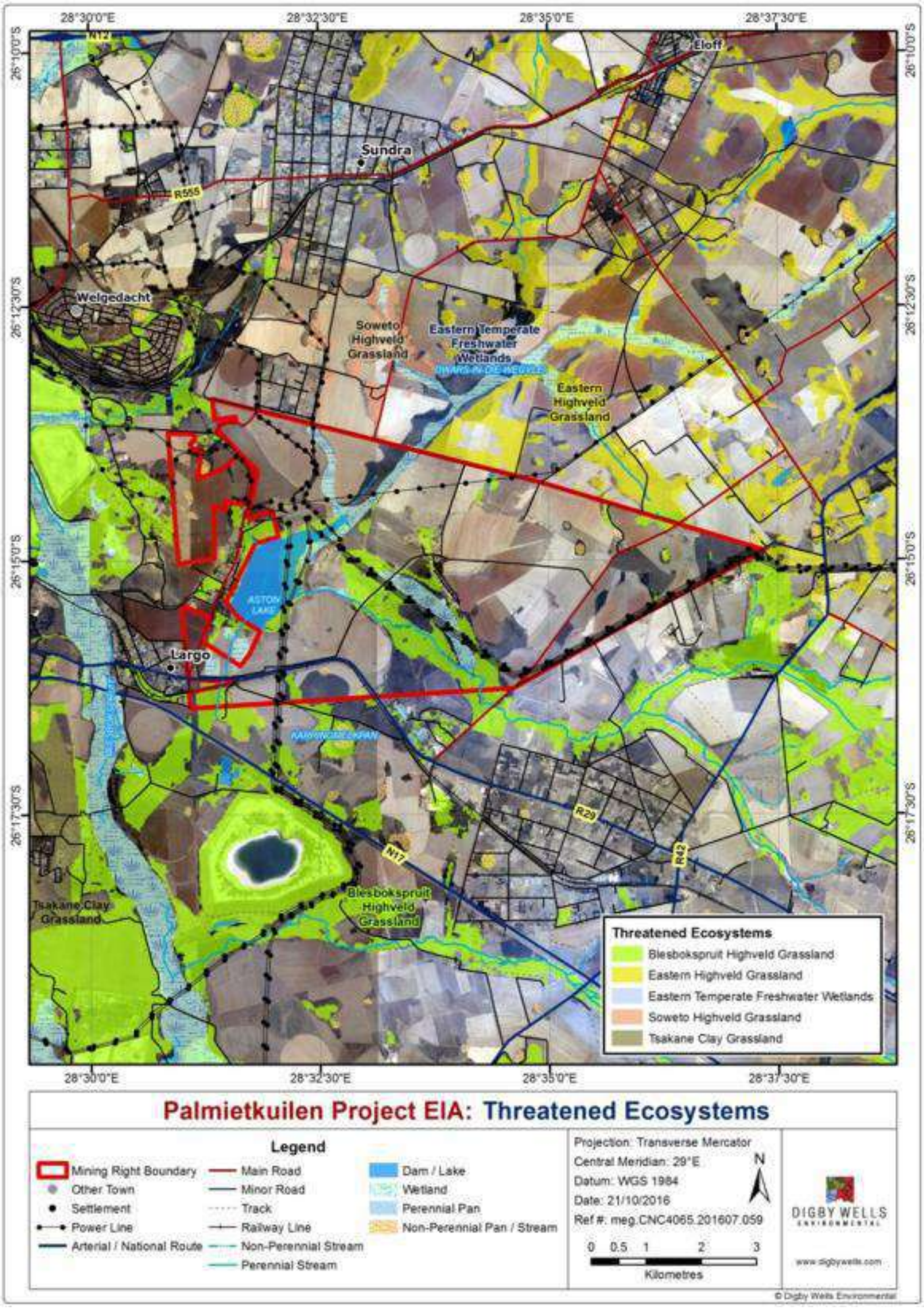
Areas were delineated based on as fine a scale as possible and are defined by one of several assessments:

- The vegetation of South Africa, Lesotho and Swaziland (Mucina and Rutherford 2006);
- National forest types recognised by the Department of Water Affairs and Forestry (DWAF), now Department of Water and Sanitation (DWS);
- Priority areas identified in a provincial systematic biodiversity plan; and
- High irreplaceability forest patches or clusters identified by DWAF (DWS).

The criteria for identifying threatened terrestrial ecosystems include six criteria overall, two of which are dormant due to lack of data (criteria B and E). The criteria are presented in Table 10-31 below and depicted in Plan 21 that shows the Blesbokspruit Highveld grassland is listed as a threatened ecosystem. Cumulative loss of these areas must be avoided.

Table 10-31: Criteria for the Listing of National Threatened Ecosystems

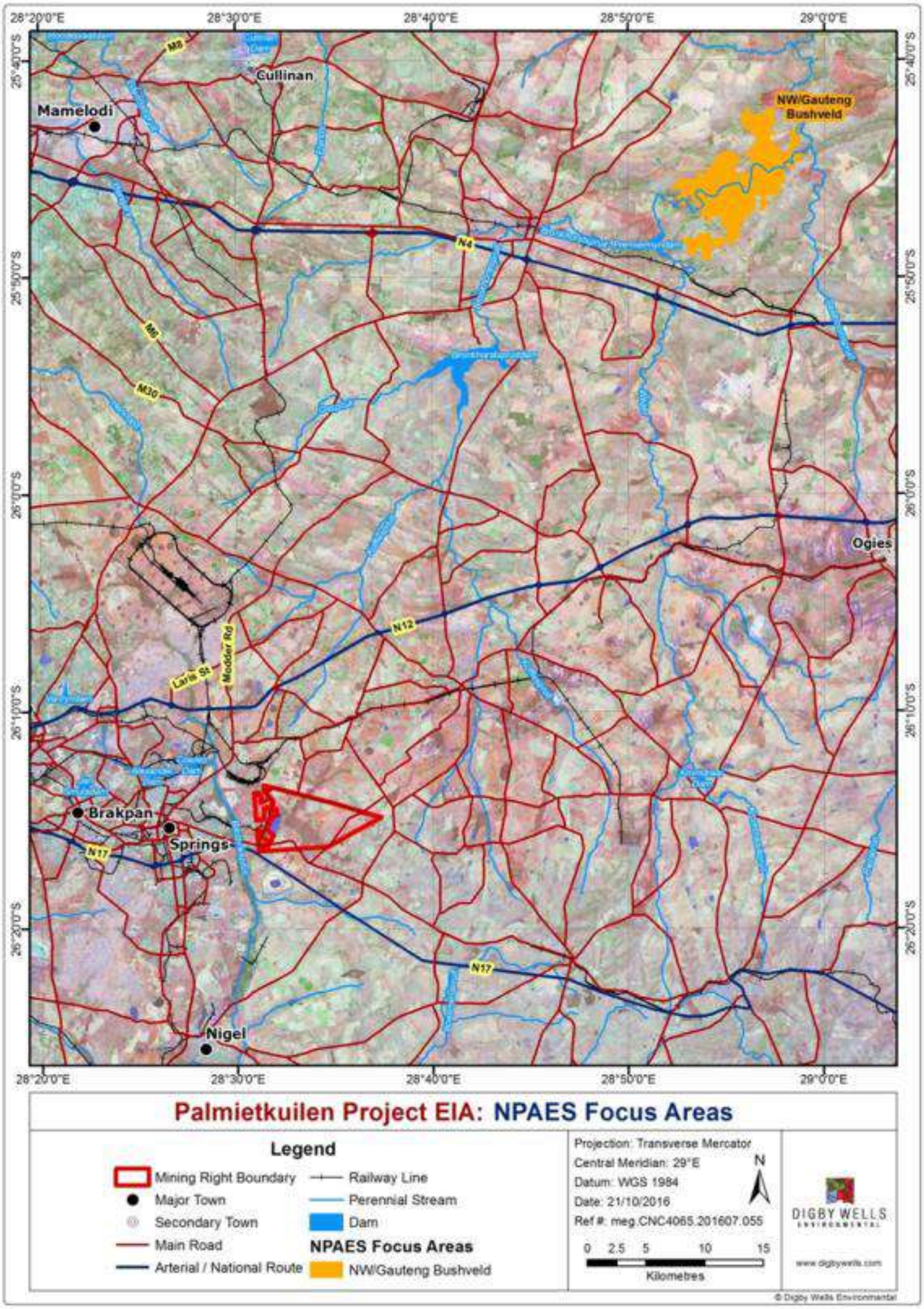
Criterion	Details
A1	Irreversible loss of natural habitat
A2	Ecosystem degradation and loss of integrity
B	Rate of loss of natural habitat
C	Limited extent and imminent threat
D1	Threatened plant species associations
D2	Threatened animal species associations
E	Fragmentation
F	Priority areas for meeting explicit biodiversity targets as defined in a systematic biodiversity plan



Plan 21: Nationally Threatened Ecosystems (SANBI)

10.1.6.4.5 Nationally Protected Areas Expansion Strategy

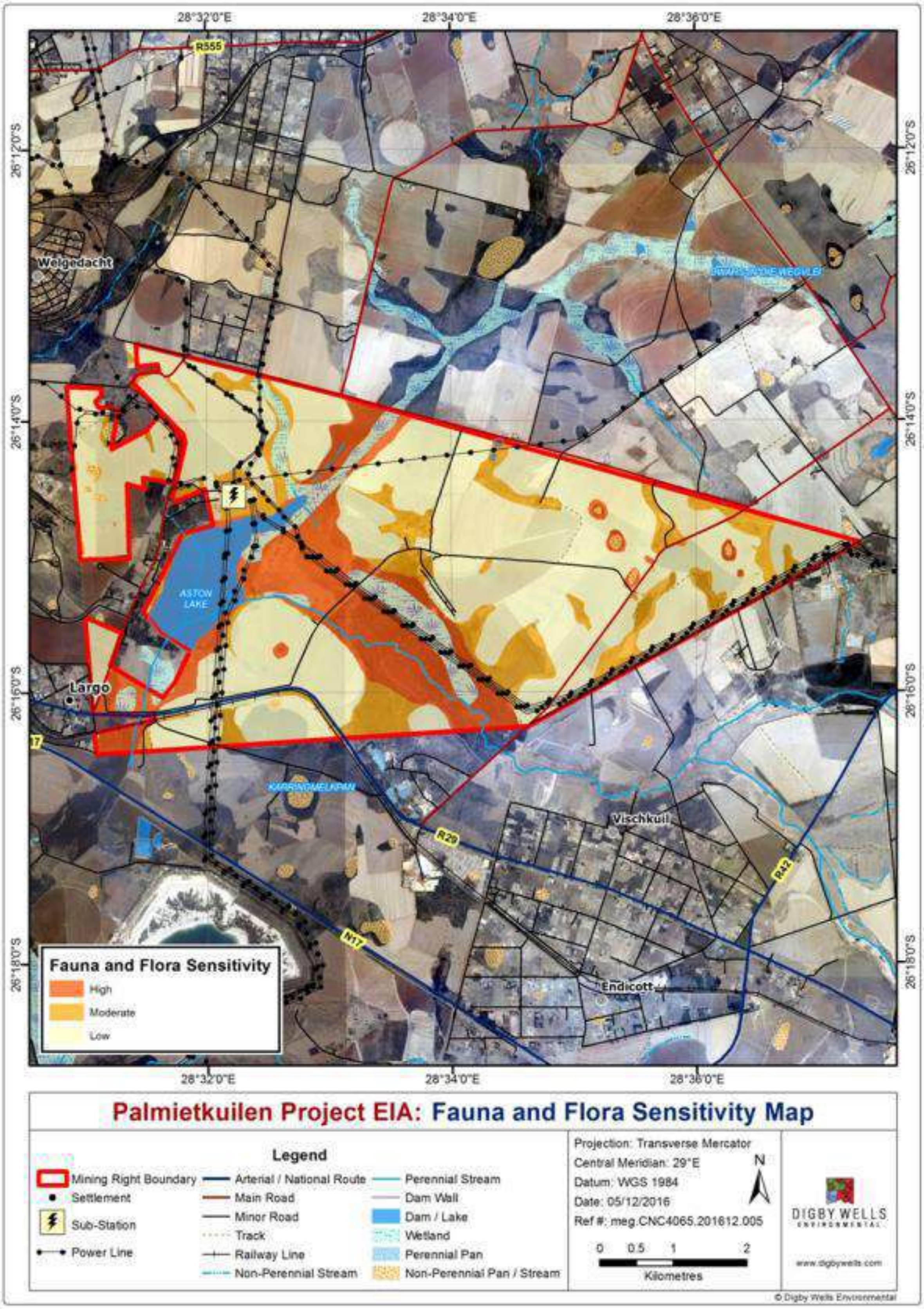
The National Protected Areas Expansion Strategy (NPAES) shows areas designated for future incorporation into existing protected areas (both national and informal protected areas). These areas are large, mostly intact areas required to meet biodiversity targets, and suitable for protection. They may not necessarily be proclaimed as protected areas in the future and are a broad scale planning tool allowing for better development and conservation planning. There are no areas earmarked for conservation within 50 km of the proposed development (Plan 22). The closest area is approximately 70 km away, the North West/Gauteng Bushveld.



Plan 22: National Protected Areas Expansion Strategy

10.1.6.4.6 Site-specific Sensitivity

The ecological sensitivity map for the site is represented in Plan 23. The Wetland/Riparian and pan vegetation units were allocated a high sensitivity since wetlands are regarded as important habitats that should be conserved due to the presence of plant SSC and habitat diversity. Further to this *Eragrostis* – dominated Grassland was assigned moderate ecological sensitivity due to the potential presence of plant SSC and current high species diversity and ecosystems function.



Plan 23: Ecological Sensitivity

10.1.7 Wetlands

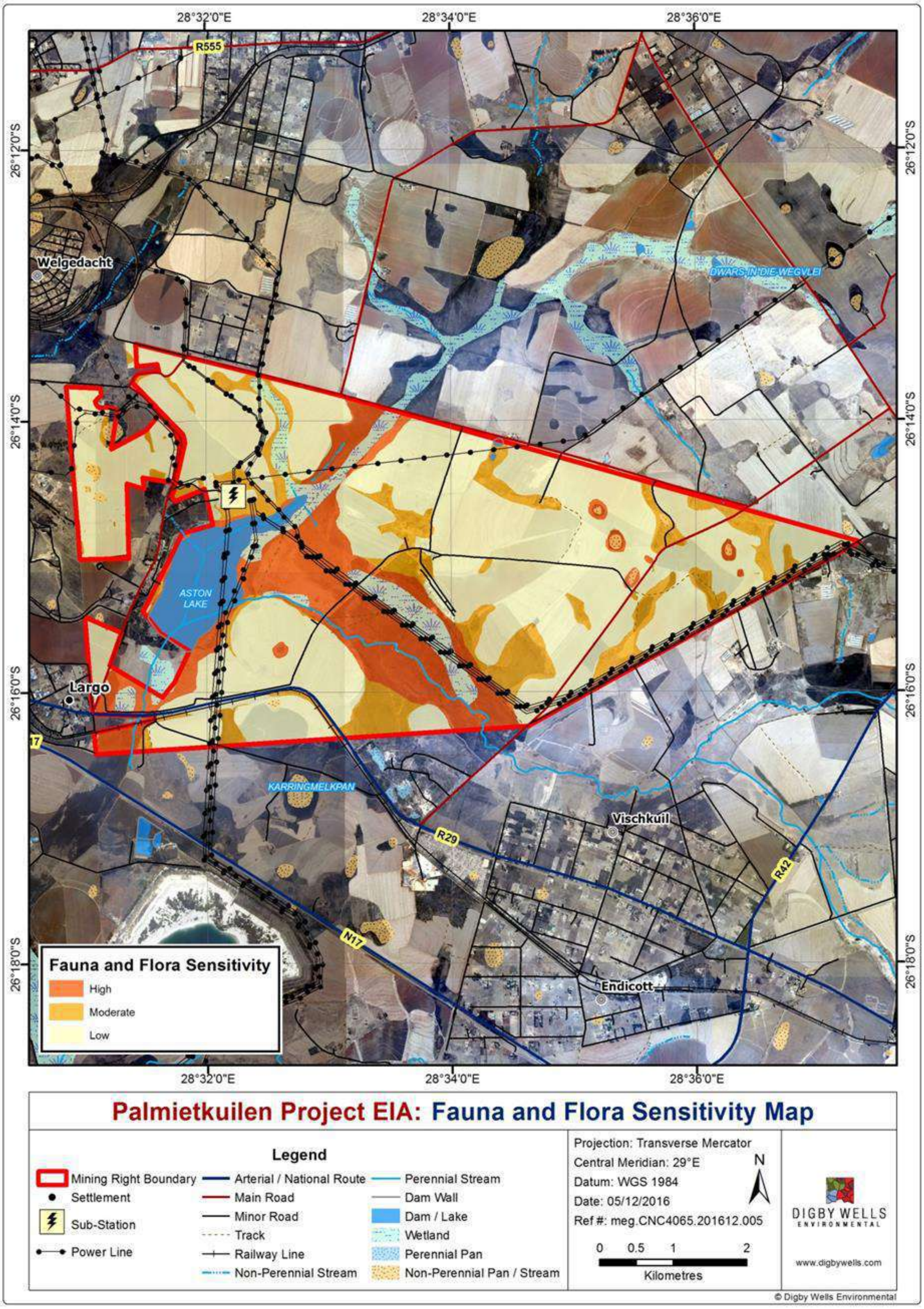
10.1.7.1 National Freshwater Ecosystem Priority Areas

The Project area is dominated by the NFEPA valley floor floodplain wetland (rank 1) associated with Aston Lake, which drains into the Blesbokspruit River Ramsar wetland and Marievale Nature Reserve approximately 4 km from the dam's outlet and approximately 6.5 km from the nearest proposed Project infrastructure. The Blesbokspruit wetland is listed as a Ramsar wetland site of International Importance; one of 17 in South Africa and the only one in the Gauteng Province. It was designated as such in October 1986 as it was one of few permanent water bodies in the former Transvaal region with ecological significance (South African Wetlands Conservation Programme, 1999). Due to this status and the connectivity to the Blesbokspruit watercourse, the valley bottom wetlands associated with the Aston Lake have an NFEPA rank of 1; the highest possible classification in the ranking criteria (refer to Table 10-32).The other NFEPA wetlands within the project area include depressions, bench flats and some small areas of valley bottom wetlands, as shown on Plan 24. These are mostly located on hillslopes up to and including the catchment divide landscape positions and are mostly found within agricultural land. All of these wetlands are classed as "other natural wetlands" and thus have a FEPA ranking of 6.

Table 10-32: NFEPA wetland classification ranking criteria

Criteria	Rank
▪ Wetlands that intersect with a RAMSAR site.	1
▪ Wetlands within 500 m of an IUCN threatened frog point locality; ▪ Wetlands within 500 m of a threatened waterbird point locality; ▪ Wetlands (excluding dams) with the majority of their area within a sub-quaternary catchment that has sightings or breeding areas for threatened Wattled Cranes, Grey Crowned Cranes and Blue Cranes; ▪ Wetlands (excluding dams) within a sub-quaternary catchment identified by experts at the regional review workshops as containing wetlands of exceptional Biodiversity importance, with valid reasons documented; and ▪ Wetlands (excluding dams) within a sub-quaternary catchment identified by experts at the regional review workshops as containing wetlands that are good, intact examples from which to choose.	2
▪ Wetlands (excluding dams) within a sub-quaternary catchment identified by experts at the regional review workshops as containing wetlands of biodiversity importance, but with no valid reasons documented.	3
▪ Wetlands (excluding dams) in A or B condition AND associated with more than three other wetlands (both riverine and non-riverine wetlands were assessed for this criterion); and ▪ Wetlands in C condition AND associated with more than three other wetlands (both riverine and non-riverine wetlands were assessed for this criterion).	4
▪ Wetlands (excluding dams) within a sub-quaternary catchment identified by experts at the regional review workshops as containing Impacted Working for Wetland sites.	5

Criteria	Rank
▪ Any other wetland (excluding dams).	6



Plan 24: NFEPA Wetland

10.1.7.2 Gauteng C-Plan

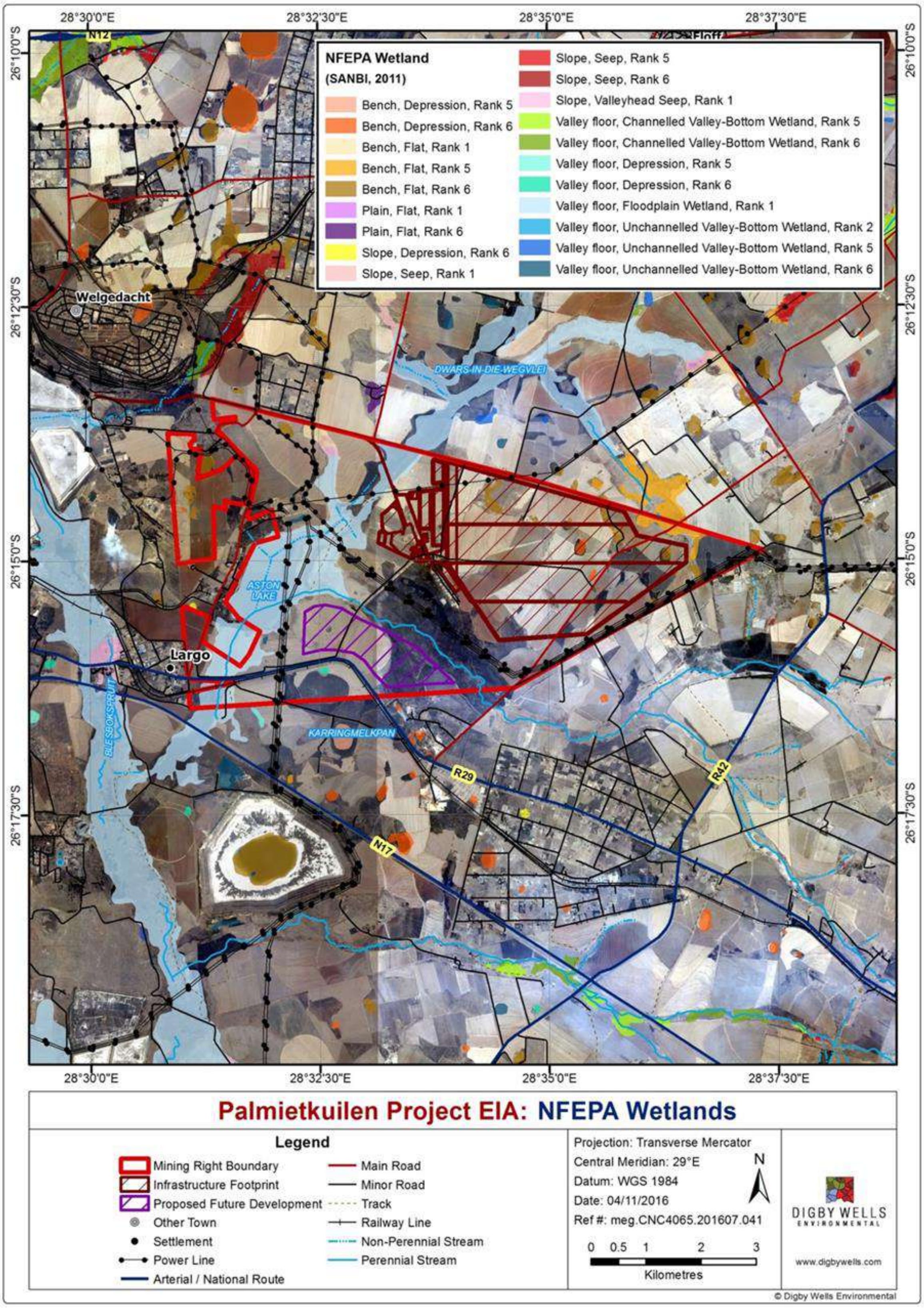
The Project area is characterised by both Critical Biodiversity Areas (CBA's) and Ecological Support Area (ESA's) as shown in Plan 18 above. The NFEPA wetlands and the buffer of 500m around them have been classified as ESAs, comprising a large proportion of the site. Furthermore, the tributary leading into Aston Lake, although not designated as an NFEPA wetland, is an 'Important' CBA and some natural areas have been identified as 'Irreplaceable'. The dominant floodplain valley bottom NFEPA wetland associated with Aston Lake and leading to the Blesbokspruit River and Ramsar wetland is designated as a mixture of ESA and CBA 'Important Areas'.

10.1.7.3 The Mining and Biodiversity Guideline

The Project location has many areas with a risk to mining according to the guideline as shown in Plan 25 and summarised in Table 10-33 below:

Table 10-33: Mining and Biodiversity Guideline Categories (SANBI, 2013)

Category	Areas associated with mining project
Legally protected	No areas.
Highest Risk: Highest Biodiversity Importance	Areas of highest risk to mining are associated with the following areas due to highest biodiversity value: a. The dominant valley floor wetlands including Aston Lake (recognised by NFEPA as rank 1) and the 500m buffer area around this; and b. The Important and Irreplaceable CBA's.
High Risk: High Biodiversity Importance	No areas
Moderate Risk: Moderate Biodiversity Importance	c. Other wetlands associated with NFEPA and their 500m buffers; and d. The ESA's



Plan 25: Mining and Biodiversity Guideline

10.1.7.4 Wetland Findings

10.1.7.4.1 Wetland Units and Indicators

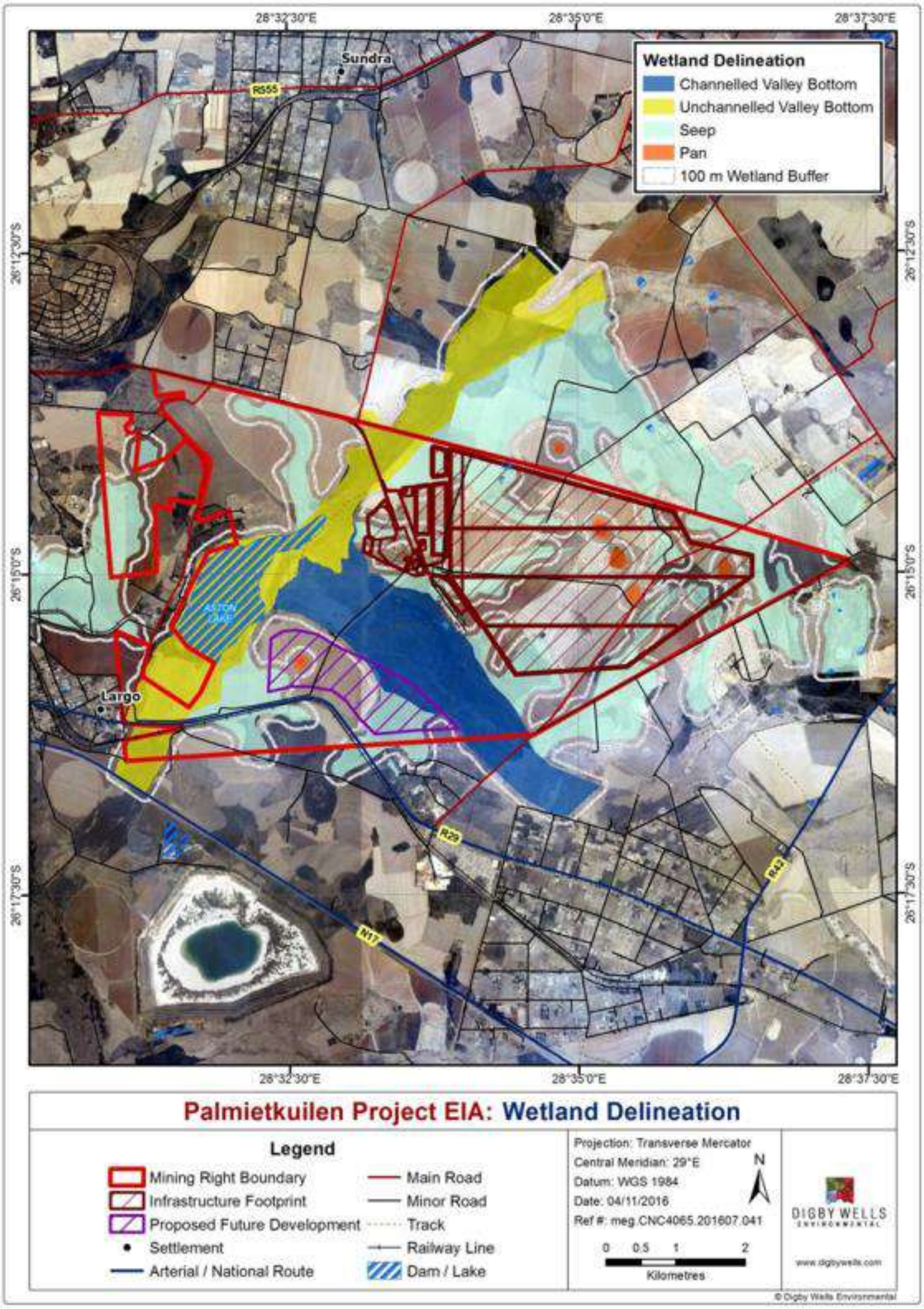
The proposed Mining Right Area is characterised by multiple wetland systems. The wetland systems total an area of 1,550.4 ha (Plan 26). There are two major valley bottom systems, one being channelled and the other unchannelled; the latter draining into the former. The unchannelled system has been dammed and is referred to as Aston Lake. The remainder of the area is characterised by extensive hillslope seeps that drain into the valley bottom wetlands and pan wetlands at the tops of the hills.

The main floral indicators, identifiable at the time of sampling (August 2016), were *Imperata cylindrica* (Cottonwool Grass) found in the hillslope seeps (Figure 10-11c) and *Typha capensis* (Bullrush) in the permanent wet zones. Much of the vegetation was unidentifiable due to the timing of the site visit and also as the area has been grazed, burnt and replaced with crop plants across the majority of the wetlands.

The soils were thus a major indicator for the delineation of the wetlands. As discussed in Section 10.1.3 above, terrestrial soils identified at the Project site are typically associated with Hutton and Clovelly soil forms whilst the wetlands were characterised by Aracadia and Wesleigh soil form (Figure 10-12).

Figure 10-11: Example photos of main wetlands present on site: a) Aston Lake; b) unchannelled valley bottom wetland; c) hillslope seep characterised by *Imperata cylindrica* (Cotton wool Grass) stand; and d) pan wetland

Figure 10-12: Characteristic soil forms identified on site showing: a) terrestrial soil, Hutton form; b) bleached E-horizon wetland soils found in the hillslope seeps, typical of Kroonstad form; and c) soils with mottling present and higher organic carbon content, typical of the valley bottom wetlands with Arcadia soil form



Plan 26: Wetland Delineation

10.1.7.4.2 Wetland Ecological Health and Functionality Assessment

As the proposed Project area has been largely transformed by agricultural activities, the wetlands have been altered significantly from their natural state. Croplands have replaced much of the naturally occurring vegetation and this has impacted the ability of wetlands to maintain biodiversity. This disturbance has also led to the establishment of alien and invasive plant species, further limiting the ability of the hydromorphic grasslands to function. The vegetation has been significantly impacted by cattle grazing and trampling as discussed in Section 10.1.5.6. The presence of urban developments and industrial infrastructure (such as powerlines and a sub-station) affect the ecological integrity of the wetlands and deter avifaunal populations.

The agricultural activities including cattle farming has resulted in impaired water quality of the wetlands associated with the site. These activities cause increased sedimentation of the systems due to exposed substrate. Sedimentation alters the natural hydrological and geomorphological functioning of the wetlands and may have an impact on aquatic life. The impaired water quality may also result from additional loading of phosphates and nitrates.

Whilst the current land use practices have compromised the natural ecological functioning and biodiversity maintenance role of these wetlands, these roles are still important, as they are linked to the greater stream network and are protected by the NWA. Most of the project area was mapped as Ecological Sensitive Areas (ESA's) according to the provincial conservation plan whilst some wetlands were CBA's. The wetlands and landscape also play an important ecological role as they are tributaries to the Blesbokspruit Ramsar Wetland of International Importance and the Marievale Bird Sanctuary. The wetland, located ±1km west of the Mining Right Area and totalling 1 858 ha, was designated as such in October 1986 as it was one of few permanent water bodies in the former Transvaal region with high ecological significance (South African Wetlands Conservation Programme, 1999). It must be noted that the Blesbokspruit is located approximately 4 km from the Aston Lake's outlet and approximately 6.5 km from the nearest proposed Project infrastructure.

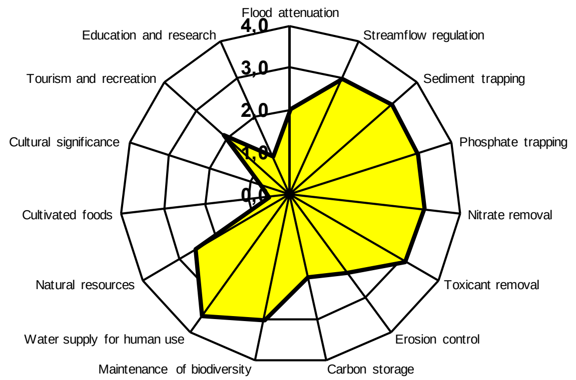
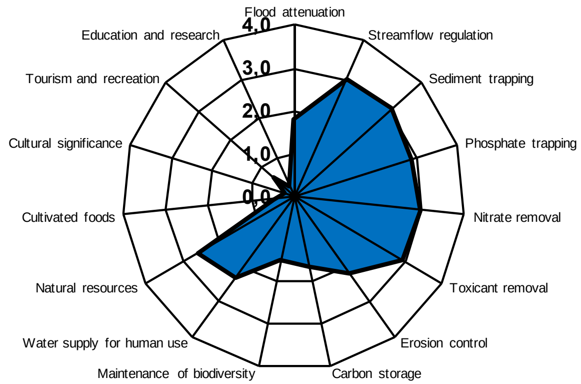
Additionally, the wetlands provide services such as flood attenuation, streamflow regulation during low flow periods and water quality improvement. The wetlands are important for the provision of the crops as well as the cattle raise on the properties. Due to the significant extent of hillslope seep wetlands, which indicate shallow groundwater, catchment recharge is an important function. The hydro-functional role of the wetlands was found to be greater than the ecosystem services offered for maintenance of biodiversity (Table 10-34).

Figure 10-13: Examples of impacts to wetland systems: a) roads crossing through wetlands; b) culverts associated with major road crossings; c) agricultural fields replacing natural vegetation; and d) cattle in the wetlands

Table 10-34: Summary of wetlands present ecological state within the Project Area

Wetland HGM Unit	Area (ha)	PES and WET-Health Score
Unchannelled Valley Bottom with Aston Lake	423.5	D – Largely modified (5.0)
Channelled Valley Bottom	404,9	D – Largely modified (5.2)
Hillslope seeps connected to the valley bottom	695.2	E – Critically modified (6.3)
Pans	26.8	D – Largely modified (4.8)

Table 10-35: Summary of wetlands ecological importance, sensitivity and services provided

<table>
<tr><th>Wetland Unit</th><th colspan="2">Importance and Sensitivity Assessment</th><th colspan="2">WET-EcoServices Assessment</th></tr>
<tr><td rowspan="3">Unchannelled Valley Bottom with Aston Lake</td><td>Ecological</td><td>High (2.2)</td><td rowspan="3">Water supply for human use (3.5)
Sediment trapping (3.2)
Phosphate trapping (3.2)
Nitrate removal (3.2)
Toxicant removal (3.1)
Streamflow regulation (3.0)
Maintenance of biodiversity (3.0)
Natural resources (2.6)</td><td rowspan="3">
</td></tr>
<tr><td>Hydrological</td><td>High (2.1)</td></tr>
<tr><td>Direct Human Benefits</td><td>Moderate (1.3)</td></tr>
<tr><td rowspan="3">Channelled Valley Bottom</td><td>Ecological</td><td>Moderate (1.8)</td><td rowspan="3">Sediment trapping (3.1)
Streamflow regulation (3.0)
Nitrate removal (3.0)
Toxicant removal (2.9)
Phosphate trapping (2.9)
Natural resources (2.6)</td><td rowspan="3">
</td></tr>
<tr><td>Hydrological</td><td>Moderate (2.0)</td></tr>
<tr><td>Direct Human Benefits</td><td>Moderate (1.1)</td></tr>
</table>

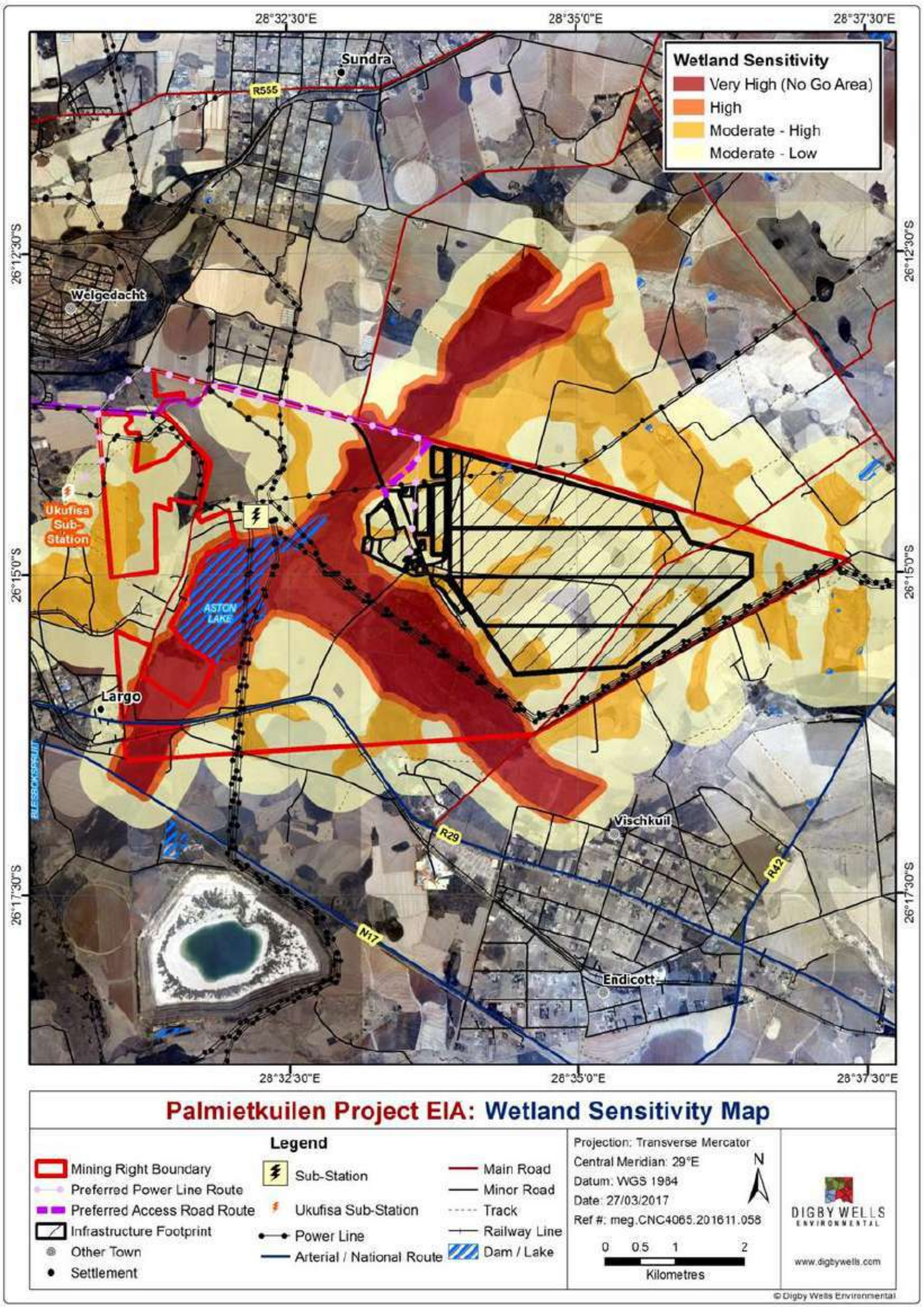
Hillslope seeps connected to the valley bottom	Ecological	Low (1.0)	Phosphate trapping (3.1) Nitrate removal (3.1) Sediment trapping (2.9) Toxicant removal (2.8) Natural Resources (2.6)	
	Hydrological	Moderate (1.9)		
	Direct Human Benefits	Low (0.8)		
Pans	Ecological	Low (0.6)	Erosion control (2.9) Toxicant removal (2.8) Phosphate trapping (2.7) Nitrate removal (2.6)	
	Hydrological	Low (0.9)		
	Direct Human Benefits	Low (0.5)		

10.1.7.5 Sensitivity Analysis and No-go Areas

The Gauteng C-Plan (GDARD, 2014) shows a considerable area within and immediately around the Mining Right Area identified as ESAs; additionally with some ‘Irreplaceable’ and ‘Important’ CBAs. These areas are largely associated with the wetlands of the area and their buffer zones. Further to this, some of these wetlands are highlighted as NFEPAs and the Ramsar Status of the Blesbokspruit wetlands was assigned a rank of 1.

According to the Mining and Biodiversity Guideline (SANBI, 2013), the Project area is characterised by large areas regarded as being highest risk to mining projects. These are areas are associated with the dominant valley floor wetlands including Aston Lake and the 500m buffer area around this as well as the identified CBA’s. Some other areas are identified as having a moderate risk to mining and these are associated with other NFEPA wetlands on the hill top and their 500m buffers; as well as the ESA’s.

Wetlands associated with the Project area, as well as their buffers, were rated according to their ecological sensitivity as listed in Table 10-36 and represented in


Wetland Sensitivity
Very High (No Go Area)
High
Moderate - High
Moderate - Low
Sundra
R555
Welgedacht
Ukufisa Sub-Station
ASTON LAKE
Largo
Vischkuil
R29
R42
N17
Endicott
28°32'30"E
28°35'0"E
28°37'30"E
26°12'30"S
26°15'0"S
26°17'30"S
Palmietkuilen Project EIA: Wetland Sensitivity Map
Legend
Mining Right Boundary
Preferred Power Line Route
Preferred Access Road Route
Infrastructure Footprint
Other Town
Settlement
Sub-Station
Ukufisa Sub-Station
Power Line
Arterial / National Route
Main Road
Minor Road
Track
Railway Line
Dam / Lake
Projection: Transverse Mercator
Central Meridian: 29°E
Datum: WGS 1984
Date: 27/03/2017
Ref #: meg.CNC4065.201611.058
0 0.5 1 2
Kilometres
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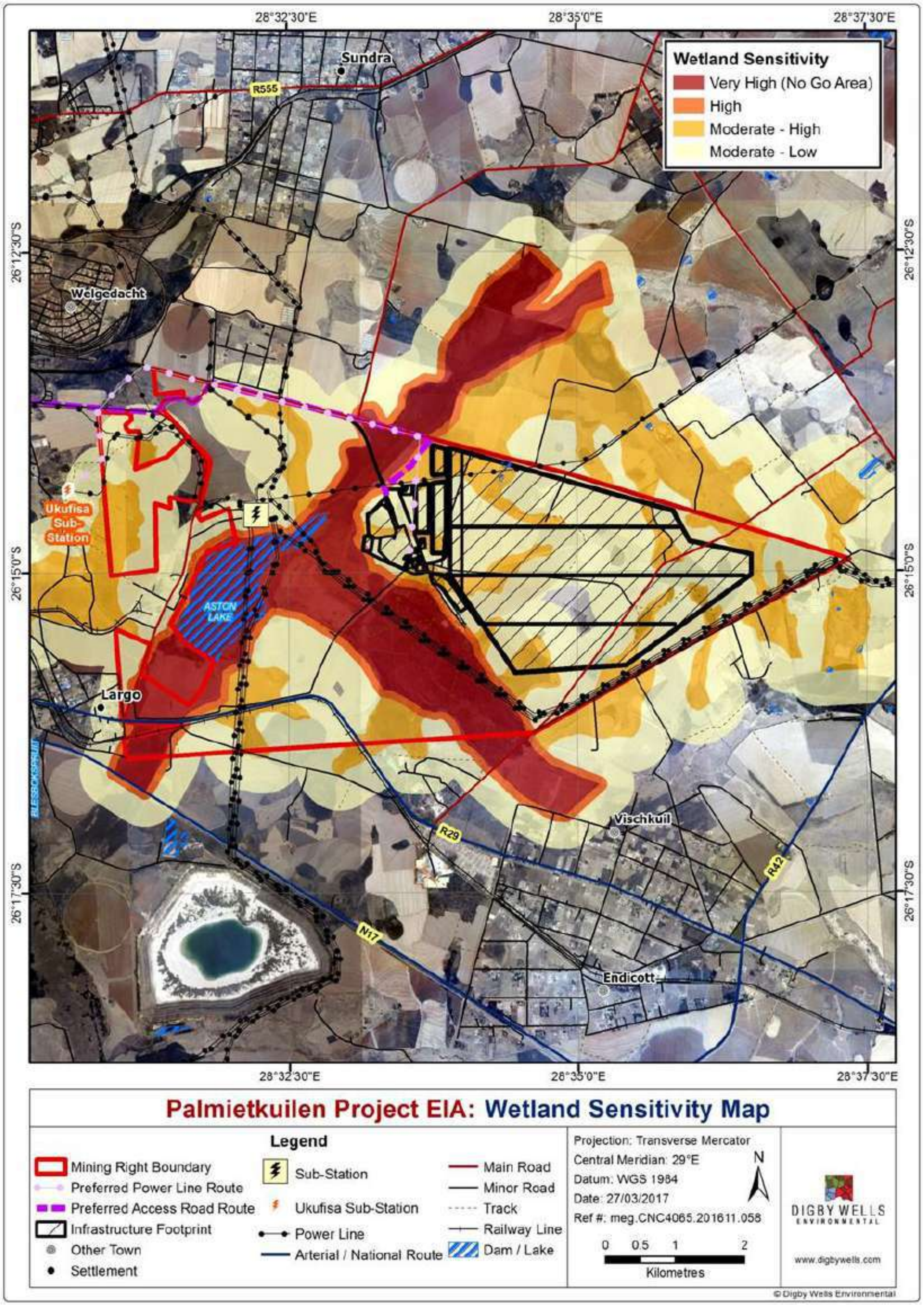
DIGBY WELLS ENVIRONMENTAL
www.digbywells.com
© Digby Wells Environmental

Plan 27. A buffer is the area surrounding the wetland within which land-use activities may directly affect the ecological character of the wetland itself, and the objective for land-use within the buffer zone should be one of sustainable use through ecosystem management, consistent with the maintenance of the ecological character of the wetland (Ramsar Convention Secretariat, 2010).

Table 10-36: Wetland sensitivity ratings

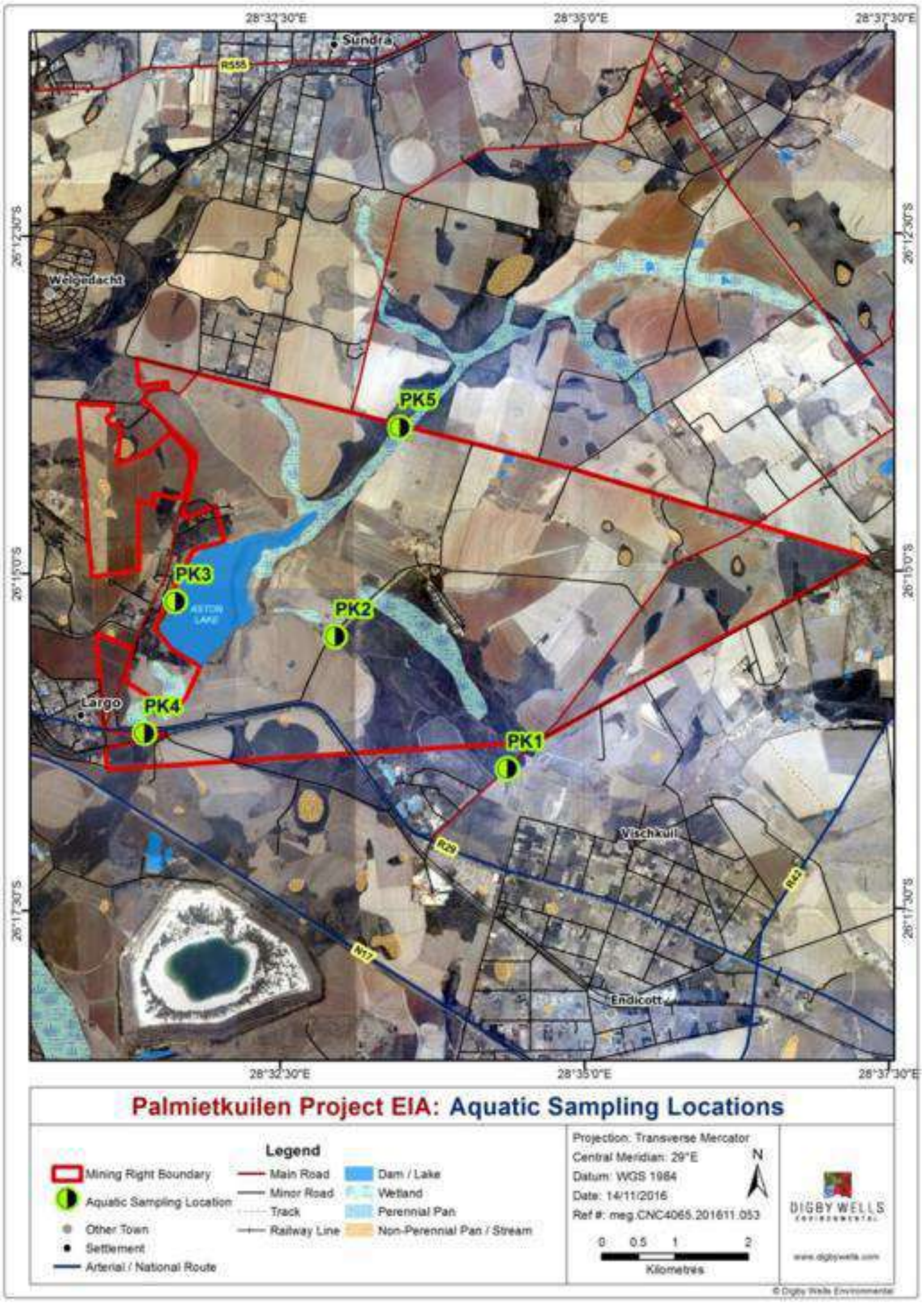
Sensitivity Rating	Wetland Areas identified
Very High – No Go areas	Valley bottom wetlands including Aston Lake.
High	The area constituting the immediate buffer area of the valley bottom wetlands; i.e. from the edge to 100 m.
Moderate – High	The hillslope seep wetlands.
Moderate – Low	The 500 m buffer zone of all wetlands as well as the impacted pans.



Plan 27: Wetland Sensitivity

10.1.8 Aquatic Ecology

The Aquatic Ecology Assessment undertaken during the EIA Phase is appended to this report as Appendix H. To establish the baseline aquatic ecological condition of the water courses associated with the proposed Project, namely the Blesbokspruit, a survey was conducted in the low flow season (August 2016) and again within the high flow season (November 2016). Further detail pertaining to the methodologies utilised to assess the baseline aquatic ecological condition are provided in the Aquatic Ecology Assessment, Appendix H. Plan 28 below depicts the aquatic sampling points utilised during both the low flow and high flow season.



Plan 28: Location of Aquatic Sampling Points (August and November 2016)

10.1.8.1 Water Quality

According to previous literature (EWR11, DWA 2008) the fish community structure in the Blesbokspruit has been altered as a result of poor water quality and the loss of specific habitat biotypes. As an example the species Austroglanis sclateri, Labeo capensis and Labeo umbratus have been lost due to "deteriorated water quality and substrate habitats" (EWR11, DWA 2008).

Based on available data on fish communities, it can be concluded that fish diversity is low as a result of poor quality substrate and habitat quality compounded by poor water quality. It should be noted that the red data species Labeobarbus kimberleyensis is expected to be present within the quaternary catchment and subsequently is potentially present in the downstream regions.

The results of the *in situ* water quality analysis are presented in Table 10-37 for the low flow (August 2016) and Table 10-38 for the high flow (November 2016) surveys.

Table 10-37: *In Situ* Water Quality Results for the August 2016 Survey

Constituent	Temperature (ºC)	pH	Conductivity (µS/cm)	Dissolved oxygen (mg/l)
Guidelines	**5-35**	**6-9**	**<700**	**>5**
PK1	18	8.8	1190	4.5
PK2	DRY	DRY	DRY	DRY
PK3	18	8.7	315	4.0
PK4	18	8.6	214	4.8
PK5	18	8.3	318	4.2

The *in situ* water quality analysis shows that temperature was an expected value of 18 ºC for a winter survey. The pH values were observed to range between 8.3 at PK5 to 8.8 at PK1. Conductivity values ranged from 1190 at PK1 to 214 µS/cm at PK4. The concentrations of dissolved oxygen ranged from 4.2 at PK5 to 4.8 mg/l at PK4.

The Surface Water Assessment (Appendix D) confirms the results depicted in the above *in situ* assessment. The chemical assessment completed in the study shows that the total dissolved solid component at the site PK1 is elevated. The dissolved elements predominantly responsible for the exceeding conductivity results are Calcium (80 mg/l), Magnesium (52 mg/l), Sodium (127 mg/l) with Chlorides and sulphates making up the highest component of the dissolved solids at 178 mg/l and 109 mg/l respectively.

The concentrations of dissolved oxygen at the sites was found to be predominately uniformly low (>5mg/l). These low concentrations would likely have a direct effect on the types of aquatic biota which will be found at the sites. Dissolved oxygen content in wetlands differs from those in river systems due to the comparable geomorphology of the water body type. Typically, a wetland dissolved oxygen concentration ranges from 3 to 7.5 mg/l and is sensitive to changes in nutrient input (McCormick and Laing 2003). As observed in the surface water results, the concentrations of nutrients (Phosphate, Nitrates and Ammonia) are relatively low. However, considering the extensive dry land agriculture and the presence of livestock it can be expected that nutrient concentrations are exceeding the original reference conditions, and thus most likely contributing to lowered concentrations of dissolved oxygen (Morgan *et. a*l., 2005).

Table 10-38: *In Situ* Water Quality Results for the November 2016 Survey

Constituent	Temperature (°C)	pH	Conductivity (µS/cm)	Dissolved oxygen (mg/l)
Guidelines	**5-35**	**6-9**	**<700**	**>5**
PK1	DRY	DRY	DRY	DRY
PK2	DRY	DRY	DRY	DRY
PK3	27	7.2	300	5.2
PK4	26	6.8	194	6.2
PK5	26	7.1	240	6.4

The high flow survey was completed in early November in order to obtain the required information before the submission of the Environmental Authorisations. Despite sufficient rainfall in the region, it appears that the rainfall may have been scattered as the southern tributary was found to be dry during the assessment. The reasoning for the dry nature of the site is difficult to discuss as site PK4 and PK5 were noted to contain more water than the previous surveys.

Water quality trends observed during the high flow survey show low dissolved solid content in the water bodies at inundated sites. This provides an indication that land use in the catchment area is not extensively affecting water chemistry. In addition, industrial activities within the catchment area appear to be limited resulting in fair water quality.

Within the receiving waterbody, the Blesbokspruit, a historical analysis of surface water quality by Ambani *et. al*., 2015 shows that water in the river system has been impacted through mining and industrial (papermill) activities upstream of the confluence with the considered river reach. Although, there are high levels of mineralization in the Blesbokspruit, acidic conditions stemming from Acid Mine Drainage (AMD) is limited in the river system with pH ranges of 6.7 to 8.8 over the period of 11 years (Ambani *et. al*., 2015). The pH values obtained in this study are within this range and thus confirm the abovementioned study for the 2016 period.

Previous studies in the Blesbokspruit have identified several sources for increased dissolved solids in the river system. These sources include a historical pulping plant, sewage discharge and the historical dewatered mine water discharge (Ambani *et. al*., 2015). It should be noted that these industrial and sewage discharges occur upstream of the study site. However, mine water discharge at the Grootvlei Mine ceased in 2011 and the pulp mill ceased functioning at the end of 2010. Thus, it the likelihood of some recovery in the Blesbokspruit is expected. In addition, the treatment of contaminated groundwater as part of the Short Term Intervention measures for AMD will likely serve to further improve water quality in the Blesbokspruit.

As per the water quality assessment completed for this study, good water quality will emanate from the considered river systems and thus will likely serve to improve conditions within the Blesbokspruit by diluting the levels of contamination within the river system.

10.1.8.2 The Intermediate Habitat Integrity Assessment

The Intermediate Habitat Integrity Assessment (IHIA) was completed on the streams of concern and populated with observations recorded during the two surveys. The results of the IHIA on instream habitat are presented in the table below (Table 10-39) with the riparian integrity assessment presented in

Table **10-40**.

Table 10-39: Intermediate Habitat Integrity Assessment for Instream Habitat

Instream	Average score	Score	Comment
Water abstraction	5.00	2.80	Limited to approximately four pivots.
Flow modification	16.67	8.67	Discharge of water from sewerage. Impoundments and several road crossings.
Bed modification	15.00	7.80	Some bed modification associated with roads and the construction of Aston lake.
Channel modification	11.67	6.07	Largely intact upper reaches. However, the Aston lake does impact on the channel.
Water quality	13.33	7.47	Agricultural return flows and some sewerage discharge.

Instream	Average score	Score	Comment
Inundation	13.33	5.33	Flooding as a result of the Aston Dam. River crossings have resulted in localised inundation upstream.
Exotic phytes	5.00	1.80	None observed within the waterbodies. However, confidence is not high.
Exotic fauna	10.00	3.20	Carp, mosquito fish and Bass are known to occur in the area.
Solid waste disposal	8.33	2.00	Some solid waste was observed in the active channel.
Total Instream	**54**		
Category		**class D**	

Table 10-40: Intermediate Habitat Integrity Assessment for Riparian Habitat

Riparian	Average score	Score	Comment
Indigenous vegetation removal	5.00	2.60	Wetland zone surrounding the channels are generally intact.
Exotic vegetation encroachment	6.67	2.40	Within the catchment area there is farming with some alien plants observed.
Bank erosion	6.67	5.60	Some erosion around the river crossings.
Channel modification	11.67	2.40	Largely intact upper reaches. However, the Aston lake does impact on the channel.

Riparian	Average score	Score	Comment
Water abstraction	5.00	2.60	Small amounts of abstraction upstream.
Inundation	13.33	4.40	Flooding as a result of the Aston Dam. River crossings have resulted in localised inundation upstream.
Flow modification	16.67	7.20	Discharge of water from sewerage. Impoundments and several road crossings.
Water quality	13.33	10.40	Agricultural return flows and some sewerage discharge.
Total Riparian	**62**		
Category		**class C**	

The IHIA results of the instream aquatic habitat was derived to be a class D or largely modified status whilst the riparian habitats within the streams assessed are classified as class C or moderately modified.

The results of the habitat assessment for instream habitat show that there are several principle drivers for the current status of the river system. The construction of the Aston Lake impoundment has resulted in the modification of natural flows, river bed and channel characteristics and extent of inundation in the catchment area. Runoff and seepage emanating from agricultural activities compounded by livestock and sewerage effluent has also acted to cumulatively reduce the integrity of the available instream habitat.

The results of the riparian component of the IHIA show that the habitat is moderately modified. Similarly to instream habitat, the primary causative impacts to riparian habitat can be attributed to the Aston Lake impoundment which has altered the natural hydrology of the catchment.

10.1.8.3 invertebrates

Sites which were inundated were selected for invertebrate assessment.

10.1.8.3.1 Integrated Habitat Assessment System (IHAS) and Biotope Assessment

The results of the IHAS completed during the surveys are presented in the table below (Table 10-41).

Table 10-41: Integrated Habitat Assessment System results for the 2016 surveys

Site	Score	Suitability	Score	Suitability
Survey	**Low Flow**		**High Flow**	
PK1	48	Poor	DRY	DRY
PK2	DRY	DRY	DRY	DRY
PK3	36	Poor	38	Poor
PK4	48	Poor	48	Poor
PK5	36	Poor	38	Poor

The results of the biotope diversity assessments are presented in the table below (Table 10-42). It is noted that this is the typical habitat present during both surveys and can serve as a guide to the available habitat should the sites become inundated.

Table 10-42: Invertebrate Biotope Diversity August (2016)

Biotope/Site	PK1	PK2	PK3	PK4	PK5
Stones in current	0	DRY	0	0	0
Stones out of current	1	DRY	0	1	1
Bedrock	1	DRY	0	1	0
Aquatic Vegetation	0	DRY	0	2	2
Marginal Vegetation In Current	0	DRY	0	0	0
Marginal Vegetation Out Of Current	1.5	DRY	2	1.5	3
Gravel	0	DRY	0	0	0
Sand	1	DRY	1	1	1
Mud	2	DRY	2	2	2
Biotope Score	6.5	DRY	5	8.5	9
Biotope Score (%)	**14**	DRY	**11**	**19**	**20**

Biotope/Site	PK1	PK2	PK3	PK4	PK5
Biotope suitability	**Poor**	DRY	**Poor**	**Poor**	**Poor**

10.1.8.3.2 South African Scoring System

The results of the SASS5 assessments completed for the study are presented below (Table 10-43 and

Table **10-44**).

Table 10-43: SASS5 Results of the Low Flow Survey

Site	PK1	PK2	PK3	PK4	PK5
SASS5	25	DRY	41	64	34
Taxa	8	DRY	12	18	12
ASPT	3.1	DRY	3.4	3.5	2.8
Category	E	DRY	E	D	E

Table 10-44: SASS5 Results of the High Flow Survey

Site	PK1	PK2	PK3	PK4	PK5
SASS5	DRY	DRY	36	50	50
Taxa	DRY	DRY	11	13	13
ASPT	DRY	DRY	3.2	3.8	3.8
Category	DRY	DRY	E	E	E

The results of the SASS5 assessment illustrate that the conditions within the considered river reach are not favourable to support diverse and sensitive aquatic invertebrates which are included in the assessment. Considering typical interpretation guidelines, the sites are classified as seriously and largely modified from reference conditions (class E and class D respectively). However, based on the poor habitat available at the sites and the non-flowing nature of the waterbody, the classification is largely due to the poor invertebrate habitat diversity at the sites rather than instream aquatic conditions (Dallas, 2007). On assessment of the Baetidae, two taxa were identified to genus level, these included *Baetis* and *Pseudocloeon* both of which are common Southern African species and are known to be tolerant to water quality deterioration.

The results of the invertebrate assessment are therefore indicative of polluted waters likely attributed to nutrient enrichment.

Although zooplankton species are not typically included in invertebrate indices, it is noted that zooplankton taxa at the site PK5 were diverse and abundant and included two large groups of taxa belonging to the class Branchiopoda. These taxa included *Triops* and *Branchipodosis* as illustrated below (Figure 10-14).

Figure 10-14: Zooplankton observed at PK5 during the November 2016 survey (left: *Triops spp.*; Right: *Branchipodosis spp.*)

Although these taxa are not regarded as being sensitive, they are rare and ecologically important (Soininen *et al.,* 2007). Due to the presence and richness of zooplankton at the site, PK5 is regarded as being unique on a catchment scale.

In addition to zooplankton, the Odonata observed within the catchment were noted as per the table below (Table 10-45). A total of five species of dragonflies were observed. This low diversity of dragonflies illustrates and confirms the poor available aquatic habitat at the various sites and throughout the catchment area.

Table 10-45: Odonata observed during the November 2016 survey

Photograph	Species	Common Names

Photograph	Species	Common Names
	*Crocotehmis erythraea*	Broad Scarlet
	*Africallagma glaucum*	Swamp Bluet
	*Ischnura senegalensis*	Tropical Bluetail
	*Anax emperator*	Blue Emperor

Photograph	Species	Common Names
	*Pantala flavescens*	Wandering Glider

10.1.8.3.3 invertebrate Response Assessment Index

The results of the invertebrate Response Assessment Index (MIRAI) assessment are presented in the table below (Table 10-46).

Table 10-46: MIRAI scores for the 2016 surveys

Invertebrate Metric Group	Score Calculated
Flow modification	34.9
Habitat	33.2
Water Quality	29.6
Ecological Score	**32.6**
Invertebrate Category	**E**

The result of the MIRAI shows that the ecological category of the river reach was determined to be a class E or seriously modified. According to the zonation and types of habitat available at the sites, it is expected that fast flowing water and cobbled substrates did not form part of the original reference conditions within the study area. These abovementioned components were thus weighted accordingly.

The results of the assessment indicate that water quality within the assessed river reaches is impacted and confirms the results of the water quality assessment

10.1.8.4 Fish Response Assessment Index

The results of the Fish Response Assessment Index (FRAI) assessment are presented in Table 10-47. It is noted that no Red Data Listed species were captured during this assessment. It is noted that taxa not expected to be in the river reach assessed and thus rated as 0 for the Frequency of Occurrence (FROC) have been removed from the table below.

Table 10-47: FRAI Results of the 2016 Study

Fish Species	Reference Frequency of Occurrence	Observed Frequency of Occurrence	Site observed
Barbus anoplus	3	1	PK4 and PK1
Barbus pallidus	2	0	None
Barbus paludinosus	3	0	None
Clarias gariepinus	3	1	PK4 and PK3
Labeo umbratus	1	0	None
Pseudocrenilabrus philander	2	1	PK4
Tilapia sparmanni	2	1	PK4
FRAI (Adjusted) %		31	
Ecological category		E	

The overall FRAI category was calculated to be seriously modified (class E). The FROC for each fish species was determined based on the presence of available habitats. The results of the FRAI indicate that although habitat was available for small *Barbus* species very few were sampled. The poor FROC of the various fish species can be linked to poor connectivity between the various river reaches. During the two surveys no water was observed between the sites PK1, PK2, PK3 and PK4. Similarly, no surface water directly connects the site PK5 with PK3. Considering these results habitat impacts are the principal driver for poor fish community responses.

10.1.8.5 Present Ecological Status

The results of the ecological classification and Present Ecological Status (PES) for the river reach considered are provided in the table below (Table 10-48).

Table 10-48: The Present Ecological Status of the river reach in this study

Category	Score	Ecological category

Category	Score	Ecological category
Riparian Habitat Ecological Category	62	class C
Fish Ecological Category	31	class E
invertebrate Ecological Category	32	class E
Ecostatus		**class D/E** **Largely/Seriously modified**

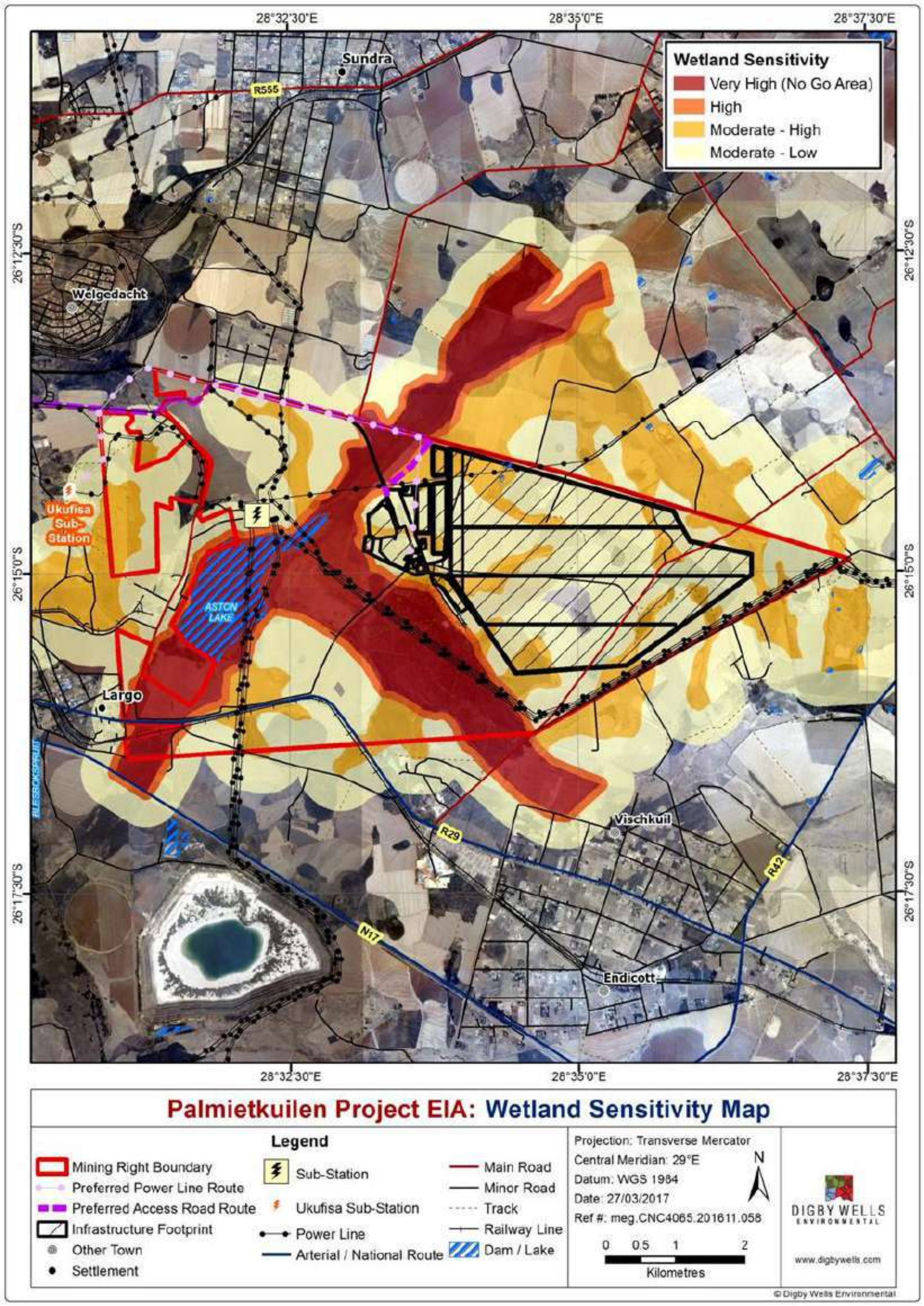
The results of the ecological classification indicate that the PES of the reach assessed in this study is a class D/E or largely/seriously modified. As discussed in the various sections above, modification of habitat quality within the assessed river reach has resulted in the loss of suitable aquatic habitat.

10.1.8.6 Sensitivity Analysis and No-Go Areas

The overall Ecological Importance and Sensitivity (EIS) of the catchment area potentially affected in the study area were assessed according to Kleynhans (1999). The results of the EIS assessment are provided below (Table 10-49).

The results of the EIS assessment derived an overall Moderate EIS score. The results of this assessment are important to consider for the impact assessment. As mentioned in the table below (Table 10-49) the Gauteng Conservation Plan has categorised several portions of the considered river systems in the study area as Ecological Support and Important Areas (Plan 18 above).

Considering the various sensitivities of the aquatic and associated wetland ecosystems associated with the proposed project, a buffer zone of 100m is recommended from the edges of the delineated wetland areas. The extent of the buffer zones and the various infrastructures are



illustrated in

Plan **27** above. Based on the layout of the project it is noted that a haul road crosses a wetland and in proximity to the species rich site PK5.

Table 10-49: EIS assessment for the catchment area (Kleynhans (1999))

Biological determinants		
Determinant	**Rating**	**Comments**
Rare and endangered biota	3	One or more species regarded as rare or endangered on a regional scale (Zooplankton and downstream Labeobarbus kimberlyensis).
Unique biota	2	The zooplanktons observed are unique on a local scale.
Intolerant biota	1	A very low proportion of the taxa are sensitive to water quality impacts.
Species richness	2	Moderate species richness particularly in reference to zooplankton.
Habitat determinants		
Diversity of aquatic habitat	1	Not diverse and illustrated by low diversity of Odonata.
Refuge value of habitat types	1	Limited connectivity between the main-stem of the Blesbokspruit and the catchment area in the study area.
Sensitivity of habitat to flow modification	1	The taxa observed in the study area are all tolerant to low flow conditions.
Sensitivity to flow related water quality changes	1	The taxa observed in the study area are all tolerant to low flow conditions coupled with related increases in the concentrations of salts.
Migration route corridor for instream and riparian biota	2	The wetland area plays an important role in migration for terrestrial fauna.
National parks and wilderness areas	3	The areas considered are part of the Gauteng Conservation Plan with delineated Ecological Support and Important Areas. Further, the RAMSAR wetland downstream of the site.
Mean	**1.7**	
EIS class	**Moderate**	

10.1.9 Air Quality

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

Ambient air quality in this region of South Africa is strongly influenced by regional atmospheric movements, together with local climatic and meteorological conditions. There are distinct summer and winter weather patterns that affect the dispersal of pollutants in the atmosphere. In summer, unstable atmospheric conditions result in mixing of the atmosphere and rapid dispersion of pollutants. Summer rainfall also aids in removing pollutants through wet deposition. Precipitation reduces wind erosion potential by increasing the moisture content of exposed surface materials–this represents an effective mechanism for suppressing wind-blown dust. Rain-days are defined as days experiencing 0.1 mm or more rainfall.

In contrast, winter is characterised by atmospheric stability caused by a persistent high-pressure system over South Africa. This dominant high-pressure system results in subsidence, causing clear skies and a pronounced temperature inversion over interior of South Africa. This inversion layer traps pollutants from near surface sources in the lower atmosphere, which results in reduced dispersion and poorer air quality. Preston-Whyte and Tyson (1988) described the atmospheric conditions in the winter months as highly unfavourable for the dispersion of atmospheric pollutants. Emissions from elevated sources, such as from tall stacks, remain stratified in the mid-troposphere and have a reduced probability of reaching the surface with high concentrations near the source.

Dispersion of atmospheric pollutants is a function of the prevailing wind characteristics at any site. The vertical dispersion of pollution is largely a function of the wind field. The wind speed determines both the distance of downward transport and the rate of dilution of pollutants. The generation of mechanical turbulence is similarly a function of the wind speed, in combination with the surface roughness (Jacobson, 2005).

The amount of particulate matter generated by wind is highly dependent on the wind speed. Below the wind speed threshold for a specific particle type, no particulate matter is liberated, while above the threshold, particulate matter liberation tends to increase with wind speed. The amount of particulate matter generated by wind is dependent also on the surface properties, for example, whether the material is crusted, the fraction of erodible particles, and the particle size distribution (Fryrear et al., 1991).

Wind roses generally comprises of 16 spokes which represent the frequencies and the directions from which winds blew during the period. The colours reflect the different categories of wind speeds. The dotted circles provide information regarding the frequency of occurrence of wind speed and different categories. The figures at the bottom of the legend represent the frequency at which calms occurred (periods with wind speed <0.5 m/s).

The spatial and annual variability in the wind field for the Palmietkuilen Project area is evident in Figure 10-15. The dominant winds are blowing from North of Northeast (14%) and North (12%) respectively. Calm conditions (wind speeds <0.5 m/s) occurred 4.2% of the time. The wind class frequency distribution per sector is given in Figure 10-18 and Table 10-50.

There is some diurnal variation in the meteorological data shown in Figure 10-16. The predominant wind direction is North of Northeast at night time (21%), North of Northeast (16%) in the morning, North of Northwest in the afternoon (11%) and North (12%) in the evening.

The seasonal variability in wind direction is depicted in Figure 10-17. The seasonal signature is similar to the diurnal patterns with winds from the North of Northeast and North dominating the wind regime.

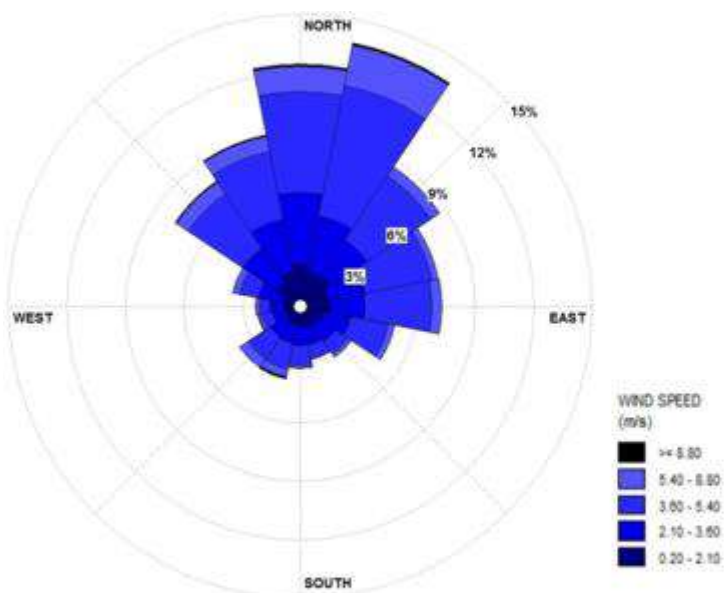


Figure 10-15: Surface Wind Rose at the proposed project site.

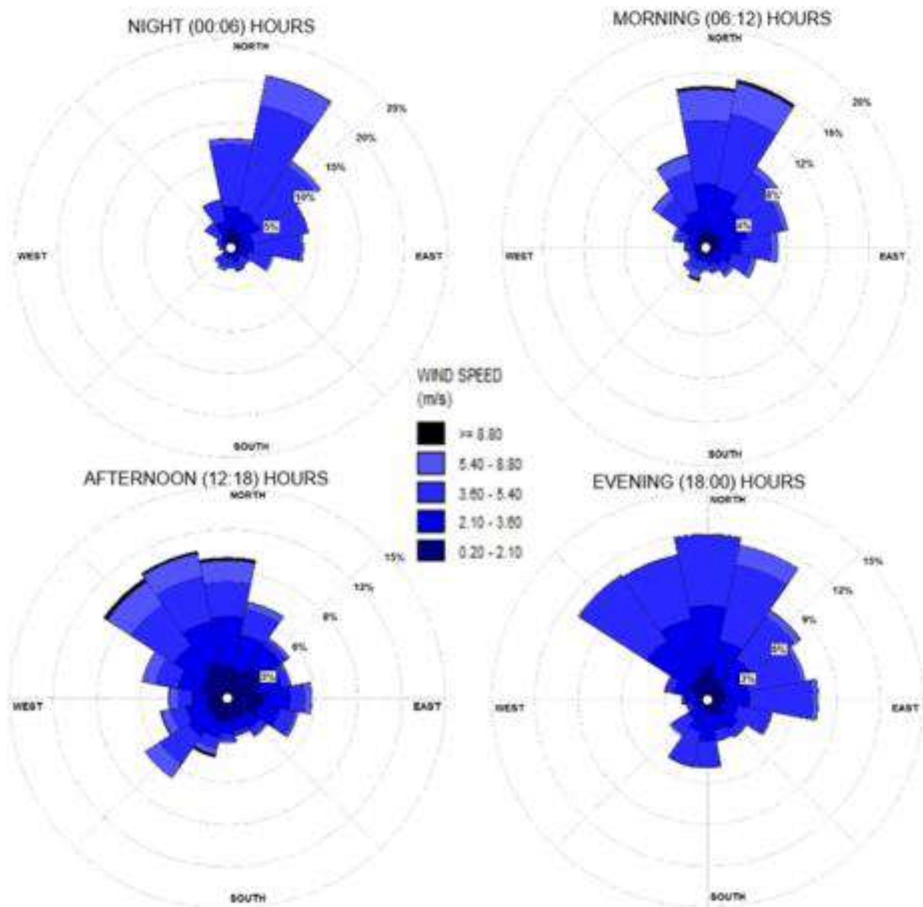


Figure 10-16: Diurnal variations of wind at night-time: 00:00 – 06:00 (top left), morning 06:00 – 12:00 (top right), afternoon 12:00 – 18:00 (bottom left) and evening 18:00 – 00:00 (bottom right).

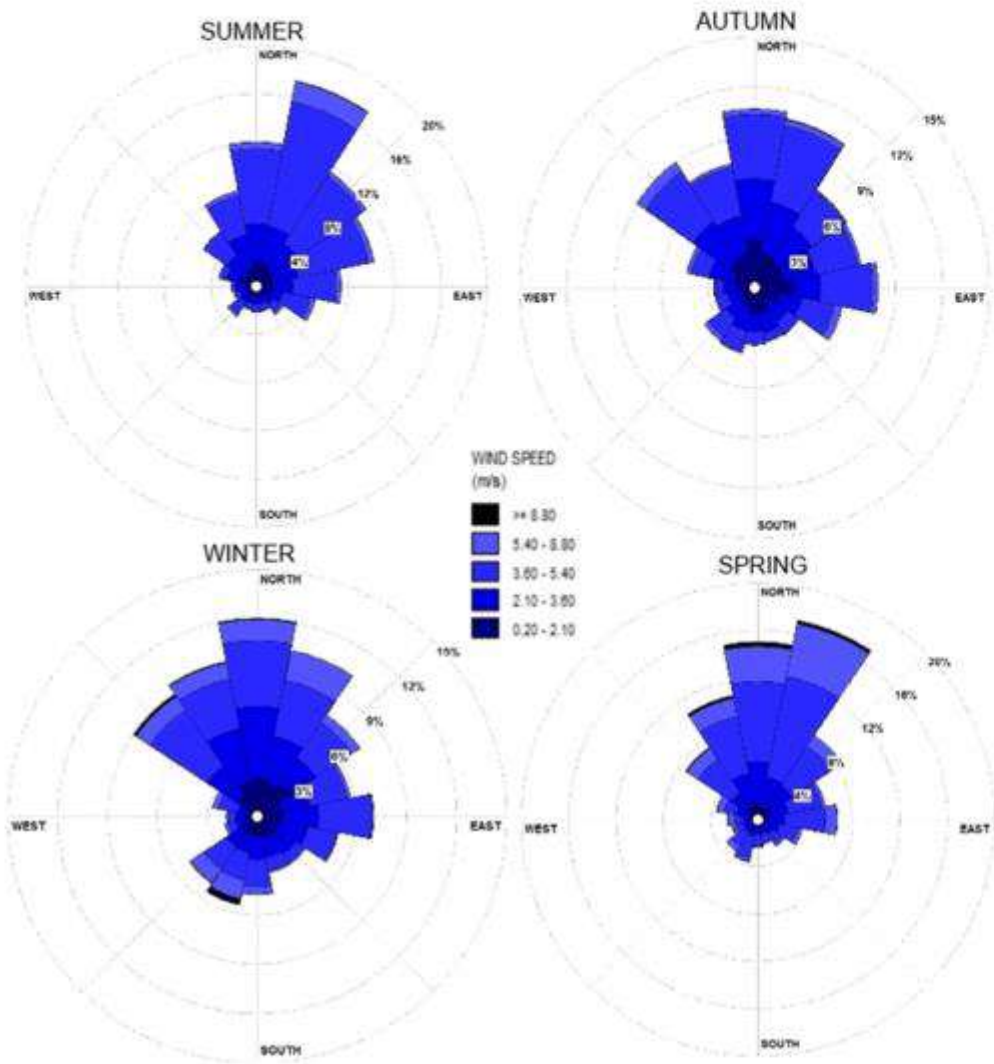


Figure 10-17: Seasonal variability of winds in summer (December – February); autumn (March – May); winter (June – August) and spring (September – November).

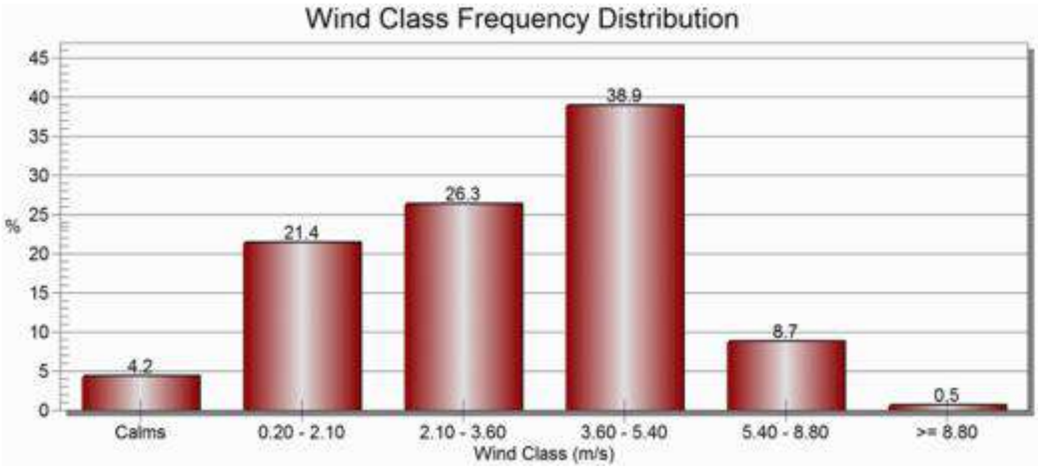


Figure 10-18: Wind class frequency distribution

Table 10-50: Wind class frequency distribution

	Directions (m/s)	0.20 - 2.10	2.10 - 3.60	3.60 - 5.40	5.40 - 8.80	>= 8.80	Total (%)
1	N	2.19	3.66	5.17	1.30	0.11	12.44
2	NNE	1.82	2.94	6.79	2.10	0.10	13.75
3	NE	1.93	2.20	3.93	0.55	0.01	8.61
4	ENE	1.51	1.89	3.50	0.31	0.01	7.22
5	E	1.58	1.78	3.41	0.49	0.00	7.25
6	ESE	1.26	1.37	1.96	0.33	0.00	4.93
7	SE	1.10	1.08	0.78	0.20	0.00	3.17
8	SSE	1.11	0.92	0.68	0.08	0.00	2.79
9	S	1.03	1.00	1.00	0.15	0.01	3.18
10	SSW	0.98	0.99	1.34	0.40	0.10	3.80
11	SW	0.92	0.96	1.37	0.52	0.00	3.77
12	WSW	0.80	0.68	0.55	0.20	0.02	2.25
13	W	0.87	0.75	0.49	0.21	0.01	2.34
14	WNW	1.02	1.18	1.00	0.33	0.00	3.54
15	NW	1.43	2.15	3.36	0.73	0.07	7.74
16	NNW	1.81	2.76	3.54	0.79	0.08	8.98
	Sub-Total	21.36	26.30	38.88	8.70	0.53	95.76
	Calms						4.24
	Missing/Incomplete						0
	Total						**100**

10.1.9.1 Wind Speed

One of the factors that favour the suspension and resuspension of loose particulates in the atmosphere is the intensity of the wind speed regime. Wind speed greater than 5.4 m/s leads to erosion of loose dust particulate matter and dispersion across the landscape (Table 10-51 and Figure 10-19). Figure 10-19 shows wind speed greater than 5.4 m/s occurs every month with potential to result in erosion of open surfaces. Although on average the wind speed is below 5.4 m/s, it can be seen from Table 10-51 that the potential is there. In total, 31 days in a year recorded wind speed greater than 5.4 m/s (~ 3 days in a month).

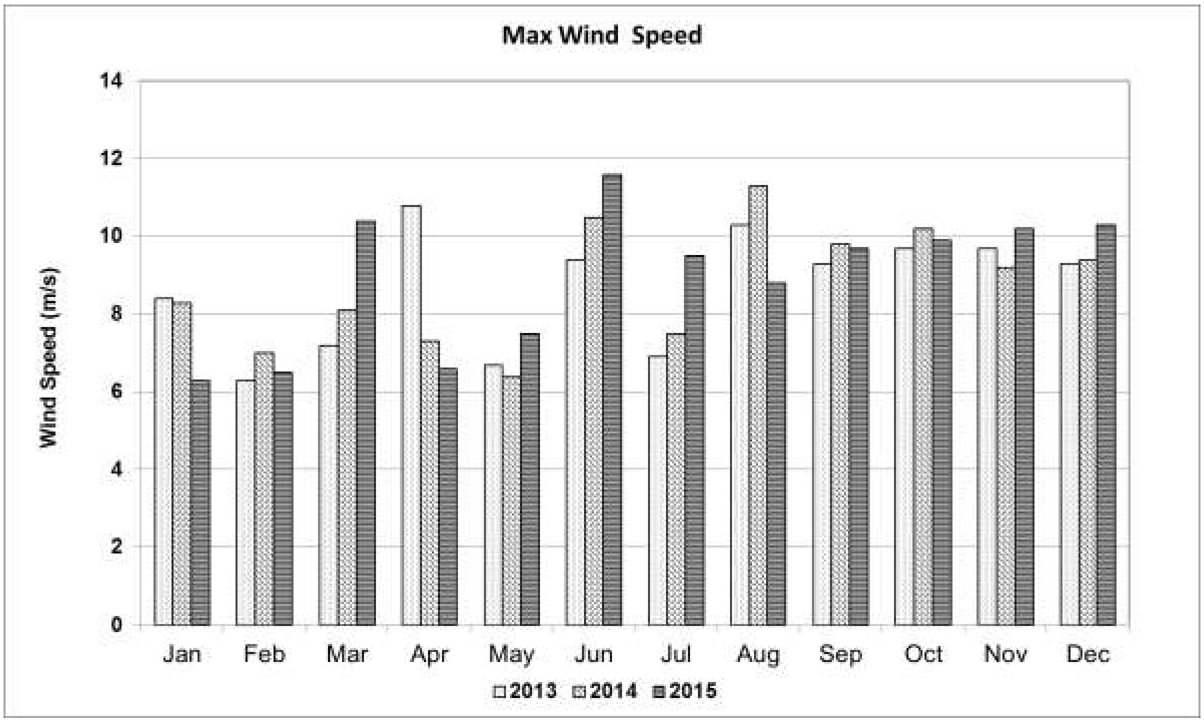


Figure 10-19: Monthly maximum wind speed

Table 10-51: Monthly wind speed records

Wind Speed (m/s)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ann
Monthly Max.	8	7	10	11	8	12	10	11	10	10	10	10	10
Monthly Ave	4	3	3	3	3	3	3	4	4	4	4	4	3

10.1.9.2 Dust Deposition Rate

Baseline monitoring of dust fallout has been on-going in the proposed project area since September 2016 and the results obtained are evaluated and discussed below. Dust deposition data is crucial as it shows monthly, seasonal, and inter-annual variability in deposition tares – pre, during and post mining operation.

The amount of dust collected at any given time is a function of the rate of deposition, which may vary widely depending on meteorological factors such as wind speed, direction, rainfall and variations in the background dust concentrations. The dust fallout sampling, analyses, comparison and interpretation was conducted according to the internationally recognised American Society for Testing and Methods (ASTM) D1739 – 98 Standard Test Method for Collection and Measurement of Dustfall (Settleable Particulate Matter). The standard procedure accepted internationally is adopted by SANS (1137:2012).

The buckets are filled with distilled water mixed with copper sulphate in solution (to stop algae growth inside the bucket) and the monitoring units will be left out on site for a period of 30±2 days. The buckets are collected and replaced with new ones on a monthly basis and transported to the laboratory for analysis.

In the South African National Dust Control Regulations (2013) standards, terms like target, action and alert thresholds were omitted. Another notable observation was the reduction of the permissible frequency of exceedance from three to two incidents within a year, non-sequential months. The standard actually adopted a more stringent approach than previously permitted and thus requires dedicated mitigation plans to ameliorate impacts. The dust fallout standard is given in the Table 10-52 below.

Table 10-52: Acceptable dust fall rates as measured (using ASTM D1739:1970 or equivalent) at and beyond the boundary of premises where dust originates

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

For the dust monitoring programme, sample log sheets have shown that the exposure period each month were not in violation of the consistent for the 30±2 days sampling window recommended in the standard. Hence, sampling each month complied with the American Society for Testing and Methods (ASTM) D1739 – 98 Standard Test Method for Collection and

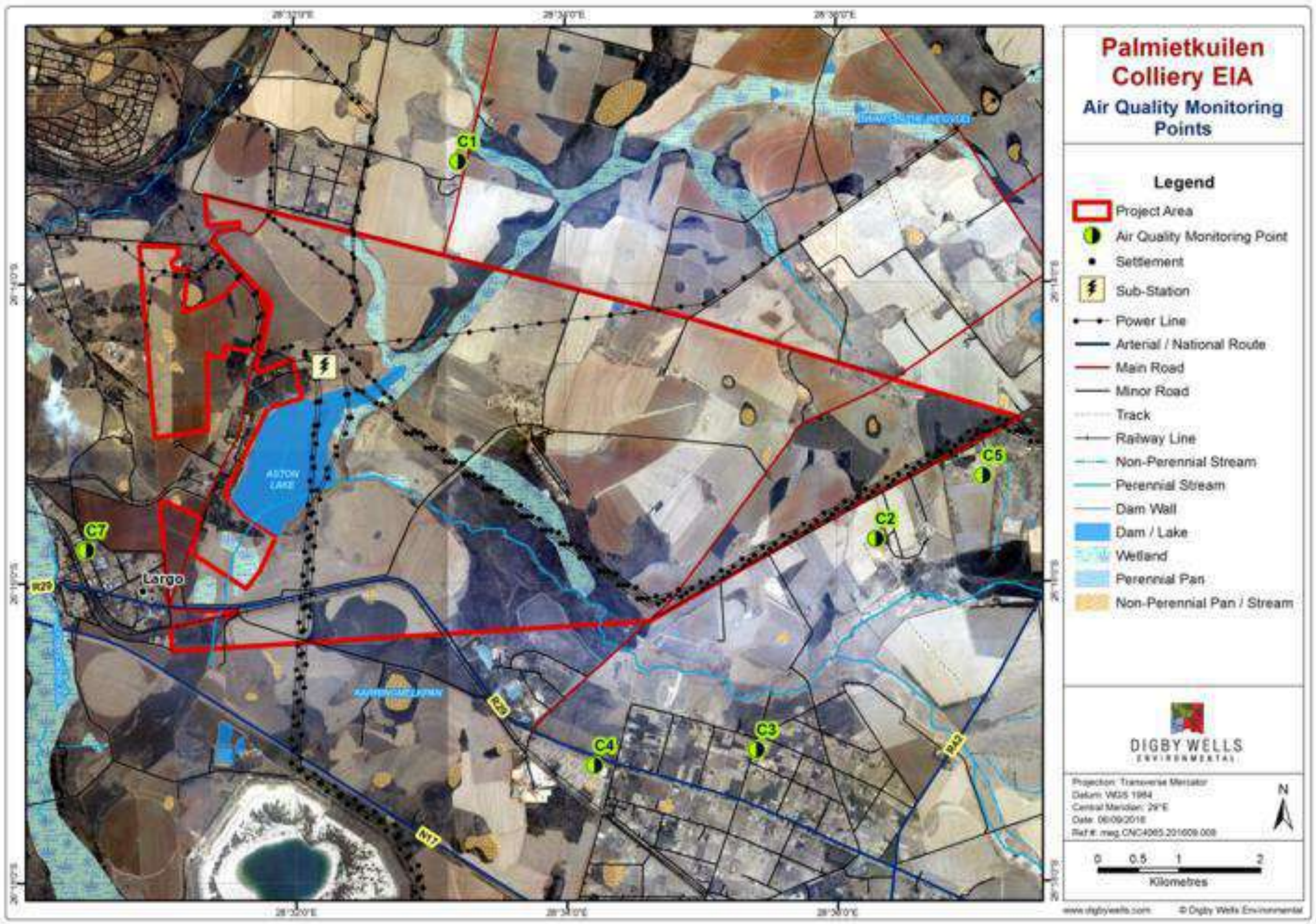
Measurement of Dustfall (Settleable Particulate Matter). The dust deposition rates observed for the different monitoring locations are displayed below in Table 10-53 and graphically in Figure 10-20. Dust deposition rate is reported for all sites in September, except sites CNC_06 and CNC_08 (access was not granted at the time to install monitors). However, for the months of October and November, data availability was 100%. Since the South African National Standard (SANS 1137:2012) “Standard Test Method for Collection and Measurement of Dustfall” (Settleable Particulates Matter) was used, the values obtained at the different sites should ideally be compared to the standard (Table 10-52). All the sites are assessed as residential sites. Months with exceedances are in red and bolded. From the observation of the filed officers, agricultural activities i.e. tilling of soil is ongoing in the area, a possible reason why the deposition rates are high at some sites. The residential limit of 600 mg/m2/day is exceeded, and in sequential months at sites CNC_01 (Oct and Nov) and CNC_04 (Sep, Oct and Nov). Hence, the aforementioned sites are in violation of the permissible frequency of exceedance (two within a year – not in sequential months as observed in the months of Oct and Nov respectively). Sites CNC_02, CNC_05 and CNC_07 all recorded at least one month of exceedance of the residential standard of 600 mg.m^2/day.

Table 10-53: Dust fallout results

Dust levels measured in mg/m2/day				
Site ID	**Sep**	**Oct**	**Nov**	**Dec**
CNC_01	243	**1209**	**752**	**
CNC_02	**808**	179	**1573**	**
CNC_03	247	182	501	**
CNC_04	**749**	**967**	**993**	**
CNC_05	465	495	**721**	**
CNC_06	*	317	477.0	**
CNC_07	395	536	**1095**	**
CNC_08	*	199	346	**

*No data (access was not granted at the time to install dust monitors)

**Awaiting data from the laboratory



Plan 29: Dust monitoring locations

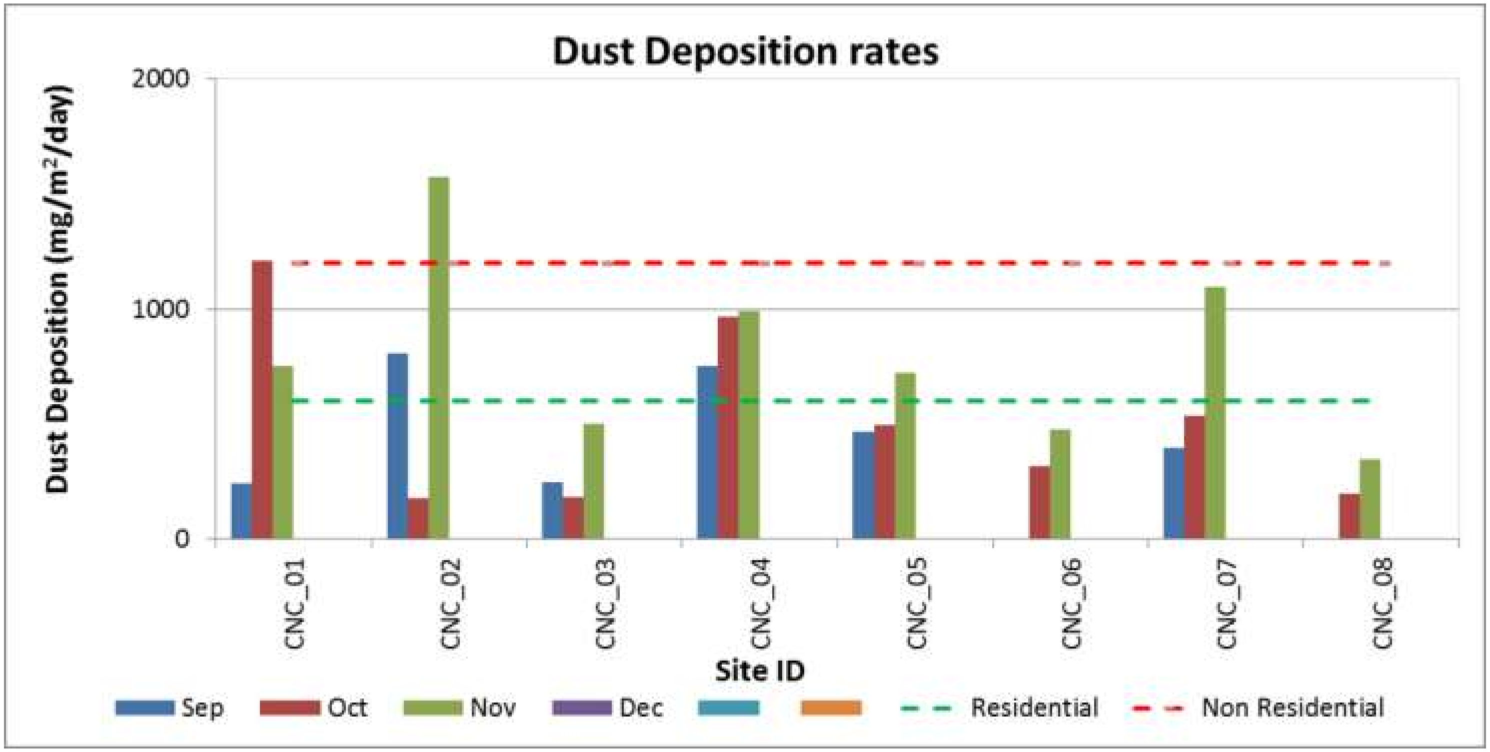


Figure 10-20: Dust deposition rates observed in the vicinity of the proposed project area.

10.1.9.3 PM_{10} and $PM_{2.5}$

10.1.9.3.1 PM_{10} Concentration

The proposed Project is going to be an open pit operation employing heavy equipment (i.e. front end loaders, haul trucks and bulldozers). The subsequent crushing and grinding, processes will have an effect on ambient air pollution with the release of fine airborne particulates both within and outside the mine premises. Currently, ambient particulate monitors are not in place to monitor background PM_{10} levels prior to mining.

However, the impact assessment section (Section 11.1.7 below), emission rates have been calculated and used in the absence of real-time measurement to assess potential impacts of the proposed project on ambient air quality during the operational phase of the mine.

10.1.9.3.2 $PM_{2.5}$ Concentrations

The same discussion as above applies to the monitoring of $PM_{2.5}$ in the proposed Project area. Since $PM_{2.5}$ baseline data is not available, the impact assessment accessed what the ambient $PM_{2.5}$ impacts would be during the operational phase of the mine. This is crucial for management planning purposes in order to curtail related impacts on ambient air quality.

10.1.9.4 Gaseous pollutants

There was no real-time measurement or passive monitoring for gaseous pollutants in the proposed project area. Background levels of gaseous pollutants, such as: SO_2, Ozone, NO_2, and CO was not available for analysis and assessment as at the time of compiling this report. Such data is always critical to determine ambient levels prior to the commencement of mining.

10.1.10 Noise

The Noise Impact Assessment undertaken during the EIA Phase is appended to this report as Appendix J. The objective of the study is to assess what the current ambient noise levels are in the area as well as what the significance of the noise impacts from the Project will be on the surrounding area. The approach used in investigating noise impacts is based on the National Noise Control regulations as well as the Gauteng Noise Control Regulations which in turn refers to the SANS 10103:2008 “The measurement and rating of environmental noise with respect to annoyance and to speech communication”. Based on the National Noise Control Regulations it is prohibited to make, produce or cause a disturbing noise, or allow it to be made, produced or caused by any person, machine, device or apparatus or any combination thereof.

According to the National Noise Control Regulations "disturbing noise" means a noise level which exceeds the zone sound level or, if no zone sound level has been designated, a noise level which exceeds the ambient sound level at the same measuring point by 7 dBA or more. According to the Gauteng Noise Control Regulations "disturbing noise" means a noise level that causes the ambient noise level to rise above the designated zone level, or if no zone level has been designated, the typical rating levels for ambient noise in districts, indicated in Table 10-54.

Table 10-54: Typical Rating Levels for Noise in Districts (SANS 10103, 2008)

Type of District	Equivalent continuous rating level ($L_{Reg.T}$) for noise (dBA)					
	Outdoors			Indoors, with open windows		
	Day-night	Day-time	Night-time	Day-night	Day-time	Night-time
	$L_{R,dn}$ [a]	$L_{Req,d}$ [b]	$L_{Req,n}$ [b]	$L_{R,dn}$ [a]	$L_{Req,d}$ [b]	$L_{Req,n}$ [b]
Residential Districts						
a) Rural districts	45	45	35	35	35	25
b) Suburban districts with little road traffic	50	50	40	40	40	30
c) Urban districts	55	55	45	45	45	35
Non-Residential Districts						
d) Urban districts with some workshops, with business premises, and with main roads	60	60	50	50	50	40
e) Central business districts	65	65	55	55	55	45
f) Industrial districts	70	70	60	60	60	50

NOTE 1 If the measurement or calculation time interval is considerably shorter than the reference time intervals, significant deviations from the values given in the table might result.

NOTE 2 If the spectrum of the sound contains significant low frequency components, or when an unbalanced spectrum towards the low frequencies is suspected, special precautions should be taken and specialist advice should be obtained. In this case the indoor sound levels might significantly differ from the values given in columns 5 to 7

NOTE 3 In districts where outdoor LR,dn exceeds 55 dBA, residential buildings (e.g. dormitories, hotel accommodation and residences) should preferably be treated acoustically to obtain indoor LReq,T values in line with those given in table 1.

NOTE 4 For industrial districts, the LR,dn concept does not necessarily hold. For industries legitimately operating in an industrial district during the entire 24 h day/night cycle, LReq,d = LReq,n =70 dBA can be considered as typical and normal.

NOTE 5 The values given in columns 2 and 5 in this table are equivalent continuous rating levels and include corrections for tonal character, impulsiveness of the noise and the time of day.

NOTE 6 The noise from individual noise sources produced, or caused to be produced, by humans within natural quiet spaces such as national parks, wilderness areas and bird sanctuaries, should not exceed a maximum Weighted sound pressure level of 50 dBA at a distance of 15 m from each individual source.

- The values given in columns 2 and 5 are equivalent continuous rating levels and include corrections for tonal character and impulsiveness of the noise and the time of day.

Type of District	Equivalent continuous rating level ($L_{Reg.T}$) for noise (dBA)					
	Outdoors			Indoors, with open windows		
	Day-night	Day-time	Night-time	Day-night	Day-time	Night-time
	$L_{R,dn}{}^{a}$	$L_{Req,d}{}^{b}$	$L_{Req,n}{}^{b}$	$L_{R,dn}{}^{a}$	$L_{Req,d}{}^{b}$	$L_{Req,n}{}^{b}$
▪ The values given in columns 3, 4, 6 and 7 are equivalent continuous rating levels and include corrections for tonal character and impulsiveness.						

The criteria utilised during the baseline assessment for the siting of the measurement locations were as follows:

- The location of the nearest farmstead, residential community and poultry farms to the project and consequently the most likely to be impacted on by the proposed mining activities; and
- The location that serves as a suitable reference point for the measurement of ambient sound levels surrounding the project. The noise measurement locations cover four locations surrounding the project area (N1 – N4).

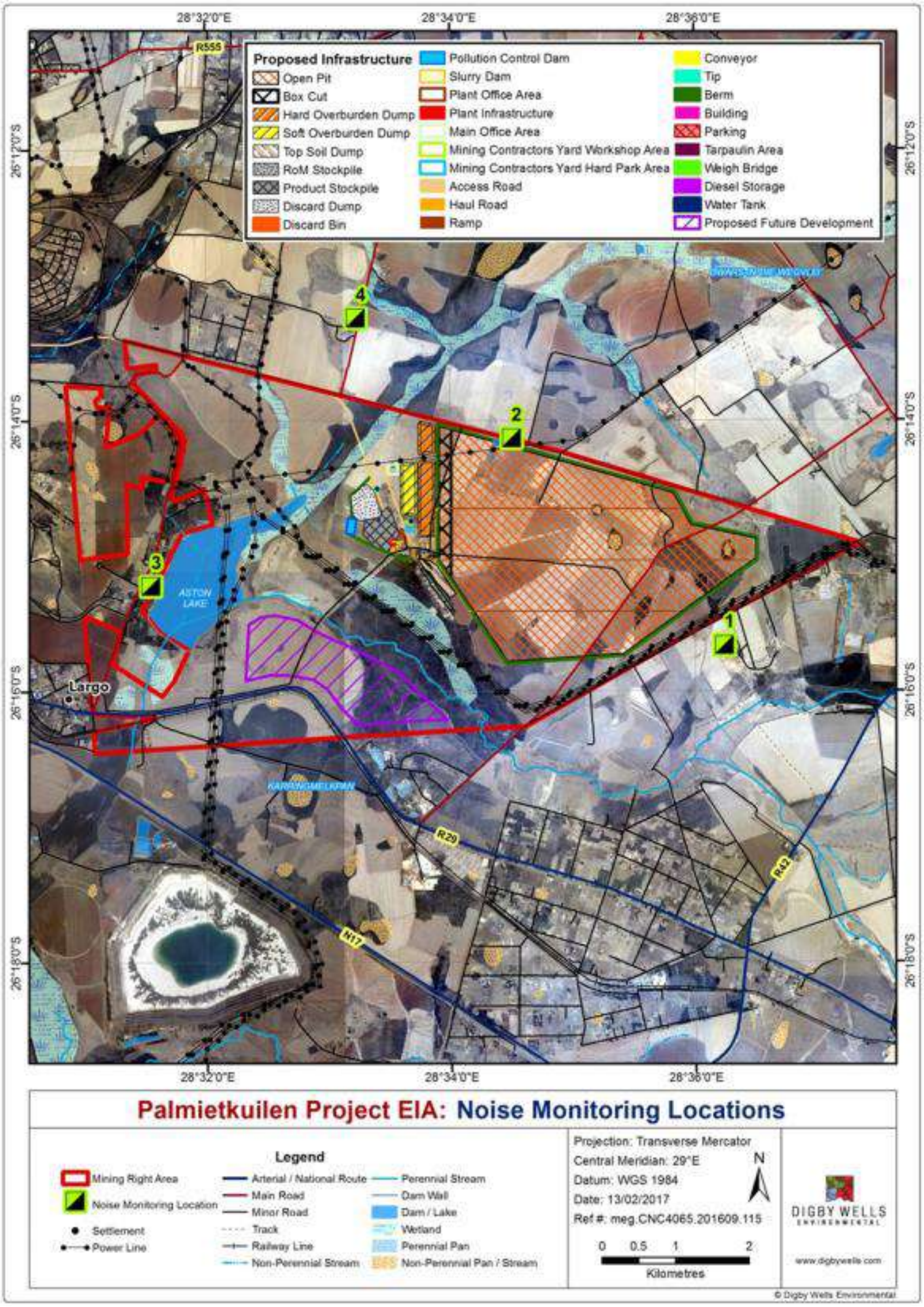
The baseline locations are presented in Table 10-55 and displayed in Plan 30 below. Further information pertaining to the methodology utilised to assess the current ambient noise levels is provided in the Noise Impact Assessment, Appendix J.

Table 10-55: Noise Measurement Locations

Site ID	Farm/location	Category of Receiver	GPS Coordinates
1	Vischkuil 274 Ptn 6	Rural	26°15'39.77"S & 28°36'14.22"E
2	Droogefontein 242 Ptn 25	Rural	26°14'7.99"S & 28°34'29.80"E
3	Aston Lake community	Suburban	26°15'13.13"S & 28°31'32.91"E
4	Droogefontein 242 Ptn 39	Rural	26°13'14.59"S & 28°33'13.73"E

10.1.10.1 Baseline Environment

The results from the noise meter recordings for all the sampled points as well as the rating limits according to the SANS 10103:2008 guidelines are presented in Table 10-56, with the time history graphs presented in **Error! Reference source not found.** to **Error! Reference urce not found.**.



Plan 30: Noise Monitoring Locations

Table 10-56: Results of Baseline Noise Measurements

Sample ID	SANS rating limit			Measurement details			
	Type of district	Period	Typical rating level dBA	$L_{Areq,T}$ dBA	Maximum/Minimum dBA	L_{A90}	Date
1	Rural	Daytime	45	52	77 / 44	46	21/09/2016
		Night time	35	48	69 / 34	40	21/09/2016
2	Rural	Daytime	45	54	88 / 39	42	22/09/2016
		Night time	35	50	84 / 22	25	22/09/2016
3	Suburban	Daytime	50	49	80 / 37	41	26/09/2016
		Night time	40	45	78 / 28	34	26/09/2016
4	Rural	Daytime	45	46	82 / 38	40	27/10/2016
		Night time	35	44	75 / 39	40	27/10/2016
	Indicates $L_{Aeq,T}$ levels above either the daytime rating limit or the night time rating limit						

10.1.10.1.1 Daytime Results

Based on the daytime results from the noise measurements it is noted that the L_{Aeq} levels predominantly measured above the SANS guideline for the maximum allowable outdoor daytime rating level for ambient noise in rural districts (45 dBA), with the background noise levels (L_{A90}) measuring below the daytime rating level guideline for rural districts (45 dBA).

Monitoring location 1 was taken near the poultry farming operations on Portion 6 of the farm Vischkuil 274. The main continuous noise sources at monitoring location 1 were the ventilation fans at the chicken houses and birdsong from the common avifauna species in the area. Farm vehicles passing by were the intermittent noise sources with aircraft also occasionally flying by overhead. The specific L_{Aeq} level was 52 dBA, with the L_{A90} level measuring 46 dBA. With a 6 dBA difference between the L_{Aeq} and L_{A90} level, the intermittent noise sources had a significant impact on the overall average.

Monitoring location 2 was taken at the homestead on Portion 25 of the farm Droogefontein 242. The main continuous noise source at monitoring location 2 was the birdsong from the common avifauna species in the area. The dog barking and vehicles passing by were the intermittent noise sources with aircraft also occasionally flying by overhead. The specific L_{Aeq} level was 54dBA, with the L_{A90} level measuring 42 dBA. With a 12 dBA difference between the L_{Aeq} and L_{A90} level, the intermittent noise sources, specifically the dog barking and the vehicles passing by, had a significant impact on the overall average.

Monitoring location 3 was taken at the community at Aston Lake. The main continuous noise source at monitoring location 3 was the birdsong from the common avifauna species in the area. The dog barking and vehicles passing by were the intermittent noise sources with aircraft also occasionally flying by overhead as well as the gusts of wind at times during the day. The specific L_{Aeq} level was 49 dBA, with the L_{A90} level measuring 41 dBA. With a 8 dBA difference between the L_{Aeq} and L_{A90} level, the intermittent noise sources had a significant impact on the overall average.

Monitoring location 4 was taken near the poultry farming operations on Portion 39 of the farm Droogefontein 242. The main continuous noise source at monitoring location 4 was the birdsong from the common avifauna species in the area as well as the ventilation fans at the chicken houses. The vehicles and trucks passing by were the main intermittent noise sources with aircraft also occasionally flying by overhead as well as frequent gusts of wind. The specific L_{Aeq} level was 46dBA, which is slightly above the rural guidelines of 45 dBA. With a 6 dBA difference between the L_{Aeq} and L_{A90} level, the intermittent noise sources, specifically the trucks passing by, had a less significant impact on the overall average.

10.1.10.1.2 Night Time Results

Based on the night time results from the noise measurements it is noted that the L_{Aeq} levels predominantly measured above the SANS guideline for the maximum allowable outdoor night time rating level for ambient noise in suburban districts (40 dBA) as well as rural districts (35 dBA), with the background noise levels (L_{A90}) ranging from below to similar to the night time rating level guideline for suburban districts (40 dBA).

The main continuous night time noise sources at monitoring location 1 were the ventilation fans at the chicken houses and high pitched sound from the insects, *Gryllidae*. A siren went off at around 04:30 (which is still classified as night time), which also impacted on the night time noise levels. The specific L_{Aeq} level was 48 dBA, with the L_{A90} level measuring 40 dBA. With a 8 dBA difference between the L_{Aeq} and L_{A90} level, the intermittent noise sources had a significant impact on the overall average.

The main continuous noise source at monitoring location 2 was the insect noise from the Grylliadae and Cicada. Gusts of wind for a short period just after 22:00, aircraft occasionally flying by overhead as well as birdsong from the avifauna starting just before 05:00 (which is still classified as night time) were the intermittent noise sources. The specific L_{Aeq} level was 50 dBA, with the L_{A90} level measuring 25 dBA. With a 25 dBA difference between the L_{Aeq} and L_{A90} level, the intermittent noise sources, specifically the birdsong creating the highest peak in the graph, had a very significant impact on the overall average.

The main continuous noise source at monitoring location 3 was the insect noise from the *Gryllidae* and *Cicada* as well as aircraft occasionally flying by overhead as well as the gusts of wind at times during the day. The specific L_{Aeq} level was 40 dBA, with the L_{A90} level measuring 34 dBA. With a 6 dBA difference between the L_{Aeq} and L_{A90} level, the intermittent noise sources had a less significant impact on the overall average. The L_{Aeq} level however is similar to the rating level guideline for suburban districts which is expected of a receptor of this nature.

The main continuous noise source at monitoring location 4 was the insect noise from the *Gryllidae* as well as the ventilation fans at the chicken houses. The vehicles passing by, gusts of wind and birdsong were the main intermittent noise sources. The specific L_{Aeq} level was 44 dBA, with the L_{A90} level measuring 40 dBA. With a 4 dBA difference between the L_{Aeq} and L_{A90} level, the intermittent noise sources had a less significant impact on the overall average.

The noise sources that were influential during the baseline measurements at the time of the noise survey and that were responsible for the day/night time levels are summarised in Table 10-57.

Table 10-57: Summary of Noise Sources Influencing Baseline Measurements around the Proposed Site

Noise source description				
Monitoring location	**Day**	**Duration**	**Night**	**Duration**
1	Vehicle activity	Intermittent	Gryllidae	Continuous
	Ventilation system	Continuous	Ventilation system	Continuous
	Birdsong	Continuous	Siren	Intermittent
2	Vehicle activity	Intermittent	Birdsong	Intermittent
	Dog	Intermittent		

Noise source description				
Monitoring location	**Day**	**Duration**	**Night**	**Duration**
	Aircraft	Intermittent	Aircraft	Intermittent
	Birdsong	Continuous		
3	Birdsong	Continuous	Gryllidae	Continuous
	Dogs	Intermittent	Cicada	Continuous
	Aircraft	Intermittent	Aircraft	Intermittent
	Vehicles	Intermittent	Wind	Intermittent
	Wind	Intermittent		
4	Birdsong	Continuous	Gryllidae	Continuous
	Ventilation system	Continuous	Ventilation system	Continuous
	Wind	Intermittent	Wind	Intermittent
	Aircraft	Intermittent	Vehicles	Intermittent
			Birdsong	Intermittent

10.1.10.2 Sensitivity Analysis and No-Go Areas

In terms of the current project location and infrastructure layout it is expected that noise impacts are likely to occur at certain receptors within the Mpumalanga Province. It is recommended that buffer zones be implemented as 'No-Go' areas that will affect the Project's current proposed layout. The 'No-Go' areas should include a 350 meters buffer from the gravel road (border between Mpumalanga and Gauteng) with respect to the current proposed open cast as well as northernmost hard overburden footprint as well as a 250 meters buffer south of the current proposed haul route section that follows the existing gravel road running past the small holdings community towards the siding.

10.1.11 Visual

The Visual Impact Assessment (VIA) undertaken during the EIA Phase is appended to this report as Appendix K. The VIA was performed using surveyed geographically referenced information and aerial photography, together with the professional opinion of an experienced visual impact assessor. The study was conducted to identify and evaluate the surface features using ArcGIS 3D Analyst Extension to create a topographical model, and the resultant slope intensity, slope aspect and viewshed models. Further detail pertaining to the methodology utilised is provided in the VIA, Appendix K.

10.1.11.1 Visual / Aesthetic Character and Topography

This section provides the results obtained from the analysis of the topographical, slope and aspect models created in ArcGIS.

The Project area and surrounds are gently undulating with numerous hills and valleys. Hills are known to create a multitude of unique habitats for both faunal and floral species increasing the expected biodiversity of the area. Hills also have significant cultural value as historical settlements were located on higher-lying areas for safety and strategic advantage.

The topographical model indicates that the elevation of the Project area increases from 1 567 mamsl at Aston Lake in the west to 1 636 mamsl in the eastern corner of the Project area. Plan 31 illustrates the topographical model and features of the Project area.

The majority of the Project area has gentle slopes of between 0° and 2.5°. Isolated steeper slopes of between 2.6° and 10.6° occur along the sides of the hills and river valleys. Plan 32 illustrates the slope model of the Project area.

Due to the undulating topography, the slope aspect / direction of the Project area is not in any specific direction. The sides of the hills and valleys slope in various different directions as illustrated by the aspect model of the Project area (Plan 33).

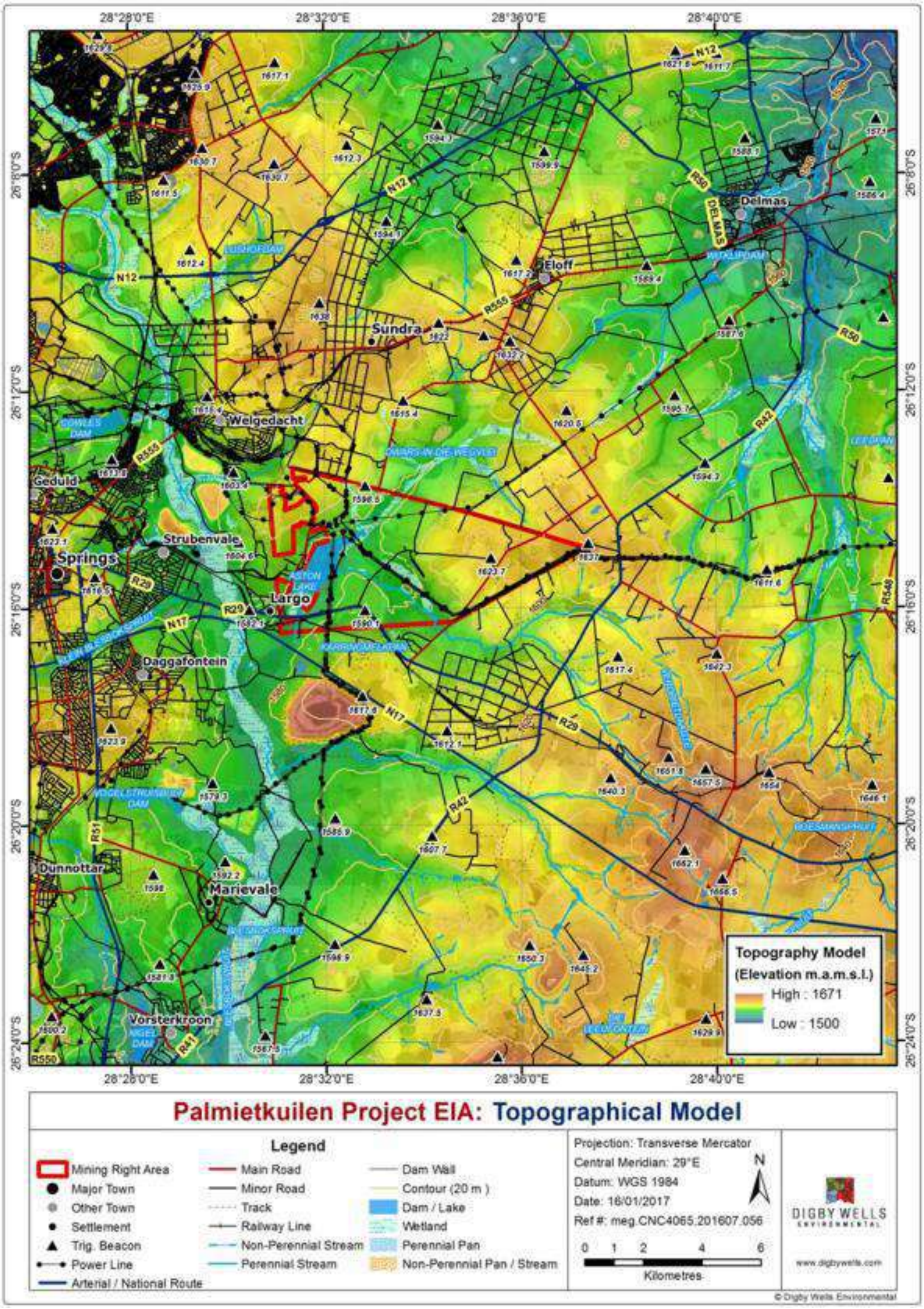
The undulating topography is expected to provide moderate screening of the proposed development; however, if the mining activities are located on a hill they will be more visible than if they are located on a lower-lying area.

Figure 10-21, Figure 10-22 and Figure 10-23 illustrate the topography and vegetation of the Project area. Figure 10-21 was taken from the northern boundary of the Project area looking in a south-easterly direction across the Project area. The farm buildings in the centre of the Project area are visible in this photograph. Figure 10-22 was also taken from the northern boundary of the Project area. This photograph was taken looking in a south-westerly direction across the Project area. The Dwarsindiewegvlei is visible in the background of the photograph. Figure 10-23 was taken from within the proposed pit looking in a north-westerly direction.

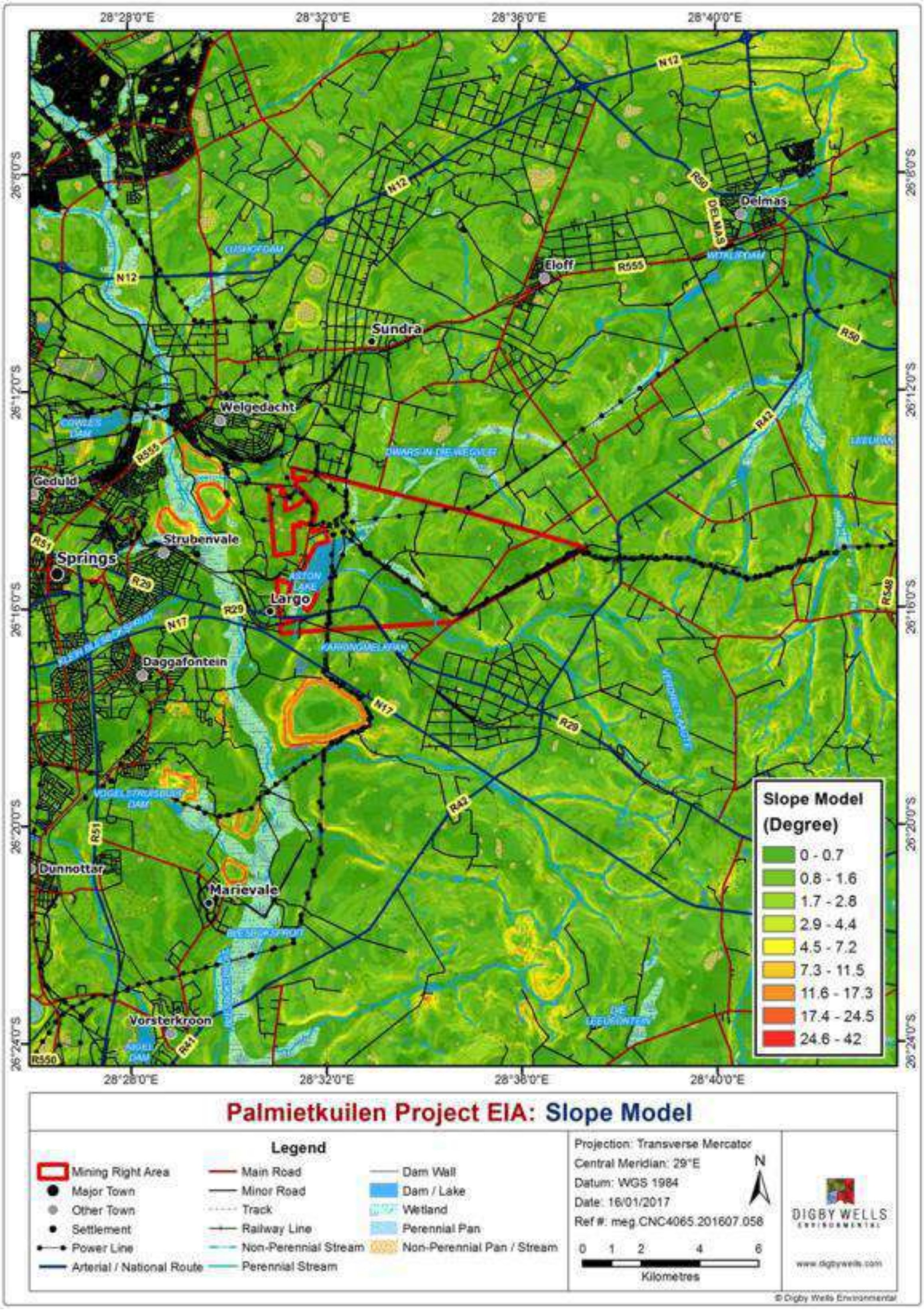
Figure 10-21: View of the Project Area

Figure 10-22: View of the Project Area and the Dwarsindiewegvlei

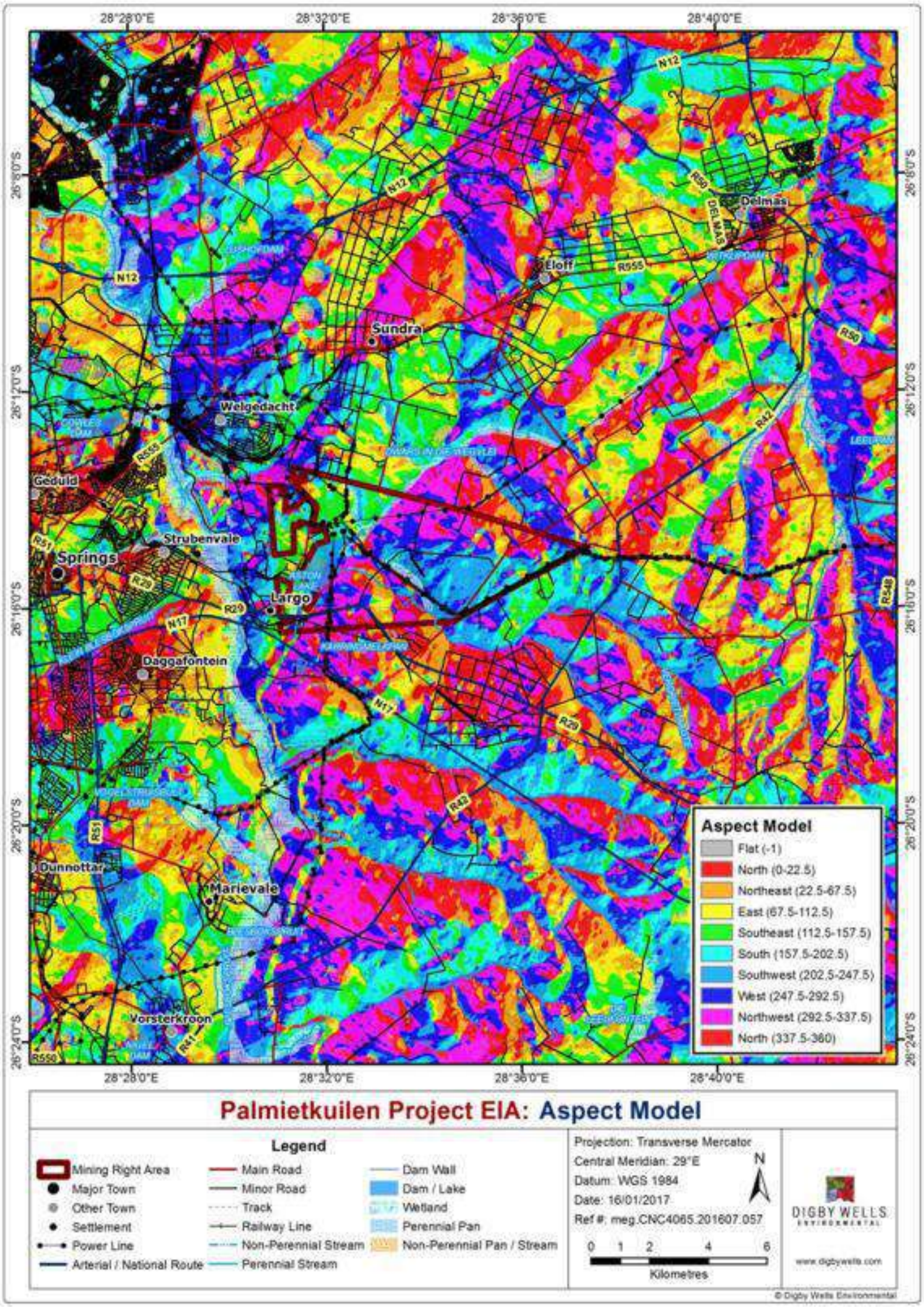
Figure 10-23: View from Within the Proposed Pit



Plan 31: Topographical Model



Plan 32: Slope Model



Plan 33: Aspect Model

10.1.11.2 Viewshed Model

The theoretical viewshed model is illustrated in Plan 34 below.

10.1.11.2.1 Daytime

The theoretical viewshed model was refined to a daytime practical viewshed model (Plan 35) with a buffer of 10 km around the proposed infrastructure and divided into areas that are likely to experience different categories of visual exposure. Due to the nature of the receiving environment it is unlikely that the proposed infrastructure will be noticeable beyond this 10 km buffer. The daytime practical viewshed model depicts the area from which the Project may potentially be visible during the day. This daytime practical viewshed model covers an area of approximately 275.79 km². The viewshed areas for the categories are listed in Table 10-58 below.

Table 10-58: Daytime Viewshed Area per Category

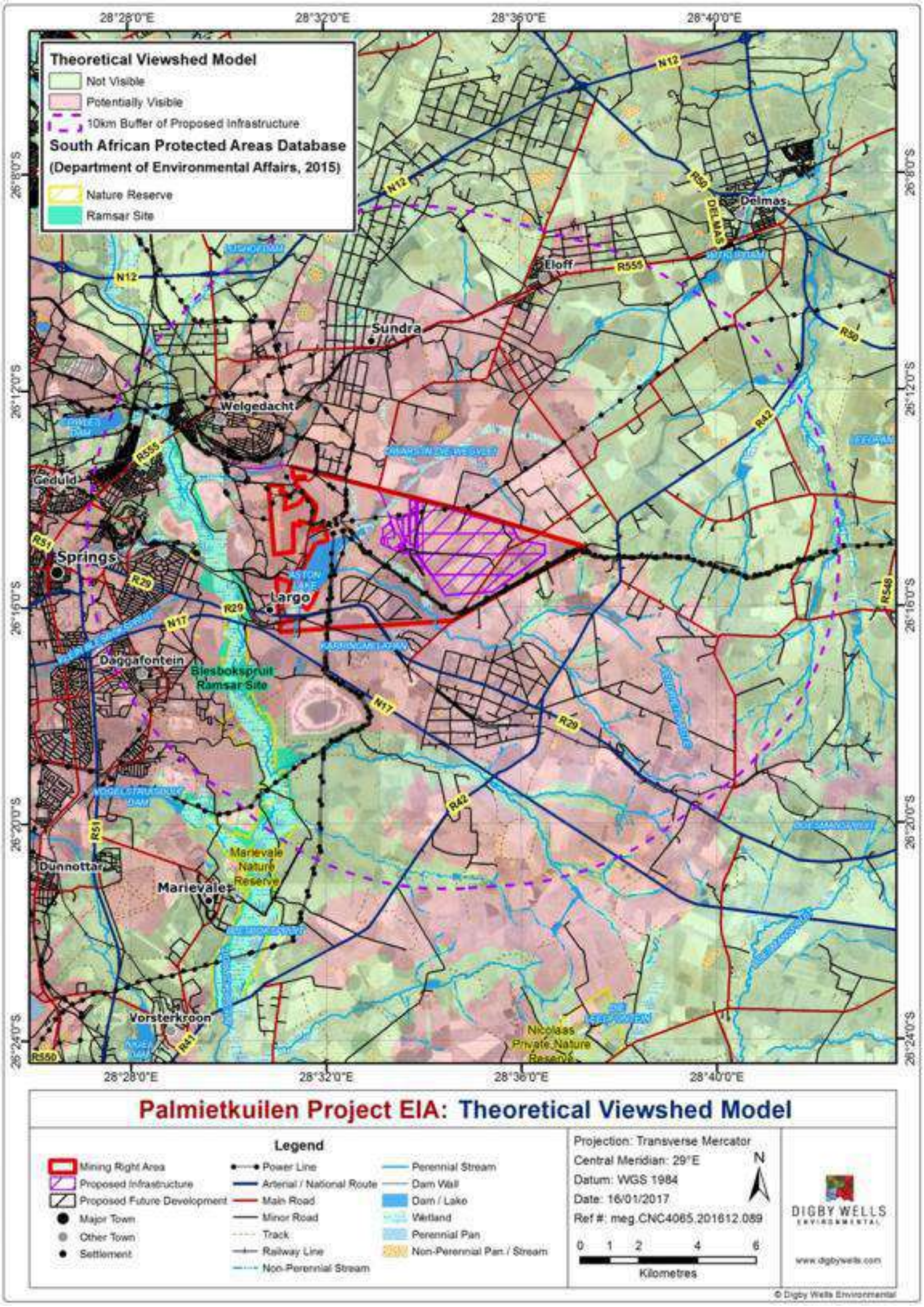
Category	Impact	Viewshed Area
0 – 2 km	Potentially Very High Visual Exposure	47.82 km²
2 – 4 km	Potentially High Visual Exposure	56.60 km²
4 – 6 km	Potentially Moderate Visual Exposure	66.60 km²
6 – 8 km	Potentially Low Visual Exposure	56.35 km²
8 – 10 km	Potentially Very Low Visual Exposure	48.43 km²

10.1.11.2.2 Night Time

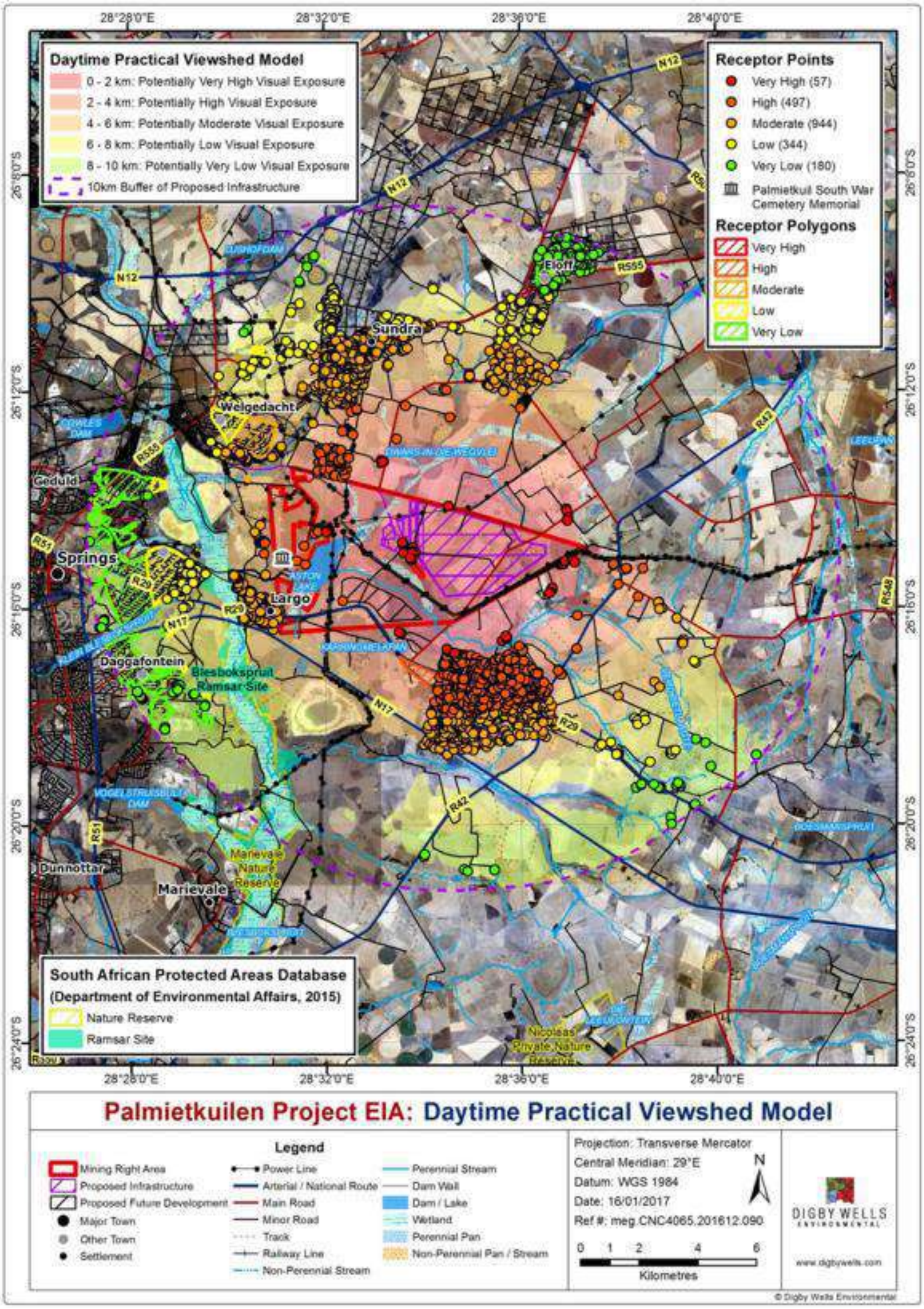
The theoretical viewshed model was refined to a night time practical viewshed model (Plan 36) with a buffer of 10 km around the proposed infrastructure and divided into areas that are likely to experience different categories of visual exposure. Due to the nature of the receiving environment it is unlikely that the night time lighting of the proposed infrastructure will be noticeable beyond this 10 km buffer. The night time practical viewshed model depicts the area from which the Project may potentially be visible at night. This night time practical viewshed model covers an area of approximately 275.79 km². The viewshed areas for the categories are listed in Table 10-59 below.

Table 10-59: Night Time Viewshed Area per Category

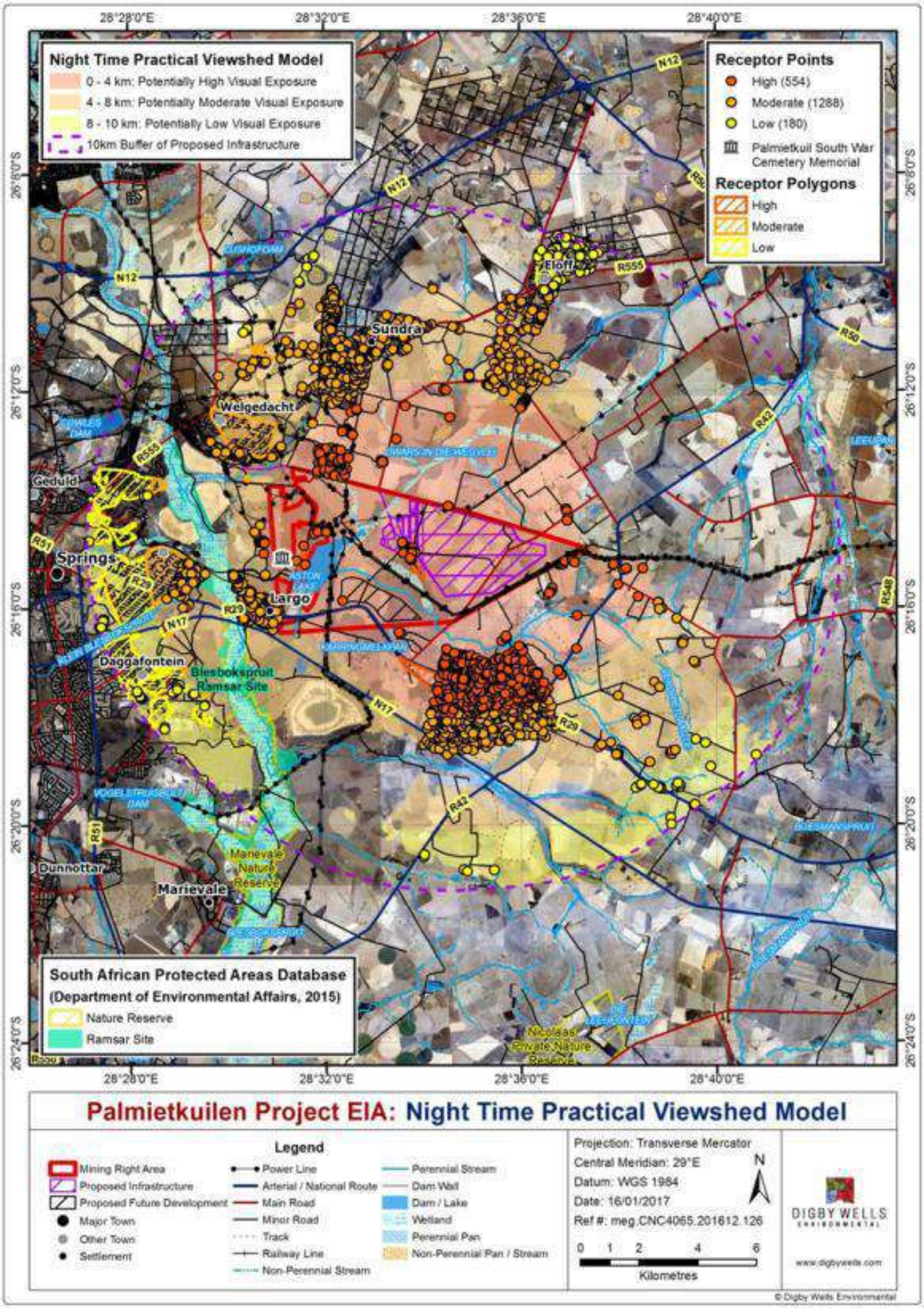
Category	Impact	Viewshed Area
0 – 4 km	Potentially High Visual Exposure	104.42 km²
4 – 8 km	Potentially Moderate Visual Exposure	122.95 km²
8 – 10 km	Potentially Low Visual Exposure	48.43 km²



Plan 34: Theoretical Viewshed Model



Plan 35: Daytime Practical Model



Plan 36: Night Time Practical Model

10.1.11.3 Sensitive Receptors

10.1.11.3.1 Daytime

The potential visual receptors identified within the daytime practical viewshed of the Project include residents of the towns and settlements within 10 km of the proposed infrastructure, residents of the surrounding farms and small holdings and road users. The daytime visual receptors are indicated on Plan 35 above.

The towns and settlements in each category of the daytime viewshed model are listed in Table 10-60 below. These urban areas are indicated as receptor polygons on Plan 35.

Table 10-60: Towns and Settlements per Category (Daytime)

Category	Impact	Towns and Settlements
0 – 2 km	Potentially Very High Visual Exposure	None
2 – 4 km	Potentially High Visual Exposure	Vischkuil
4 – 6 km	Potentially Moderate Visual Exposure	Endicott Largo Sundra
6 – 8 km	Potentially Low Visual Exposure	Strubenvale Welgedacht
8 – 10 km	Potentially Very Low Visual Exposure	Daggafontein Eloff

A total of 2 022 receptor points (farm residences including farm workers houses and residences on small holdings) were identified within the daytime practical viewshed area. The number of receptor points within each category is shown in Table 10-61 below.

Table 10-61: Number of Receptor Points per Category (Daytime)

Category	Impact	Number of Receptor Points
0 – 2 km	Potentially Very High Visual Exposure	57
2 – 4 km	Potentially High Visual Exposure	497
4 – 6 km	Potentially Moderate Visual Exposure	944
6 – 8 km	Potentially Low Visual Exposure	344
8 – 10 km	Potentially Very Low Visual Exposure	180

Road users of the N17 national route, the R29, R42 and R555 regional roads, secondary roads and farm roads within the daytime practical viewshed area are potential visual receptors of the Project. The main roads within each category are shown in Table 10-62 below.

Table 10-62: Main Roads per Category (Daytime)

Category	Impact	Main Roads
0 – 2 km	Potentially Very High Visual Exposure	None
2 – 4 km	Potentially High Visual Exposure	R29 R42
4 – 6 km	Potentially Moderate Visual Exposure	N17 R29 R42 R555
6 – 8 km	Potentially Low Visual Exposure	N17 R29 R42 R555
8 – 10 km	Potentially Very Low Visual Exposure	N17 R29 R42 R555

The Blesbokspruit Ramsar Site, the Marievale Nature Reserve and Bird Sanctuary and the Blesbokspruit IBA are all potential visual receptors of the Project as they fall within the daytime practical viewshed area. The Palmietkuil South War Cemetery Memorial is also within the daytime practical viewshed area of the Project.

10.1.11.3.2 Night Time

The potential visual receptors identified within the night time practical viewshed of the Project include residents of the towns and settlements within 10 km of the proposed infrastructure, residents of the surrounding farms and small holdings and road users. The night time visual receptors are indicated on Plan 36 above.

The towns and settlements in each category of the night time viewshed model are listed in Table 10-63 below. These urban areas are indicated as receptor polygons on Plan 36.

Table 10-63: Towns and Settlements per Category (Night Time)

Category	Impact	Towns and Settlements
0 – 4 km	Potentially High Visual Exposure	Vischkuil

Category	Impact	Towns and Settlements
4 – 8 km	Potentially Moderate Visual Exposure	Endicott Largo Strubenvale Sundra Welgedacht
8 – 10 km	Potentially Low Visual Exposure	Daggafontein Eloff

A total of 2 022 receptor points (farm residences including farm workers houses and residences on small holdings) were identified within the night time practical viewshed area. The number of receptor points within each category is shown in Table 10-64 below.

Table 10-64: Number of Receptor Points per Category (Night Time)

Category	Impact	Number of Receptor Points
0 – 4 km	Potentially High Visual Exposure	554
4 – 8 km	Potentially Moderate Visual Exposure	1288
8 – 10 km	Potentially Low Visual Exposure	180

Road users of the N17 national route, the R29, R42 and R555 regional roads, secondary roads and farm roads within the night time practical viewshed area are potential visual receptors of the Project. The main roads within each category are shown in Table 10-65 below.

Table 10-65: Main Roads per Category (Night Time)

Category	Impact	Main Roads
0 – 4 km	Potentially High Visual Exposure	R29 R42
4 – 8 km	Potentially Moderate Visual Exposure	N17 R29 R42 R555
8 – 10 km	Potentially Low Visual Exposure	N17 R29 R42 R555

The Blesbokspruit Ramsar Site, the Marievale Nature Reserve and Bird Sanctuary and the Blesbokspruit IBA are all potential visual receptors of the Project as they fall within the night time practical viewshed area. The Palmietkuil South War Cemetery Memorial is also within the night time practical viewshed area of the Project.

10.1.12 Blasting and Vibration

The Blast and Vibration Assessment was undertaken by Blast Management & Consulting (Blast Management) during the EIA Phase. The Blast and Vibration Assessment is appended to this report as Appendix L. The site was visited and structure identification was done on 25 October 2016. This site visit was conducted specifically to get an understanding of the location of the open pit for the project and identifying the structures and installations surrounding the proposed open pit area.

Baseline influence: There are no blasting activities currently being done or no operations yet.

10.1.12.1 Baseline Influence

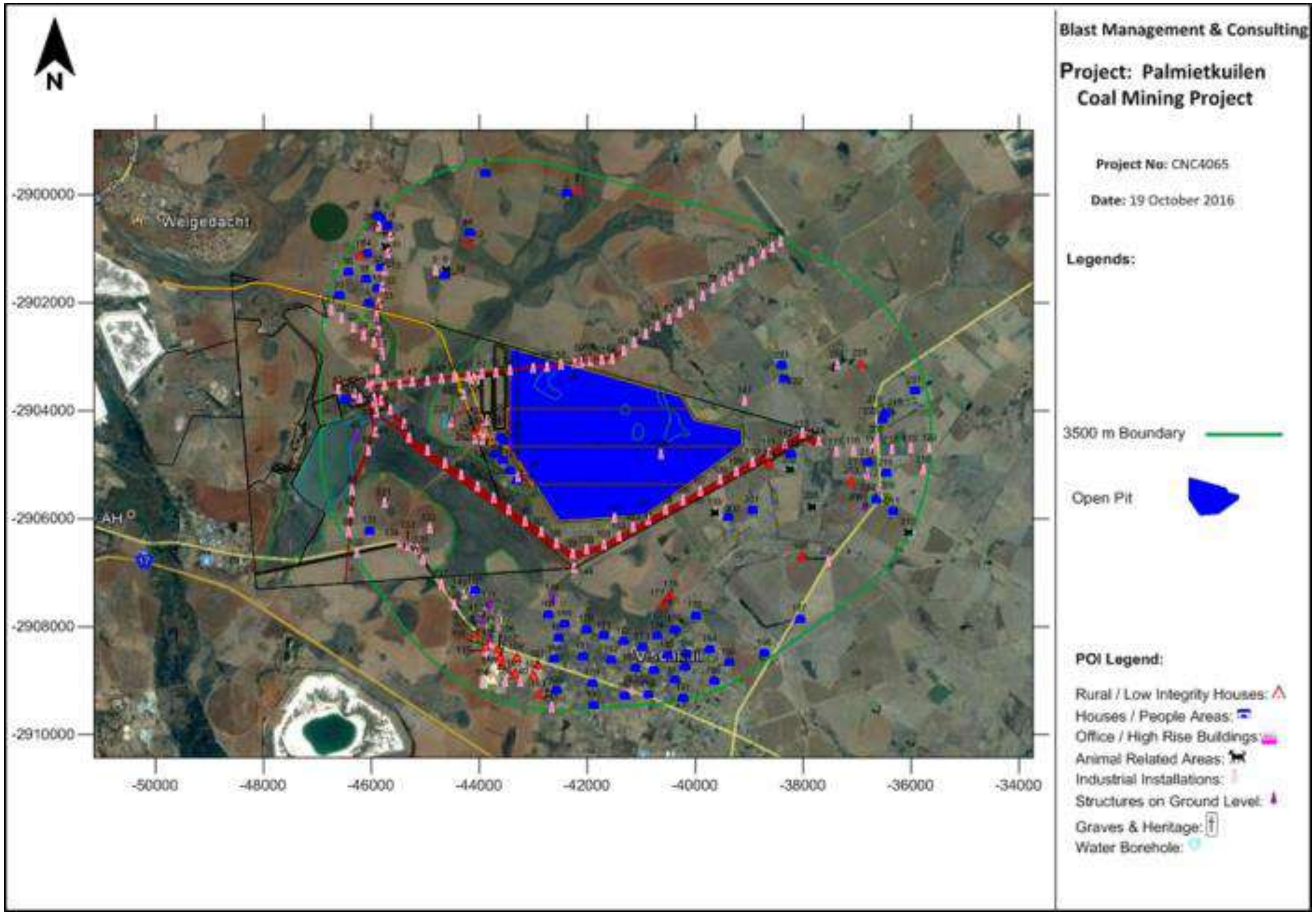
The baseline is zero with no specific influence from blasting as the mine is not operational. No specific monitoring was done during the baseline investigation. Baseline data is considered at zero level.

10.1.12.2 Structure Profile

As part of the baseline, all possible structures in a possible influence area are identified. The site was reviewed using Google Earth imagery. Information sought during the review was to identify surface structures present in a 3500 m radius from the proposed open pit area, which will require consideration during modelling of blasting operations, e.g. houses, general structures, powerlines, pipelines, reservoirs, mining activity, roads, shops, schools, gathering places, possible historical sites, etc. A detailed list was prepared of all structures in the vicinity of the open pit area. The list includes 233 structures and Point of Interests (POI) within the 3500 m boundary (refer to the Blast and Vibration Assessment, Appendix L) that fall within the classification presented in Table 10-66. Plan 37 shows an aerial view of the open pit area and surroundings with POIs.

Table 10-66: POI Classification used

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



Plan 37: Aerial view and surface plan of the proposed mining area with points of interest identified

10.1.13 Cultural Heritage Assessment

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

10.1.13.1 Palaeontological Context

Voids created by the dissolution of Malmani dolomites have the potential to contain fine- to coarse-grained alluvium accumulated during periodic flooding. These features may be represented by bodies of breccia, sandstone and siltstone with a likelihood of containing palaeontological or archaeological material. Based on the South ASAHRIS palaeontological sensitivity map (SAHRA, 2013a), fossil heritage associated with this lithostratigraphic unit is inclusive of a range of shallow marine to intertidal stromatolite and fossiliferous cave breccia with a very high sensitivity.

The Vryheid Formation is the main potential fossiliferous rock underlying the site-specific Project area and rated as having a very high sensitivity on the Palaeontological-Sensitivity Map (PSM). This formation is inherently associated with coal and fossil plants. Fossil plants in general resemble modern plants. These fossils are more likely to be recognised in the shales between the coal seams or in fine grained mudstones and shales. They may be found in sandstone, but are not as well preserved (Bamford, 2016). Common fossils associated with the Vryheid Formation include Permian *Glossopteris* flora, diverse palynomorphs, rare insects and fossil woods, and non-marine bivalves (SAHRA, 2013c).

10.1.13.2 The Stone Age

The Stone Age denotes the period in which hominids, primarily the genus *Homo*, produced stone tools, also referred to as lithics. In South Africa this Age is divided into three periods, name the Early- (ESA), Middle- (MSA) and Later Stone Age (LSA) after Goodwin and Van Riet Lowe (1929).

Large hand axes and cleavers produced from coarse-grained material dominate the ESA assemblage, dating from approximately 2 million years to 250 thousand years ago (Esterhuysen & Smith, 2007). The MSA dates from approximately 300 000 to 20 000 years ago. Early MSA industries are characterised by high proportions of minimally modified blades, represented by the Levallois technique (Clark, 1982). The LSA dates from approximately 40 000 years ago to the historical period and is wholly associated with anatomically modern *Homo sapiens*. In addition, the latter part of the southern African LSA is associated with hunter-gatherer societies, antecedents of the San or Bushmen and Khoi.

10.1.13.3 The Farming Community Period

The Farming Community Period (FCP, also known as the Iron Age) correlates with the arrival in and migration through the landscape of various Bantu-speaking groups. The only known FCP expressions in the Project study area are associated with Late Farming Community (LFC) groups. The earliest identified formal LFC settlement of the local study area[4] dates to around 1 500 AD. This settlement is related to early BaFokeng. Identifiable tangible markers for the presence of these early settlers are material cultural remains[5] and stonewalled settlements.

10.1.13.4 Historical Context

The Voortrekker settlements in the region were primarily agrarian, characterised by an economy based on cultivation and stock farming. The settlements were typically *werfs* (homesteads) accommodating family and labour units located on large farms on which crops were cultivated and livestock raised. The earliest settlements also produced a unique, vernacular architecture including simple houses (colloquially known as *hartbeeshuisies)*. These were usually constructed of reeds or poles, either thatched in total, or walls plastered with mud and cow dung. In areas where little suitable wood occurred, the walls were constructed of stone of sunbaked clay bricks and plastered with mud and cow dung. As these settlements became more permanent, another typical vernacular architecture developed, typified by square houses surrounded by a porch covered by a veranda (*stoep*).

It was not until the 1880's, with the discovery of gold on the Witwatersrand, that the primary economy of the region changed (Brodie, 2008). Within the local study area, gold was first discovered in 1899, some 14 years after the initial discovery. Gold was discovered in the east on the farm Geduld 134 IR, adjacent to the site-specific study area[6] (*then known as Palmietfontein 61*). This discovery occurred immediately prior to the outbreak of the South African War of 1899 – 1902 (*also known as the Second Anglo-Boer War*). A number of battles and skirmishes occurred during the war, but the most notable in proximity to the site-specific study area was the Battle of Witpoort on 16 July 1900.

During the South African War, mining operations functioned at limited capacity. The Main Reef was therefore only identified after the war towards the east. This discovery ultimately culminated in the establishment of the Grootvlei Proprietary Mine Limited and town of

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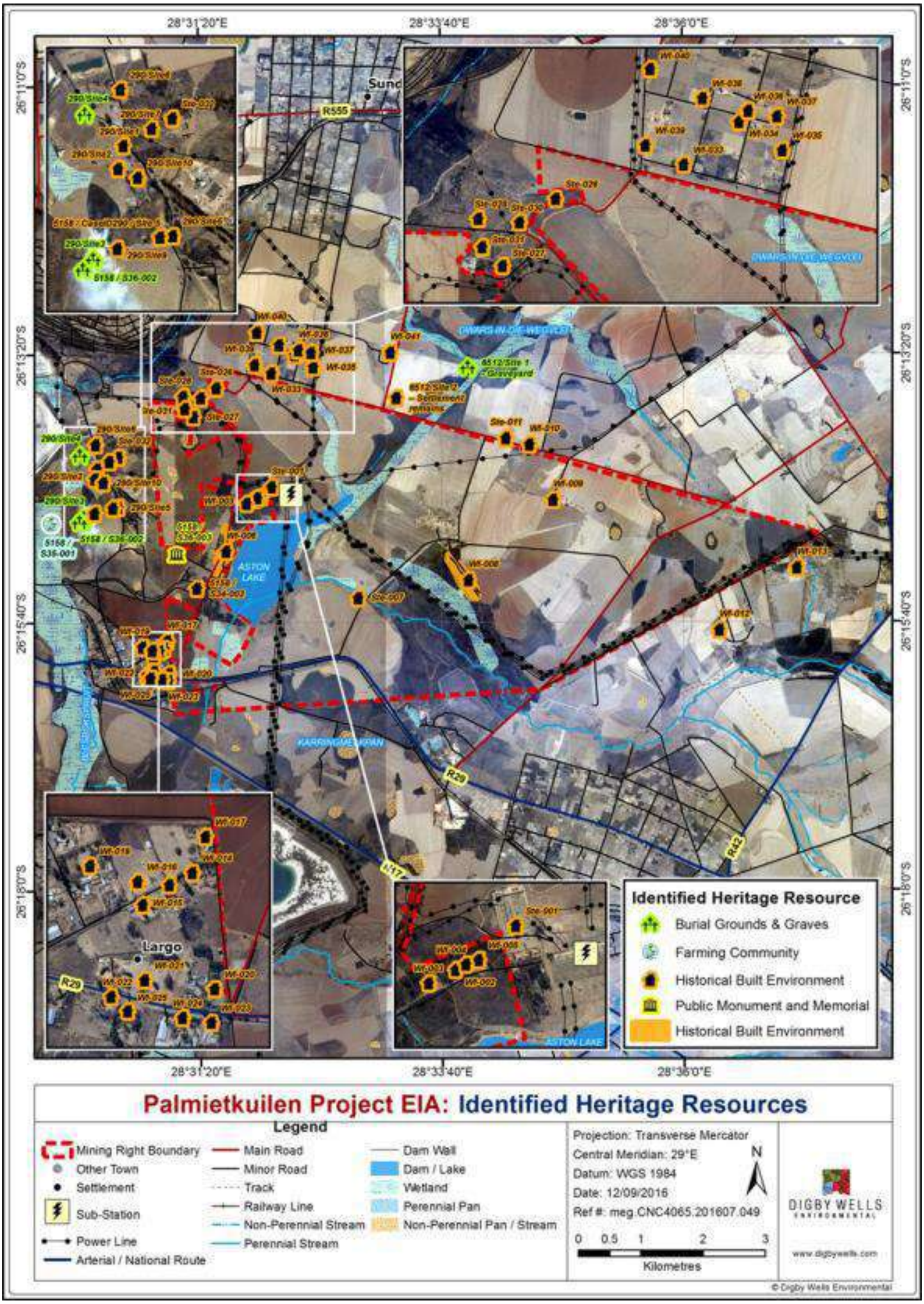
[4] The local study area comprises the applicable local municipality and includes the land and properties adjacent to and surrounding the Project area

[5] Material culture remains are discussed in terms of ceramic distribution in the region. To this end the works of Huffman **Invalid source specified.** are used as the primary text to identify ceramics that in turn provide relative temporal markers for occupation in the region. Although ceramics are used as broad cultural and/or linguistic markers as well, it is acknowledged that ceramics do not necessarily equate to narrowly defined ethnic groups.

[6] The site-specific study area comprises the Project boundary, including any exclusion zones, servitudes and other operational boundaries

Springs in 1904. Sites of Cultural Importance which have been identified within and around the Project area are shown in Plan 38.



Plan 38: Identified Heritage Resources

10.1.13.5 Updated Baseline Cultural Landscape

The updated baseline cultural landscape considered the predominant landscape based on the identified heritage resources within the local and site-specific study area only. Secondary and primary data collection results demonstrate that the principal tangible cultural landscape is associated with the historical period, identified by the historic built environment in the form of homesteads / werfs and burial grounds.

Table 10-67: Identified heritage resource types in the local and site-specific study area

Heritage Resource Types	Number Identified
Archaeological – Late Farming Community	1
Burial Grounds & Graves	72
Historical Built Environment	83
Public Monument and Memorial	1
Recent heritage	1
Grand Total	**158**

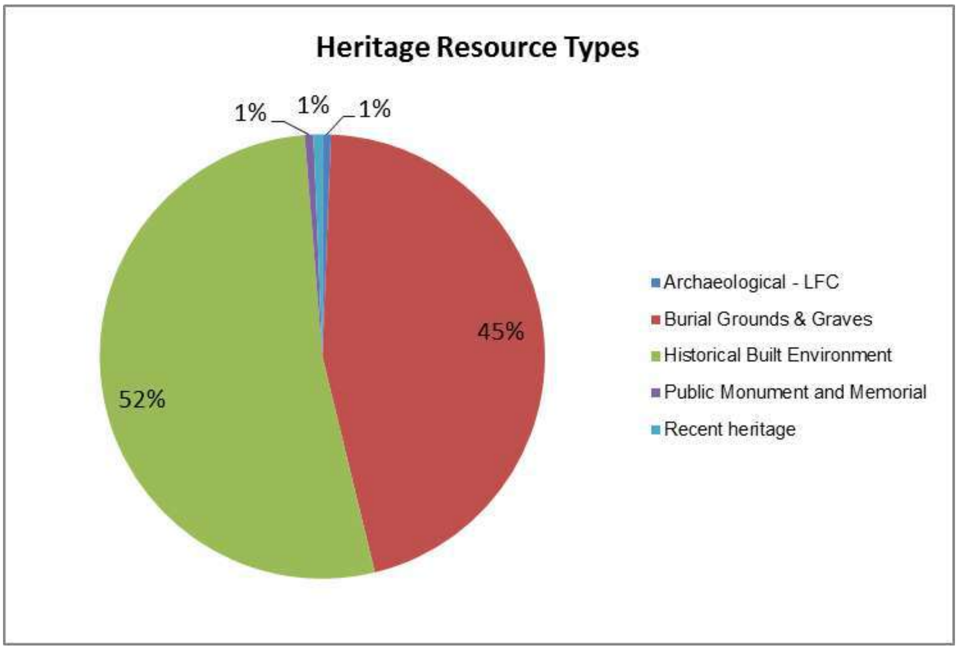


Figure 10-24: Categories of identified heritage resources in the local and site-specific study area

Figure 10-25: Examples of the current state of the cultural landscape, and burial grounds within the site-specific study area

Historically, *Voortrekkers* moved into the region, which they perceived as void of indigenous populations, and established settlements. These settlements were characterised by an agrarian cultivation and stock farming-based economy (The Voortrekkers, 2014). Small towns developed from these settlements, usually established on parts of the larger farms to serve the administrative needs of the *Voortrekker* communities. Limited infrastructure was constructed, such as wagon roads and river crossings. Typical vernacular architecture developed, typified by square houses surrounded by a porch and several outbuildings.

Gold was discovered in this region on the farm Geduld 134, adjacent to the site-specific study area (*then known as Palmietfontein 61*). This discovery culminated in the establishment of the town of Springs in 1904.

With the onset of World War II, the gold compounds associated with the Grootvlei Proprietary Mine Limited were taken over by the Union Defence Force (UDF) and used as the main training centre for black soldiers (Monama, 2014; Commonwealth War Graves Commission). It has been reported that the training centre provided propaganda course for blacks to avert boredom among the troops and enable them to influence non-enlisted blacks about the implications of the war for South Africa and the black population in particular (Monama, 2014). As part of this complex, the Palmietkuil South War Cemetery Memorial was established, containing 217 Commonwealth burials of the Second World War (Commonwealth War Graves Commission).

A survey of historical aerial imagery completed as part of the HSR confirmed the identified historic agrarian landscape of the site-specific study area. In addition, several small areas of industrialisation associated with mining and urban development were also noted.

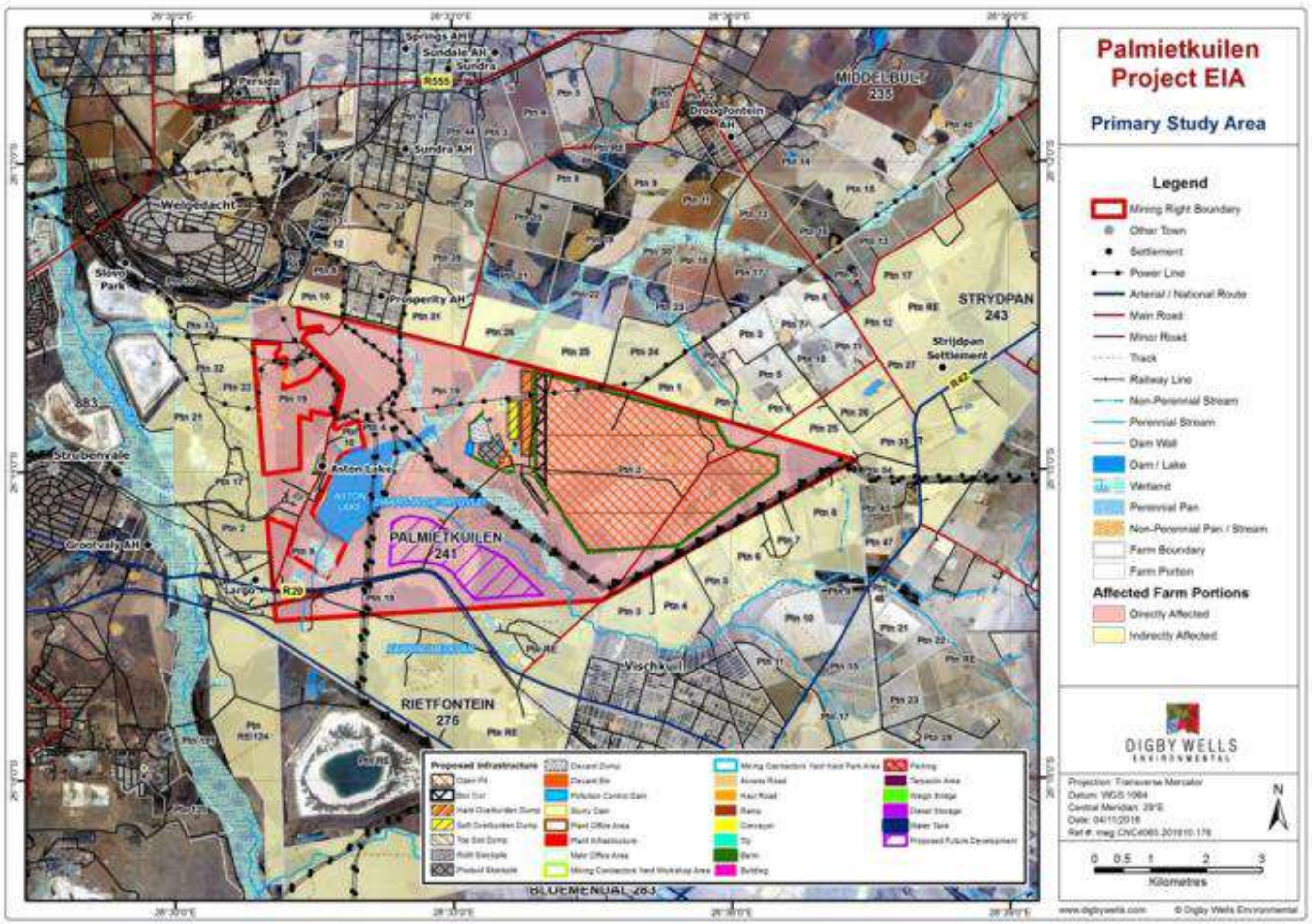
10.1.14 Social

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

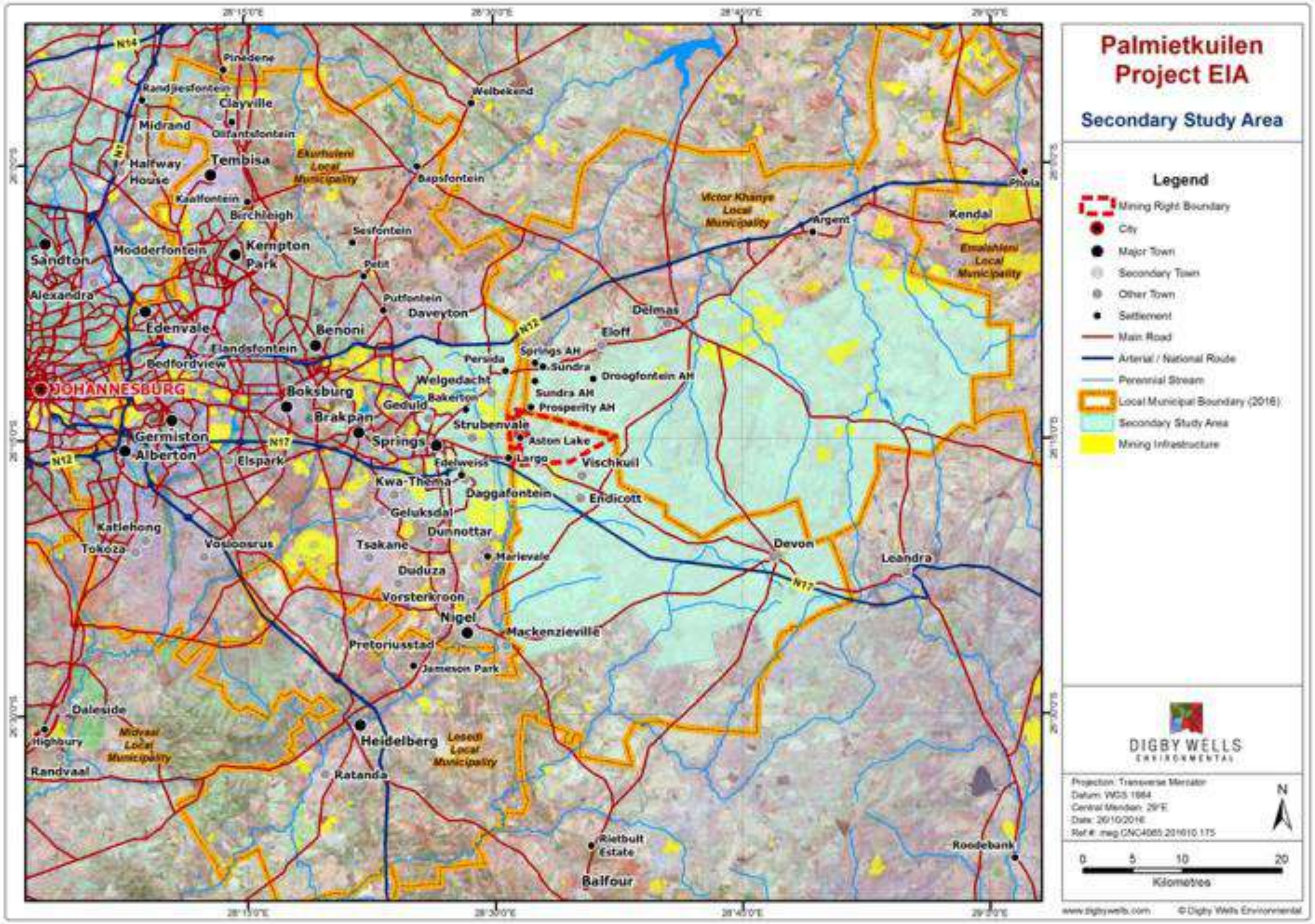
In defining the study areas, the manner in which publicly-available socio-economic data is aggregated was taken into account. The study areas were thus defined to correspond to *existing administrative boundaries*. The study areas for the SIA are:

- The *primary study area* – the area likely to experience impacts related to the physical intrusion of Project infrastructure and project-related activities. This study area is defined as the extent of the farm portions comprising the footprint of the existing prospecting right area (i.e. Portions 1, 2, 4, 9, 13 and 19 of Palmietkuilen 241 IR) and a 100m buffer directly surrounding this area (Plan 39) – the Project area.
- The *secondary study area* encompasses the primary study area and exceeds it in scale and includes the area likely to experience (a.) impacts related to the "*economic pull"* exerted by the Project and (b.) the *indirect or induced impacts* of the proposed Project. The typical reach of these impacts (i.e. an area circumscribed by a radius of up to 15km) includes Wards 72, 75 and 76 of the Ekurhuleni Metropolitan Municipality (EMM), Ward 12 of the Lesedi Local Municipality (LLM), and Ward 7 of the Victor Khanye Local Municipality (VKLM) (Plan 40). Considering that the impacts of the proposed Project would likely vary across municipal wards (e.g. Local Economic Development (LED) activities and employment will likely be concentrated within LLM, while influx related impacts would be more pronounced in Ward 7 of VKLM). Ward statistics are considered against the backdrop of its host municipality in order to highlight outlying trends.

The first subsection describes the socio-economic characteristics of the secondary study area, while the final section provides a detailed description of the primary study area.



Plan 39: Primary Study Area



Plan 40: Secondary Study Area

10.1.14.1 Secondary Study Area

The secondary study area is defined as Ward 12 of LLM in which the proposed Project is located, as well as the municipal wards directly surrounding the proposed Project site; these include Ward 72, 75 and 76 of EMM as well as Ward 7 of VKLM. These municipal wards are administered through local municipalities, each of which has an executive mayor, proportionally elected councillors and ward councillors who are responsible for representing the needs of the people in the respective wards. None of the communities within the study area falls within the jurisdiction of Traditional Governance.

10.1.14.1.1 Demographic Characteristics

Population Distribution and Growth

Ward 12 comprises the rural areas along the eastern and southern parts of LLM. The Ward borders Mpumalanga Province and is the largest ward in the municipality in terms of land mass and hosts, amongst others, the settlements and agricultural holdings of Aston Lake, Vischkuil, Endicott, KwaZanzele, Umbila, Hallgate, Bothasgeluk and Skyling. Population densities are generally low. In 2011 the Ward had a total population of 9 842 (or 10% of the municipal population). This population comprised 2 542 households which equates to an average household size of between 3 and 4 members, which is slightly higher than the municipal average (Table 10-68).

Human settlement within Ward 72, 75 and 76 is characterised by two contrasting distribution patterns. Approximately two thirds of the area is sparsely populated; residential uses in this area comprise small holdings and commercial farms. In contrast, several high density areas are found in the area (e.g. Bakerton, Springs, Strubenvale, Petersfield, Gugulethu, Everest, Slovo Park, and Welgedacht). These areas host more than 95% of this area’s total population, which in 2011 comprised approximately 94 100 individuals. The majority of households (84%) consist of four or less members, while the average household size (3) is similar to that of the EMM (Table 10-68). The population and households are distributed relatively equally across all three wards, with Ward 76 having a slightly smaller population and number of households.

Ward 7 covers the rural area west of the project and is situated towards the south of Delmas. Population densities are generally very low throughout most of the area. In 2011 the Ward had a total population of 11 320 (or 15% of the VKLM population) (Table 10-68). This population comprised 3 015 households, which equates to an average household size of 3.8 persons, which is similar to that of VKLM.

Municipal trends indicate that Ward populations likely increased with between 6% and 12% since 2011, while the number of households increased with between 18% and 32% (Table 10-68).

Table 10-68: Population and household size

Area	Population			Households			Average household size		
	Ward 2011	LM 2011	LM 2016 (% growth)	Ward 2011	LM 2011	LM 2016 (% growth)	Ward 2011	LM 2011	LM 2016
Ward 12 (LLM)	9824	99520	112472 *(13%)*	2542	29665	39294 *(32%)*	3.9	3.4	2.9
Ward 72,75,76 (EMM)	94096	3178472	3379104 *(6%)*	29981	1015466	1299490 *(28%)*	3.1	3.1	2.6
Ward 7 (VKLM)	11320	75453	84151 *(12%)*	3015	20547	24270 *(18%)*	3.8	3.7	3.5
Source: StatsSA, 2013; StatsSA, 2016									

Age and Gender Distribution

Table 10-69 below indicates the gender distribution of the respective Ward and Municipal populations. It shows that generally males outnumber females throughout all areas; with the proportion of males being considerably higher in the Ward 12 of LLM (16%) and Ward 7 of VKLM (6%). The gender distribution among households heads indicate that between 20 and 24% of all the Ward's households are headed by females (StatsSA, 2013). The age distribution of the various Ward and Municipal populations are relatively similar, with approximately a quarter of each population aged 14 year and younger, whereas the economically active cohort (15-64 years) of each population ranging between 67% and 72%.

Table 10-69: Age and gender distribution

Area	Gender distribution *Males (Females)*			Age category in years					
				0-14		15-64		65+	
	Ward 2011	LM 2011	LM 2016	Ward 2011	LM 2011	Ward 2011	LM 2011	Ward 2011	LM 2011
Ward 12 (LLM)	58% (42%)	52% (48%)	52% (48%)	23%	26%	72%	69%	5%	5%
Ward 72,75,76 (EMM)	51% (49%)	51% (49%)	51% (49%)	22%	24%	72%	72%	7%	4%
Ward 7 (VKLM)	53% (47%)	51% (49%)	51% (49%)	26%	28%	67%	67%	7%	5%
Source: StatsSA, 2013; StatsSA, 2016									

Language and Racial Distribution

The racial distribution of the municipal and ward populations is indicated in Table 10-70 below, which shows that Black Africans comprise the overwhelming majority amongst all the municipal populations; however, on a ward level the dominance is less pronounce with a slightly larger proportion of Whites, especially in Ward 72, 75 and 76 where the population comprise an almost equivalent number of Black Africans and Whites.

The most prominent language spoken within Ward 12 is IsiZulu (37%), closely followed by Afrikaans (31%), a similar distribution was found within Ward 7 of VKLM. Within Ward 72, 75 and 76, the most common spoken language is Afrikaans (38%), followed by English (19%) and IsiZulu (14%) (StatsSA, 2013). The racial distribution is presented in Table 10-70 below.

Table 10-70: Racial distribution

Area	Racial distribution					
	Black African		White		Other	
	Ward	LM	Ward	LM	Ward	LM
Ward 12 (LLM)	65%	77%	32%	20%	2%	1%
Ward 72,75,76 (EMM)	47%	79%	46%	16%	7%	5%
Ward 7 (VKLM)	67%	82%	30%	16%	3%	2%
Source: StatsSA, 2013						

Education

The level of education within each of the areas comprising the secondary study area is presented in Table 10-71 below. Generally the level of education among Ward populations mimics the educational level throughout the remainder of the respective municipalities (i.e. LLM, EMM and VKLM). The level of education also rarely varies significantly between males and females. The level of education seems to be the highest among Wards located in EMM: About 3% of the population aged 20 years and older have had no formal schooling, while 31% completed secondary schooling and another 15% have attained additional degrees, diplomas or other higher qualifications. This distribution is relatively similar across all three wards (StatsSA, 2013). Municipal trends show that the number of adults who completed Grade 12, increased considerably between 2011 and 2016 (Table 10-72).

Table 10-71: Level of education

Education level	Area					
	Ward 12	LLM	Ward 72, 75 and 76	EMM	Ward 7	VKLM
No schooling	8%	6%	3%	4%	14%	10%
Some primary	23%	24%	16%	19%	25%	26%
Completed primary	6%	5%	4%	4%	5%	6%
Some secondary	36%	35%	31%	34%	32%	33%
Grade 12	21%	22%	30%	28%	18%	20%
Higher	6%	8%	15%	11%	6%	5%
Source: StatsSA, 2013						

Table 10-72: Number of individuals that completed Grade 12

Area	Year		% Increase
	2011	2016	
LLM	24752	31948	29%
EMM	1071136	1202640	12%
VKLM	16067	16768	4%
Source: StatsSA, 2013; StatsSA, 2016			

10.1.14.1.2 Employment Levels and Income Distribution

Employment rates within an area are linked to the size of the economy as well as to personal income, education levels and skills. This section provides and overview of employment levels, sector of employment and income distribution for each of the municipal areas comprising the secondary study area.

- Ward 12 of LLM

In 2011, the employment rate among the Ward's labour force was about 45% of the total population (older than 15) and 81% among the economically active population. These trends simulated that of LLM; however, the latter had a slightly higher level of unemployment.

Employment was mostly provided within the formal sector (82%), which is likely driven through activities within the manufacturing, wholesale and trade, energy, as well as services and finance sectors (StatsSA, 2013). Major economic activities in the Ward consist of commercial agriculture and dryland crop production, in addition to a small number of light industries. Unemployment among the economically active population (11%) is low when compared to the corresponding figure for the LLM. Employment and unemployment patterns vary considerably across genders with a greater percentage of females who are classed as unemployed and not economically active; also males far outnumber (18%) females among those who are employed on both a Ward and Municipal level.

Generally, income levels across the Ward and Municipality population are low, with between 43% and 46% of people earning no monthly income (Table 10-73). Of those not earning any income, females outnumber males with about 20%. It is notable that of those earning an income, females are also worse off than males, this gender discrepancy tend to increase considerably within the higher income brackets (Table 10-73).

Table 10-73: Income distribution

Area	Gender	Income category				
		No income	R 1 - 800	R 801 – 3 200	R 3 201 – 12 800	R 12 801 +
Ward 12	Male	37%	13%	28%	15%	7%
	Female	57%	15%	19%	7%	2%
	General	46%	14%	24%	12%	5%
LLM	Male	36%	20%	23%	14%	7%
	Female	49%	21%	19%	8%	3%
	General	43%	20%	21%	11%	5%
Source: StatsSA, 2013						

- Ward 7 of VKLM

The employment rate among the Ward's labour force was about 48% of the total population (older than 15) and 75% among the economically active population, which is substantially higher than the Municipal average (66%) (StatsSA, 2013). Employment was mostly provided within the formal sector (79%) (StatsSA, 2013). Unemployment among the economically active population (12%) is low when compared to the corresponding figure for the VKLM (17%). Employment and unemployment patterns vary considerably across genders, with a slightly greater percentage of females than males who are classed as unemployed and not economically active. Also, males far outnumber (29%) females among those who are employed on both a Ward and Municipal level.

Income levels across the Ward and Municipal population are low, with between 44% of people earning no monthly income (Table 10-74). Of those not earning any income, females outnumber males by far on both a Municipal and Ward level (20%). It is notable that of those that are earning an income, females are again worse off than males; similar to LLM this gender discrepancy tend to increase considerably within the higher income brackets in both the Ward and Municipality.

Table 10-74: Income Distribution

Area	Gender	Income category				
		No income	R 1 - 800	R 801 – 3 200	R 3 201 – 12 800	R 12 801 +
Ward 7	Male	34%	16%	30%	14%	34%
	Female	54%	18%	18%	7%	54%
	General	**44%**	**17%**	**25%**	**10%**	**44%**
VKLM	Male	38%	21%	24%	12%	38%
	Female	51%	22%	19%	6%	51%
	General	**44%**	**22%**	**22%**	**9%**	**44%**
Source: StatsSA, 2013						

- Ward 72, 75 and 76 of EMM

The employment rate among the wards' labour force was 56% of the total population (older than 15) and about 81% among the economically active population (StatsSA, 2013). Employment was mostly provided within the formal sector (92%), which is likely driven through activities within the manufacturing, wholesale and trade, energy, as well as services and finance sectors (EMM, 2013). Unemployment among the economically active population (19%) is low when compared to the corresponding figure for the EMM. Employment or unemployment patterns are relatively similar across genders throughout the three wards; however, there are a greater percentage of females than males who are classed as discouraged job-seekers. Youth unemployment is also a major challenge in the respective wards (EMM, 2013).

Generally, income levels across the wards' populations are low, with more than 53% of people earning less than R 800 a month. This number varies considerably across the wards, with Ward 75 and 76 reflecting relatively higher levels of income and Ward 72 a substantially lower level. Of those not earning any income, females outnumber males with 13%. It is notable that of those earning an income, females are also worse off than males.

10.1.14.1.3 Community health

Access to health services is an important aspect of socio-economic well-being. The study area is serviced by several hospitals, health care centres, clinics and mobile clinics; with the latter focussing on rural households.

Access to health services and facilities is an important aspect of socio-economic well-being. The secondary study area have access to several hospitals, health care centres, clinics and mobile clinics; with the latter focussing on isolated rural areas.

Data available for EMM, which comprised a significant proportion of the study area, revealed that within the under-5-year age group, communicable diseases and maternal, perinatal and nutritional conditions accounted for almost 75% of deaths among males and females, while injuries accounted for around 12% for both genders. Whereas within the 5–14-year age group, communicable diseases and maternal, perinatal and nutritional conditions accounted for 36.6% of deaths among females versus 28.8% among males. There were also differences for HIV/AIDS and TB mortality (23.9% among females versus 21.8% among males), and injury-related deaths (19.5% among females versus 29.0% among males). Within the 25–64-year age group, the majority of deaths were due to HIV/AIDS and TB plus non-communicable diseases (64.8% among males and 70.1% among females). Injuries accounted for a small proportion of deaths in this age group, with the percentage being much higher among males than females (15.4% versus 4.3%).

South Africa is experiencing a severe generalised HIV/AIDS epidemic, which is affecting the social and economic fabric of the country. The causes are multifactorial, but poverty, lack of education and vulnerability are important contributing factors. HIV/AIDS incidence has increased slightly in LLM from 11% in 2013 to almost 13% in 2015, within EMM the rate declined from 27% reported in March 2011 to 15% in 2013,

Tuberculosis (TB) management remains a challenge in South Africa and in the study area; especially its co-morbidity with HIV/AIDS. Diseases of poverty, mostly infectious diseases, are resulting in high infant and maternal mortality in the rural pockets of the study area.

10.1.14.1.4 Housing and Tenure Status

The majority of households in the secondary study area reside in formal dwellings. Ward 7 in VKLM boasts the highest proportion of formal dwellings while Ward 12 of LLM has the lowest proportion of households residing in formal housing (63%) (Table 10-75), this area also has largest proportion of households who reside in informal housing (35%). These households generally reside in informal settlements in areas such as Kwazanele, Phumolong and several unnamed settlements scattered throughout the study area (Figure 10-26). The high proportion of informal dwellings in this Ward also explains why a large proportion of households do not have access to electricity and flush sanitation services, which unlike water, are usually provided only to households residing in formal housing units.

Housing type is also linked to ownership. Security of tenure contributes to more permanent and conventional housing types (e.g. formal), while a lack of security is often associated with informal dwellings. Just more than one third of dwellings within the Ward 7 and 12 is privately owned, of these almost two thirds have been fully paid off. The numbers of privately owned homes are considerably higher within Ward 72, 75 and 76, with more than half of all households indicating this type of tenure. A large proportion (38-41%) of the population residing in Ward 7 and 12 occupy their homes at no additional cost.

Table 10-75: Type of housing

Area	Housing category					
	Formal			Informal		
	Ward 2011	LM 2011	LM 2016	Ward 2011	LM 2011	LM 2016
Ward 12 (LLM)	63%	86%	90%	35%	13%	9%
Ward 72,75,76 (EMM)	78%	78%	81%	22%	22%	19%
Ward 7 (VKLM)	84%	81%	85%	10%	16%	14%
Source: StatsSA, 2013; StatsSA, 2016						

Table 10-76: Tenure status

Area	Tenure category			
	Owned and fully paid off	Owned but not yet paid off	Rented	Occupied rent-free
Ward 12	23%	11%	29%	38%
Ward 72, 75 and 76	24%	28%	34%	14%
Ward 7	22%	8%	29%	41%
Source: StatsSA, 2013				

Figure 10-26: Informal settlement located 2.5km south-east of the proposed Project Site

10.1.14.1.5 Household Services

Table 10-77 to Table 10-79 indicate the type of services that households have access to. Household access to water, sanitation and energy within on Ward level is generally lower than the municipal average, with the exception being Wards within EMM, where household access is equivalent to municipal levels (Table 10-77). Household's access to regional water schemes is the lowest within Ward 12 of LLM (64%) and Ward 7 of VKLM (54%). Households in these two areas also seem to have limited access to flush sanitation facilities, with only 51% and 57% of households in Ward 12 and 7 having access to flush sanitation facilities. In contrast the majority of household's residing within EMM enjoy high levels of access to piped water and flush sanitation.

Household access to electricity for lighting, heating and cooking on Ward level is generally lower than the corresponding municipal average. The proportion of households who have access to electricity indicate that populations residing in LLM and VKLM generally have less access than households residing in EMM (Table 10-79).

Table 10-77: Household access to water

Source	Housing category					
	Ward 12	LLM	Wards 72, 75 and 76	EMM	Ward 7	VKLM
Regional/local water scheme	64%	89%	95%	96%	54%	76%
Borehole	31%	8%	1%	1%	30%	15%
Other	5%	3%	4%	3%	13%	6%
Source: StatsSA, 2013; StatsSA, 2016						

Table 10-78: Household access to sanitation

Sanitation facility	Area					
	Ward 12	LLM	Wards 72, 75 and 76	EMM	Ward 7	VKLM
Flush toilet	51%	89%	76%	85%	57%	79%
Pit toilet	41%	7%	16%	7%	23%	9%
Other	8%	4%	8%	6%	20%	8%
Source: StatsSA, 2013; StatsSA, 2016						

Table 10-79: Household access to energy

Primary and secondary energy sources per use	Area					
	Ward 12	LLM	Wards 72, 75 and 76	EMM	Ward 7	VKLM
Lighting						
Electricity	70%	90%	75%	82%	76%	85%
Candles	26%	9%	19%	13%	21%	13%
Cooking						
Electricity	50%	78%	72%	79%	57%	64%
Paraffin	13%	8%	22%	16%	15%	19%
Heating						
Electricity	38%	61%	59%	66%	44%	46%
None	13%	13%	9%	11%	32%	18%
Source: StatsSA, 2013; StatsSA, 2016						

10.1.14.2 Primary Study Area

This section focuses on the characteristics of the primary study area as defined above – namely, the extent of the farm portions comprising the footprint of the Mining Right Area and a 100m buffer directly surrounding this area. The following aspects of the study area are described:

- Land ownership;
- Socio-economic characteristics of the population residing in the vicinity of the study area; and
- Stakeholder perceptions and attitudes.

10.1.14.2.1 Properties within the Mining Right Area

The proposed project will inevitably acquire several portions of the farm Palmietkuilen 241 IR. The land use activities on these portions are illustrated in Plan 8 above and described throughout the remainder of this section.

Commercial Agriculture

Agricultural activities within the Project area comprise irrigated and dry-land commercial maize and soya farming operations. Farmlands are under the ownership of privately owned companies (i.e. Palmietkuilen (Pty) Ltd/Schoeman Boerdery, Namutoni Boerdery (Pty) Ltd) and generally produce for the local market within Gauteng and Mpumalanga. Farmland is either used by owners or leased out on an annual basis to other farmers who will cultivate the land and/or use it to graze livestock. Farms provide permanent employment for a number of permanent employees, which include unskilled farm labour and semi-skilled managerial staff. Farming operations are solely dependent on ground and surface water as well as extensive support infrastructure, which include pivoted irrigation systems, warehouses, workshops, farm office and worker accommodation, etc. The aforementioned improvements are essential for commercial production and required substantial financial investments from farm owners.

Figure 10-27: Farmland on Palmietkuilen Ptn 2 prepared for commercial maize farming

Livestock Grazing

Several landowners are involved in livestock farming and use their properties to graze mostly cattle on areas specifically designated for grazing, or on harvested agricultural fields. Livestock farmers have established herds, of which they periodically sell off the young at local auctions and abattoirs or to feedlots; while other livestock farmers purchase animals annually and raise them to sell.

Grazing practices of households involved with subsistence livestock farming differ from commercial farmers in the sense that these households only possess very small numbers of livestock (e.g. pigs, goat, sheep and cattle) and rely on limited grazing areas within the extent of their homestead or community.

Residential Land Use

Land within the Project area is also used for residential purposes by numerous households. These households can be sub-divided into three broad categories: landowning households, households who formally lease residences on properties, and households of domestic/farm workers or non-landowning farm dwellers/occupants.

In most instances landowning families reside permanently on the affected properties, usually together with households comprising direct and/or extended families. Generally landowning families have resided on their land for several generations. For instance the Rossouw Poultry and Broiler Farm operations are a third generation family farm.

The Project area also hosts a substantial number of households of farm workers/dwellers, domestic workers and those employed at nearby towns (e.g. Springs, Endicott, Vischkuil, etc.). Of particular note is a community that resides on Portion 2 of Palmietkuilen 241 IR, which comprise approximately 70 households. A detailed profile of these households is presented in Section 10.1.14.2.5. In terms of Extension of Security of Tenure Act, 1997 (Act No. 62 of 1997) (ESTA), the aforementioned land occupiers are entitled to certain land tenure rights, which prevents new landowners and government from evicting them unless the provisions of ESTA have been strictly followed.

Public infrastructure

Infrastructure within the Project area includes formal and informal residential dwellings, buildings used for business purposes (e.g. commercial farming infrastructure), privately owned service infrastructure (e.g. boreholes, piping, pivot irrigation systems, and dams), public infrastructure (e.g. Eskom Substation, Strijdpan Road and transmission lines) and communal infrastructure which include Umbila Farm School which is situated adjacent to the community residing on Palmietkuilen 241 IR Ptn 2. Roads within the Project site include both tarred and gravel roads; the majority of these roads are deteriorated due to lack of maintenance and likely become very difficult to use after heavy rains. These roads are used on a daily basis to commute to urban centres such as Springs, Strubenvale and Endicott.

10.1.14.2.2 Neighbouring Properties

Livelihood activities on properties forming the north-east, east, and southern boundary of the MRA mostly comprise commercial maize farming (including dry land and irrigated fields), livestock grazing, commercial poultry farming operations and some residential uses. Generally these properties are sparsely populated with residential uses limited to the homes of the primary land user’s household and a number of dwellings occupied by either domestic or farm labourers. It should be noted that a number of residential structures on the north-eastern and eastern boundary of the MRA falls within a 500m radius of the open pit.

Aston Lake forms a substantial part of the western boundary of the mining right area, and separates the proposed mining operation from the Aston Lake Community on the opposite side of the water body.

10.1.14.2.3 Institutions and Settlements Surrounding the Primary Study Area

Several sensitive socio-economic *elements* were identified in the vicinity of the primary study area; each of these is described below:

Aston Lake Community

Land uses within the Aston Lake vary considerably and include residential, business and recreational uses. It is expected that those who own lakeside properties settled alongside the lake due to the proximity to the lake, tranquillity of the area, and associate recreational activities, while other landowners have purchased properties with the intention to develop residential accommodation.

Figure 10-28: Aston Lake and Community

Aston Lake

Aston Lake, also known as the Umbila Dam, is home ground to Benoni Angling Society. The Lake is used almost exclusively for recreational and/or competitive fishing, as no boats or jet skies are allowed. The Lake is mostly visited on weekends and is furnished with basic camping facilities and ablution services.

Figure 10-29: Recreational fishing at Aston Lake

Commercial Poultry Farming Operations

Several Commercial Poultry Farms are situated within the vicinity of the primary Project area, with the closest operation situated just more than 500m to the north of the proposed location of the Palmietkuilen open-pit. These operations include Rossouw Poultry and Broilers (Pty) Ltd that is part of the Rossgro Group, which has commenced commercial operations in 2003. The Rossgro Group is a family owned business, which specialises in the poultry industry, especially egg production, layer hen rearing, broiler production, and animal feeds.

Rossgro’s rearing farms receives chicks from stock breeding farms, these chicks are kept in chicken houses, which houses tens of thousands of birds at a time. Rearing operations in turn supply stock to Rossgro's broiler breeder and egg production farms. The Company have distribution outlets in Mpumalanga, Gauteng and Limpopo. Poultry produce is sold to major South African food retailers including Checkers Hyper, Shoprite and Pick and Pay.

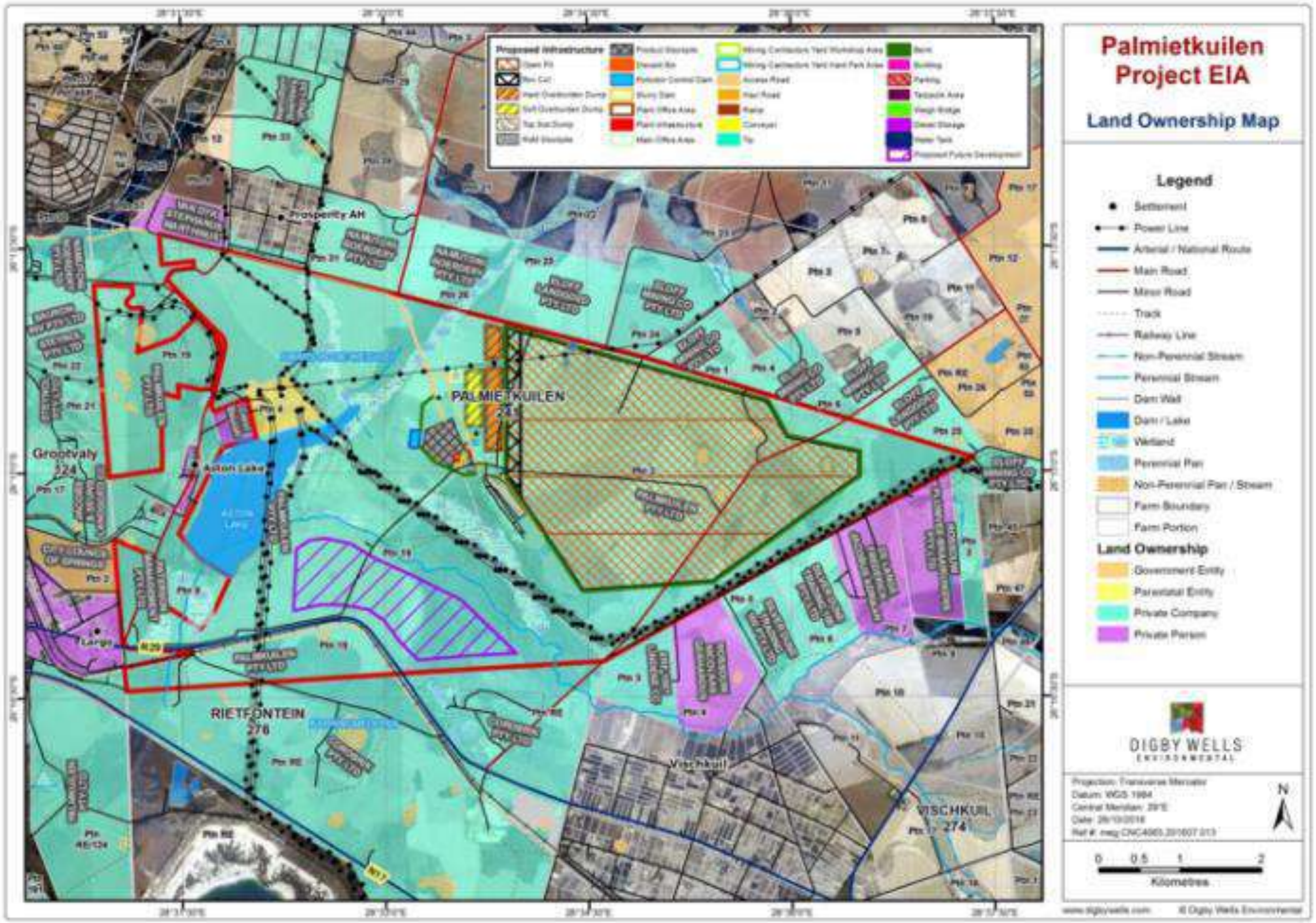
Poultry farms are generally managed and controlled on an exceptionally delicately balanced protocol which ensures the stability and well-being of the birds, any minor disturbance thereto will create a disruption and death. The major factors influencing the wellbeing of the birds are water, food, light, noise level, vibrations, and air quality. Due to the fact that mines often result in bio-physical impacts that change the levels of the aforementioned variable, these operations strongly prefer to be located some distance away from Mining and/or other Industrial operations, which could impact on the viability of the operations. Other considerations that need to be taken into account:

- Substantial investments are required to develop a commercial farming operations, such as those surrounding the proposed Project;
- Poultry farms, especially farms like the Rossouw Farm, which forms part of a of system of farms, directly and indirectly results in employment of hundreds people, who are either employed at the operation or at operations which are dependent on the potentially affected operation; and
- It is unlikely that the operation can be re-established elsewhere due to the fact poultry farms are usually linked to a continuous production cycle, for instance production farms cannot deliver products if breeding is temporarily stopped.

Figure 10-30: Commercial Poultry Farming Operation adjacent to the Mining Right Area

10.1.14.2.4 Land Ownership

Plan 41 below indicates that the Project area comprises mostly land under the private ownership of Palmietkuilen Pty Ltd, who also own Schoeman Boerdery, with several sections falling under parastatal ownership. Parastatal land within the Project area is owned by Eskom Pty Ltd, who operates a substation from the property. Palmietkuilen Pty Ltd, as well as several others (e.g. Namutoni Boerdery, Silver Dune Trading), own several properties within and surrounding the Project area. Usually, where a landowner owns several farms, these are generally all run as one business. Therefore, the sale of, or impact on, one farm could impact on the business operations of several farms.



Plan 41: Ownership of Properties within the Primary Study Area

10.1.14.2.5 Socio-Economic Characteristics and Livelihoods

The socio-economic household survey conducted for the Project explored the socio-economic characteristic of households and individuals who form part of the community who resides on Ptn 2 of Palmietkuilen 241 IR. A total of 45 households were included in the survey; these households comprised 204 household members. The findings of the survey are presented in the remainder of this section.

Demographics

The demographic attributes of surveyed households include the age and gender distribution of household members, sizes and composition of households, the incidence of polygamy, number of tenants, general migration trends, settlement patterns, home language, ethnicity and religion, as well as education and skills.

- Age and Gender Distribution

The age distribution of the surveyed population indicates a relatively old population with only 17% of household members being younger than 10 years, and an average age of almost 30 years. The population's gender ratio indicates that females and males are equally distributed. The age/gender distribution of the surveyed population is shown in Figure 10-31. The narrowing of the distribution amongst males in the 15-24 age brackets, likely suggests a nett out-migration of young men in search of economic opportunities elsewhere. Apart from that, the relatively narrow base of the pyramid (denoting a small proportion of young persons) suggests that the population growth rate is fairly low and/or potential high child mortality rate.

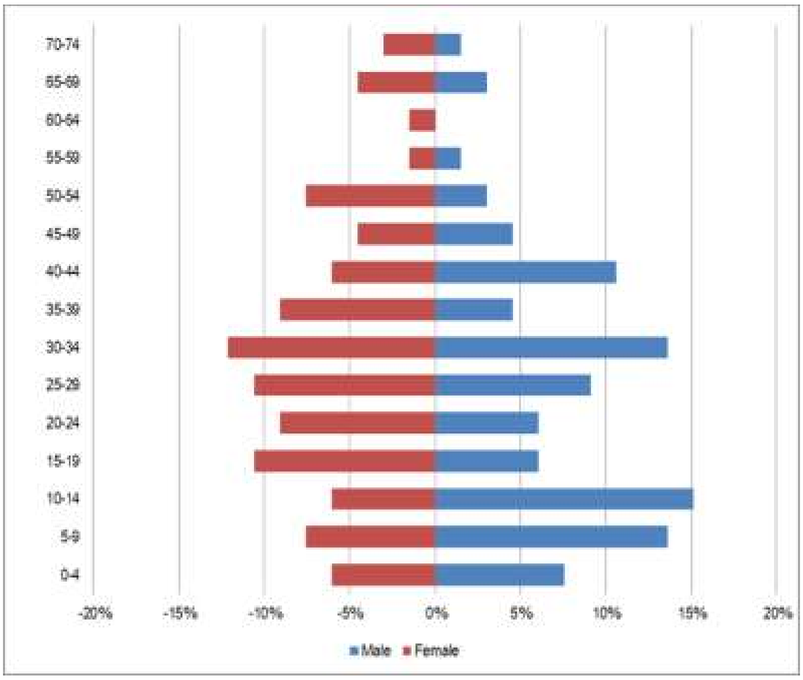


Figure 10-31: Age and gender distribution

- Household Composition

The average household size (calculated by dividing the total number of household members recorded during the survey by the number of surveyed households) is between four and five members. It is relatively uncommon for extended family members to share the same household; siblings, grandchildren, nieces and nephews, in-laws and parents of household heads comprise only 20% of the members of the surveyed households.

The composition of the average household is shown in Figure 10-32. Comparing the ratio of children to parents (household head or his/her spouse), the average couple in an average sized household has at least 1 child living with them. None of the households reported a female household head. Only one quarter of the persons aged 19 years or older are married, while divorce is relatively rare – having been reported by only 1% of surveyed individuals. The remainder are either living together with their partner (30%) or are single (43%).

In addition to permanent household members several homesteads also offer accommodation to tenants. Just more than a quarter of households (27%) rent out rooms to tenants, with the average number of tenants per affected household being between two and three persons. The survey recorded a total of 30 tenants.

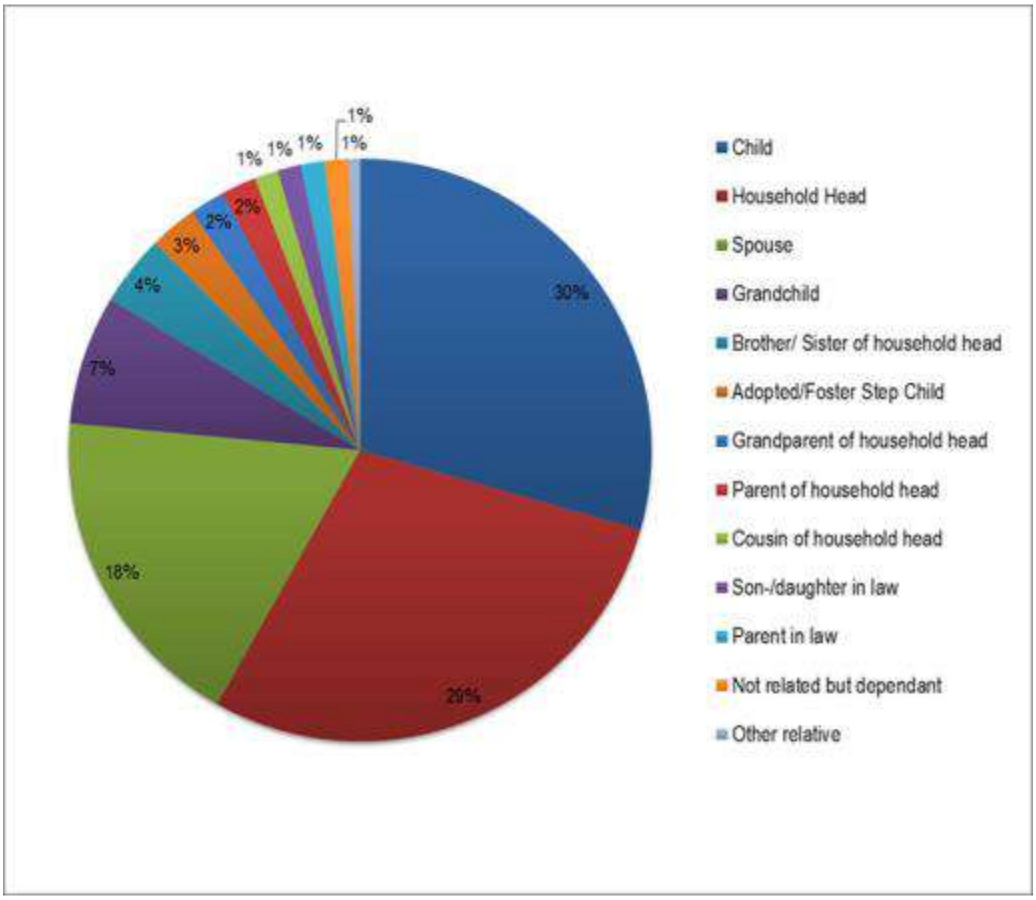


Figure 10-32: Relationship of household members to the household head

– Land Tenure and Residency

On average households occupied their current homestead for 25 years, although this varies between households (Table 10-80); with almost half of the households indicating that they have resided at their current dwelling for more than 30 years, followed by approximately a third of households who resided in the area for less than 20 years.

The majority of surveyed households are South African (94%) followed by those that have migrated from Lesotho (6%). South African households generally moved to their current residence from elsewhere in Gauteng, Mpumalanga, Kwazulu-Natal, or Limpopo. In almost all instances, households indicated that they were given permission by the farm owner to occupy the land.

Only 27% of households reported that they had to pay for the land (or use of the land) where they reside, payment is usually to the farm owner. It should be noted that this figure does not take into account the number of households who pay indirectly for housing through working on the farm where they reside. Most households (84%) indicated that they did not have an alternative home. Weekly or seasonal migration of household members is uncommon, with the entire adult population (aged 20 years or older) reportedly living in their households permanently.

Table 10-80: Duration of residency at Palmietkuilen 241 IR Ptn 2

Number of years	Proportion of households
5-9	13%
10-14	4%
15-19	13%
20-24	11%
25-29	9%
30-34	27%
35>	22%

- Language

Household languages are relatively diverse, with IsiZulu spoken by just more than half of surveyed households, followed by Sepedi/Sesotho (20%), isiXhosa (14%) and isiNdebele (6%) speaking households.

- Education and Skills

School attendance is relatively high amongst those of school going age (6-18 years), with most children (83%) attending primary school. Attendance varies considerably between boys (94%) and girls (69%), with attendance amongst girls being 25% lower.

Table 10-81 indicates that the relatively high rate of school attendance among the households' children is a relatively recent phenomenon; it is reflected in the relatively low education levels of adult household members, with nearly 51% of adults not having been able to complete primary schooling, of these 29% had no schooling at all. In contrast to the lower attendance rates among females reported earlier, the number of females who have completed primary education (50%) far outnumbers their male counterparts (29%). In terms of literacy, 59% of the surveyed population older than 10 years are able to read at a basic level, again with the number of literate females outnumbering their male counterparts.

Table 10-81: Education levels of persons over 18 years

Education level	Male	Female	Total
No education	39%	19%	29%
Some primary	26%	19%	22%
Some secondary	29%	50%	40%
Completed secondary	3%	13%	8%
Tertiary	3%	0%	2%

As part of the survey, respondents were presented with a list of skills (e.g., administrative, clerical, driving or mechanical skills.) that could provide opportunities for employment on mining-related projects. Respondents were asked to indicate whether any household members possessed one or more of the listed skills. Such “employable skills” are relatively rare among the surveyed household members; of the adult population, only 23 individuals indicated that they have any of the skills indicated in the questionnaire, with the most prominent skill being driving, followed by operation of heavy equipment (Table 10-82).

Table 10-82: Prevalence of employable skills among persons over 18 years

Skill	Total
Driving	13
Operation of heavy equipment	5
Computer Operating	2
Building/Construction	2
Plumbing	1
Total	**23**

Livelihoods

Livelihoods, in the sense that the term is used here, refer to strategies that households and individuals employ to meet their economic and survival needs. Such strategies may involve cash income, but this is not necessarily the case; as a household may also meet its needs through subsistence activities (e.g., growing food, and bartering produce for necessities). A household or individual may engage in more than one form of livelihood, some being cash-based and others being subsistence-oriented.

The first sub-section below outlines the main livelihood strategies of surveyed *households*. This is followed by a discussion of the economic activities of *individual* household members, and how this contributes to the overall household economy. The third sub-section gives and overview of households' income and expenses. The final sub-sections discuss some of the most prevalent livelihood strategies among the surveyed population, namely agriculture, self-employment/piecework and petty trading.

- Household Livelihood Strategies

As was mentioned, a household may pursue more than one livelihood strategy. Nearly two thirds of surveyed households (63%) rely on two or more types of livelihoods. Figure 10-33 depicts the most common forms of livelihood identified amongst the survey population and indicates the percentage of households who identified each as being either their most important or second-most important form of livelihood. The figure shows that salaried employment at surrounding commercial farms is the most important means of survival for the majority of households: 41% of households identified this as their primary livelihood, while another 3% identified it as their second-most important source of livelihood. The next-most common forms of livelihoods are self-employment (which is important either as a primary or a secondary source of livelihood) and sales of livestock or livestock products (which is equally important as a primary and secondary source of livelihood). Social grants form the second most important source of livelihood for only 11% of surveyed households.

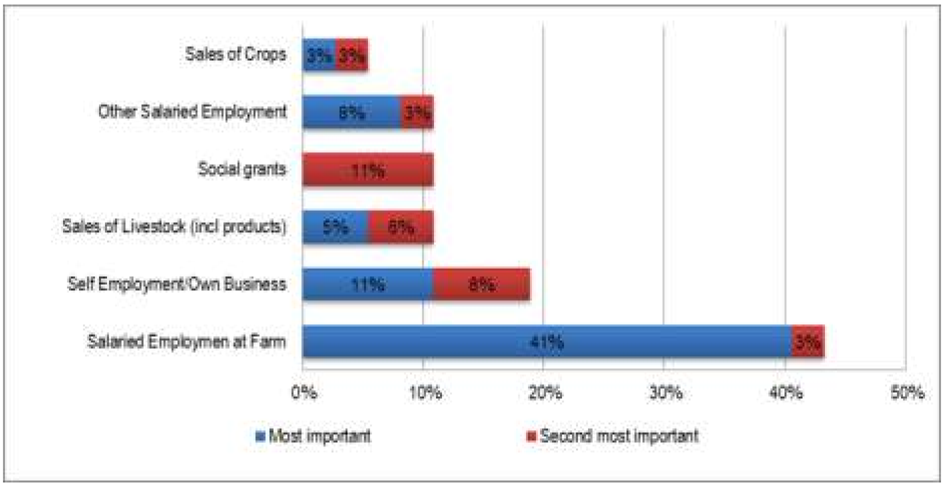


Figure 10-33: Livelihood strategies and their importance to households

- Contribution of individuals to the households economy

In keeping with the results that farming related employment is the most common primary *household* livelihood strategy, this activity is also the most frequent occupation among *individuals* aged 18 years and older. As indicated in Table 10-83, 22% of surveyed adults cited farm-related employment as their primary occupation; this is followed by day labour/piecework and petty trading (if non-income related activities such as staying at home, not looking for work or still in school/studying are disregarded). Almost no adult household members indicated that they practice a secondary occupation to supplement household income.

Table 10-83: Primary occupations of persons 18 and older

Livelihood activity	% of population
Employed as Farmworker	22%
Unemployed and looking for Work	22%
Day Labourer/Pieceworker	14%
Petty Trading	12%
Staying at home not looking for work	8%
Social grants	8%
Livestock Sales	6%
Other salaried employment	6%
Domestic worker	2%
Too old/sick to work	2%

- Household Income and Expenses

Only 42% of surveyed households reported that they received some form of cash income in the month prior to the survey. Table 10-84 lists the most common sources of households' main monetary income. Following this, Figure 10-34 provides a more detailed breakdown of income sources; it also indicates which income streams are regular (i.e. weekly or monthly), occasional (several times a year) or infrequent (once or twice a year, or less). As can be seen from the figure, about one-quarter of the surveyed households earn cash income from farm related-employment. A relatively large proportion of households (17%) reported that they receive a regular income from social grants. Monthly income from farm-related to employment was between R 1000 and R 5000 per month, while the amount received from social grants tend to be less than R 1000.

Table 10-84: Main sources of cash income

Income source	Proportion of households
Salary from Farm related employment	23%
Other Salaried/Waged employment	16%
Social grants/pension	14%
Tenants	12%
Self-employment	9%

Livestock sales	9%
Crop sales	9%
Petty trading	9%
Mining employment	7%

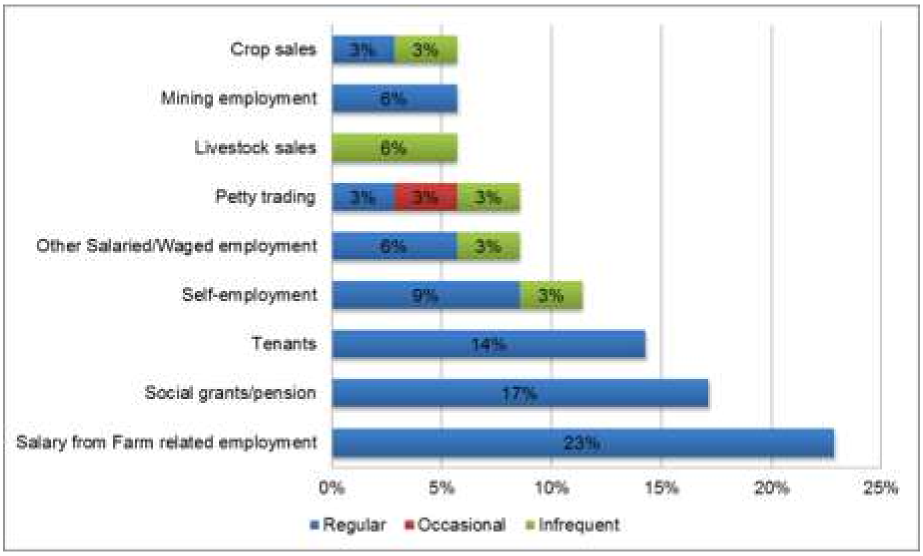


Figure 10-34: Sources of cash income

The most important household *expenditure* items are shown in Table 10-85. The table indicates the percentage of households who deemed each item as important, and have spent money on that item during the month preceding the survey. Food is by far the most common and important expenditure item, followed by medical expenses and clothes.

The average amount spent on each item is shown in

Table 10-86 below, which indicates that households on average spend more money on food than any other item; relatively large amounts are also spent on medical costs, transport, clothes and child care. It is estimated that households spent on average just more than R 5 500 in the month prior to the survey.

Table 10-85: Most important expenditure items

Expense item	% Households for which this is the most important expenditure item	% Households for which this is the second most important expenditure item	% Households for which this is the third most important expenditure item
Food	64%	14%	13%
Child care	4%	27%	26%
Clothes	0%	32%	13%
Furniture	28%	5%	0%
Household energy	0%	18%	9%
Education	0%	0%	13%
Personal care items	4%	0%	9%
Medical expenses	0%	0%	9%
Transport	0%	0%	4%
Cigarettes and alcohol	0%	0%	4%
Livestock expenditure	0%	5%	0%

Table 10-86: Average expenditure on items during the previous month (entire household)

Expense item	Estimated Amount
Food	R 929.07
Child Care	R 660.00
Clothes	R 762.50
Household Energy	R 160.00
Education	R 500.00
Personal Care Items	R 500.00
Medical Expenses	R 750.00
Transport	R 700.00
Cigarettes and Alcohol	R 300.00
Livestock Expenditure	R 250.00
Total	**R 5 511.57**

- Agriculture

Farming is an important livelihood strategy for several households, both as a supplementary food source, and as a means to generate an income. Almost two thirds of households indicated that they have access to arable land which they use, or have used in the past, for cultivation. This land is usually limited to single fields or vegetables patches located near the homestead. The majority of households who *do not* have access to land (78%), indicated that they either have no need for land or that there is not enough land available to produce a sufficient amount of food.

Households are generally allowed by the landowner to use land for small-scale agriculture at no additional cost; however, several households indicated that they have to rent land from the farmer for cultivation. Households tend to have access to very small pieces of arable land, which limits cultivation to vegetable gardens. The most common types of vegetables grown by surveyed households include potatoes, pumpkin, spinach and beans. It is common for households to either sell all of these crops or consume all, with almost none of the households indicating that they produce enough for dual usage.

- Livestock

Livestock husbandry is fairly uncommon amongst the surveyed households, and it is mostly limited to poultry; however some households do own sheep, pigs or goats. Only 13 of surveyed households have poultry (mostly chickens). Most households keep livestock and poultry either for domestic consumption or sales or a combination thereof.

Table 10-87: Types, numbers and uses of livestock

Type of livestock	Number of households with at least one	Average no. per household
Poultry	13	19
Pigs	2	16
Goats	2	23
Sheep	2	3

Almost two thirds of households (65%) reported that they do not have any access to grazing areas for their livestock, which is why very few households own livestock. This is understandable as the most common type of livestock is poultry, which are typically left to wander around the homestead. Households, who do have access to grazing areas, usually do not have to travel considerable distances to reach them, with an average time taken to reach a grazing area being within 3 minutes, indicating that animals are grazed within the general pastures of the community.

When households who reported *not* having access to grazing land were asked the reasons for this, the most common answers (apart from the one that the household does not own any livestock) were that they had no permission to graze animals on the lands surrounding the property they currently reside.

Infrastructure and Services

This section discusses infrastructure and services, including housing, water and sanitation, refuse disposal, energy and fuel used for domestic purposes, transport, communication, and access to education and health facilities.

Social services and amenities are relatively well utilised by the displaced households; Table 10-88 shows the percentage of households who use a variety of services, as well as the first, second and third most common location where the respective services/resources are accessed. The most common access points for services are Springs, Endicott and Kwa-Thema.

Table 10-88: Utilisation of services/resources

Service	Most common location for access	% accessing	2nd most common location for access	% accessing	3rd most common location for access	% accessing
Primary school	Kwa-Thema	64%	Springs	36%	n/a	-
Secondary school	Kwa-Thema	70%	Springs	30%	n/a	-
Clinic	Springs	44%	Endicott	44%	Kwa-Thema	8%
Hospital	Springs	61%	Heidelberg	26%	Endicott	13%
Shops	Springs	100%	n/a	-	n/a	-
Bank	Springs	100%	n/a	-	n/a	-
Pension/ grant pay point	Springs	86%	Endicott	14%	n/a	-
Police station	Springs	100%	n/a	-	n/a	-

- Housing and Structures

The average number of structures per household is two, although some have as many as 6 structures. More than 70% of households have a combination of structures which include at least a brick house, a tin shack and a standalone toilet facility (Table 10-89).

Table 10-89: Types of household structures

Type of structure	Number	% of households with at least 1	Average number
Mud hut/ traditional dwelling	1	2%	2
Jojo Tank	1	2%	2
Standalone shop/Business	4	9%	1
Graves	6	13%	3
Storage	6	13%	1
Kitchen	8	17%	1
Veranda (Stoep)	22	47%	1
Toilet	33	70%	1
Tin shack	36	77%	1
Brick house	41	87%	5

– Water, Sanitation, Refuse disposal and Energy

All households obtain water for domestic purposes from a tap inside their homestead. Apart from human consumption and washing, households also commonly use water for irrigation of crops and tending to livestock.

The types of sanitation facilities used by households are shown in Figure 10-35. Pit latrines are by far the most common, accessed by three quarters of all households; however, almost one tenth of households do not have access to any sanitation facility and resort to using the bush. It is relatively common for households to share sanitation facilities, with just less than 15% of households indicating that they share their facility with another household. Access to sophisticated refuse disposal methods are lacking among surveyed households. Village or communal dumping of refuse is by far the most common method of discarding refuse (75%).

All surveyed households indicated that they have access to electricity; despite this households still rely on a variety of energy sources (electricity, coal, wood and paraffin) for cooking purposes. In contrast all households use electricity for lighting.

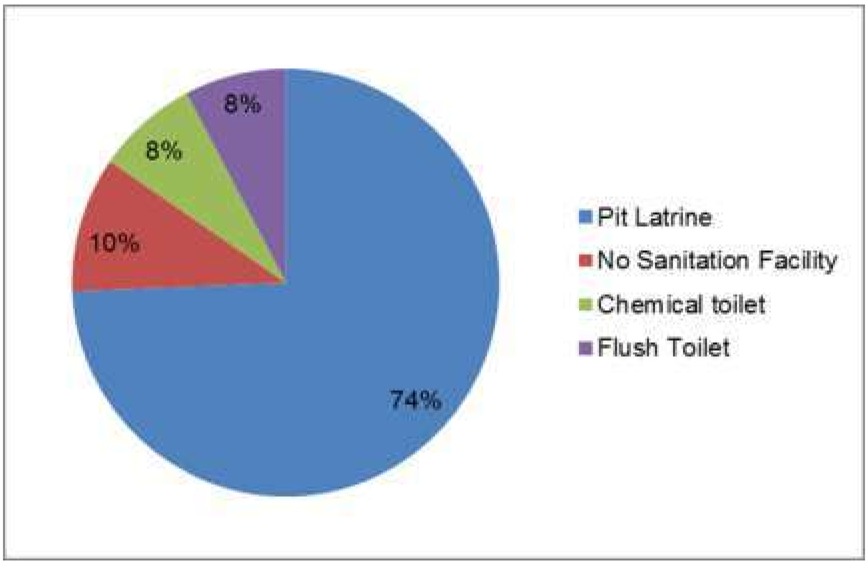


Figure 10-35: Type of household sanitation

- Transport

Table 10-90 shows the principal method of transport to work as well as shops and services, which reveals that the varying methods are used for each purpose. Travel by foot is the primary means of transport to work (which is mostly on surrounding farms), followed by public transport. Public transport is the most common mode of travel to shops and other public services, which are located in areas such as Springs and Kwa-Thema.

Table 10-90: Principal mode of transport to work and shops

Destination	On foot	Public transport	Other
Work	71%	17%	12%
Shops and services	11%	82%	8%

- Healthcare Facilities

Healthcare facilities are well utilised among the displaced households. All households indicated that they were able to access a public hospital or clinic the last time one of the household's members fell ill. Just less than two thirds of households indicated that at least one household member visited a public health care facility in the two weeks prior to the survey. None of the households opted to consult a traditional healer as their first point of consultation. On average, households are within an hour and 10 minutes' walk of a public health care facility.

Indicators of Poverty and Vulnerability

Indicators of poverty and vulnerability investigated as part of the household survey includes food security, money shortages, health indicators, ownership of moveable assets, common problems and needs, and the presence of social networks.

- Food Security

The majority of households (72%) indicated that they had suffered food shortages at some period during the year prior to the socio-economic survey. The period during which household's experienced shortages varies considerably, however, a slightly larger proportion of households seem to have shortages during the first seven months of the year. The period of shortages coincides with the period during which money shortages are experienced by most households, namely January to July (Figure 10-36).

Insufficient financial resources (which either prevent households from buying/growing food or force them to sell domestically-grown food to secure cash, as reported earlier), is the most frequently cited reason (84%) for inadequate nutrition, followed by lack of access to markets to purchase food (11%) and households who sold their food for cash income (5%).

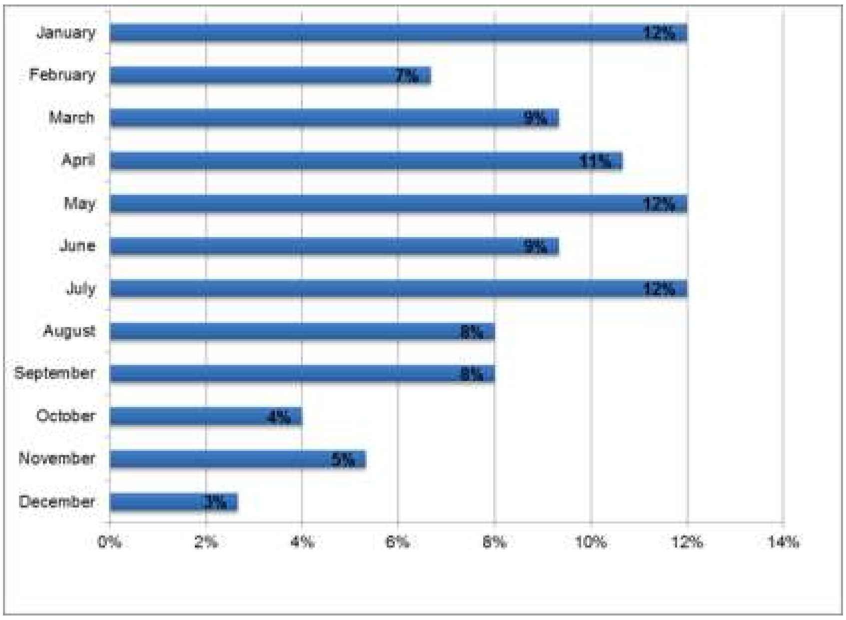


Figure 10-36: Months during which food shortages were experienced

- Money Shortages

The majority (73%) of surveyed households experienced money shortages in the year prior to the survey. The average duration of shortages is three months, while some households experience a chronic shortage. Shortages are most common from January to July (Figure 10-37).

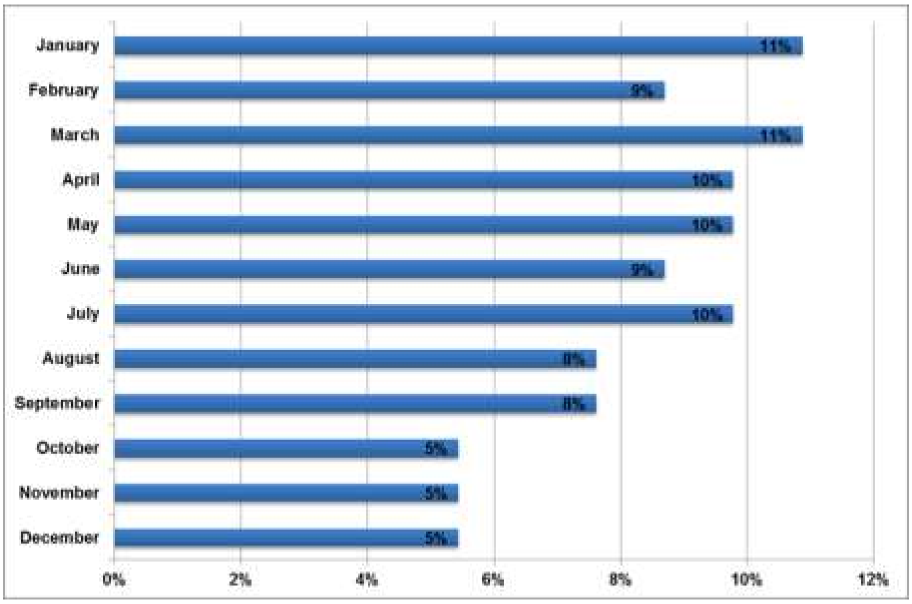


Figure 10-37: Months during which money shortages occur

- Health

Aspects of community health that were assessed during the survey include:

- Prevalence of disabilities;
- Knowledge and behaviour pertaining to HIV/AIDS; and
- General community health issues.

- Disabilities

Disabilities pertaining to sight, hearing and mobility are the most common among surveyed households, with a total of 13 households having at least one member affected by one or more of these disabilities.

- Knowledge of HIV/ AIDS

Knowledge and testing of HIV/AIDS is common among households, with 86% of interviewed members indicating that they are aware of the Virus, although being tested for the HIV/AIDS is lacking slightly behind awareness of the condition, with 11% less households having at least one member who has been tested (Figure 10-38). However, 52% of households reported that they had between two and five members tested for HIV/AIDS.

Related to the above aspect, is knowledge pertaining to the availability of condoms within the household's community. Almost all households (97%) affirmed that condoms are available in their community.

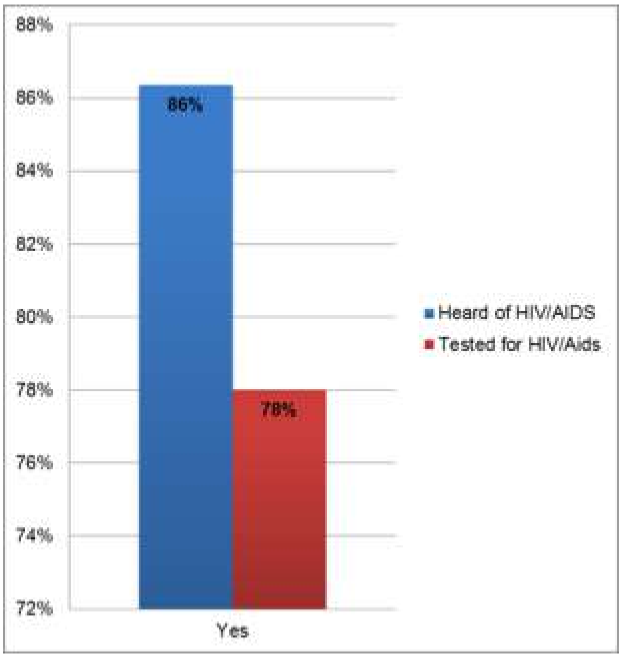


Figure 10-38: Knowledge of HIV/ AIDS and prevalence of testing

- Community Health

Households were presented with a list of common health conditions, and were asked to indicate if any of their family members had suffered from the conditions over the past three years. As shown in Table 10-91 below, eye infections, stomach problems and high blood pressure is the most common disease to affect households, with between 15 and 20% of households having had on average one member infected over the past year. In most cases, households seek treatment from a modern health facility only.

Households were also asked about health problems resulting in death of family members, in the past five years. The mortality rate among the surveyed population was extremely low, with only 2% of households reported that they have lost someone during this period. In most instances the cause of death was unknown.

Table 10-91: Prevalence of common health conditions

Health condition	% affected households	Average number per household	Treatment method	
			Modern	Traditional and modern
Eye infection	20%	1	100%	0%
Stomach ache	20%	1	100%	0%
High blood pressure	15%	1	50%	50%
Skin rash	12%	1	80%	20%
Diabetes	10%	1	50%	50%
Witchcraft	5%	1	0%	100%

Health condition	% affected households	Average number per household	Treatment method	
			Modern	Traditional and modern
Edema	5%	1	100%	0%
Respiratory illness	5%	1	100%	0%
Worms	5%	1	100%	0%
Diarrhoea	5%	1	100%	0%
Overall		**1**	**82%**	**18%**

- Ownership of Assets and Facilities

As indicated in

Table **10-92**, most common household assets include basic necessities, including cell phones (100% of households, average of two per households), beds and tables (more than 92% of households own at least 2 of each), stove, and bank accounts.

Table 10-92: Assets and facilities

Asset	% households who own at least one	Average per households (among those who own any)
Cell phone	100.0%	2
Table	96.2%	2
Television	96.2%	2
Bed	92.3%	2
Electric Stove	88.5%	1
Bank Account	80.8%	1
Refrigerator	76.9%	1
Radio	73.1%	1
DVD	69.2%	1
Washing Machine	53.8%	1
Coal/Paraffin Stove	46.2%	1
DSTV	34.6%	1
Satellite Dish	34.6%	1
Car	23.1%	1
Personal computer	23.1%	1
Geyser	11.5%	1

Asset	% households who own at least one	Average per households (among those who own any)
Bicycle	11.5%	1
Motorcycle	7.7%	1

– Problems and Needs

During the survey, respondents were presented with a list of putative problems or needs, and then asked to indicate the severity of each in their community. The responses are summarised in Figure 10-39. Lack of employment, transport, health care facilities, access to businesses or markets, and education are all problems that negatively influence the quality of life of at least 72% of households. Eviction from land, illegal land uses, community conflict and prostitution seemingly do not concern most households.

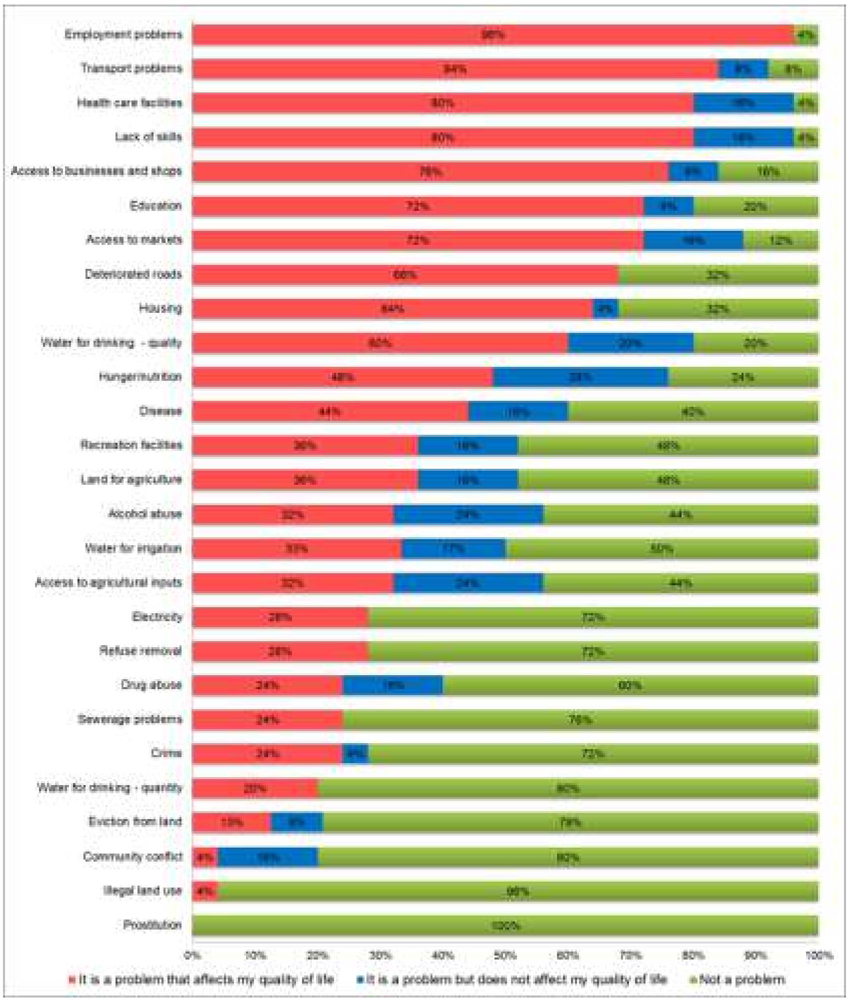


Figure 10-39: Needs analysis

– Social Networks

The lack of social networks constitutes an indicator of vulnerability, since such networks can play a significant role in terms of providing support and assistance to households who are experiencing difficulties. During the socio-economic survey, almost two thirds of respondents (63%) indicated that they have relatives in other households in the community where they reside. Just more than half of all households depend on relatives and friends in the same settlement for assistance with taking care of sick, elderly and children, finding employment, exchanging goods and services and borrowing money.

10.1.14.2.6 Stakeholder Perceptions

Stakeholder perceptions of a proposed development are critical inputs into the SIA process. While perceptions are frequently based on insufficient information, this in itself may lead to, or increase, resistance to the proposed development. Insufficient project information could also raise unrealistic expectations amongst affected parties and/or host communities. A thorough understanding of the origin of stakeholder perceptions is therefore required, not only to put impacts into perspective, but also to identify mitigation measures that will address potential social risks to the proposed project.

In addition to the stakeholders interviewed for the SIA study (refer to the detailed methodology provided in the SIA, Appendix N), the SIA also takes into account the stakeholder issues and concerns raised during the public participation process for the EIA study (which is on-going) (DWE, 2015g). The EIA public participation process has already consulted key stakeholders and government departments at the regional level, as well as some farm owners and other local-level stakeholders. Consultations for the SIA focused on potentially affected parties in the project area.

The main ‘social’ issues and concerns raised these respondents are summarised below:

- In general landowners are very resistant to the project, as they have seen what happens at other open cast coal mines, throughout the surrounding area, e.g. Delmas, Rehabilitated Gold Mining Operations in Springs etc. They are concerned that the implementation of mitigation will not continue and that rehabilitation will not take place;
- Coal dust will affect grazing capacity of land as well as have major implications for farmers who cultivate grazing, which they then harvest and sell to cattle farmers;
- Most directly affected households indicated that it would be impossible for them to reside within the vicinity of an operational Coal Mine, and recommended that the Mine purchases their entire property;
- Potential resettlement of farmworkers and associated loss of livelihoods: If property owners sell their farms, their farm workers will be without work and place of residence. They do not have the skills to work on the Project, and they and their families will be devastated;

- Loss of sense of community, mostly as a result that the proximity of the operation will result in people moving out of the immediate area, which will break up existing community networks – that are important to the farming community;
- Several landowners strongly recommended that if the applicant considers to buy them out, the sales agreement should (a.) compensate for any standing business-related costs and (b.) allow sufficient time to re-establish the farm/business elsewhere. It was cautioned that the relocation process is complicated by the fact that you need to re-establish infrastructure etc.;
- Stakeholders recommended that the Mine should appoint an independent property valuation expert to value their properties pre-mining, and that this valuation should inform any future negotiations in terms of purchases;
- Strongly feels that the regulatory authorities (DMR, DEA, Local and Regional Government etc.,) are not competent and diligent enough to regulate stipulations in EMPs. In other words it is irrelevant of what the EIA team suggest to mitigate potential impacts, the regulation of these measures will inevitably fail, which has been seen at many other mines;
- Concerned that the project can exacerbate existing population influx into surrounding townships and/or informal settlement, which may place additional pressure on housing and increase the incidence of crime;
- Insufficient/selective consultation: Several landowners and land users have reportedly not been informed and consulted about project;
- Insufficient information leads to feelings of uncertainty/insecurity. Business owners are reluctant to plan ahead, or implement medium- to long term plans that are already in an advanced planning stage (for example expansion of current business and farming operations);
- Owners of properties neighbouring the mine, which will likely not be bought out by the mine, are concerned that the mine will ultimately result in a devaluation of property or impact the viability of their farming operations. Several landowners indicated that they purchased these properties for investment purposes and would actually incur financial losses if the Mine is developed;
- A large number of respondents are concerned that blasting will result in structural damage to residential and business structures;
- The land area in which the site falls is zoned for agriculture, and should be rezoned accordingly;
- Farmers will insist that the project proponent buys the whole property, in case properties are affected by mining or surface infrastructure, and not only portions thereof, as most farmers would not prefer farming next to a mining operation;
- Loss of sense of place, mostly as a result of potential air, noise and visual pollution, population influx, increased traffic and perceived increase in crime. Property owners

have acquired land and developed their properties out of a love for characteristics of the area, mining related pollution could have devastating effects on the sense of community among farmers;

- Pollution/depletion of ground and surface water. It is strongly believed that the proposed mine could deplete and/or pollute water sources. All the properties and livestock farming operations are exclusively reliant on groundwater;
- Pressure on community services and public infrastructure, especially roads. Most respondents expressed a concern with regards to the potential deterioration of local roads;
- Population influx and the presence of a construction workforce will lead to increases in social pathologies; deteriorating safety and security conditions;
- Uncertainties to whether compensation will be sufficient and timed correctly to re-establish businesses and residences elsewhere.

10.1.14.3 Sensitivity Analysis and No-Go Areas

Two types of project alternatives are considered in this section:

- The “no-go” option and alternative uses of the Project area in the event that the Project is not implemented; and
- Alternative infrastructure options and layouts.

10.1.14.3.1 The “No-Go” Option and Land Use Alternatives

The No-Go Option

The most pertinent project alternative in the case of this project is the ***no-go alternative***. The approach adopted in the assessment of impacts in this study entailed a comparison between anticipated future socio-economic conditions, with and without the Project. Hence the no-go alternative would essentially imply that none of the impacts (negative and positive) would materialise, and that socio-economic conditions in the Project area would continue to display their current characteristics and trends.

Alternative Land Use Options

When considering the allocation of land for development and in deciding applications for planning permission affecting agricultural land, the agricultural implications must be considered together with the environmental, cultural and socio-economic aspects. In particular, prime quality agricultural land should normally be protected against permanent development or irreversible damage, such as in the case of the proposed Project.

Land use decisions must be evaluated in terms of sustainability, broadly defined as balancing environmental, economic and social equity concerns. The primary land use categories that encompass basic functions are residential, commercial, industrial, recreational, institutional and agricultural uses. Optimal land use is determined by a number of factors, including climate, resources, population growth, economic activity and topography. When considering a new development for an area, it is required that other land use alternatives are considered to ensure that the development is justified and viable.

If not used for mining (the no-go option), possible alternative ***land uses*** include commercial agriculture combined with low-density residential uses (current land use). With regards to ***agriculture***, the soils and land use impact assessment has found that the project site is situated on prime agricultural land (Digby Wells, 2015e). Due to the developed agricultural land, the possibility of using the proposed project site for ***residential*** purposes is unlikely. However, it should be considered that due to steady population growth and existing housing demand in the region, the likelihood of using the proposed project site for ***residential*** purposes is increasing as housing demand increases.

Mining appears to be the most viable and appropriate land use option from a social perspective, as it will result in considerably more economic growth and socio-economic development than either residential use and/or commercial agriculture (Economic impact Assessment, 2016), by offering the following:

- New direct and indirect employment opportunities for local community members;
- Enhancing the skills base among local community members and allowing for income generating activities;
- Growth and diversification of the local and regional economy;
- Increased economic contribution to the municipal areas, enabling better development of the towns and surrounding areas; and
- Increased power generation and associated downstream benefits as result of increase in security of coal supply.

10.1.14.3.2 Mine Plan, Infrastructure Layout and Affected Land Uses

As part of the Scoping Phase of the Project, sensitivities were identified for the various environmental and social aspects considered alongside the proposed development footprint. The identified sensitivities were plotted against the initial infrastructure site layout and conveyor and road routing options. Based on the results of the various specialist findings, the initial proposed development footprint was amended to reduce significant negative impacts to the current environment and associated aspects.

Current project planning indicates that alternative transport coal transport methods are still being considered, this being hauling coal via truck or conveyor to the Welgedacht siding, along the same route along the northern boundary of the mining right area. These two options are almost equally undesirable from a social perspective and will not result in significantly different impacts, as both alignments are uninhabited and are expected to have similar visual intrusion, property fragmentation and displacement impacts.

10.1.15 -Economic

Urban-Econ Development Economists was appointed to undertake the Economic Impact Assessment (Appendix O) undertaken during the EIA Phase. Primary and secondary data were gathered to create the socio-economic profile of the delineated zone of influence. The baseline profile assisted in gaining an understanding of the communities and economic activities to be likely affected or benefit from the proposed project. This included description of the study area's composition and locational factors and economic and labour profiles. Specific attention was paid to the economic composition of the area affected by the project's footprint and its potential environmental effects, i.e. visual, noise, air pollution, etc.

10.1.15.1 Economic Profile of the Lesedi Local Municipality

Several indicators exist that can describe the economy of a region or an area. The most common variables that are used for the analysis include production and Gross Domestic Product per Region (GDP-R) or Gross Value Added (GVA). The GDP-R represents the total value of sales of goods and services, or the turnover of all economic agents in a region; while the GVA, using the output approach, represents the sum of value added created by all residents within a certain period, which is typically a year. The trend at which the GDP-R has been changing in the past is also referred to as an economic growth indicator. It is a measure of both the performance of an area and the well-being of the citizens of an area.

The GDP-R of the LLM was valued at R7 241 million in 2015 in current prices (Quantec, 2016). The Lesedi economy accounted for 12% of the Sedibeng District Municipality's Gross Domestic Product (GDP) and contributed 0.6% towards Gauteng's GDP. Evidently, the Lesedi Local Municipality, at a provincial level, constitutes a relatively small economic production and output.

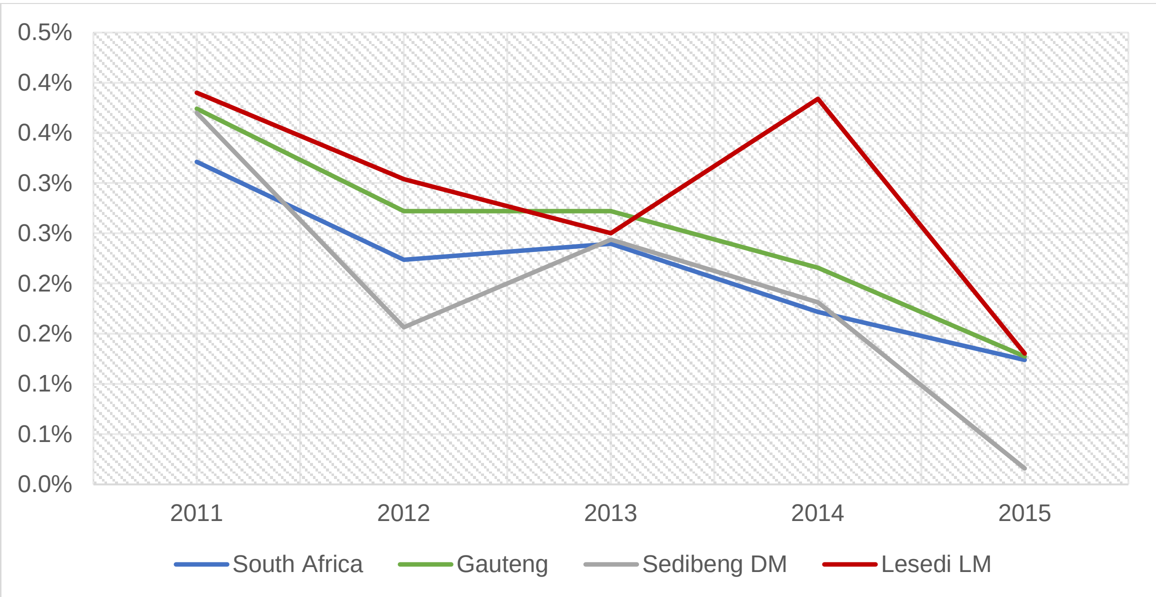


Figure 10-40: GDP-R growth trends for study areas (Urban-Econ Calculations based on Quantec, 2016)

Figure 10-40 above indicates that the Lesedi LM has had an average growth rate of 2.9% between 2011 and 2015. This was higher than the average growth rates observed for the other economies, such as the district, the province and the country, suggesting that the Lesedi economy is more resilient towards external fluctuations and was capable to show better performance in the challenging domestic and global economic environment observed in the past few years. Similar to the other economies under analysis, it has shown a steady slowdown in economic growth. A further stagnation of economic growth is forecast expected for 2016 to 2017 due to the drought and political uncertainties.

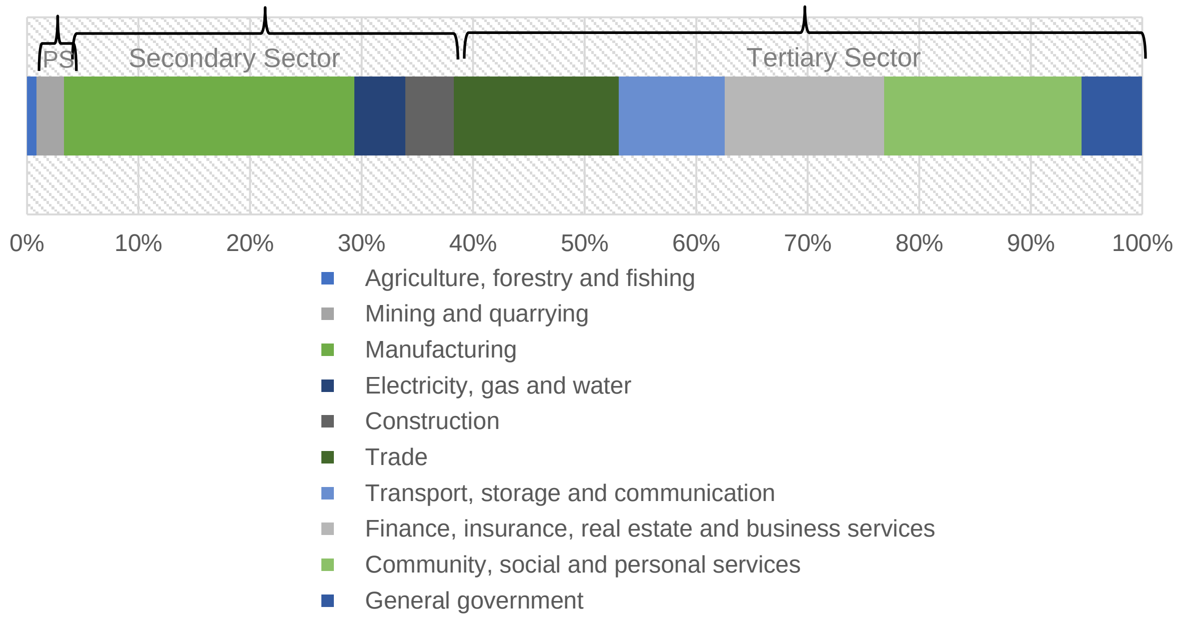


Figure 10-41: Lesedi Local Municipality Economic Sectors Composition (Quantec, 2016)

The Manufacturing Sector, Community, Social and Personal Services and the Trade Sector are the top contributing industries to the GDP in the LLM. In addition, the tertiary sector has the greatest contribution (62%) to the overall GDP of LLM. This indicates that as much as Lesedi is largely considered rural and agricultural, it has progressed and evolved significantly with regard to the secondary and tertiary sectors over time. This is in line with global shifts and transitions across sectors of the economy. The secondary sector makes up 35% of the municipality's GDP.

All sectors, excluding general government have experienced a decline in GDP between 2014 and 2015. Additionally, all sectors have had fluctuating growth rates over the past five years, with a common trend of the most drastic decline from 2008 due to the global financial and local electricity crisis. Lastly, the general government sector has had the steadiest growth rate over the past four years.

10.1.15.1.1 Lesedi labour force and its dynamics

Employment is the primary means by which individuals who are of working age may earn an income that will enable them to provide for their basic needs. As such, employment and unemployment rates are important indicators of economic well-being. Employment figures further serve as indicators of labour market performance. This, additionally, provides information pertaining to economic sectors and their respective labour absorption. The following paragraphs examine the study area's labour force and dynamics.

Table 10-93: Labour Statistics

Indicators	South Africa	Gauteng	Sedibeng DM	Lesedi LM
Total Population	51770562	12272264	916485	99519
Working Age Population	33919109	310407	637320	68274
Employed	13254829	4481719	272706	31764
Formal	9772038	3416349	206129	22755
Informal	1640933	408178	26427	3527
Unemployed	5586624	1592928	126921	10940

(Source: Stats SA, 2011)

In 2011, 65.5% of South Africans were of working age. Similarly, 68% of LLM residents were of working age. Just under half of the working age population of the LLM was employed, and the majority of these were working in the formal sector. At the same time, on a local level, 16% of the working age population are unemployed whereas on a provincial and national level, the unemployment rates were 18% and 25%, respectively (Stats SA, 2011). The above suggests that the employment situation in the Lesedi LM was on average better than that in the province or nationwide.

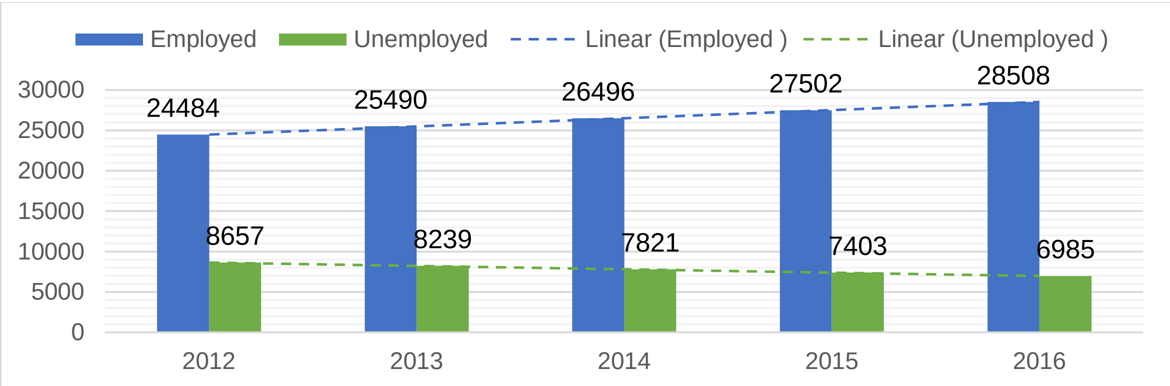


Figure 10-42: Five-year employment and unemployment trends for Lesedi Local Municipality (Urban-Econ Calculations based on Quantec, 2013)

Over the five-year period from 2012-2016, the number of the unemployed labour force has been decreasing. On the contrary, in the same period, the number of employed people has been increasing. These trends indicate that employment situation is gradually improving on an annual basis in the LLM. At a national scale, though, the employed and unemployed are both gradually increasing on an annual basis.

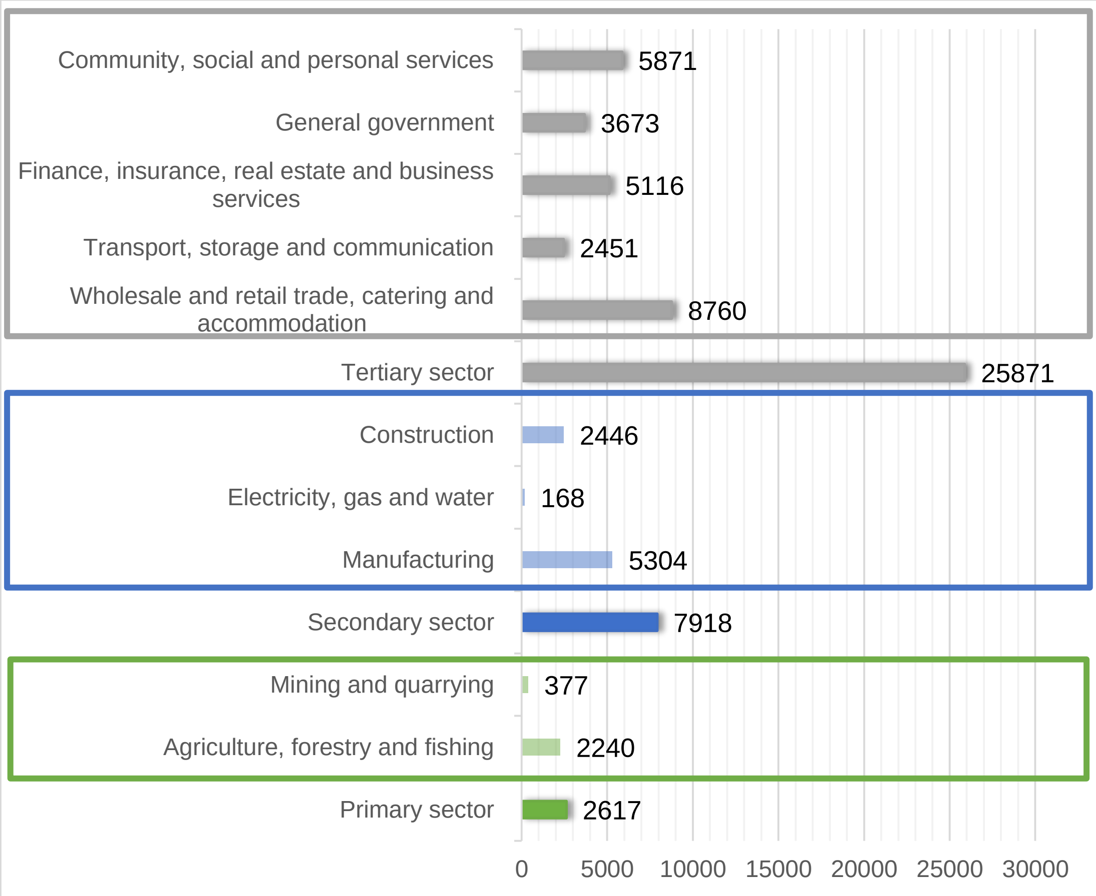


Figure 10-43: Employment by Sector Lesedi LM (Quantec, 2015)

Of all the sectors of the economy, the tertiary sector employs the largest number of people. The specific sectors with the highest employment numbers are wholesale and retail trade, catering and accommodation, community, social and personal services and manufacturing. The aforementioned sectors are evidently key sectors in the municipality, given that a similar trend was observed in terms of their contribution to GDP. Most of the sectors have had a gradual increase in employment over the past five years. The transport, storage and communication and construction sector have had the highest increase in employment. No significant job shedding has occurred in the past five years in all the local sectors.

Mining contributes a very small percentage towards employment in the LLM. In 2015, it employed about 377 people. Agriculture on the other hand, provided 6.2% of all employment opportunities in the municipality. Importantly, its employment has been steadily increasing in the last few years; while employment by the mining sector has been stagnating.

10.1.15.1.2 Lesedi income levels

In general, household income levels are a basis for determining poverty levels in a community. Additionally, the income levels of a particular area provide some insight into the economic behaviour of a particular community, i.e. the purchasing power of that community and vulnerability to changes in the economy. Table 10-94 indicates the distribution of monthly household income for the different study areas.

Table 10-94: Household Income across study areas

	Study Area			
	South Africa	**Gauteng**	**Sedibeng**	**Lesedi**
01 No income	2 152 374	641 878	47 326	4 310
02 R1-R4800	646 925	133 482	12 872	1 195
03 R4801-R9600	1 076 164	191 067	18 918	1 744
04 R9601-R19200	2 464 927	446 414	43 369	4 720
05 R19201-R38400	2 751 482	646 012	48 080	5 622
06 R38401-R76800	1 887 290	562 895	38 100	4 359
07 R76801-R153600	1 338 859	426 949	29 710	3 175
08 R153601-R307200	1 045 790	365 495	22 258	2 275
09 R307201-R614400	685 507	285 292	13 045	1 468
10 R614401-R1228800	270 758	142 327	4 283	567
11 R1228801-R2457600	81 663	44 320	1 083	122
12 R2457601 or more	47 744	22 517	702	112
13 Response not given	680	376	23	-
Total	**14 450 163**	**3 909 024**	**279 769**	**29 669**

(Stats SA, 2011)

Based on the 2011 income profile of households, it can be deduced that the average household monthly income is R10 495 in 2016 prices for a household size of 3 in the Lesedi LM (Stats SA, 2011). Less than two thirds of the LLM residents are low income earners, whereas one third is ranked as middle income earners.

Considering the conflict between the agricultural and mining industries in terms of land uses, it is worthwhile examining the income levels derived from these sectors. The average income in the agricultural sector on a provincial scale is R1 287 per week, which sums up to R5 146 per month (Urban Econ Calculations based on Labour Force Survey, 2014). The average income in the mining sector is just over double that of the agricultural sector, where mining employees earn an average of R3 452 weekly, or R13 808 monthly (Urban-Econ Calculations based on Labour Force Survey, 2014). It is clear that the mining industry employees earn more than employees in the agricultural sector.

10.1.15.2 Importance of agriculture

10.1.15.2.1 Land capability and capacity in the Lesedi Local Municipality

On a national scale, high potential arable land comprises only 22% of total arable land in South Africa (PGTA, 2012). In general, the Gauteng Province has the least number of commercial farming units (Africa, 2012). At a district level, the Sedibeng District Municipality IDP states that the district has good agricultural potential, with areas of varying agricultural viability (Sedibeng DM, 2016). Furthermore, the Sedibeng District Municiplaity has three agricultural hubs of which one is the Lesedi agricultural hub.

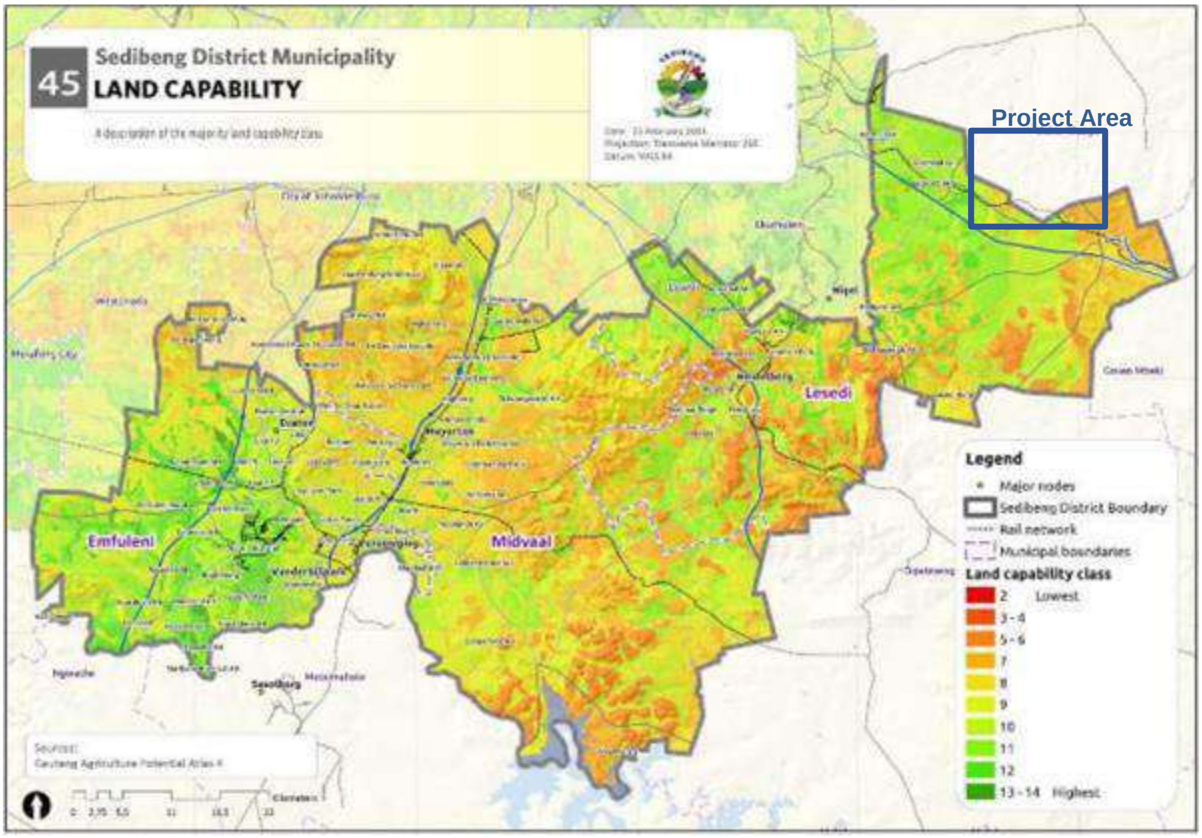


Figure 10-44: Land Capability in the Sedibeng District Municipality (Sedibeng DM, 2016)

The LLM is largely an agricultural municaplity from a spatial perspective (Lesedi LM, 2016). Figure 10-45 demonstrates that the western and north-eastern regions of Lesedi have the most concentrated land capbility in the municipality. It is evident that the proposed project area is proposed to be located on land, which capability class is classified between 9 and 12, denoting high agricultural land capability. It can then be argued that these are also the areas that make the greatest contribution towards agricultural production in the municipality.

A major concern for the Sedibeng District Municipality is the continued loss of high potential agricultural land to other land uses. The preservation, development, and sustainable use of agricultural land are integral to ensure long-term food security in South Africa (Sedibeng DM, 2016). The NDP concurs that the national food security goal for South Africa is to maintain a positive trade balance for primary and processed agricultural products, whilst job creation and increased agricultural productivity are needed to address food security at a household and individual level in rural areas (National Planning Commission, 2011). In addition, food security is a key element for poverty alleviation and addressing inequality. Moreover, the Comprehensive Africa Agriculture Development Programme aims to increase agricultural productivity to a minimum of 6% annually, as this increase in food production is required to alleviate poverty and to eliminate hunger on the continent.

10.1.15.2.2 Agricultural sector's GDP contribution and labour force dynamics in the LLM

The agricultural sector has contributed an average of 1.7% to the LLM's GDP over the past five years (Urban-Econ calculations based on Quantec, 2015). The agricultural sector in the LLM employed 2 240 individuals in 2015, which makes up about 6% of the municipality's total employment. The LLM's agricultural sector employment figure constitutes well over a quarter of the total agricultural figure in the Sedibeng DM (Quantec, 2015). This suggests that although the agriculture makes a relatively small contribution towards the Lesedi economy, it is considered to be a prominent contributor to agricultural activities not only in the district but also in the province.

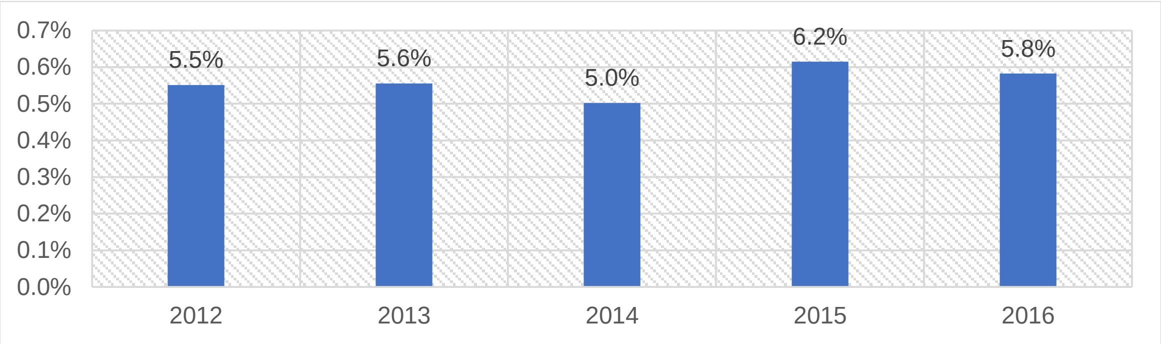


Figure 10-45: Agricultural sector employment contribution over five years (Urban-Econ Calculations based on Quantec, 2015)

The dominant crops found in the proposed project area are Maize and Soya beans. The same pattern of cultivated crops is observed in the surrounding areas. The rest of the land is pasture. The agricultural activity demonstrated in the SDF correlates with what the land is currently used for.

In 2015, 4 242 000 tons of maize was produced in the Gauteng Province. This makes 5.2% of the national maize production. At the same time, 50 600 000 tons of soya beans was produced in 2015 in the Gauteng Province, which contributed 7% to the national soya beans production.

The agricultural activities observed in the Project area in November 2016 include both crop production and livestock grazing. The area also hosts a number of chicken farms that focus on egg production.

10.1.15.2.3 Egg industry in brief

As mentioned previously, aside from crop farming, the area houses livestock farming. The national trends in red meat production have been on par with consumption. On the contrary, local poultry production has increased significantly over the past 20 years and has not been able to meet the greater increase in local demand for white meat (WWF, 2006). The consumption of chicken continuously grows and exceeds the total consumption of red meat. Thus, chicken is currently one of South Africa's major agricultural imports (DAFF, 2016).

In terms of the egg industry, it is the fourth largest animal sector in South Africa with a gross revenue of R9.8 billion in 2015 (SAPA, 2014; SAPA, 2015). The general trends observed in the egg industry in the past few years can be summarised as follows:

- In 2015, there were 24.9 million **layer hens** in the country, showing a 2.1% increase compared to the previous year (SAPA, 2015).
- Gauteng was the single **biggest Province** in terms of concentration of egg farming activities accounting for 24.7% of layer birds in the country (SAPA, 2014).
- About 7 887 people (workers, supervisors, and managers) were employed by the egg industry in 2014 (SAPA, 2014).
- **Egg production** has been on a downward trend since 2012 (SAPA, 2014); however, 2015 seen a 2.05% growth compared to 2014 reaching 407 770 of cases per week (SAPA, 2015). A total of 7 654 443 988 eggs were produced in 2015 weighing 446 388 tons (SAPA, 2015).
- **Consumption of eggs** amounted to 7 854 355 543 in 2015 weighting 458 047 tons (SAPA, 2015). The per capita consumption of eggs in 2015 reached 150 eggs per annum, which is higher than the numbers observed in 2013 and 2014, but still below the highest point of 153 eggs per annum recorded in 2012 (SAPA, 2015) (SAPA, 2014). This suggests though that the demand for eggs in the country is slowly improving. It is still far below the global per capita figures of 251 for the USA, 220 for Russia, and 300 for China, which clearly illustrates the considerable scope for increase per capita consumption of eggs in South Africa, especially considering price competitiveness of eggs compared to other sources of animal protein (SAPA, 2014).
- South Africa **exported** 7 432 tons of egg products including shell eggs and other egg products in liquid and dry forms (SAPA, 2015). In 2014, chicken shell eggs earned R58.9 million in export revenue for the country (SAPA, 2014).
- **Imports of eggs and egg products** in liquid and dried forms amounted to 342.5 tons in 2015, which is a sharp decline from 462.2 tons in 2014 (SAPA, 2015).
- The egg industry faces a number of **challenges** in South Africa. Rising inputs costs including feed costs, labour, fuel, and electricity coupled with a weak South African rand are among the major aspects affecting the profitability of the industry (SAPA, 2014). Producers are receiving a diminishing share of the consume price (DAFF, 2015). Nonetheless, as seen above, the demand for egg products remain high and exceeds the current domestic production volumes.

10.1.15.2.4 Maize production and high potential arable land for food security in the country

South Africa is the main maize producer in the Southern Africa Development Community (SADC). Maize is a vital grain crop in South Africa due to its attributes as a major feeder grain and staple food for the majority of the South African population. Furthermore, it has been the largest contributor (47.3%) towards the gross value of field crops for the past five seasons (DAFF, 2016). The demand for maize in developing countries is projected to double by 2050. The demand is driven by population growth as well as changes in income and urbanisation that induce changes in dietary patterns in the emerging economies (Shifew, 2011). However, there are challenges hampering the optimal production of maize.

Maize is grown across a range of altitudes and latitudes than any other food crop, under temperatures ranging from cool to very hot, on wet to semi-arid lands and in many different types of soils. In this robust context, maize still remains vulnerable to climate change and is primarily a rainfed crop. The dependence on rainfall causes annual variations in maize yields and production. The changes in precipitation patterns increase the probability of short-term crop failures and long-term production declines. In addition, it is anticipated that climate change will excacerbate water scarcity in the coming decades, impacting the production and yields (Shifew, 2011).

Table 10-95: Maize Production in past five years in South Africa (Department of Agriculture, 2016)

Season	2010/2011	2011/2012	2012/2013	2013/2014	2014/2015
Plantings (ha)	2 372 300	2 699 200	2 781 200	2 688 200	2 652 850
Production (t)	10 360 000	12 120 656	11 810 600	14 250 000	9 941 650
Yield (ha/t)	4.37	4.49	4.25	5.30	3.75

The majority of maize produced in South Africa is consumed locally; consequently, the domestic market is very important to the industry. Food security is imperative and agricultural land conservation is key in this quest. The Gauteng Province has a relatively small contribution to the overall national maize production. Nonetheless, the accummulation of mainly maize and soya beans amongst other crops as well as livestock and chicken farming in the Lesedi LM play a notable role in food production.

10.1.15.3 Importance of coal mining

10.1.15.3.1 Baseline of mining in the LLM

Mining activities in the LLM are relatively small. In 2015, mining contributed a meagre 0.6% towards the local economy's GDP and created 377 employment opportunities (Quantec, 2016).

Figure 10-46 serves to demonstrate the distribution of mining and agricultural land uses in the LLM. It is clear that the footprint of past and in some instance present mining and quarrying activity is scattered across the municipality but is largely concentrated in the south and western region, whereas agricultural land uses dominate the municipality. The footprints of the largest mine in the municipality and other smaller mines are situated to the west of the proposed project area, but the footprint across the LLM is limited. Gold mining is no longer taking place in the area due to the uneconomic nature of the remaining reserves, however numerous old/defunct shafts such as those linked to the Nigel Gold Mine are still present in the area (Sedibeng DM, 2016).

Mining-related activities in close proximity to the proposed project area include a slimes dam adjoining the south of N17 to the west of Vischkuil/Endicott. In addition, shale and brick clay quarries are located to the north of Vischkuil. Towards the south west of the proposed project area, various mining activities took place. The activities included mining, refining, handling of gold, silver and platinum group metals (Sedibeng DM, 2016).

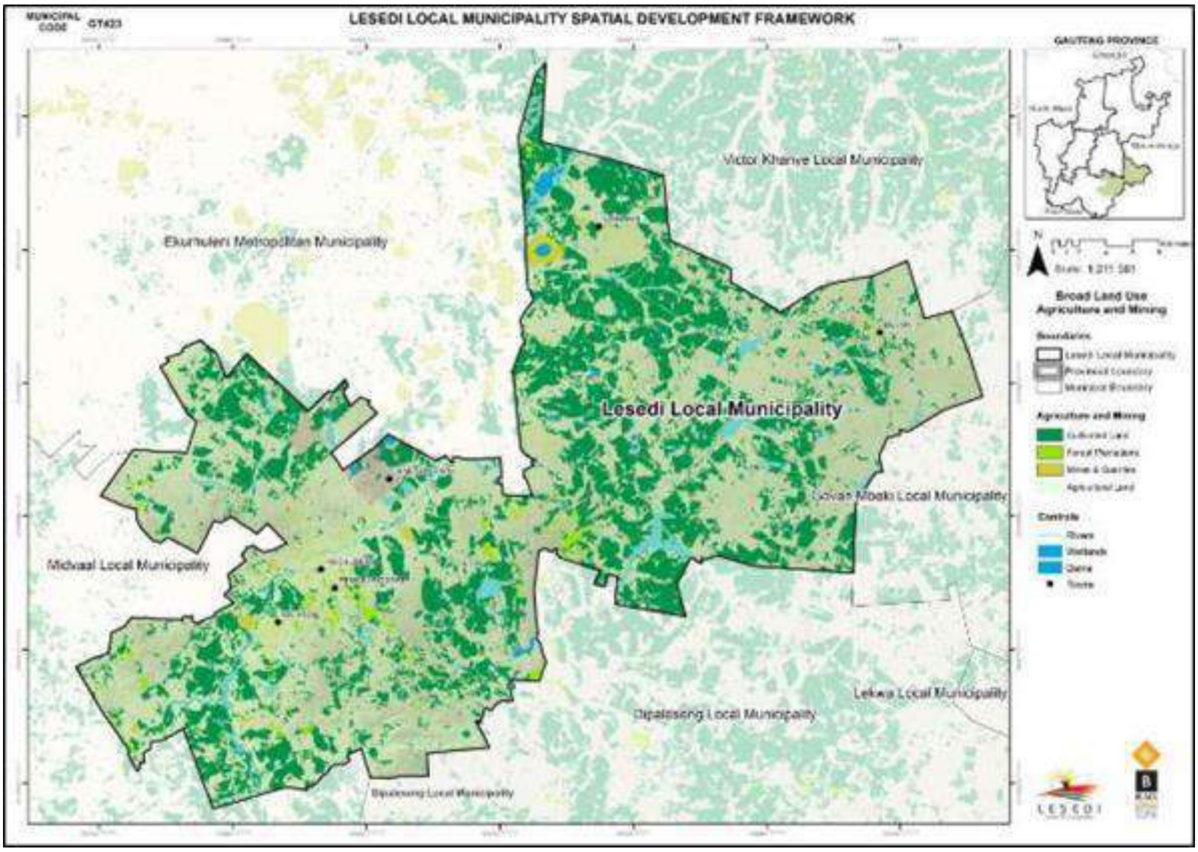


Figure 10-46: Mining and Agriculture Contrast in Lesedi Local Municipality (Lesedi LM, 2016)

Figure 10-47 demonstrates that the project area dominantly has medium mining potential and a portion with low mining potential. Furthermore, to the south of the project area, a very small area has high mining potential. Evidently, the region has high land capability but also has notable mining potential.

Figure 10-47: Mining Potential in study area and broader surrounding area (Council for GeoScience; Mapable)

10.1.15.3.2 Strategic importance of coal mining and sustainable coal supply for long-term energy security

The South African Coal Roadmap was developed to explore the required interventions in support of the coal industry from the current period to 2040 (Fossil Fuel Foundation and SANEDI, 2013). Key indications are that, even in a low carbon world, there will still be a demand for export coal to 2040 and beyond. The roadmap states that coal exports can continue to provide a significant source of foreign revenue for South Africa.

Approximately 224 million tons of coal is mined annually; 28% of this coal is exported, 53% is utilised for electricity generation, and the remainder is distributed across various industries (Eskom, 2016). The Coal Roadmap estimates that 4 000 million tons of coal are required by 2050, of which only half is currently secured with contracts. The rest is not contracted yet (Fossil Fuel Foundation and SANEDI, 2013). Thus, new mines will need to be developed in the Central Basin, where the proposed project is located, as well as in Waterberg.

The coal that can be mined at the proposed mining project includes export quality coal, which can potentially be sold to other countries. However, it is likely to be blended with the lower quality seams to retain the required qualities for supply to the coal-fired power station located in the region.

The supply of coal to Eskom for generating electricity is at risk due to the price disparity between the domestically supplied coal and coal for export. It is estimated that up to 800 million tons of the unsecured contracts are at risk to be diverted to export markets, which could create a significant supply shortage of coal in the future (Fossil Fuel Foundation and SANEDI, 2013). Additionally, investment in South Africa is being deterred due to the unfavourable policy and legislative environment, labour risks, and better returns in other commodities and geographies. If the desirability of investing in South African coal mines declines further, this could result in future reductions in the availability of coal for both local and export market (Fossil Fuel Foundation and SANEDI, 2013).

In terms of employment, close to 80% of the direct employment associated with the coal value chain is in coal mining itself (Fossil Fuel Foundation and SANEDI, 2013). This implies that there is a possibility for a high labour absorption in the coal value chain, which can contribute to reducing the unemployment rate.

In the context of the current Project, the mine has a LOM of about 53 years, which means that coal produced by the mine will be available even after 2060. Thus, the proposed project is in direct alignment with the South African Coal Roadmap and can be seen as a strategic project that would contribute to energy security in the country.

10.1.15.4 Zone of influence profiling – land uses and activities

The Project area is dominantly constituted of cultivated commercial fields, irrigated land, and water bodies. There is a township located in the project area called Umbila. The surrounding areas are also comprised of cultivated commercial fields with the main agricultural production including maize farming, soya bean farming and chicken farming. In addition, there are agricultural holdings, residential areas, commercial activity, industrial activity and mining activity (refer to Figure 10-48).

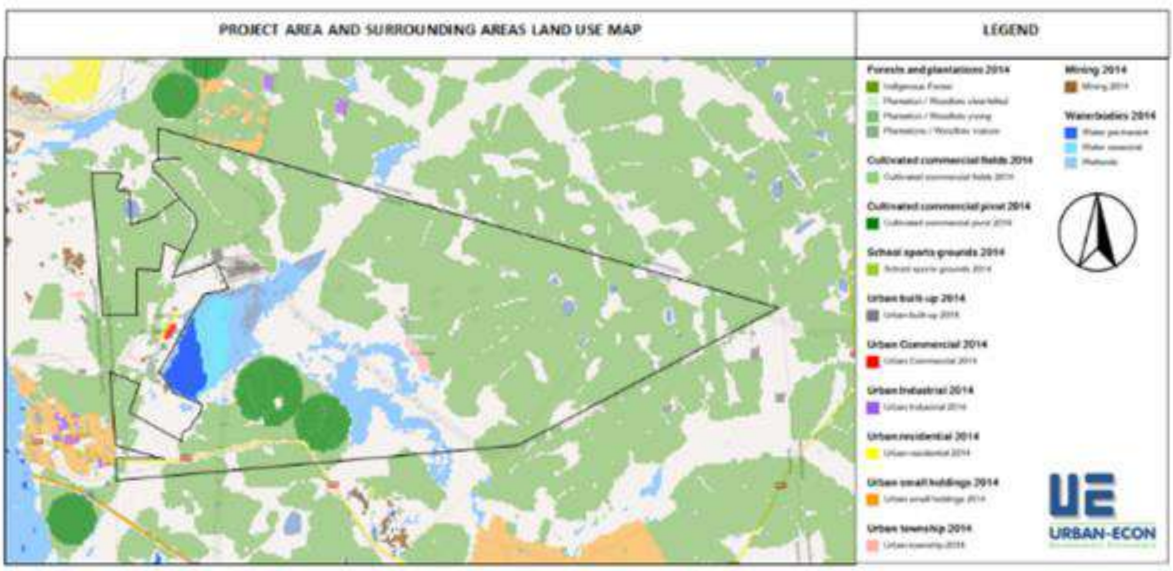


Figure 10-48: Project Area and surrounding areas land use map (extracted from Mapable)

(Source: UrbanEcon)

The discussion below outlines the details of farming activity per farm portion of the successfully contacted directly affected farms and adjacent farms.

Table 10-96: Economic profile of the directly impacted area (project site)

Farm Portion (s) and size	Agricultural activity and size	Yield	Revenue generated	Number of Employees	Concerns raised
Portion 2, 13 and 19 of Farm Palmietkuilen 3419 Ha	Crop Farming: Maize Farming (945 Ha) Soya Beans (472 Ha) Navy Beans (472 Ha)	7.5t/Ha 2.3t/Ha 2t/Ha	R19.1 million p.a R6.5 million p.a R12.3 million p.a	45 permanent employees 40 temporary (5 months) employees	▪ Food security ▪ Land rehabilitation ▪ Pollution ▪ Job losses-increased unemployment ▪ A disconnection in local business connections ▪ Business closures ▪ Utilising land for mining is unsustainable and short sighted
Portion 9,4,10 and 13 of Farm Palmietkuilen 362.87 Ha	Crop Farming Maize Farming Schoeman Boerdery	73 Ha	No Data Available	No Data Available	▪ Community located around portion 9 ▪ Lake on land

Table 10-97: Economic profile of adjacent activities

Farm Portion (s) and size	Agricultural activity and size	Yield	Revenue generated	Number of Employees	Concerns raised
Portion 5 and 6 of Farm Vischkuil 274	Chicken Egg Farming	*109 776 dozen eggs/week	*R74.8 million p.a	*49-63	N/A
Portion 8 of Farm Vischkuil 274	Chicken Egg Farming	*125 125 dozen eggs/week	*R85.2 million p.a	*56-72	N/A

Farm Portion (s) and size	Agricultural activity and size	Yield	Revenue generated	Number of Employees	Concerns raised
Portion 2 of Farm Vischkuil 274	Chicken Egg Farming	*96 250 dozen eggs/week	*R65.6 million p.a	*43-55	N/A
Portion 39 of Farm Droogefontein 242	Chicken Egg Farming	*123 123 dozen eggs/week	*R83.9 million pa	*55-71	N/A
Portion 33 of Farm Droogefontein 242	Chicken Egg Farming	*123 123 dozen eggs/week	*R83.9 million pa	*55-71	N/A
Portion 21 and 22 of Farm Grootvaly 124.	No activity currently taking place	N/A	N/A	N/A	▪ No concerns raised
Portion 17 of Farm Grootvaly 124.	Chicken Egg Farming Livestock Farming (≈153 cattle)	300 dozen eggs/week	*R0.2 million p.a	10 permanent employees 4 permanent employees	▪ Dust negatively affects chickens ▪ Blasting affects laying process ▪ Chicken mortalities increase ▪ Decrease in eggs produced ▪ Water quality reduction ▪ Water shortage
Remainder of Farm Rietfontein 276.	Factory: Brick Making Quarry for Clay	No data available	No data available	150 employees	▪ No concerns raised

(*values in asterisks are based on estimations)

10.1.15.4.1 Property values in the surrounding area

The purpose of this section is to provide a baseline profile of the existing property values within the zone of influence, which includes properties that would be directly affected by the proposed mining development and properties that may be indirectly affected as a result of environmental effects (i.e. noise, dust, and visual pollution), as well as properties already located in close proximity to existing mining activities. The latter is done to determine whether mining activities have a negative impact on property values and the extent of this impact.

For the purpose of this study, the following land categories were analysed:

- Irrigated land:
  - within the zone of influence;
  - within proximity of zone of influence and located in close propinquity to existing mining activities;
- Dry land:
  - within the zone of influence;
  - within proximity of zone of influence and located in close propinquity to existing mining activities;
- Chicken farms:
  - within the zone of influence;
  - within proximity of zone of influence and located in close propinquity to existing mining activities; and
- Agricultural holdings and residential areas within the study area

Figure 10-49 indicates the identified zone of influence, existing mining activities surrounding the zone of influence, as well as the agricultural holdings within and around the zone of influence indicated in red.

Agricultural Holdings within and near Zone of Influence and properties located near existing mining activities

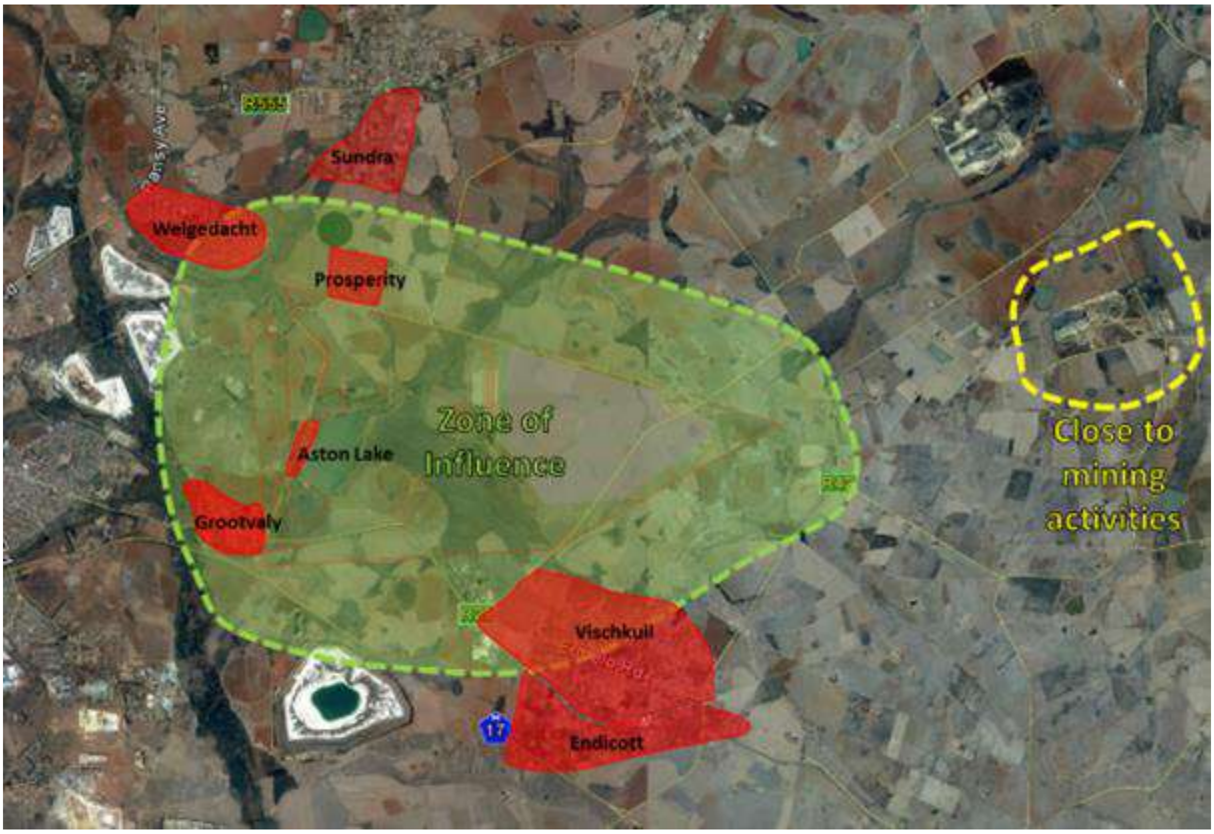


Figure 10-49: Agricultural Holdings within and near Zone of Influence and properties located near existing mining activities

The property values referred to in this section are based on the comparable average sales prices as obtained from the deeds registry office through the Lightstone database. The comparable average sales price reflects the potential market value of an identified property, based on the average sales price within the study area, and is not an exact property valuation amount, but rather an estimated figure based on primary data. The average sales price therefore, provides a representative sales amount for the identified study area. The information obtained from the Lightstone database was augmented with data obtained from the interviews with various real estate agents operating in the area and specialising in agricultural holdings, agricultural land, and residential properties.

Figure 10-50 illustrates the properties that are included in the property value analysis.

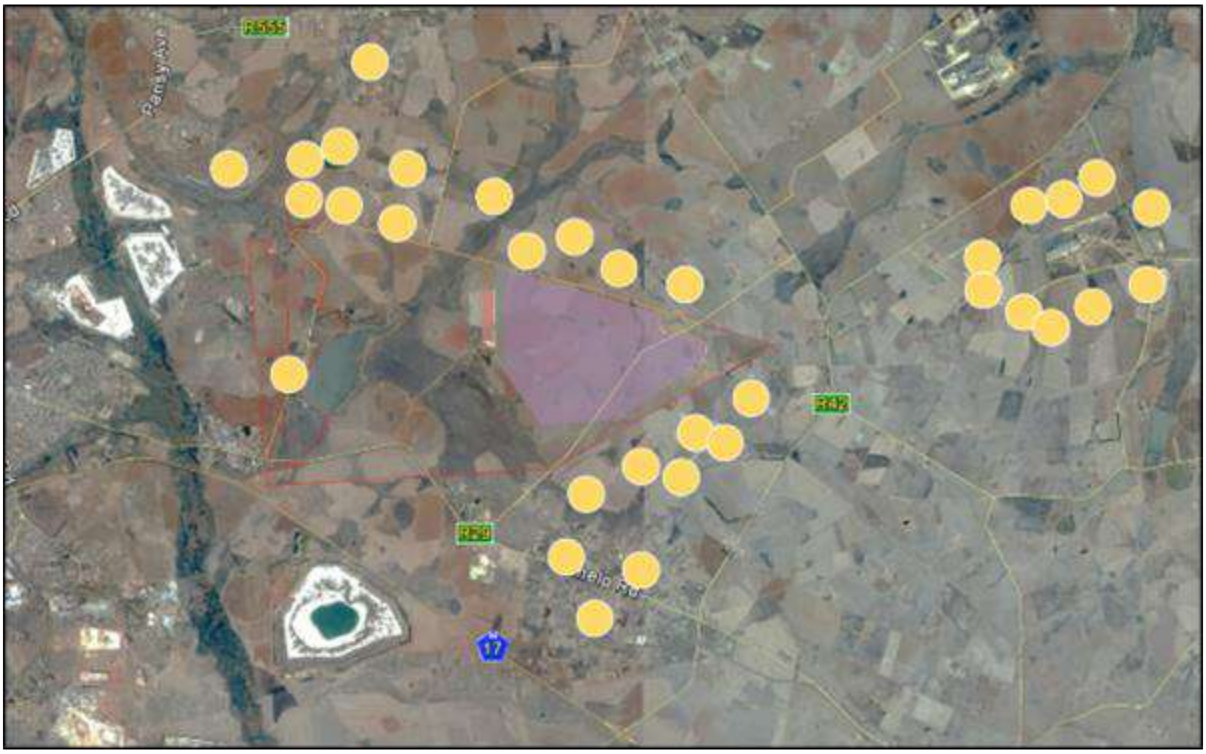


Figure 10-50: Properties in and near Zone of Influence

The intention of the property analysis is to provide a baseline profile of the current property values in the identified area. A number of attributes including proximity, accessibility, size, existing services, zoning rights, etc., affect these values. For example, properties with good accessibility and with existing services could have a higher value than those that do not. Certain conditions raise property values and others bring them down. Other factors influencing property values include the following:

- Physical Attributes: Location, topography, availability of water, etc.;
- Accessibility to Economic Activities: Good access to employment opportunities adds value to property;
- Neighbourhood Amenities: Shopping centres, medical facilities, schools etc.; and
- Transport Linkages: Good access to national and regional roads adds value to property.

10.1.15.4.2 Irrigated land

In order to determine the average value of irrigated land, four irrigated properties were identified and examined. These properties are located within the identified zone of influence and are largely owned by private family trusts and farming industries.

Table 10-98 provides detail in terms of the size and value of the reviewed properties. As indicated in the table, the irrigated property values within the study area vary in sizes and range between R 1.4 million to R 1.5 million. This translates to roughly between R30 000 and R 55 000 per hectare.

Table 10-98: Examples of property values of irrigated land within the zone of influence

Property	Size	Value	Unit cost (R/ha)
1	26 Ha	R 1 444 934	R 55 574
2	41 Ha	R 1 509 000	R 36 805
3	52 Ha	R 1 543 214	R 29 677
4	26 Ha	R 1 412 964	R 54 344

In order to determine the effect that close proximity to the existing mining activity has on the value of irrigated property, a property with these characteristics has been identified.

Table 10-99: Examples of property values of irrigated land within proximity of the zone of influence and located in close propinquity to mining activities

Property	Size	Value	Unit cost (R/ha)
5	175 Ha	R 3 835 700	R 21 918

Table 10-99 indicates that the size of the identified property is roughly 175 hectares, with a total value of R 3.8 million and R 21 918 per hectare. When compared to the property values within the zone of influence it is evident that the irrigated property located in close proximity to existing mining activities has a lower value than those within the zone of influence. The identified property (property 5) is 50% less than the average value of the properties identified in the zone of influence.

10.1.15.4.3 Dry land

As indicated, a number of dry land portions are included in this property profile. These land portions are typically categorised as vacant land with very limited farming activity currently taking place on the land. The following table indicates the land values for the identified dry land portions within the zone of influence.

Table 10-100: Examples of property values of dry land within the zone of influence

Property	Size	Value	Unit cost (R/ha)
6	133 Ha	R 1 722 264	R 12 949
7	134 Ha	R 1 736 014	R 12 955
8	132 Ha	R 1 736 514	R 13 155
9	116 Ha	R 2 243 214	R 19 338
10	134 Ha	R 2 139 214	R 15 964
11	163 Ha	R 1 956 186	R 12 001
12	129 Ha	R 1 956 186	R 15 164
13	77 Ha	R 1 627 714	R 21 139

The dry land property values within the zone of influence are typically 130 ha in size or more, and range between R1.6 million and R 2.2 million per property. This translates into roughly R12 000 – R22 000 per hectare. It is evident that the values of these properties are about three to four times lower than that of the irrigated properties, when looking at per ha unit cost.

The land values of dry land for properties that are in close proximity to existing mining activities, as indicated in the table below suggest that these properties have a significantly higher value than those within the zone of influence. Possible reasons for this are that these properties could have existing land rights that are suitable for associated mining activities such as light industrial or commercial land rights. In order to determine this, a detailed analysis is required. Therefore, it can't be concluded that the mining activities have contributed to the higher value, but rather, that the mining activities do not necessarily have a negative impact on these values.

Table 10-101: Examples of property values of dry land within proximity of the zone of influence and located in close propinquity to mining activities

Property	Size	Value	Unit cost (R/ha)
14	64 Ha	R 3 236 242	R 50 566
15	64 Ha	R 2 632 776	R 41 137
16	95 Ha	R 2 757 776	R 29 029
17	393 Ha	R 3 764 701	R 9 579
18	68 Ha	R 2 874 479	R 42 271
19	64 Ha	R 3 236 242	R 50 566
20	239 Ha	R 3 381 092	R 14 146

The property values in the table above range between R2.6 million and R3.7 million, which translates to roughly between R9 000 to R50 000 per hectare. When compared to the properties within the zone of influence, it is evident that properties located in close proximity to existing mining activities are on average 55% higher in value when compared to those located within the zone of influence.

10.1.15.4.4 Chicken farm

There is a large presence of chicken farming within the study area. Therefore, the property values of these farms are also included in this study. Four chicken farms were identified within the zone of influence, and one chicken farm was identified in close proximity to existing mining activity areas.

The following table indicates the property values for the chicken farms located within the zone of influence. As indicated, the property values of chicken farms in the zone of influence range between R1.7 million and R2 million, with roughly between R14 000 and R33 000 per hectare.

Table 10-102: Examples of property values of chicken farms within the zone of influence

Property	Size	Value	Unit cost (R/ha)
21	57 Ha	R 1 896 526	R 33 272
22	112 Ha	R 2 063 851	R 18 427
23	92 Ha	R 2 018 014	R 21 934
24	124 Ha	R 1 763 514	R 14 221

The table below indicates the property value for the identified chicken farm that is within close proximity to the existing mining area.

Table 10-103: Examples of property values of chicken within the region and located in close propinquity to mining activities

Property	Size	Value	Unit cost (R/ha)
25	60 Ha	R 3 133 515	R 52 225

Based on the table above, it is evident that the chicken farm located in close proximity to the mining activity has a property value of R 3.1 million, or R52 225 per hectare. This suggests that the value is roughly 58% higher than the properties located within the zone of influence.

10.1.15.4.5 Vischkuil

The property value information for the agricultural holdings located in Vischkuil, is based on the average price and size per property. As indicated in Table 10-104 below, the average size of properties in Vischkuil is 1.6 hectare, which value averages at R 1.1 million per property. The majority of property owners in Vischkuil owned their properties for a period of eight years and more. This suggests that the property market in the area is stable implying that it is well established and unlikely to change. In terms of property market activity, it is evident that there is some property market activity in the area. The properties being sold in Vischkuil are largely 3-4 bedroom residential properties along with some farm portions. A real estate agent from the area stated that a squatter camp situated between the proposed mine and Vischkuil, has negatively affected the property values of the area. The agent does not believe any further decline in property values can emerge from the introduction of a mine near the area.

Table 10-104: Property value profile of Vischkuil

Indicator	Description
Type of dominant property	Freehold Residential

Number of properties	6 registered properties
Average size of properties	1.6 Ha
Average price of property	R 1 070 000
Key characteristics	
Ownership duration	80% of Vischkuil property owners own property for a period of 8 years and more

10.1.15.4.6 Endicott

Table 10-105 provides property value information for Endicott, which is based on the average size and price per property.

Table 10-105: Property value profile of Endicott

Indicator	Description
Type of dominant property	Freehold Residential
Number of properties	4 properties
Average size of properties	18 Ha
Average price of property	R 1 286 800
Key characteristics	
Ownership duration	100% of Endicott property owners own property for a period of 8 years and more

As indicated, the average size of properties in Endicott is 18 hectare and values at R1.3 million per property. All of the property owners in Endicott owned properties in the area for a period of eight years and more. This suggests that the property market in the area is very steady. In contrast, one of the real estate agents in Endicott argued that the property values are low in the area with one of the reasons being the distance to town. Another real estate agent concurred stating that it is not easy to sell agricultural land in the area. This is due to the banks giving out between 60%-80% of loans in the area and the rest is required from the buyer. The agent further stated that people scarcely purchase plots in the area and therefore, it proves difficult to re-sell plots.

10.1.15.4.7 Aston Lake

As indicated in Table 10-106 below, the average size of properties in Aston Lake is 0.9 hectare and values at R660 000 per property. Roughly, two thirds (67%) of property owners in Aston Lake owned their properties for a period of eight years and more. This suggests that the property market in the area is relatively steady. In terms of the property market activity in Aston Lake, it is evident that there is some activity taking place. The majority of units being sold in the area are 2-3 bedroom housing units along with a number of vacant stands. In addition, the average Living Standard Measurement (LSM) within Aston Lake is between 4 and 7. This suggests that the population within Aston Lake has moderate access to basic goods and services are of low- to middle- income group.

Table 10-106: Property value profile of Aston Lake

Indicator	Description
Type of dominant property	Freehold Residential
Number of properties	69 properties
Average size of properties	0.9 Ha
Average price of property	R 660 000
Key characteristics	
Ownership duration	67% of Aston Lake property owners own property for a period of 8 years and more
LSM profile	LSM 4 - LSM 7

10.1.15.4.8 Welgedacht

Table 10-107 below provides property value information for Welgedacht.

Table 10-107: Property value profile of Welgedacht

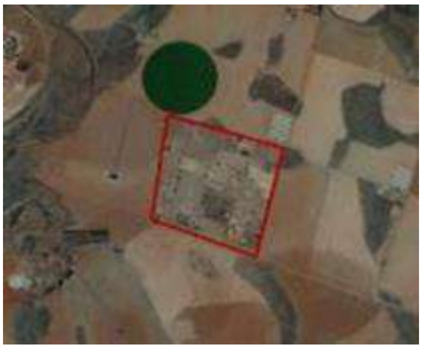
Indicator	Description
Type of dominant property	Freehold Residential
Number of properties	1335 properties
Average size of properties	1 Ha

Average price of property	R 620 000
Key characteristics	
Ownership duration	70% of Welgedacht property owners own property for a period of 8 years and more
LSM profile	LSM 6 – LSM 7

As indicated, the average size of properties in Welgedacht is 1 hectare and values at R620 000 per property. About 70% of property owners in Welgedacht owned property for a period of eight years or more. In terms of property market activity, it is evident that there are currently very few properties for sale in the area. This suggests that the property market activity within the area is relatively low and that people are more likely to stay within the area than move out.

The average LSM for the Welgedacht area is between 6 – 7, indicating that the local population has moderate access to basic goods and services and represent middle-income households.

10.1.15.4.9 Prosperity



Prosperity is located in the northern region of the zone of influence, and has an average property size of 4 hectares and an average value of R660 000 per property. The majority of property owners in Prosperity owned their property for a period of eight years and more. Similar to the previous agricultural holdings indicated in this section, the property market is well established and unlikely to change. Recent listings indicate that the property market in Prosperity is not active. Only two properties are currently listed for sale.

Table 10-108: Property value profile of Prosperity

Indicator	Description
Type of dominant property	Freehold Residential
Number of properties	52 properties
Average size of properties	4 Ha
Average price of	R 660 000

property	
Key characteristics	
Ownership duration	83% of Prosperity property owners own property for a period of 8 years and more
LSM profile	Data unavailable

10.1.15.4.10 Sundra

Table 10-109 provides property value information for Sundra.

Table 10-109: Property value profile of Sundra

Indicator	Description
Type of dominant property	Freehold Residential
Number of properties	51 properties
Average size of properties	2.5 Ha
Average price of property	R 1 750 000
Key characteristics	
Ownership duration	69% of Sundra property owners own property for a period of 8 years and more
LSM profile	LSM 7 – LSM 8

As indicated, the average size of properties in Sundra is 2.5 hectares and values at an average of R 1.7 million per property. Roughly 69% of property owners in Sundra owned properties in the area for a period of eight years or more. There are a number of properties currently listed for sale in the larger Sundra area. These properties are largely farm portions and vacant land. This suggests that the property market activity within the area is quite active.

The average LSM for the Sundra area is 7 – 8, indicating that the local population in Sundra has higher access to basic goods and services than that of the surrounding areas and represent middle to higher-income household groups.

10.1.15.4.11 Key observations

Table 10-110 below provides a summary of the key observations in the property value analysis.

Table 10-110: Property Values key observations

Property Type	Average Land Value (R/Hectare)		Key observation
	Within Zone of Influence	In close propinquity to mining activities	
Irrigated land	**R 44 100**	**R 21 918**	It is evident that, based on the analysis of the identified properties, the irrigated land located within the zone of influence has a significantly higher value than those close to mining activities. It is assumed that in this case the mining activities seem to have some effect on the property values. However, it should be noted that the property values are influenced by a number of attributes (directly and indirectly); therefore, any change in property values can never be attributed only to one factor whether it is mining or not.
Dry land	**R 15 333**	**R 33 899**	The identified dry land portions located in close proximity to existing mining activities have a much higher value than those within the zone of influence. This suggests that the mining activities do not necessarily have a negative impact on the property values of dry land.
Chicken Farm	**R 21 963**	**R 52 225**	The chicken farm located next to existing mining activities has a value of more than double that of the chicken farms located in the zone of influence. Based on this, it is evident that the mining activities do not negatively affect the value of farmland used for chicken farming. However, these property values can be attributed to much more than just mining activities.
Agricultural Holdings	The agricultural holdings that were identified are all located within and around the zone of influence. Due to the nature and proximity of these land portions, the likelihood of a negative impact on property values is limited. However, it can be assumed that due to its location, the Aston Lake land portions are likely to be slightly more affected by the visual effect of the proposed mine compared to other agricultural holdings in the area.		

Figure 10-51 provides a visual representation of the property values as identified in the Project area and those used for the baseline assessment.

Figure 10-51: Property Values within and near Zone of Influence

10.1.16 Traffic

As mentioned above, the TIA, appended to this report as Appendix P, was undertaken by Mariteng Consulting Engineers (Pty) Ltd 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.

10.1.16.1 Existing Road Network

The existing road network surrounding the Project area includes the following roads:

- Road R29 (also referred to as Ermelo Road) is a single lane road running in an east-west direction to the south of the Project site. The road links Springs and surrounding area with areas such as Delmas. Road R29 falls under the jurisdiction of the Gauteng Provincial Administration;
- Road D1133 is a single lane surfaced road for a distance of approximately 950m (measured from the R29/D1133 intersection. The remaining section of the road has a gravel surface. Road D1133 falls under the jurisdiction of the Gauteng Provincial Administration. Road D1133 traverses the Project site as the road is located partially within the mining belt;
- The road serving Aston Lake is a surfaced road to the west of the Project site. The road falls under the jurisdiction of the Ekurhuleni Municipality;

- Road D1255 is a gravel road serving only the farming community abutting the road to the north of the Project site. Road D1255 falls under the jurisdiction of the Gauteng Provincial Administration;
- Milner Street is a single lane road running in a north-southern direction. The road services the Welgedacht residential area, as well as the rail siding located to the north-west of the applicant site. The road falls under the jurisdiction of the Ekurhuleni Municipality; and
- Welgedacht Road/Main Road runs in a west to northern direction. The road links the Project area with Springs to the south and the N12 in the north. The road is a single lane road with road widening at the intersection with Milner Street. The Welgedacht Road/Main Road & Milner Street is signalised. Welgedacht Road/Main Road falls under the jurisdiction of the Gauteng Provincial Administration.

10.1.16.2 Trips generated by the Proposed Project

The proposed development will generate the following trips:

- Mine personnel will access the site via the Weltevreden/Main Road & Milner Street intersection along Road D1255 and is approximately 36 additional trips, during the weekday morning and weekday afternoon peak hour respectively; and
- Hauling truck traffic via the "Haul Road Access" along Road D1225 and is approximately 31 additional trips, during the weekday morning and weekday afternoon peak hour respectively. The hauling truck traffic will only travel between the site and the Welgedacht Rail Siding. The truck traffic will therefore not travel through the Weltevreden/Main Road & Milner Street intersection.

No external road upgrades are required at Road R29/Road D1133 or Road D1133/Proposed Access Road intersections, to accommodate the additional development traffic. The gravel road may not have the pavement strength to carry the additional general mine traffic and delivery vehicles. The civil engineer need to determine the pavement design required to accommodate the additional mine traffic expected to operate along this section of the road.

10.1.16.3 Existing Public Transport Infrastructure

Taxis services are provided along Weltevreden/Main Road & Milner Street, approximately 9.0km from the entrance to the applicant site.

The total expected work force that will make use of the public transport serves is 20 commuters per 8 hour shift. This equates to 1.7 taxis. It is expected that with the new destination created, the local taxi industry may introduce a new route to accommodate the expected demand.

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. The Project activities will include the following:

Table 11-1: Description of Activities to be Assessed

Project Phase	Project Activity
Construction Phase	▪ Site establishment; ▪ Site clearing, including the removal of topsoil and vegetation; ▪ Construction of mine related infrastructure, including haul roads, pipes, dams; ▪ Construction of washing plant; ▪ Relocation of Infrastructure; ▪ Blasting and development of initial box-cut for mining, including stockpiling from initial box-cuts; and ▪ Temporary storage of hazardous products, including fuel and explosives.

Project Phase	Project Activity
Operational Phase	▪ Stripping topsoil and soft overburden; ▪ Removal of overburden, including drilling and blasting of hard overburden; ▪ Loading, hauling and stockpiling of overburden; ▪ Development and operation of surface infrastructure; ▪ Drilling and blasting of coal; ▪ Load, haul and stockpiling of ROM coal; ▪ Use and maintenance of haul roads for the transportation of coal to the washing plant; ▪ Water use and storage on-site; and ▪ Storage, handling and treatment of hazardous products (including fuel, explosives and oil) and waste.
Decommissioning Phase	▪ Demolition and removal of all infrastructure, including transporting materials off site; ▪ Rehabilitation, including spreading of soil, re-vegetation and profiling or contouring; ▪ Environmental monitoring of decommissioning activities; and ▪ Storage, handling and treatment of hazardous products (including fuel, explosives and oil) and waste. ▪ Post-closure monitoring and rehabilitation.

11.1 Potential Impacts

It is noted that only direct impacts are assessed in this section, risks are assessed in Section 11.2.

11.1.1 Soil, Land Use and Land Capability Impact Assessment

11.1.1.1 Construction Phase

During the construction phase, the impacts to consider are those relating to the disturbance of the natural soil site. When soil is stripped, the physical properties are changed and this impacts on the soil health. During soil stockpiling, the soils' chemical properties will deteriorate unless properly managed. These will lead to loss of the topsoil layer. Vehicles will drive on the soil surface during the construction phase, thereby causing compaction of the soils. This reduces infiltration rates and ability for plant roots to penetrate the compacted soil. Vegetation cover will be reduced and runoff potential will be increased. In which increased runoff potential will lead to increased erosion hazards. Soils should be handled with care from the construction phase through to the decommissioning phase. Topsoil and subsoil should not be stockpiled together as the topsoil's seed bank and natural soil fertility would be diluted. The relevant Project activities and their potential impacts on soils are provided in Table 11-2 below and discussed in subsequent subsections.

Table 11-2: Interactions and Impacts during Construction

Interaction	Impact
Site clearance and topsoil removal. Surface infrastructure development	Loss of land capability
	Loss of topsoil as a resource
	Soil compaction from heavy machinery and vehicles
The construction of stockpiles	Soil erosion due to wind and surface water runoff
	Loss of land capability
	Loss of land use
	Loss of topsoil as a resource

11.1.1.1.1 Impacts Description

Loss of Topsoil as a Resource

Topsoil will be removed from a soil profile; the profile loses effective rooting depth, water holding capacity and soil fertility. Large volumes of topsoil will be removed in preparation for open pit mining and site infrastructure. The removed soil will be stockpiled and can be lost if not managed correctly. Soil is susceptible to erosion because vegetation will be cleared before construction takes place in infrastructure area. Topsoil stockpiles and roads will be susceptible to erosion.

Soil Compaction

Soil will be susceptible to compaction from heavy construction equipment and vehicles when soil is stripped and stockpiled. Soil compaction reduces ability of plants to absorb water due to soil pores being decreased, reduces water infiltration rate and bulk density increases.

Loss of Land Capability and Land Use

When topsoil is removed from the infrastructure areas, the land capability is reduced to nothing and land use will change from intensive cultivation (72%) to mining. There is loss of agricultural potential and topsoil degradation. The land capability during this phase will be reduced from classifiable (72%) to non-classifiable.

11.1.1.1.2 Management Objectives

The management objectives are to limit the impacts that could occur on the site. The following management objectives are recommended:

- Soils are only to be stripped by truck and shovel method to reduce compaction levels, however a bowlscrapers can be used even though they are ideal for creating roads or building dams;
- Stripped soils are to be placed in the correct stockpile allocations to reduce cross contamination of soils. These soils must be monitored and maintained in a reasonably fertile state; and
- Vegetation cover on all stockpiled soils is essential to eliminate erosion.

11.1.1.1.3 Management Actions and Targets

Management actions and targets include the following:

- Ensure proper stormwater management designs are in place;
- The topsoil should be stripped by means of an excavator bucket and loaded onto dump trucks;
- If possible topsoil should be stripped when the soil is dry, as to reduce compaction;
- Topsoil stockpiles are to be kept to a maximum height of 10 m;
- Topsoil of 0.3 m of the soil profile should be stripped first and stockpiled separately;
- The subsoil of 0.4 – 1.2 m will then be stripped and stockpiled separately for deep soils like Hutton and Clovelly. Hutton and Clovelly can be stripped and stockpiled together since their soil properties are similar. Wetlands soils (Katspruit and Arcadia) should not be stripped and stockpiled together and should not be mixed with Hutton and Clovelly;
- Soils to be stripped according to the soil stripping ratios and stockpiled accordingly;
- If any erosion occurs, corrective actions must be taken to minimise any further erosion from taking place;
- If erosion has occurred, topsoil should be sourced and replaced, shaped to reduce the recurrence of erosion;
- Only the designated access routes are to be used to reduce any unnecessary compaction;
- The handling of the stripped topsoil should be minimised to ensure the soil's structure does not deteriorate significantly;
- The stockpiles should be vegetated to reduce the risk of erosion, and to reinstitute the ecological processes within the soil; and

- Compaction of the removed topsoil must be avoided by prohibiting traffic on stockpiles.

11.1.1.1.4 Impact Ratings

The Construction Phase impacts on soil, land use and land capability are rated in Table 11-3 and Table 11-4.

Table 11-3: Loss of Topsoil as a Resource and Soil Compaction

Dimension	Rating	Motivation	Significance
Impact Description: During any excavation activity, the soil chemical and physical properties are impacted on. The movement of heavy machinery on the soil surface causes compaction which reduces the vegetation's ability to grow and as a result erosion could occur. Large areas of land will be cleared increasing the runoff potential of the area.			
Prior to Mitigation/Management			
Duration	5	Largest volumes of topsoil will be removed in preparation of open pit mining but may last after this phase	Moderate (negative) - 91
Extent	3	Loss of topsoil will only occur within project area	
Intensity	5	Loss of usable topsoil may result in compaction and erosion which can be serious.	
Probability	7	By excavating the soil it will certainly impact on the soil	
Nature	Negative		
Mitigation/Management Actions			
▪ Follow adequate stripping guidelines (refer to Section 14 of the Soil, Land Use and Land Capability Assessment report, Appendix C); ▪ Topsoil should be stripped by means of an excavator bucket and loaded onto dump trucks; ▪ If possible topsoil should be stripped during dry months, as to reduce compaction ▪ Only clear vegetation when and where necessary; ▪ Only remove topsoil when and where necessary ; ▪ Ensure topsoil is stored in one dedicated stockpile, 10 m high and away from drainages lines and surface water; ▪ Only the designated access routes are to be used; ▪ If erosion occurs, corrective actions must be taken to minimise any further erosion from taking place; ▪ Soils to be stripped according to the soil stripping ratios and stockpiled accordingly; ▪ Stockpiles are to be maintained in a fertile and erosion free state by sampling and analysing annually for nutrients and soil pH, and vegetating the stockpiles to reduce erosion; ▪ Compaction of the removed topsoil should be avoided by prohibiting traffic on stockpiles; ▪ Prevent unauthorised borrowing of stockpiled soil; and			

Dimension	Rating	Motivation	Significance
▪ Ensure proper storm water management designs are in place (refer to Surface Water Assessment, Appendix D).			
Post-Mitigation			
Duration	5	Loss of topsoil makes land less productive. Usable soil will be stripped and stockpiled if this is done without following the mitigation measures the impact might have a long term effect. Effects will occur long after the project life	Minor (negative) - 45
Extent	2	Loss of soil will only occur within project area	
Intensity	2	Loss of usable soil may result in loss of good productive soils	
Probability	5	If mitigation measures are followed it is likely that the impact will occur	
Nature	Negative		

Table 11-4: Loss of Land Capability and Land Use

Dimension	Rating	Motivation	Significance
Impact Description: Removal of soil layers will impact on land capability and potential land use due to compaction and erosion. The land capability during this phase will be reduced from classifiable (72%) to non-classifiable. Land use will be changed from agriculture (63%) to mining, thus increasing the impact on soils.			
Prior to Mitigation/Management			
Duration	7	Largest volumes of topsoil will be removed in preparation of open pit mining. Removal of soil from profile reduces the land capability to non-existent, this impact is permanent	Major (negative) – 112
Extent	2	Loss of topsoil within the disturbed area will only occur on the project area (open pit and infrastructure)	

Dimension	Rating	Motivation	Significance
Intensity	7	Loss of soils is very serious and will have negative impact. Loss of usable topsoil on the specific disturbed area will result in loss of land capability and land use. Soil regeneration takes a very long time.	
Probability	7	By removing topsoil the impact on land capability and land use on the specific disturbed area is certain	
Nature	Negative		
Mitigation/Management Actions			
▪ No land capability mitigation measures are possible during the construction and operational phases because the land use is changed from intensive cultivation (agriculture) to open pit mining.			
Post-Mitigation			
Duration	7	No mitigation measures are possible and the impacts will be permanent	Major (negative) – 112
Extent	2	Loss of soil will only occur within project area	
Intensity	7	Loss of usable soil will result in loss of good productive soils. Impact is serious on soils	
Probability	7	By excavating the soil it will certainly impact on soil	
Nature	Negative		

11.1.1.2 Operational Phase

During the operational phase, erosion and compaction of all exposed areas and land capability and land use are the major impacts to consider. The relevant Project activities and their potential impacts on soils are provided in Table 11-5 below and discussed in subsequent subsections.

Table 11-5: interactions and Impacts during Operational Phase

Interaction	Impact
The construction of stockpiles	Soil erosion due to wind and surface water runoff
	Loss of Land Capability
	Loss of Land Use
	Loss of topsoil as a resource

Operation and maintenance of the topsoil	Loss of topsoil as a resource: compaction and erosion

11.1.1.2.1 Impacts Description

Loss of Stockpiled Topsoil

When topsoil is compacted or eroded, the soil profile is compromised and its ability to function as a growth medium is restricted. The movement of heavy machinery on the soil surface causes compaction which reduces the vegetation's ability to grow and as a result the risk of erosion will increase. The loss of topsoil will have a high negative impact and the natural regeneration of few millimetres of topsoil takes hundreds of years.

Loss of Land Capability and Land Use

When topsoil is removed from the open pit, the land capability is reduced to nothing and land use will change from intensive cultivation to mining. There is loss of agricultural potential and topsoil degradation. The land capability during this phase will be reduced from classifiable to non-classifiable.

11.1.1.2.2 Management Objectives

The following management objectives are to limit the impacts that could occur on the site:

- If erosion occurs, corrective actions must be taken to limit and reduce the impact from spreading;
- Bare areas need to be assessed for compaction and ripped if required; and
- Stripped red and yellow soils should not be stockpiled and stored together. These soils must be monitored and maintained in a reasonably fertile state.

11.1.1.2.3 Management Actions and Targets

The following management actions and targets are provided:

- Ensure proper storm water management designs are in place;
- The topsoil should be stripped by means of an excavator bucket and loaded onto dump trucks;
- If possible topsoil should be stripped when the soil is dry, as to reduce compaction;
- Topsoil stockpiles are to be kept to a maximum height of 10 m;
- Topsoil of 0.3 m of the soil profile should be stripped first and stockpiled separately;
- The subsoil of 0.4 – 1.2 m will then be stripped and stockpiled separately for deep soils like Hutton and Clovelly; Hutton and Clovelly can be stripped and stockpiled together since their soil properties are similar. Wetlands soils (Katspruit and Arcadia) should not be stripped and stockpiled together and should not be mixed with Hutton and Clovelly;

- Soils to be stripped according to the soil stripping ratios in Section 14 and stockpiled accordingly;
- If any erosion occurs, corrective actions must be taken to minimise any further erosion from taking place;
- If erosion has occurred, topsoil should be sourced and replaced, shaped to reduce the recurrence of erosion; and
- Only the designated access routes are to be used to reduce any unnecessary compaction.

11.1.1.2.4 Impact Ratings

The Operational Phase impacts on soil, land use and land capability described above are rated in Table 11-6 and Table 11-7.

Table 11-6: Loss of Stockpiled Topsoil

Dimension	Rating	Motivation	Significance
Impact Description: Topsoil losses can occur during the operational phase as a result of rainwater runoff and wind erosion from roads and soil stockpiles. Compaction of soils during operational phase will occur.			
Prior to Mitigation/Management			
Duration	5	Largest volumes of topsoil will be removed in preparation of open pit mining but may last after this phase	Moderate (negative) - 91
Extent	3	Loss of topsoil will only occur within project area	
Intensity	5	Loss of usable topsoil may result in loss of land capability and land use. Soil regeneration takes a very long time.	
Probability	7	By excavating the soil it will certainly impact on the soil	
Nature	Negative		
Mitigation/Management Actions			
▪ Follow adequate stripping guidelines in Section 14; ▪ Topsoil should be stripped by means of an excavator bucket and loaded onto dump trucks; ▪ If possible topsoil should be stripped when soil is dry, as to reduce compaction ▪ Ensure topsoil is stored in one dedicated stockpile, 10 m high and away from drainages lines and surface water; ▪ Only the designated access routes are to be used; ▪ If erosion occurs, corrective actions must be taken to minimise any further erosion from taking place; ▪ Stockpiles are to be maintained in a fertile and erosion free state by sampling and analysing			

Dimension	Rating	Motivation	Significance
annually for nutrients and soil pH, and vegetating the stockpiles to reduce erosion; ▪ Compaction of the removed topsoil should be avoided by prohibiting traffic on stockpiles; ▪ Prevent unauthorised borrowing of stockpiled soil; and ▪ Ensure proper storm water management designs are in place.			
Post-Mitigation			
Duration	5	Loss of topsoil makes land less productive. Usable soil will be stripped and stockpiled, if this is done without following the mitigation measures the impact might have a long term effect. Effects will occur long after the project life	Minor (negative) - 40
Extent	2	Loss of soil will only occur within project area	
Intensity	3	Loss of usable soil may result in loss of good productive soils	
Probability	4	By excavating the soil it will certainly impact on soil	
Nature	Negative		

Table 11-7: Land Use and Land Capability

Dimension	Rating	Motivation	Significance
Impact Description: When topsoil is removed from the open pit, land capability is reduced to nothing. The land use will be change from intensive cultivation to mining. As the pit expands in size the level of this impact increases as larger areas of land are converted.			
Prior to Mitigation/Management			
Duration	7	The impact will be permanent, reducing capability	Major (negative) - 112
Extent	2	Loss of land capability and land use will occur on a limited scale	
Intensity	7	Loss of natural soils is very serious and impact is negative	

Dimension	Rating	Motivation	Significance
Probability	7	The impact on land capability and land use is certain as it changes from arable to non-arable and from intensive cultivation to mining	
Nature	Negative		
Mitigation/Management Actions			
▪ No land capability mitigation is possible during the operational phase because the land use is changed from agriculture to open pit mining.			
Post-Mitigation			
Duration	6	Impact on land capability and land use will remain after project and potentially irreversible	Moderate (negative) – 84
Extent	2	Loss of land capability and land use will occur on a limited scale	
Intensity	6	Loss of soil is very serious and impact is negative.	
Probability	6	The impact on land capability and land use is almost certain	
Nature	Negative		

11.1.1.3 Decommissioning Phase

The major impacts to consider in the decommissioning and rehabilitation of the site will be the loss of topsoil as a resource through erosion and compaction. When the decommissioning and removal of infrastructure takes, vehicles will drive on the surface compacting it and this reduces infiltration rates as well as the ability for plant roots to penetrate the compacted soil. Vegetation cover will be reduced and increases runoff potential, therefore increased runoff potential leads to increased erosion hazards. During the decommissioning and rehabilitation phase, the open pit will be rehabilitated as per the rehabilitation guideline (refer to Rehabilitation Report, Appendix Q).

Table 11-8: Interactions and Impacts during Decommissioning and Rehabilitation

Interaction	Impact
Demolition of infrastructure will take place	Loss of topsoil as a resource- erosion and compaction
	Land capability
Rehabilitation activities will cover the extent of the	Loss of topsoil as a resource- erosion and

infrastructure footprint areas and will include the ripping of the compacted soil surfaces, spreading of topsoil and establishment of vegetation	compaction
	Loss of Land capability

11.1.1.3.1 Impacts Description

During rehabilitation and decommissioning phase, there will be a final void which significantly impacts on the final land capability and land use. The infrastructure areas can be rehabilitated and as a result the impact may be reduced if mitigation measures are implemented.

11.1.1.3.2 Management Objectives

The rehabilitation process needs to be monitored for erosion. If erosion occurs corrective actions must be taken to limit and reduce the impact from spreading. Bare areas need to be assessed for compaction or contamination and ripped if required. If contamination has occurred, these soils need to be removed and dumped in a licensed landfill site.

After the infrastructure removal and rehabilitated, the areas must be assessed for compaction and possible erosion risk and corrected immediately.

11.1.1.3.3 Management Actions and Targets

The following management actions and targets are provided:

- Only the designated access routes are to be used to reduce any unnecessary compaction;
- Compacted areas are to be ripped to loosen the soil structure and vegetation cover re-instated;
- Implement land rehabilitation measures as defined in rehabilitation report;
- Topsoil should be replaced for rehabilitation purposes and used for their designated final purposes;
- Ensure proper storm water management designs are in place;
- Correction actions (erosion berms) must be taken to minimise any further erosion from taking place;
- The foundations of infrastructure must be removed; and
- Ensure proper storm water management designs are in place.

11.1.1.3.4 Impact Ratings

The Decommissioning Phase impacts on soil, land use and land capability are described above are rated in Table 11-9.

Table 11-9: Rehabilitation of Open pit and Infrastructure areas

Dimension	Rating	Motivation	Significance
Impact Description: Restoration of land capability to its pre-mining state or agreed upon alternative.			
Prior to Mitigation/Management			
Duration	5	The loss of land capability for open pit area will likely be permanent	Moderate (negative) - 91
Extent	3	Impact will occur on a local scale	
Intensity	5	Loss of natural soil is serious and impacts negatively.	
Probability	7	The impact will be certain as there will be not enough material	
Nature	Negative		
Mitigation/Management Actions			
▪ Rehabilitate according to the rehabilitation plan; ▪ Return the land conditions capable of supporting grazing land use; and ▪ Contour slopes to minimise erosion and run-off.			
Post-Mitigation			
Duration	7	If rehabilitation measures are implemented correctly impact will be permanent	Moderate (positive) + 78
Extent	2	Impact will occur on a limited scale	
Intensity	4	The intensity will be increased if mitigation measures are implemented	
Probability	6	Impact will be almost certain to occur if mitigation measures are implemented	
Nature	Positive		

11.1.2 Flora and Fauna Impact Assessment

11.1.2.1 Construction Phase

During the construction phase, cultivated areas (851 ha), *Eragrostis* – dominated Grassland (280 ha), Riparian areas (Pan-26 ha and Wetlands 26 ha, with a portion of this being *Irreplaceable* according to the Gauteng C-Plan) will be cleared (refer to Table 11-10 below). The impact of loss of cultivated fields and alien bushclumps is neutral but the loss of the *Eragrostis* – dominated Grassland and Riparian areas (assigned a high sensitivity) will have negative impacts on biodiversity. It is not anticipated that any plant SSC will be lost. Should any plant SSC be recorded within the infrastructure development footprint area, it should be reported to the relevant authorities and a relocation strategy must be compiled. Once all permits are in place, such species must be relocated.

The relevant Project activities and their potential impacts on flora and fauna are provided in Table 11-11 below and discussed in subsequent subsections.

Table 11-10: Loss of Habitat from Surface Infrastructure

Vegetation/Habitat Type	Areas Disturbed (ha)
Eragrostis Grassland	280
Wetland (Irriplaceble)	26
Pan	26
Cultivated	851
	332 ha (excluding Cultivated)

Table 11-11: Interactions and Impacts

Interaction	Impact
Site clearing	Loss of *Eragrostis*-dominated Grassland and Riparian Areas
	Habitat fragmentation and edge effects

11.1.2.1.1 Impacts Description

For site clearing, one of the habitats that have been rated as high or very high will be impacted on, the Wetlands unit. The *Eragrostis* – dominated Grassland represents a ubiquitous habitat that shows moderate ecological sensitivity and as a result, the intensity of the impact was rated as moderate. Further to this, the extent of the impact is limited to a small area and will not have considerable negative impacts on overarching biodiversity of the site.

Ecosystem function is the measure of the combined functioning of the vegetation and associated species, faunal habitats and wetlands, all of which result in the ecosystem health. Clearing for the infrastructure will affect the ecosystem functioning in two main ways. The first is the fragmentation of the ecosystem, which will occur with land surface changes. Fragmentation occurs in conjunction with edge-effects, which change the composition of the ecosystem on the edge of structures such as buildings and roads. The consequence of this is a loss of cohesiveness between larger fragments of habitat which limits the exchange of genes and resources across them. An additional contributor to loss of ecosystem function is the introduction of alien and invasive species. Disturbance to the soil after vegetation clearing results in the establishment of alien species, that may form dense monospecific stands.

11.1.2.1.2 Management Objectives

The objective of management measures is to ensure that the impact to habitat is restricted only to the footprint area and that alien plant invasion does not take place as a result of development.

11.1.2.1.3 Management Actions and Targets

In addition, the following mitigation and management measures have been prescribed:

- The footprint area should be kept as small as possible;
- Existing 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;
- An Alien Invader Plant species (AIPs) management plan should be implemented, whereby the disturbed site is monitored quarterly for at least two years to ensure that alien invasion does not take place.

11.1.2.1.4 Impact Ratings

The impacts on Flora and Fauna during the Construction Phase, as described above, are rated in the Table 11-12, Table 11-13 and Table 11-14 below.

Table 11-12: Loss of Habitat/Vegetation Types, Grassland

Dimension	Rating	Motivation	Significance
Activity: Site Clearing			
Impact Description: Loss of *Eragrostis* – dominated Grassland			
Prior to Mitigation/Management			
Duration	Permanent (7)	Native vegetation/ fauna habitat will be removed (52ha) for surface infrastructure and the impact will be permanent. Fauna species will move away with no permanent impact on them. Occasional and accidental moralities may occur.	Moderate (negative) 84
Extent	Very limited (2)	The area to be cleared is minor in comparison to the extent of the vegetation unit, as well as the extent of the total study area. No faunal SSC was encountered in the area of disturbance; therefore no direct impact is expected.	
Intensity type of impact	Moderate (-3)	Since the vegetation unit has been assigned moderate ecological sensitivityand as CBA areas are avoided, the impact is not regarded as particularly significant for terrestrial biodiversity.	

Dimension	Rating	Motivation	Significance
Probability	Certain (7)	Clearing of vegetation will definitely take place for the establishment of infrastructure.	
Nature	Negative		
Mitigation/Management Actions			
▪ Rehabilitation of the disturbed area should take place after construction, whereby a mixture of native grass species harvested from climax *Themeda* grassland and native grass species (such as *Cynodon dactylon*) are planted immediately to prevent erosion; ▪ A pre-construction survey must be undertaken to verify the site conditions; and ▪ The footprint area should be limited as far as possible.			
Post-Mitigation			
Duration	Project Life (5)	The area can be reinstated to the former land use, such as grazing after decommissioning.	Minor (negative) 49
Extent	Very limited (1)	The area to be cleared is minor in extent.	
Intensity type of impact	Minimal (1)	Loss of cultivated areas has a negligible impact on flora and fauna.	
Probability	Likely (7)	It is unlikely that compaction will have an effect after rehabilitation, should the area be compacted, the area can be ripped prior to rehabilitation.	
Nature	Negative		

Table 11-13: Potential Impacts of the Construction Phase – Loss of Habitat/Vegetation Types, Riparian

Dimension	Rating	Motivation	Significance
Activity: Site Clearing			
Impact Description: Loss of Riparian areas, Wetlands and Pans			
Prior to Mitigation/Management			

Dimension	Rating	Motivation	Significance
Duration	Permanent (7)	Native vegetation/ fauna habitat will be removed for surface infrastructure and the impact will be permanent. Fauna species will move away with no permanent impact on them. Occasional and accidental moralities may occur.	Moderate (negative) 98
Extent	Very limited (2)	The area to be cleared is minor in comparison to the extent of the vegetation unit, as well as the extent of the total study area. No faunal SSC was encountered in the area of disturbance; therefore no direct impact is expected.	
Intensity type of impact	Moderate (-5)	Since the vegetation unit has been assigned moderate ecological sensitivity, and C-Plan irreplaceable category, and is earmarked for destruction, the impact is regarded as particularly significant for riparian, wetlands and pans biodiversity.	
Probability	Certain (7)	Clearing of vegetation in wetlands will definitely take place for the establishment of infrastructure.	
Nature	Negative		
Mitigation/Management Actions			
▪ Rehabilitation of the disturbed area should take place after construction, whereby a mixture of native grass species harvested from wetland areas are planted immediately to prevent erosion; and ▪ The footprint area should be limited as far as possible.			
Post-Mitigation			
Duration	Permanent (7)	The area can be reinstated to the former land use after decommissioning.	Minor (negative) - 49
Extent	Very limited (1)	The area to be cleared is minor in extent.	
Intensity type of impact	Minimal (1)	Loss of Riparian, wetlands and pans areas has a negligible impact on flora and fauna.	
Probability	Likely (7)	It is unlikely that compaction will have an effect after rehabilitation, should the area be compacted, the area can be ripped	
Nature	Negative		

Table 11-14: Potential Impacts of the Construction Phase – Habitat Fragmentation and Alien Invasion

Dimension	Rating	Motivation	Significance
Activity: Site Clearing			
Impact Description: Habitat fragmentation and edge effects resulting in alien plant invasion			
Prior to Mitigation/Management			
Duration	Medium-term (3)	Habitat fragmentation and alien plant invasion will take place for a period of 2 – 5 years.	Minor (negative) -63
Extent	Limited (2)	Alien plants will establish around disturbed areas associated with the construction phase.	
Intensity type of impact	Serious (4)	Alien plant invasion is a serious problem with significant ecological consequences; hence its reference in the NEMBA and CARA legislation.	
Probability	Certain (7)	Since alien plants have already been recorded on site, the spread of these species due to disturbance will invariably take place. The seedbank in the soil will contain alien species.	
Nature	Negative		
Mitigation/Management Actions			
▪ An alien plant species management plan should be compiled and implemented.			
Post-Mitigation			
Duration	Medium-term (3)	As seedlings emerge, they will be removed bi-annually as part of an alien management plan.	Minor (negative) -30
Extent	Limited (2)	Alien plants will establish around disturbed areas associated with the construction phase.	
Intensity type of impact	Minimal (1)	Alien plant invasion is serious for terrestrial biodiversity; however, if these species are controlled timeously, the impact will be reduced.	

Dimension	Rating	Motivation	Significance
Probability	Highly Probable(5)	Since alien plants have already been recorded on site, the spread of these species due to disturbance will invariably take place. The seedbank in the soil will contain alien species.	
Nature	Negative		

11.1.2.2 Operational Phase

During the operational phase of the development, topsoils and overburden will be stripped and topsoils stockpiled. Progressive Open Pit Mining will cause planned loss of habitat and flora and fauna species, this is however discussed in the construction section. Furthermore the activity of increased vehicular movement and associated human activities on the site will occur. The following impacts on flora and fauna are expected per activity.

- Vegetation clearing in opencast pit area as pit expand;
- Blasting and vibration;
- Waste Rock Berms – noise during operational phase/expansion;
- Product Stockpile – noise and vehicle movement;
- Overland Conveyor Belt – noise impacts on animals / coal dust on vegetation/spills;
- Haul and Access Roads, faunal road deaths, dust and noise; and
- Crushing and Screening Plant – noise/dust on neighbouring vegetation and fauna.

11.1.2.2.1 Impact Description

Due to increased vehicular movement on site, fauna may be disturbed due to noise and dust. Further to this, roadkill of smaller fauna and birds may take place.

11.1.2.2.2 Management Objectives

The objective of management measures is to ensure that road-kills do not take place and faunal disturbance is kept to a minimum.

11.1.2.2.3 Management Actions and Targets

Signage should be erected to indicate a minimum speed limit of 30 km/hr on access roads on site. Signage should also warn drivers of the risk of animal kills on the road. Further to this, driving of vehicles should be restricted to daylight hours.

11.1.2.2.4 Impact Ratings

The impacts on Flora and Fauna during the Operational Phase, as described above, are rated in Table 11-15 below.

Table 11-15: Increased Vehicular Movement on Site

Dimension	Rating	Motivation	Significance
Activity: Increased vehicular movement and noise on site			
Impact Description: Disturbance to fauna on site (noise, road-kills)			
Prior to Mitigation/Management			
Duration	Project life (5)	The impact will last for the project life.	Minor (negative) - 40
Extent	Very limited (2)	The extent is limited since surface infrastructure is minimal.	
Intensity type of impact	Moderate (3)	No Red Data fauna species are expected to be at risk and the impact will not be frequent.	
Probability	Probable (4)	This is a commonly observed impact but it is not definite.	
Nature	Negative		
Mitigation/Management Actions			
▪ Erect signage on site applicable to specific areas; ▪ Environmental training must be undertaken with regards to faunal species; ▪ Adhere to speed limits (40 km/h); ▪ Make use of internal fencing; and ▪ Avoid vehicle movement at night.			
Post-Mitigation			
Duration	Project Life (5)	The impact will last for the project life.	Negligible(negative) 4
Extent	Very limited (1)	The extent is limited since surface infrastructure is minimal.	
Intensity type of impact	Minimal (1)	No Red Data fauna species are expected to be at risk and the impact will not be frequent.	
Probability	Rare (2)	Road-kills will be minimal if the speed limit is adhered to and activity is reduced during the night.	
Nature	Negative		

11.1.2.3 Closure and Rehabilitation Phase

Decommissioning will take place after mining has ceased production. The dismantling of surface infrastructure will involve increased activity on site and minor disturbance of the flora and fauna. This may promote the establishment of alien plant species if seeds persist in the seedbank. The impact of this will be minor. Rehabilitation of all open and disturbed areas must take place. This will be a positive impact.

11.1.2.3.1 Impact Description

When the soil is disturbed, alien plants in the seedbank will establish and spread. Rehabilitation must take by using local indigenous grass species (Andropogon appendiculatus, Andropogon eucomus, Andropogon huillensis, Aristida congesta subsp. Barbicollis, Arundinella nepalensis, Cynodon dactylon, Eragrostis capensis, Eragrostis curvula, Eragrostis gummiflua, Eragrostis racemose, Fingerhuthia Africana, Hyparrhenia hirta, Hyparrhenia tamba, Imperata cylindrical, Melinis repens, Paspalum dilatatum, Setaria sphacelata, Sporobolus africanus, Sporobolus pyramidalis, Themeda triandra, Trichoneura grandiglumis and Tristachya leucothrix) that are sown in the correct depth and method, and type of topsoil, which is layered on the correct slope.

11.1.2.3.2 Management Objectives

The objective for this phase will be to maximise the success of the rehabilitation that will take place after infrastructure is removed, and to furthermore reduce any impacts that may occur during this phase. In addition the objective of the management actions will be to ensure that alien plant species do not establish and erode the natural capital of the area.

11.1.2.3.3 Management Actions and Targets

Decommissioning of infrastructure in the proposed Palmietkuilen Coal Mine MRA will be predominantly a rehabilitation activity of footprint areas including surface infrastructure and the open pit. In order for this to be a positive impact the removal of the infrastructure must be completed so as to not harm or negatively impact surrounding vegetation. Furthermore the rehabilitation must be conducted in such a manner to achieve rehabilitation objectives for the process. These objectives will be to ensure the footprint areas are re-vegetated and that erosion through runoff and wind does not occur. Efforts will be maximised if rehabilitation is completed in the before the first rains (November) fall so as to make use of the rainfall to assist in plant recruitment. An alien plant management plan should be implemented.

11.1.2.3.4 Impact Ratings

The impact on flora and fauna during the Decommissioning Phase, as described above, are rated in Table 11-16 and Table 11-17 below.

Table 11-16: Establishment of Alien Plant Species

Dimension	Rating	Motivation	Significance
Activity: Dismantling and removal of infrastructure			
Impact Description: Alien plant invasion may take place			
Prior to Mitigation/Management			
Duration	Medium-term (3)	Alien plant invasion may occur for a short period of time.	Minor (negative) 36

Dimension	Rating	Motivation	Significance
Extent	Limited (2)	Alien plants will establish around disturbed areas associated with the decommissioning phase.	
Intensity type of impact	Serious (4)	Alien plant invasion is a serious problem with significant ecological consequences; hence its reference in the NEMBA and CARA legislation.	
Probability	Probable (4)	Since alien plants have already been recorded on site, the spread of these species due to disturbance will invariably take place. The seedbank in the soil will contain alien species.	
Nature	Negative		
Mitigation/Management Actions			
▪ An alien plant species management plan should be implemented for two years.			
Post-Mitigation			
Duration	Medium-term (3)	As seedlings emerge, they will be removed quarterly as part of an alien management plan.	Negligible (negative) 24
Extent	Limited (2)	Alien plants will establish around disturbed areas associated with decommissioned infrastructure.	
Intensity type of impact	Minimal (1)	The impact is significantly reduced if controls are implemented.	
Probability	Probable (4)	Since alien plants have already been recorded on site, the spread of these species due to disturbance will invariably take place. The seedbank in the soil will contain alien species.	
Nature	Negative		

Table 11-17: Rehabilitation of infrastructure footprint areas

Dimension	Rating	Motivation	Significance
Activity and Interaction: Rehabilitation of infrastructure footprint areas			
Impact Description: Restoration of vegetation and habitat types.			

Duration	Short term (2)	If rehabilitation is not completed effectively it will have to be re-done.	(Minor Positive) +21
Extent	Limited (2)	Only certain parts of the site will have re-vegetated cover, this will include all open areas left behind by infrastructure removal, this will include the open pit.	
Intensity	Moderate (3)	The effectiveness of the rehabilitation will determine the intensity.	
Probability	Unlikely (3)	It's unlikely that the rehabilitation will be as effective as pre-mining vegetation cover	
Nature	Positive		
Impact Description: Rehabilitation of infrastructure footprint areas			
Duration	Permanent (7)	If rehabilitation is completed successfully this impact will be permanent	(Moderate positive) +84
Extent	Local (3)	The general area beyond the project site will be positively impacted on.	
Intensity	Positive (4)	Vegetation will be restored.	
Probability	Almost certain (6)	With correct implementation this impact has a high probability of occurring	
Nature	Positive		

11.1.3 Surface Water Impact Assessment

11.1.3.1 Construction Phase

The following Project activities are likely to cause an impact to surface water during the construction phase:

- Site clearing, including the removal of topsoil and vegetation;
- Construction of mine related infrastructure, including haul roads, pipes, dams;
- Construction of washing plant;
- Relocation of Infrastructure; and
- Blasting and development of initial box-cut for mining, including stockpiling from initial box-cuts.

Table 11-18 provides the Project activity interaction and the resultant impact during the construction phase.

Table 11-18: Interactions and Impacts during the Construction Phase

Interaction	Impact
Removal of vegetation and exposure of soils	Sedimentation of surface water resources leading water siltation of water to deteriorated water quality
Movement of heavy machinery and vehicles during the construction phase	Reduced surface water infiltration and baseflow as a result of soil compaction
	Alteration in surface water drainage patterns
Lay down of impenetrable surfaces such as concrete roads	Reduced surface water infiltration and baseflow as a result of impervious surfaces
	Alteration in surface water drainage patterns
	Increased velocity in surface water runoff leading to erosion and consequent sedimentation of surface water resources
Alteration to the natural topography for the new boxcut	Alteration in surface water drainage patterns

11.1.3.1.1 Impacts Description

The removal of vegetation for site clearance and for the development and establishment of infrastructure will expose soils to erosion elements. Eroded material may cause sedimentation in the Aston Lake downstream. The movement of heavy machinery and vehicles during the construction phase may cause compaction of soils resulting in reduced infiltration of surface water and reduced baseflow. A further impact as a result of this interaction is the alteration in current surface water drainage patterns. This is also applicable to areas where impermeable surfaces such as offices and workshops will be developed. Increased runoff velocity as a result of impermeable surfaces and compaction may further result in erosion and sedimentation of the Aston Lake. The development of the new boxcut will further alter the onsite drainage patterns.

11.1.3.1.2 Management Objectives

To minimise or prevent potential surface water impacts on water quality and/or quantity during construction on the Aston Lake and its tributaries.

11.1.3.1.3 Management/ Mitigation Measures

The following mitigation measures are recommended:

- Development of the storm water management structures to ensure that sediment generated during the construction phase is conveyed to the silt trap, and clean water is diverted away from the boxcut and dirty water areas;
- Soils compacted by heavy machinery in areas that are not utilised post construction can be ripped to allow infiltration;

- Roads should be maintained regularly to ensure that surface water drains freely off the road preventing erosion; and
- Ensure that storm water management structures are within good working condition through regular inspection, especially after large storm events.

11.1.3.1.4 Impact Ratings

The impacts on surface water during the Construction Phase, as described above, are rated in Table 11-19, Table 11-20 and Table 11-21 below.

Table 11-19: Increased Sedimentation of Surface Water Resources

Dimension	Rating	Motivation	Significance
Activity & Interaction: Site clearing for the development of surface infrastructure through the removal of vegetation exposing soil to erosion			
Impact Description: Sedimentation of surface water resources resulting in the deterioration of water quality			
Prior to mitigation/ management			
Duration	Medium term (3)	More sediment deposition may occur during rainy months	Minor (negative) – 40
Extent	Local (3)	Sedimentation may potentially affect nearby Aston Lake downstream water users on the Palmietkuilen Farm.	
Intensity type of impact	Medium term - negative (4)	Serious loss to moderately sensitive environment limiting ecosystem function	
Probability	Probable (4)	It is probable that the impact may occur	
Nature	Negative		
Mitigation/ Management actions			
▪ Development of the storm water management structures to ensure that sediment generated during the construction phase is conveyed to the silt trap, and clean water is diverted away from the boxcut and dirty water areas ▪ Soils compacted by heavy machinery in areas that are not utilised post construction can be ripped to allow infiltration ▪ Roads should be maintained regularly to ensure that surface water drains freely off the road preventing erosion ▪ Ensure that storm water management structures are within good working condition through regular inspection, especially after large storm events. ▪ The silt trap and storm water management structures should be inspected after large storm events to ensure that there are no blockages or breaches. Should blockages or breaches occur, then immediate action should be undertaken to remove debris or to repair breached areas; and ▪ Vegetation clearing should be limited as much as possible to areas where it is absolutely			

Dimension	Rating	Motivation	Significance
Activity & Interaction: Site clearing for the development of surface infrastructure through the removal of vegetation exposing soil to erosion			
needed.			
Post- mitigation			
Duration	Short term (2)	Less than a year to reverse the impact if mitigation measures are applied.	Negligible (negative) – 18
Extent	Limited (2)	Storm water management structures will limit sedimentation of the lake and its tributaries.	
Intensity type of impact	Minor - negative (2)	Minor effects on the environment	
Probability	Unlikely (3)	Unlikely but may happen even when mitigation measures are implemented	
Nature	Negative		

Table 11-20: Reduced Surface Water Infiltration

Dimension	Rating	Motivation	Significance
Activity & Interaction: Movement of heavy machinery and vehicles for site clearing and for the development of surface infrastructure during the construction phase			
Impact Description: Reduced surface water infiltration as well as an alteration in surface water drainage patterns as a result of soil compaction from the movement of heavy machinery and vehicles			
Prior to mitigation/ management			
Duration	Medium term (3)	Impacts will occur during the construction phase and can be reversed during this time	Minor (negative) – 60
Extent	Local (3)	Reduced baseflow may have a minor impact on local streamflow within the Palmietkuilen Farm extending beyond the site	
Intensity type	Medium term -	Environmental damage can be reversed	

Dimension	Rating	Motivation	Significance
Activity & Interaction: Movement of heavy machinery and vehicles for site clearing and for the development of surface infrastructure during the construction phase			
of impact	negative (4)	in less than a year	
Probability	Highly Probable (6)	It is highly probable that the impact may occur	
Nature	Negative		
Mitigation/ Management actions			
▪ Vegetation clearing should be limited as much as possible to areas where it is absolutely needed; ▪ Implementation of the storm water management plan to capture sediment and convey it to the silt trap; and ▪ Compact soils can be loosened through soil ripping in areas where compact areas are not in use post construction.			
Post- mitigation			
Duration	Short term (2)	Less than a year to reverse the impact	Negligible (negative) – 24
Extent	Limited (2)	Limited to the site	
Intensity type of impact	Minor - negative (-2)	Minor effects on the environment	
Probability	Unlikely (3)	Unlikely to take place after mitigation	
Nature	Negative		

Table 11-21: Alteration in surface water drainage patterns and Water reaching Aston Lake

Dimension	Rating	Motivation	Significance
Activity & Interaction: Blasting and development of initial box-cut for mining, including stockpiling from initial box-cuts resulting in the alteration of the natural topography			
Impact Description: Alteration in surface water drainage patterns and a reduction in the amount of water reaching the Aston Lake and reduced flow to Blesbokspruit.			
Prior to mitigation/ management			
Duration	Permanent (7)	The boxcut will remain permanent therefore the impacts will occur beyond the life of the project.	Moderate (negative) – 98
Extent	Limited (2)	Limited to the two subcatchments of the Aston Lake	

<table>
<tr><th>Dimension</th><th>Rating</th><th>Motivation</th><th>Significance</th></tr>
<tr><td colspan="4">Activity & Interaction: Blasting and development of initial box-cut for mining, including stockpiling from initial box-cuts resulting in the alteration of the natural topography</td></tr>
<tr><td>Intensity type of impact</td><td>Long term - negative (-5)</td><td>Environmental damage will be long term, as there will be reduced storm flow to the Aston Lake used by the surrounding communities.</td><td rowspan="3"></td></tr>
<tr><td>Probability</td><td>Certain (7)</td><td>The impact will occur</td></tr>
<tr><td>Nature</td><td>Negative</td><td></td></tr>
<tr><td colspan="4">Mitigation/ Management actions</td></tr>
<tr><td colspan="4">▪ Implementation of the storm water management plan to prevent clean water from flowing into the boxcut. Unfortunately, there are no mitigation measures for direct rainfall falling into the boxcut;
▪ As much as is possible, water should be reused and any treated storm flows released downstream;
▪ Backfilling and rehabilitation of old boxcuts as mining progresses</td></tr>
<tr><td colspan="4">Post- mitigation</td></tr>
<tr><td>Duration</td><td>Medium term (3)</td><td>Impacts will occur only until the boxcut areas are backfilled</td><td rowspan="5">Minor (negative) – 63</td></tr>
<tr><td>Extent</td><td>Very Limited (1)</td><td>Limited to an isolated part of the site</td></tr>
<tr><td>Intensity type of impact</td><td>Long term - negative (-5)</td><td>Environmental damage will be long term</td></tr>
<tr><td>Probability</td><td>Certain (7)</td><td>The impact will occur</td></tr>
<tr><td>Nature</td><td>Negative</td><td></td></tr>
</table>

11.1.3.2 Operational Phase

The following project activities are likely to cause an impact to surface water during the operation phase:

- Stripping topsoil and soft overburden;
- Removal of overburden, including drilling and blasting of hard overburden;
- Loading, hauling and stockpiling of overburden;
- Drilling and blasting of coal;
- Load, haul and stockpiling of ROM coal;
- Use and maintenance of haul roads for the transportation of coal to the washing plant; and
- Water use and storage on-site.

Table 11-22 provides the activity interaction and the resultant impact during the operational phase.

Table 11-22: Interactions and Impacts of Activity

Interaction	Impact
Runoff from the dirty water areas (waste water dams, crushing plant, conveyors and product stockpile)	Runoff reporting into the Aston Lake and the unnamed streams flowing to it resulting in water contamination or the deterioration of the water quality
Development and operation of surface infrastructure (pollution control dams, stockpiles, workshops & offices, crushing and screening plant)	Reduction of Catchment Yield as dirty water runoff within the mine will be contained in the PCD.

11.1.3.2.1 Impacts Description:

Dirty water runoff laden with carbonaceous material from the contaminated surfaces and the infrastructure within the mine (ROM stockpiles, crushing plant, conveyors and product stockpile) has the potential to contaminate and silt up the natural water resources or streams, should it not be contained within the mine. This impact will therefore deteriorate the water quality in both the Aston Lake and the Blesbokspruit.

Containment of dirty water runoff from within the mining area will reduce the amount of runoff reporting to the Aston Lake. A decrease in the catchment yield may have an impact on the flow required for the ecological reserve. However, the total infrastructure footprint area amounts to approximately 10.72 km^2 which approximates to 3.1% of the total catchment area of the Aston Lake of 344 km^2. The percentage decrease in MAR reporting to Aston Lake will result from the capture of dirty water as the mine develops. This decrease of 3% is not considered to be significant in light with the mitigation measures prescribed.

11.1.3.2.2 Management Objectives

To minimise or prevent potential surface water impacts on water quality and/or quantity during operation on the Aston Lake and its tributaries.

11.1.3.2.3 Management/ Mitigation Measures

This section provides the necessary management measures to prevent and/or reduce the identified impacts:

- Ensure that all the dirty water emanating from the dirty water areas be collected via silt traps before entering the PCD for re-use within the mine, to prevent unnecessary discharge into the environment;
- The dirty water collection trenches should be cleaned regularly to reduce the build up of washed off coal fines and ensure they are able to accommodate and convey the

1:50 year peak flows. This material should be disposed to an appropriate licenced facility;

- Stockpiling should be monitored so that the side slopes do not encourage erosion of the slopes resulting in silt transported into the trenches from the stockpiles, allowing some silt to settle on the dirty water site rather than in the channels; and
- In addition to the control of storm water, water quality monitoring should form part of the system where water in the PCD's are monitored for quality. This ensures that pollution sources are monitored during the mining operational process and in the unlikely event of any spillages the downstream impacts can be estimated. The main constituents to check would be the TDS, EC, Salts and some chemical parameters that such as (pH, SO_4 and other metals.)

11.1.3.2.4 Impact Ratings

The impacts on surface water during the Operational Phase, as described above, are rated in Table 11-23 below.

Table 11-23: Water Quality Deterioration

Dimension	Rating	Motivation	Significance
Activity & Interaction: Development and operation of surface infrastructure			
Impact: Water contamination leading to deterioration of water quality			
Pre-Mitigation			
Duration	Project Life (5)	Due to the nature of the mining activities the contamination of water resources may occur over the project life if mitigation measures are not in place.	Moderate - negative (90)
Extent	Region (5)	The impacts may affect the Aston Lake	
Intensity	Serious - negative (-5)	This may have serious impacts on the water quality that will be made available to the downstream water users (agricultural- livestock watering and crop irrigation)	
Probability	Almost Certain (6)	Without appropriate mitigation, the probability of the impact occurring is almost certain	
Nature	Negative		
Mitigation Measures			

Dimension	Rating	Motivation	Significance
Activity & Interaction: Development and operation of surface infrastructure			
▪ Ensure that all the dirty water emanating from the dirty water areas be collected via silt traps before entering the PCD for re-use within the mine, to prevent unnecessary discharge into the environment; ▪ The dirty water collection trenches should be cleaned regularly to reduce the build up of washed off coal fines and ensure they are able to accommodate and convey the 1:50 year peak flows. This material should be disposed to an appropriate licenced facility. ▪ Stockpiling should be monitored so that the side slopes do not encourage erosion of the slopes resulting in silt transported into the trenches from the stockpiles, allowing some silt to settle on the dirty water site rather than in the channels; ▪ In addition to the control of storm water, water quality monitoring should form part of the system where water in the PCD's are monitored for quality. This ensures that pollution sources are monitored during the mining operational process and in the unlikely event of any spillages the downstream impacts can be estimated. The main constituents to check would be the TSS, EC, Salts and some chemical parameters that such as (pH, SO4 and other metals).			
Post-Mitigation			
Duration	Medium term (5)	Impact may occur over the project life even if if mitigation measures are t in place however at a different scale	Minor (negative) (60)
Extent	Region (5)	The impacts may affect the flow in the Aston Lake and possibly contributes to the Blesbokspruit.	
Intensity	Moderate - negative (-5)	This may have serious impacts on the downstream agricultural water users	
Probability	Probable (4)	Has previously occurred and could therefore occur.	
Nature	Negative		

11.1.3.3 Decommissioning and Post Closure Phase

The project activities which are likely to cause an impact to surface water during the decommissioning and post closure phase:

- Demolition and removal of all infrastructure, including transporting materials off site; and
- Rehabilitation, including spreading of soil, re-vegetation and profiling or contouring.

Table 11-24 provides the activity interaction and the resultant impact during the decommissioning and post Closure phase.

Table 11-24: Interactions and Impacts during the Decommissioning and Post Closure Phase

Interaction	Impact
Movement of heavy machinery and vehicles compacting soils during demolition of infrastructure and rehabilitation processes	Alteration of natural surface water drainage patterns and reduced infiltration
Loosening of soil during demolition of infrastructure and rehabilitation processes	Sedimentation of surface water resources leading to deteriorated water quality
Restoration of topography to a pre-mining state and re-vegetation of disturbed areas	Return of natural drainage patterns as a result of freely draining topography

11.1.3.3.1 Impact Description

The movement of heavy machinery and vehicles during the decommissioning phase may cause compaction of soils resulting in reduced infiltration of surface water. A further impact as a result of this interaction is the alteration in current surface water drainage patterns. Increased runoff velocity as a result of compaction may further result in erosion and sedimentation of the Aston Lake.

11.1.3.3.2 Management Objectives

a) To ensure that rehabilitation is undertaken strictly according to the rehabilitation and closure study undertaken as part of the EIA.

11.1.3.3.3 Management Actions and Targets

The following actions and targets are required:

- Leaving the storm water management structures in place during the decommissioning and post closure phase until the rehabilitation process is completed. This will ensure that sediment generated during this phase is captured.
- Storm water management structures should be inspected after large storm events to ensure that there are no blockages or breaches. Should blockages or breaches occur, then immediate action should be undertaken to remove debris or to repair breached areas.
- Soils compacted by heavy machinery can be ripped to allow infiltration.
- Rehabilitation processes such as restoring the topography to a pre-mining state, and re-vegetation of disturbed areas will assist in returning natural surface water drainage patterns.

11.1.3.3.4 Impact Ratings

The impacts on surface water during the Decommissioning and Post Closure Phase, as described above, are rated in Table 11-25 and Table 11-26 below.

Table 11-25: Reduced Surface Water Infiltration and Alteration in Drainage Patterns

Dimension	Rating	Motivation	Significance
Activity & Interaction: Movement of heavy machinery during the decommissioning and rehabilitation phases resulting in soil compaction			
Impact Description: Reduced surface water infiltration as well as an alteration in surface water drainage patterns as a result of soil compaction from the movement of heavy machinery and vehicles			
Prior to mitigation/ management			
Duration	Medium term (3)	Impacts will occur during the decommissioning phases and can be reversed during this time	Minor (negative) – 36
Extent	Limited (2)	Compacting will be confined to the access roads thus only small areas will be affected within the catchment of the Dwars-in-die-wegvlei	
Intensity type of impact	Medium term - negative (-4)	Environmental damage can be reversed in less than a year	
Probability	Probable (4)	The impact may occur	
Nature	Negative		
Mitigation/ Management actions			
▪ Compact soils should be loosened through soil ripping.			
Post- mitigation			
Duration	Short term (2)	Less than a year to reverse the impact	Negligible (negative) – 18
Extent	Limited (2)	Limited to the site	
Intensity type of impact	Minor - negative (-2)	Minor effects on the environment	
Probability	Unlikely (3)	Unlikely but may happen if mitigation measures are not implemented	
Nature	Negative		

Table 11-26: Sedimentation of Surface Water Resources

Dimension	Rating	Motivation	Significance

Activity & Interaction: Loosening of soil during rehabilitation processes			
Impact Description: Sedimentation of surface water resources resulting in reduced water quality			
Prior to mitigation/ management			
Duration	Medium term (3)	Seasonal high flows are likely to disperse sediment build up	Minor (negative) – 40
Extent	Local (3)	Sedimentation may potentially affect the storage capacity of Aston Lake.	
Intensity type of impact	Medium term - negative (-4)	Environmental damage can be reversed in less than a year	
Probability	Probable (4)	It is probable that the impact may occur	
Nature	Negative		
Mitigation/ Management actions			
▪ Storm water management structures should be left in place until after rehabilitation is complete; and ▪ Storm water management structures should be inspected after large storm events to ensure that there are no blockages or breaches. Should blockages or breaches occur, then immediate action should be undertaken to remove debris or to repair breached areas.			
Post- mitigation			
Duration	Short term (2)	Less than a year to reverse the impact	Negligible (negative) – 18
Extent	Limited (2)	Storm water management structures will limit sedimentation to the infrastructure site and silt trap	
Intensity type of impact	Minor - negative (-2)	Minor effects on the environment	
Probability	Unlikely (3)	Unlikely but may happen if mitigation measures are not implemented	
Nature	Negative		

11.1.4 Groundwater Impact Assessment

The potential impacts of the opencast mining relate to the fact that mining requires dewatering to facilitate for dry working conditions within the facilities. The dewatering cone will extend into the immediate vicinity of the mine, and may reduce the available groundwater if there are local groundwater users that have boreholes which are within the radius of influence of the cone of depression caused by dewatering. Another potential impact is contamination emanating from the mining vicinities. The contamination may migrate into the local aquifer where it might reach sensitive receptors such as humans that make use of groundwater and natural ecosystems that depend on the groundwater.

11.1.4.1 Groundwater Numerical Modelling Results

The proposed mining could potentially impact the groundwater quantity and quality. No-go areas were identified based on the groundwater numerical model with respect to the potential groundwater quantity and quality impacts, as discussed below.

11.1.4.1.1 Impact on Groundwater Quantity - Cone of Dewatering

Mine dewatering will result in the lowering of the water table, creating a cone of depression. After mine closure and subsequent cessation of the dewatering programme, the water level will start to recover. The cone of dewatering will therefore be at its maximum at the end of the mining operation.

Based on the numerical model conducted, the size of the no-go area is defined by a drawdown of 5 m. Lowering of the water table by less than 5 m is not considered to be significant and is not shown in the Groundwater Sensitivity Plan (Plan 42). Streams and wetlands are generally fed by groundwater as baseflow. Therefore, lowering of the groundwater level could potentially lower the amount of water fed to streams and wetlands.

As illustrated in Plan 42, the no-go area is predominantly in the mine boundary area and no private boreholes located beyond the mine area are located within the no-go area. The numerical model was used to predict the size and shape of the contamination plume 100 years after closure.

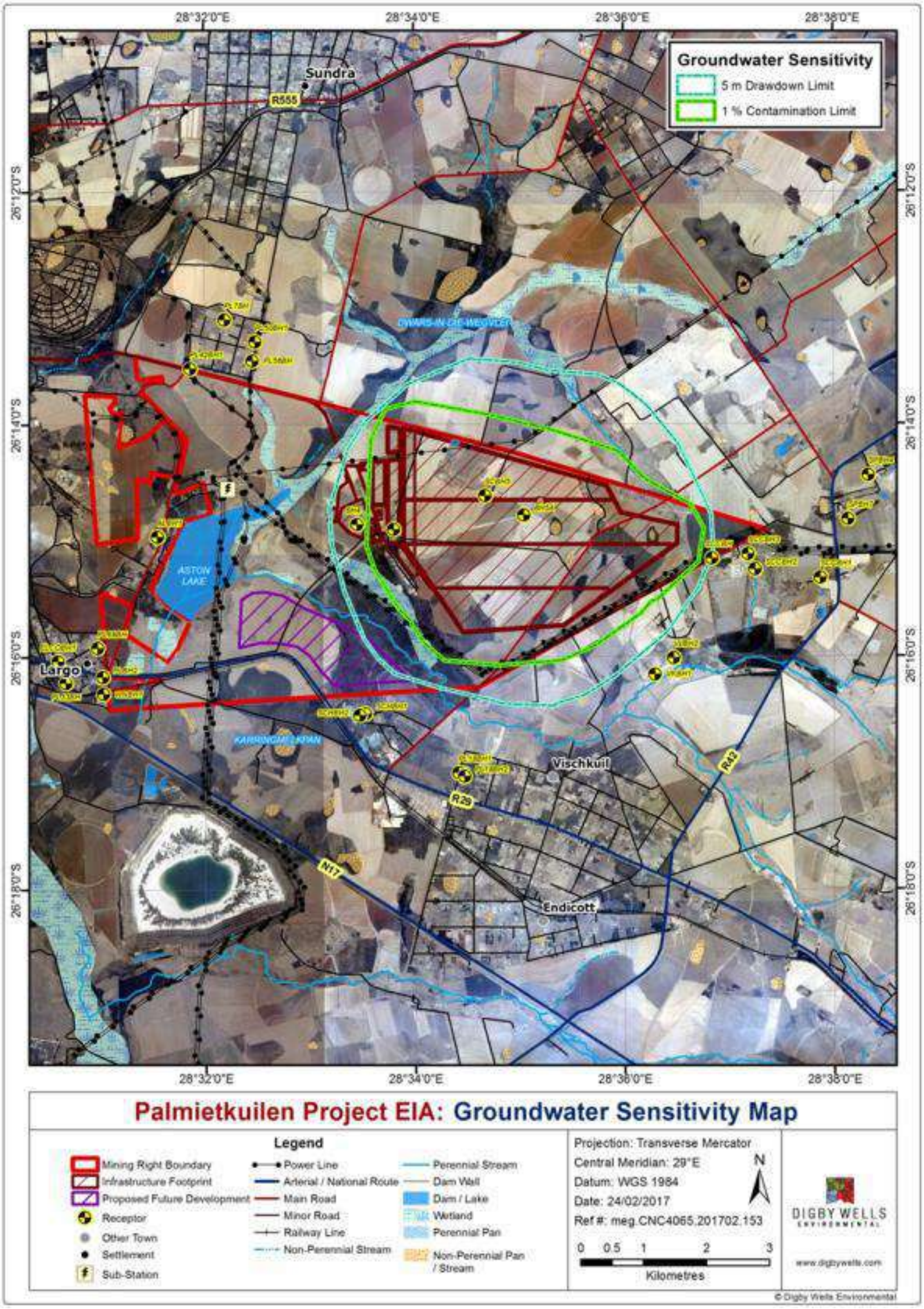
11.1.4.1.2 Impact on Groundwater Quality- Contamination Plume

Mining is likely to alter the natural geochemistry as a result of exposure of the sulfides to oxygenation. This could result in sulfate contamination as observed in the coal mines within the region, where the concentration could reach up to 2500 mg/L.

Contamination plumes predominantly migrate as a result of advection. However, no or limited contamination is expected to reach the identified potential receptors during operations, due to the hydraulic gradient being towards the mining and abstraction areas.

After mine closure, however, dewatering will cease and groundwater will recover and start to flow towards the rivers and streams. The contamination plume will be transported with the groundwater flow. Due to the limited hydraulic permeability of the region, however, the plume is relatively considered to not be extensive.

A source-term concentration of 100% has been simulated and the no-go concentration area has been defined by 1%. If, for example, the concentration of sulfate at the pit is 100 mg/L, a contour value of 50% indicates a concentration value of 50 mg/L. The plume extends into the vicinity of Verdrietlaagte wetland/stream and Dwars-in-die-Wegvlei' wetland/stream and could potentially have a negative effect on the wetland/stream water quality. Decant is predicted after closure at approximately 1.3 L/s and could have a negative effect on the Dwars-in-die-Wegvlei' wetland/stream quality if not properly managed.



Plan 42: Groundwater sensitivity map

11.1.4.2 Construction Phase

The following Project activities are likely to cause an impact to groundwater during the construction phase:

- Site clearance and topsoil removal across the project area;
- The construction of overburden stockpile areas; and
- The construction of PCDs.

The potential impacts to groundwater caused by these activities are discussed in Table 11-27 below.

Table 11-27: Interactions and impacts during the construction phase

Interaction	Impact
Site clearing	Lowering of the water table, if the site clearing will take place below the water table
Construction of overburden stockpile areas and PCDs	Lowering of the water table, if the construction activities are going to take place below the water table

11.1.4.2.1 Impact Description

The groundwater table at the proposed infrastructure area is between 1 m and 16.27 m below surface. Site clearing and construction activities that would involve excavation below the water table depth will therefore have a potential impact on the groundwater quantity and quality.

11.1.4.2.2 Management/ Mitigation Measures

The following management measures are recommended for potential groundwater impact during the construction phase:

- Site clearance and construction activities should take place above the water table, if applicable. No impact on the groundwater is expected if the activities take place above the water table; and
- Site clearance and construction activities should be restricted to areas of absolute necessity;
- If trenches are going to be excavated below the water level, dewatering of the aquifer to lower the water table locally can be considered to ensure that the construction takes place above the groundwater level and the water quality remains acceptable. The abstracted water can be utilised for dust suppression, vegetation irrigation or discharged to pollution control dams for evaporation. Since the groundwater is not expected to be polluted at this stage, the utilisation of the water for activities such as dust suppression or irrigation will not cause negative environmental impacts; and

- Install long term monitoring boreholes. The positions of the monitoring boreholes are provided in Section 8.1.4, Part B.

11.1.4.2.3 Impact Ratings

The impacts on groundwater during the Construction Phase, as described above, are rated in Table 11-28 below.

Table 11-28: Potential Groundwater Impacts during the Construction Phase

Dimension	Rating	Motivation	Significance
Activity & Interaction: Site clearing for the development of surface infrastructure through the removal of the top soil and weathered rocks			
Impact Description: Lowering of the water table			
Pre-Mitigation			
Duration	Short term: Less than 1 year (2)	Construction activities are expected to be short-lived (i.e. during the construction phase)	Negligible (-15)
Extent	Limited (1)	Site clearing will only occur within and immediately around the project site	
Intensity type of impact	Negative (-2)	Any dewatering will have minor environmental significance	
Probability	Unlikely (3)	Dewatering during the construction phase (if any) is unlikely to cause environmental impact considering limited rock permeability, the duration and excavation depth.	
Nature	Negative		
Mitigation/ Management actions			
• Avoid or minimise construction activities to a depth of below the water table; • Restrict areas that must be cleared of vegetation for construction activities to those absolutely necessary; • If that is not possible, dewatering of the aquifer to locally lower the water table can be considered to ensure that the construction takes place above the groundwater level and the water quality remains acceptable. The abstracted water can be utilised for dust suppression, vegetation or discharged to pollution control dams for evaporation. Since the groundwater is not expected to be polluted at this stage, the utilisation of the water for activities such as dust suppression or irrigation (if applicable) is not expected to cause environmental impacts; and • Install groundwater monitoring boreholes to assess the time series water level and quality impacts and trends.			
Post-Mitigation			
Duration	Short term: Less than 1 year (2)	Any lowering of the water table during the construction phase is expected to be shallow and recover relatively quickly	Negligible (-8)
Extent	Limited (1)	No impacts are expected however if	

		they occur they will be reduced to isolated parts of the mine where site clearing is going to take place	
Intensity x type of impact	Negative (-1)	Considering that the construction phase will be for a short period, the intensity will be minimal	
Probability	Rare (2)	It is unlikely for groundwater impact to occur during the construction phase, especially with the implementation of the above proposed management plan	

11.1.4.3 Operational Phase

The following Project activities are likely to cause an impact to groundwater during the operational phase:

- Groundwater dewatering;
- PCDs;
- Slurry deposition; and
- Overburden and topsoil stockpiling.

The potential impacts to groundwater caused by these activities are discussed in Table 11-29 below.

Table 11-29: Interactions and impacts during the operational phase

Interaction	Impact
Groundwater dewatering	Water level lowering
Pollution control dam	Groundwater contamination due to seepage from the dam
Slurry and discard deposition and temporary stockpiles	Groundwater contamination due to seepage
Overburden stockpiles	Groundwater contamination due to seepage

11.1.4.3.1 Impact Description

Mine dewatering is crucial to keep the mine workings dry for safe working conditions. and geotechnical stability if there are issues which need management. If the pit is to be used without dewatering boreholes ahead of time the impacts will be similar to having dewatering holes. Dewatering could start prior to excavations. This can potentially impact the groundwater environment negatively by lowering the water level and creating a cone of depression in the top weathered aquifer where the majority of private boreholes are often located. It has however been found that the dewatering cone will not affect any current boreholes.

The estimated groundwater inflow rate at various stages of the life of mine are listed in **Error! Reference source not found.** and illustrated in **Error! Reference source not und.**. The total inflow rate is expected to increase as the mine area increases to a maximum inflow of 1,790 m^3/d. It should be noted that this estimate is based on permeability studies conducted on 5 boreholes only. Due to this, together with the other limitations (refer to Section 20.4), the inflow rate should be considered with a certainty of approximately 60%.

Inflow rate is not only a function of the aquifer properties, but also the mine plan (mined area, depth and excavation rate). A maximum drawdown of 63 m expected to occur. The maximum radius of influence is predicted to be 3 km, with 1.3 km going beyond the project area boundary and the remaining contained within the Project area.

Table 11-30: Estimated Groundwater Inflow Rates

Year	Inflows (m^3/d)		Year	Inflows (m^3/d)
Y0	0		Y10	580
Y1	375		Y11-15	701
Y2	385		Y16-20	815
Y3	397		Y21-25	984
Y4	404		Y26-30	1120
Y5	419		Y31-35	1260
Y6	453		Y36-40	1410
Y7	460		Y41-45	1560
Y8	517		Y46-50	1690
Y9	572		Y51-53	1790

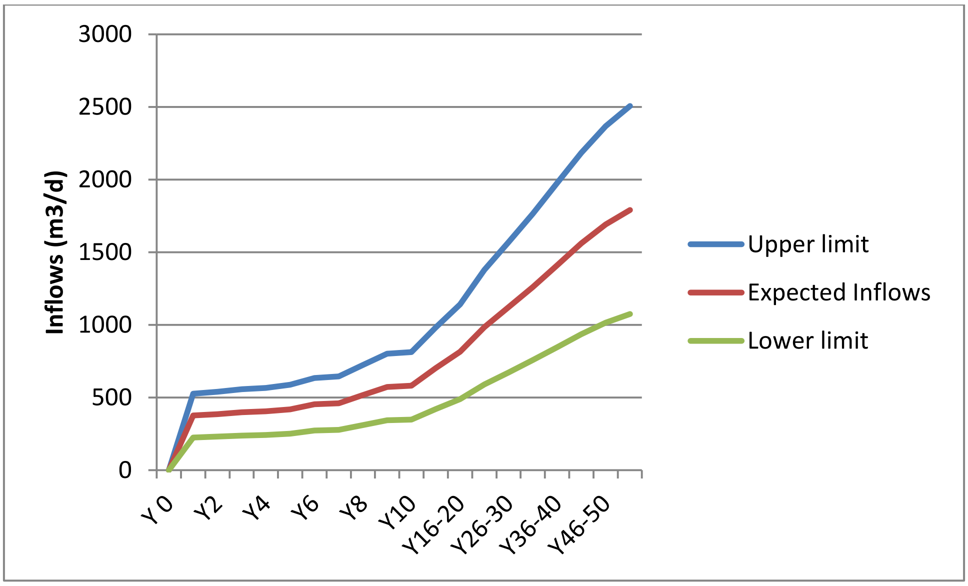


Figure 11-1: Estimated groundwater inflow rates

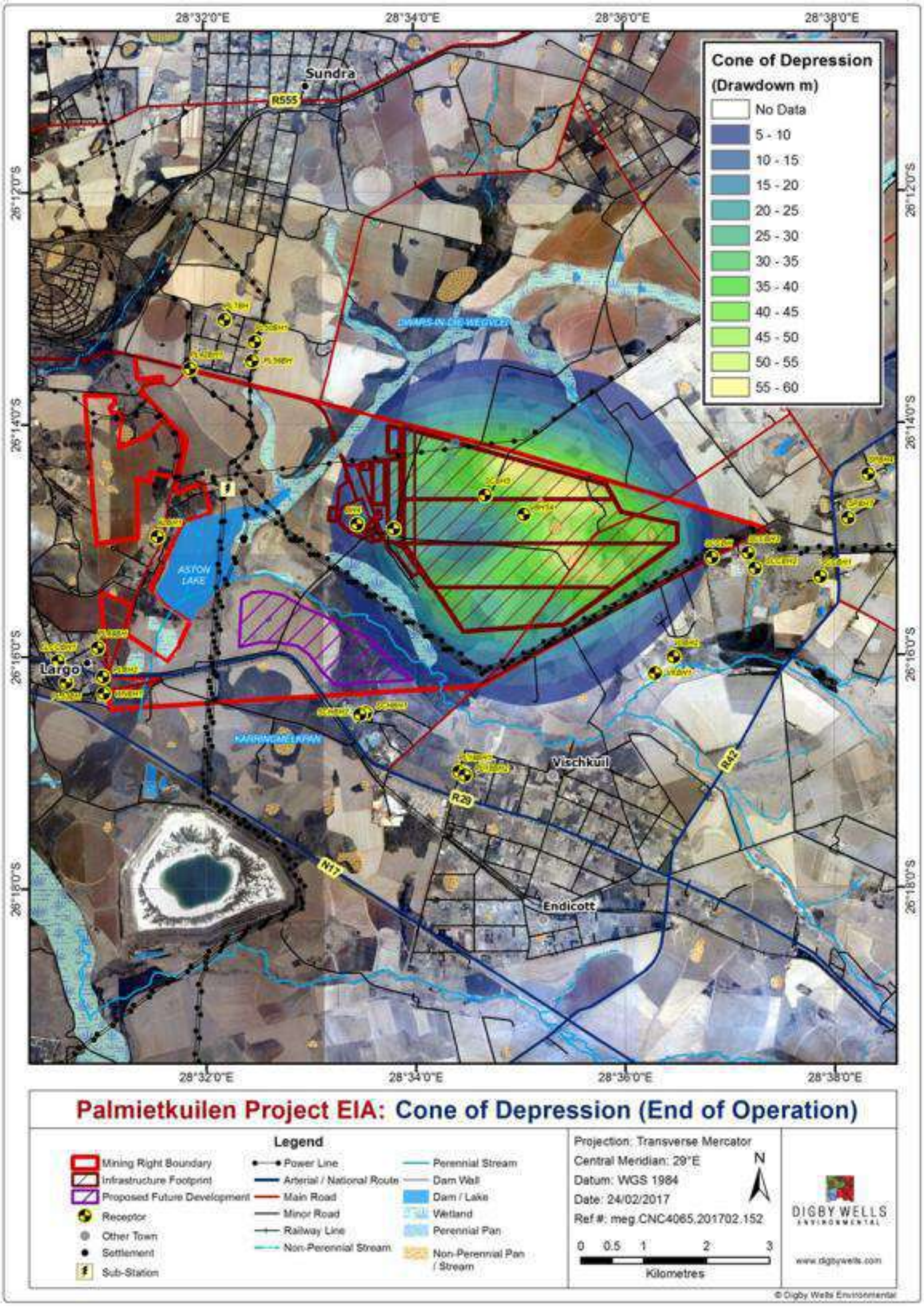
Assessments of various coal mines show that saline water with acidic or alkaline pH can be released from the mine workings and stockpiles once the coal and rocks are exposed to oxygen and moisture. This is also true in the nearby mines in the coalfields where the sulfate contamination is at around 2500 mg/L. It is therefore reasonable to assume that such contamination could occur at the Project site.

During operation any contaminants that will originate from the mine workings will be pumped out as part of the mine dewatering process. No or limited contaminants are expected to migrate away from the mine area into streams or private boreholes. The water pumped out is assumed to be kept in closed circuit and utilised on the mine.

11.1.4.3.2 Management Actions and Targets

The following are management measures are recommended for potential groundwater impact during the operational phase:

- Contain the contaminated water in the mine water systems;
- Monitor the effects of dewatering; and
- Minimise the impact associated with the lowering of the water table. Always keep the dewatering level close to the coal seam floor, not deeper if dewatering boreholes are used.



Plan 43: Estimated Cone of Depression at the End of Operation

11.1.4.3.3 Impact Ratings

The impacts on groundwater during the Operational Phase, as described above, are rated in Table 11-31 - Table 11-34 below.

Table 11-31: Potential Groundwater Impacts during the Operational Phase – Mine Dewatering

Dimension	**Rating**	**Motivation**	**Significance**
Activity & Interaction: Mine dewatering and creation of cone of dewatering			
Impact Description: Lowering of the water table			
Pre-Mitigation			
Duration	Beyond project life (6)	The water level will remain below its natural level for some time after the life of a project	Moderate (-91)
Extent	Local (3)	The cone of depression extends beyond the development area.	
Intensity type of impact	Serious (4)	Mine dewatering will result in lowering of the water table within the site, with a potential impact on the local wetlands and streams	
Probability	Definitely (7)	Definite: There are sound scientific reasons to expect that the impact will definitely occur with a >80% probability	
Nature	Negative		
Mitigation/ Management actions			
▪ Store the dewatered water in pollution control dams and ensure that the dams will have sufficient storage volume. If that is not possible, alternatives such re-introduce treated water into the streams or selling the water to another industry should be investigated.; ▪ Dewatering should be conducted efficiently and should be from a depth not more than the coal seam floor if required; ▪ If impact is confirmed through monitoring, management solutions should be implemented acceptable to the authorities such as the purchase of impacted land or the provision of alternate sources of water; and ▪ Groundwater monitoring should be conducted.			
Post-Mitigation			
Duration	Beyond project life (6)	The water level will remain below its natural level for some time after the life of a Project.	Minor (-27)
Extent	Limited (2)	With the above stated mitigation methods, the extent is expected to be limited.	
Intensity type of impact	Minor - negative (-1)	If the abstracted water is stored in PCDs or treated and re-introduced to the streams, the environmental significance is rated as minor.	

Probability	Unlikely (3)	With the application of the proposed mitigation plans, the probability of the impact will be unlikely.	

Table 11-32: Potential Groundwater Impacts during the Operational Phase – Contamination from Open Pit Mining

Dimension	Rating	Motivation	Significance
Activity & Interaction: Groundwater contamination as a result of open pit mining and, seepage from the PCD and waste stockpiling			
Impact Description: Contamination plume in the groundwater			
Prior to mitigation/ management			
Duration	Beyond project life (6)	Groundwater contamination due to mine disturbance will occur during the operational phase and is expected to persist even after closure.	Minor (negative) – 40
Extent	Limited (2)	The contaminated groundwater is unlikely to feed the rivers and will not contaminate an area larger than the mine footprint. This is due to the groundwater dewatering that will intercept the contamination plume during the operation phase. The net inflow will be toward the pit	
Intensity type of impact	Minor – negative (-2)	The mine dewatering is expected to maintain the hydraulic head of the mine area to be below the regional groundwater level, thus containing the contamination plume to within the mine property.	
Probability	Probable (4)	The impact is likely to occur, although the plume is unlikely to not migrate beyond the mine area during the operational phase.	
Nature	Negative		
Mitigation/ Management actions			
▪ Concurrent rehabilitation should be conducted to minimise water and oxygen inflow from the atmosphere; ▪ The pit should be enclosed with berms to contain surface water runoffs from entering; ▪ Management solutions should be provided following an agreement with the farmers with impacted groundwater or mine purchase land; and ▪ Utilise any contaminated water where possible.			
Post management			
Duration	Beyond project life (6)	Groundwater contamination due to mine disturbance will occur during the operational phase and is expected to persist even after closure	Negligible (negative) – 30

Dimension	Rating	Motivation	Significance
Activity & Interaction: Groundwater contamination as a result of open pit mining and, seepage from the PCD and waste stockpiling			
Impact Description: Contamination plume in the groundwater			
Extent	Limited (2)	With the implementation of the above stated mitigation methods, the impact extent can be minimised to the site only	
Intensity x type of impact	Minimal – negative (2)	The dewatering of the open pit mine will contain the pollution plume during the operational phase, with minor effects on the groundwater environment	
Probability	Unlikely (3)	The impact is unlikely to be significant with the implementation of the above stated mitigation methods	

Table 11-33: Potential Groundwater Impacts during the Operational Phase – Contamination from Seepage of Waste Stockpiles and Slurry Dam

Activity & Interaction: Groundwater contamination as a result of seepage from the waste stockpiles and slurry dam			
Impact Description: Contamination plume in the groundwater			
Prior to mitigation/ management			
Duration	Permanent (7)	The stockpiles and slurry dam are likely to seep and contaminate the groundwater, even after mine closure	Minor (negative) – 77
Extent	Limited (2)	The contaminated groundwater is unlikely to feed the rivers and will not contaminate an area larger than the mine footprint. This is due to the groundwater dewatering that will intercept the contamination plume during the operation phase.	
Intensity type of impact	Minor (-2)	The mine dewatering is expected to maintain the hydraulic head of the mine area to be below the regional groundwater level, thus containing the contamination plume to within the mine property.	
Probability	Definite (7)	Seepage from unlined dams will definitely impact the groundwater	
Nature	Negative		
Mitigation/ Management actions			

Activity & Interaction: Groundwater contamination as a result of seepage from the waste stockpiles and slurry dam			
Impact Description: Contamination plume in the groundwater			
▪ Slurry dam, overburden and topsoil stockpiles should be managed to minimise infiltration of contaminants to the groundwater. Mitigation methods that should be considered include the correct placement of the stockpile and covering them with soil to minimise rainfall infiltration and mobilisation of dissolved metals and vegetate them. The shape of the stockpile should be managed to control the ease with which water can run off from the facility; ▪ Implement the required prevention mechanisms at the discard and slurry stockpiles to prevent pollution migration; and ▪ Discard being placed back into the pit should be put on the coal seam floor or as low as possible and definitely below the water table in areas where there will be no oxygenation and water throughflow.			
Post management			
Duration	Permanent (7)	Groundwater contamination due to mine disturbance will occur during the operational phase and is expected to persist even after closure	Negligible (negative) – 30
Extent	Limited (2)	With the implementation of the above stated mitigation methods, the impact extent can be minimised to the site only	
Intensity type of impact	Minimal – negative (2)	The dewatering of the open pit mine will contain the pollution plume during the operational phase, with minor effects on the groundwater environment	
Probability	Unlikely (3)	The impact is unlikely to be significant with the implementation of the above stated mitigation methods	

Table 11-34: Potential Groundwater Impacts during the Operational Phase – Contamination from PCD

Activity & Interaction: Dirty mine water storage in the PCD			
Dimension	**Rating**	**Motivation**	**Significance**
Impact Description: Groundwater contamination due to seepage from PCD			
Prior to mitigation/ management			
Duration	Project life (5)	Seepage of contaminated water will occur during the operation of the dams	Minor (negative) – 70
Extent	Limited (2)	The impact from the pollution control dam is expected to be local and limited to within 150 m of the PCD footprint area	
Intensity type of impact	Minor (3)	Once contamination starts, it take time to rehabilitate naturally	
Probability	Definite (-7)	Seepage from unlined PCD will definitely impact the groundwater	
Nature	Negative		

<table>
<tr><td colspan="4">Mitigation/ Management actions</td></tr>
<tr><td colspan="4">▪ Apply a liner underneath the PCDs to minimise or avoid infiltration; and
▪ Monitor the groundwater quality for impact detection.</td></tr>
<tr><td colspan="4">Post management</td></tr>
<tr><td>Duration</td><td>Project life (5)</td><td>The seepage from the pollution control dams will take place throughout the project life</td><td rowspan="4">Negligible (negative) – 21</td></tr>
<tr><td>Extent</td><td>Very limited (1)</td><td>With the application of a liner, the plume will be very limited</td></tr>
<tr><td>Intensity x type of impact</td><td>Minimal (-1)</td><td>The intensity is minimal with the application of liners</td></tr>
<tr><td>Probability</td><td>unlikely (3)</td><td>The impact is unlikely to occur</td></tr>
</table>

11.1.4.4 Post Closure Phase

The following Project activities are likely to cause an impact to groundwater during the decommissioning and post closure phases:

- Groundwater contamination; and
- Mine decant.

The potential impacts to groundwater caused by these activities are discussed in Table 11-35 below.

Table 11-35: Interactions and Impacts during the Decommissioning and Post-Closure Phase

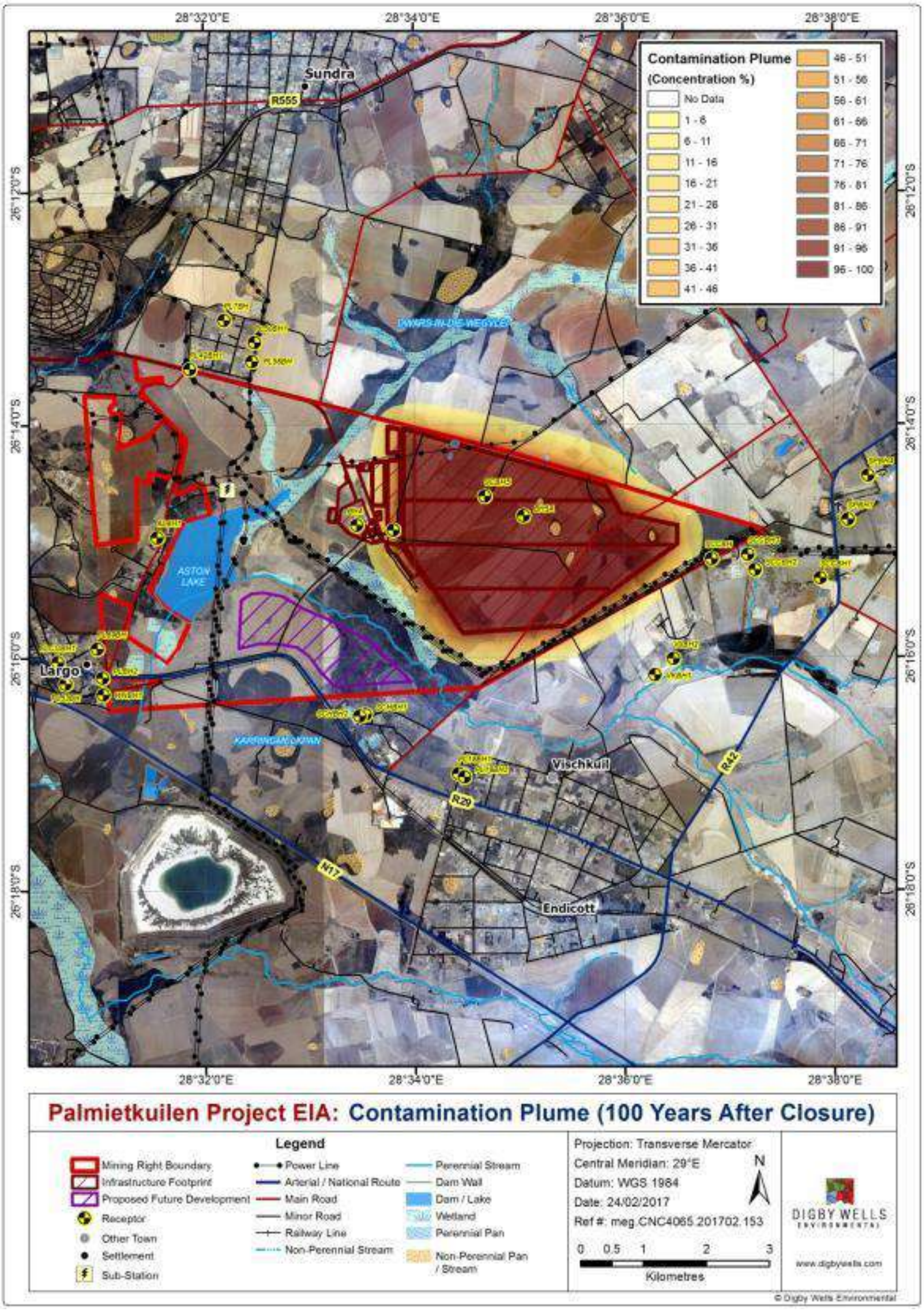
Interaction	Impact
Mine water contamination	Groundwater and possibly stream contamination
Mine decanting	Surface water contamination

11.1.4.4.1 Impact Description

Once the mine is closed and dewatering ceases, groundwater will start to recover to its pre-mining level. Following full recovery (expected to be around 35 years after closure) the contaminants will start to migrate away from the mine site.

A geochemical assessment was conducted by Geostratum Groundwater and Geochemistry Consult (2016) (Appendix R) which reported that 5% of the rocks (consisting of carbonaceous rocks and sandstone adjacent to coal seams) have a significant potential to generate AMD. It is also expected that the discard and slurry will have the potential to generate leachates.

The simulated contamination plumes 100 years after closure are displayed in Plan 44. The plume is simulated in terms of percentage; a sulphate concentration of 100% is assumed at the source of contamination. The plume is expected to extend approximately 500 m beyond the project area boundary.



Plan 44: Contamination plume migration 100 years after mine closure

Model simulations and hydrostatic calculations show that the mine is likely to decant after closure. The decanting is expected to occur at a locality shown in Plan 45. A summary of the decant includes:

- The decanting will start 35 years after mine closure and is expected to decant at a rate ranging between 3 and 7 L/s, with the average being 5 L/s (Figure 11-2); and
- Once the decant (which is expected to be poor in quality) reaches the stream, it can migrate at a higher rate compared to groundwater flow and could have a negative impact on the down-gradient riverine ecosystem and land owners.

It should be noted any unsealed exploration boreholes or geological fractures enhanced by mine blasting could also be decant zones if their topographic elevation is lower than the hydraulic head. It is impossible to inform at this moment if and when such structures will be formed. Annual monitoring for seepage and decant followed by rehabilitation will be required.

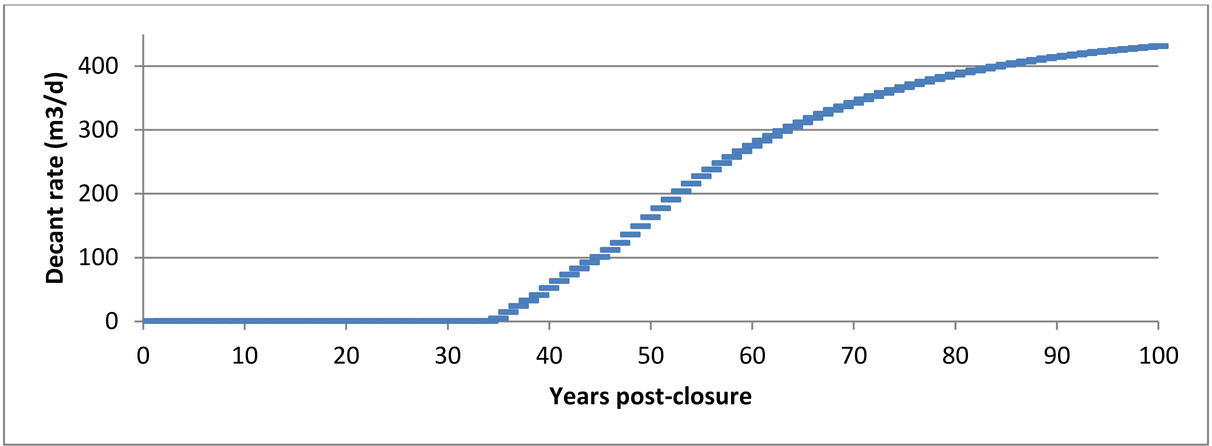
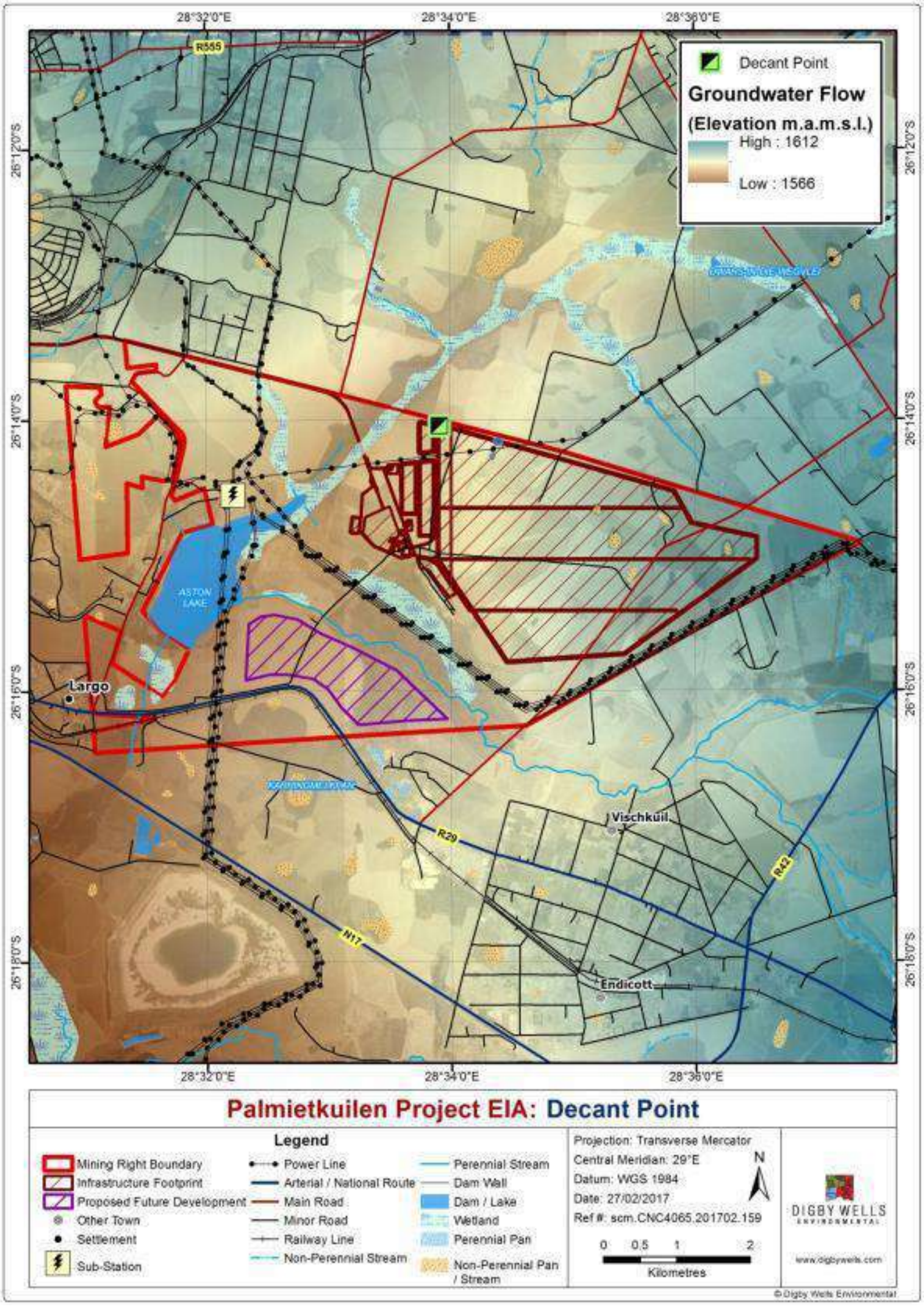


Figure 11-2: Predicted decanting period and rate



Plan 45: Potential Decant Location

11.1.4.4.2 Management Actions and Targets

The following actions and targets are required:

- Contain the contamination plume to within the mine area, by active or passive mitigation ways;
- Place all potentially leachate generating materials as low as possible in the the mining pit to prevent leachate generation and movement;
- Minimise the generation of poor quality water; and
- Minimise the impact associated with the decant by intercepting and treating it before joining the streams.

11.1.4.4.3 Post-Closure Phase Impact Ratings

The impacts on groundwater during the Decommissioning and Post Closure Phase, as described above, are rated in Table 11-36 and Table 11-37 below.

Table 11-36: Potential Impacts after Mine Closure – Mine decanting and Contamination

Dimension	Rating	Motivation	Significance
Activity & Interaction: Mine decanting and contamination of surface water bodies			
Impact Description: Decanting of the closed mine			
Prior to mitigation/ management			
Duration	Permanent (7)	Once the mine starts to decant, it is not expected to stop naturally	Moderate (negative) – 105
Extent	Local (3)	The decant can to flow to the streams and affect the surface water quality negatively	
Intensity x type of impact	Serous- negative (-5)	The decant is expected to have a significant impact and require effective management and rehabilitation measures to prevent irreplaceable impacts.	
Probability	Certain (7)	Based on analytical and numerical modelling, it is certain that there will be a decant after mine closure	
Nature	Negative		
Mitigation/ Management actions			

Dimension	Rating	Motivation	Significance
Activity & Interaction: Mine decanting and contamination of surface water bodies			
▪ The decant should be captured before joining the streams. It should be treated, passively if possible using wetlands, and re-introduced into the streams. As experienced from other coal mines, the decant quality could be up to 2500 mg/L of sulfate; ▪ If an impact is confirmed through monitoring, management solutions should be implemented acceptable to the authorities such as the purchase of impacted land or the provision of alternate sources of water; ▪ The pit should be backfilled and rehabilitated after closure to minimise water and oxygen inflow from the atmosphere; ▪ The potentially leachate generating material should be placed at the bottom of the mining pits; ▪ Decant rate and quality should be monitored as part of the regular groundwater monitoring; amd ▪ The numerical model should be updated annually for the first 2 years with the monitoring data. There after the model can be updated once in 5 years.			
Post- mitigation			
Duration	Permanent (7)	The decant is expected to continue for the foreseeable future	Negligible (negative) – 30
Extent	Limited (2)	With the re-introduction of the treated water into the surface water system, the extent of impact will be limited	
Intensity type of impact	Minimal - negative (-1)	Once the decanted water is treated and re-introduced to the streams, the environmental significance is rated as minimal to no loss. There will be a land impact of wetlands to treat the water or evaporation areas	
Probability	Unlikely (3)	If the decant is treated to the SANS or river quality objectives, its impact is unlikely	

Table 11-37: Potential Impacts after Mine Closure - Contamination

Dimension	Rating	Motivation	Significance
Activity & Interaction: Groundwater contamination as a result of opencast mining			
Impact Description: Contamination plume in the groundwater			
Prior to mitigation/ management			
Duration	Beyond project life (6)	Groundwater contamination due to potential acid mine drainage or dissolution of heavy metals will occur even after the mine closure	Minor (negative) – 48
Extent	Local (3)	The contaminated groundwater can feed boreholes that would be drilled at or close to the rehabilitated pit. The maximum extent from the pit sides is 550 m	

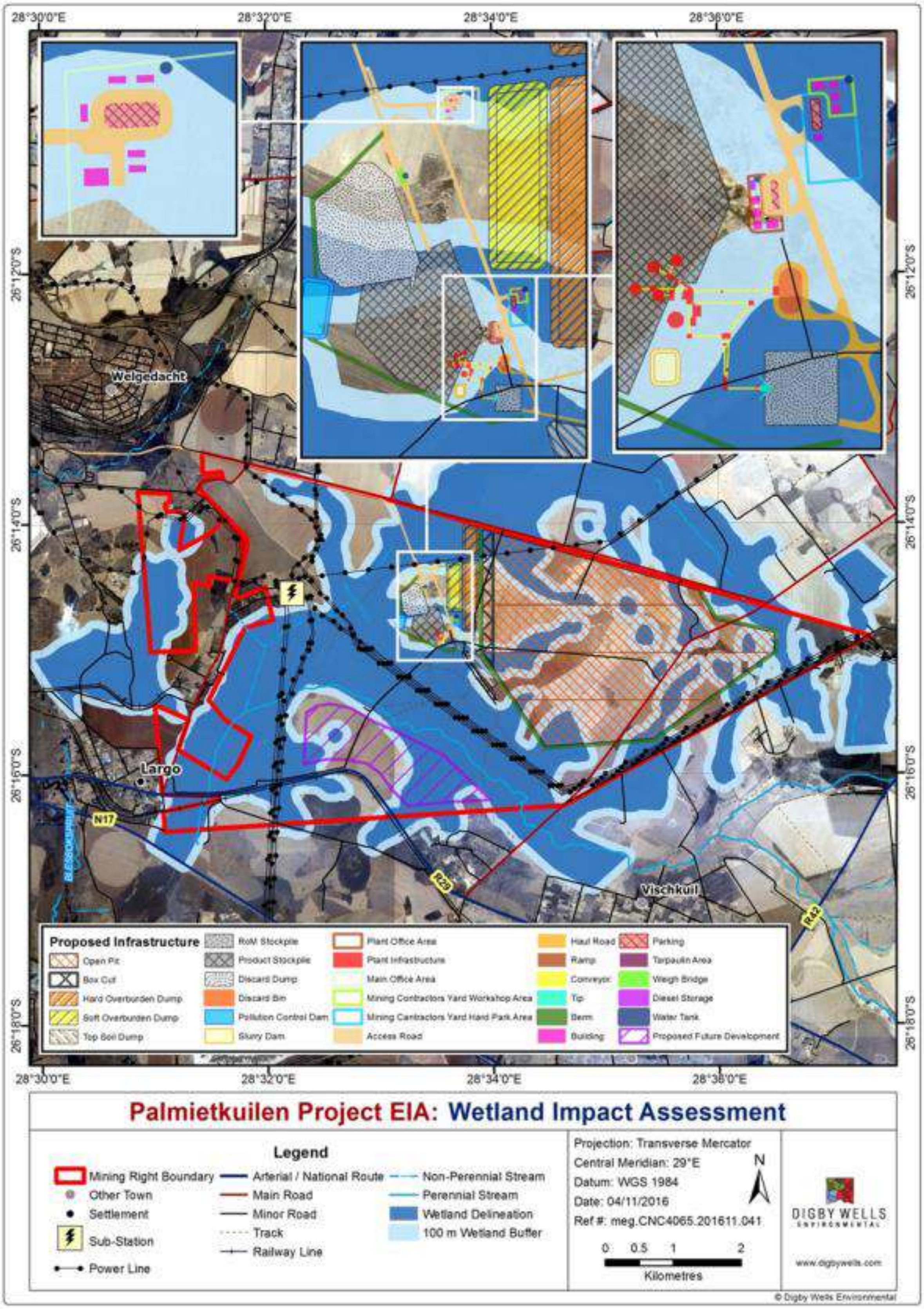
Dimension	Rating	Motivation	Significance
Activity & Interaction: Groundwater contamination as a result of opencast mining			
Impact Description: Contamination plume in the groundwater			
Intensity type of impact	Moderate – negative (-3)	Overall the streams are gaining from the returing groundwater baseflow. There will be a risk of contaminants migrating from the pit area to the wetlands and streams which modelling shows not to be extensive but this needs to be monitored and appropriate action taken if necessary.	
Probability	Likely (4)	The impact is likely to occur since the groundwater will recover after closure and start to decant	
Nature	Negative		
Mitigation/ Management actions			
- Groundwater will flow away from the mine footprint if the hydraulic head within the mine is higher than the surrounding elevation. Ensure that water quality is not poor by placement of leachate generating materials in a position where they will not adversely affect water quality; - If impact is confirmed through monitoring, management solutions should be sought for upon agreement with the farmers or communities with impacted groundwater or mine purchase land; and - Monitoring of groundwater water levels and mine inflow rates should be conducted.			
Post management			
Duration	Beyond project life (6)	Groundwater contamination due to mine disturbance will continue even after mine closure	Negligible (negative) – 30
Extent	Limited (2)	With the implementation of the above stated mitigation methods, the impact extent can be minimised to the site only	
Intensity x type of impact	Minor – negative (2)	If the decanting spot is managed properly, the contaminant plume can be contained, with minor effects on the groundwater environment	
Probability	Unlikely (3)	The impact is unlikely to occur if the above stated mitigation plans are implemented	

11.1.5 Wetlands Impact Assessment

A total of 255.2 ha of wetland area will be lost; of which 201.9 ha is associated with the open pit and 53.3 ha the supporting infrastructure (Table 11-38; Plan 46). The subsequent sections detail the expected impacts to wetlands associated with the project.

Table 11-38: Areas of Wetlands Directly Associated with the Mine Plan and Infrastructure

Mine Plan and Infrastructure unit	Total area (ha) of wetland
Open pit mine area	201.9
All supporting infrastructure	53.3
Total	**255.2**



Plan 46: Wetland Impact Assessment

11.1.5.1 Construction Phase

The construction phase activities that will have an impact on the wetlands are summarised below.

Table 11-39: Construction Phase Interactions with Wetlands

Interaction		Impact
1	Site Clearance, including the removal of topsoil and vegetation, for the construction of mine-related infrastructure	Loss of wetland habitat (soils and vegetation) totalling 53.3 ha for infrastructure and 201.9 ha associated with the open pit area.
2	Construction of mine-related infrastructure and blasting and development of initial box-cut for mining	Construction and development activities within a greenfield site are a negative impact to functioning wetlands and catchment.

11.1.5.1.1 Impact Description

The construction phase will result in a loss of wetland areas of 53.3 ha for infrastructure and 201.9 ha for the open pit area. Since the impact is irreversible, this will result in permanent loss of ecosystem services provided by the wetlands in question.

Although the wetlands of the area are not in a pristine condition due to agricultural use, the proposed project activities will significantly alter the baseline state of the surrounding wetlands as these systems are not currently affected by industrial or mining activities. This is realised through habitat fragmentation, spreading of alien and invasive species, increased incidence of erosion, potential water quality deterioration and disturbance to avifauna and other fauna utilising the wetlands.

11.1.5.1.2 Management Objectives

Wetland management objectives are to inform AOL where there are interactions of the proposed activities with wetlands during the construction phase and how best they can mitigate and manage the impacts if the project is to go ahead. This is important as the naturally occurring habitat and ecosystems play a major role in supporting a range of ecological processes and biodiversity in the region. These objectives are to prevent/minimise the loss of or further damage to natural wetland ecosystems and their buffer areas as protection of wetland ecosystem is a national objective; particularly of NFEPA wetlands.

11.1.5.1.3 Management Actions and Targets

The proposed project will result in significant residual impacts to the wetlands and thus rigorous management will be needed. From a perspective of ecological sensitivity, the proposed project could result in significant, irreversible impacts to wetlands. If the project is to go ahead, the Wetland Management Plan must be used to inform mitigation actions, including:

- The edge of the non-directly affected valley bottom wetlands must be clearly demarcated in the field as sensitive receptors and no-go zones. This should also include at least a 32 m buffer zone.
- Wetland monitoring must be carried out during the construction phase to ensure no unnecessary impact to wetlands is realised; and if so this action should be put in place as soon as possible;
- Mitigation and management actions provided in the following reports done by Digby Wells as part of this project should be used to guide the effective management of the ecological wetland resources affected by the proposed project:
  - Air Quality Report (Appendix I);
  - Aquatic Ecology Report (Appendix H);
  - Fauna and Flora Report (Appendix F);
  - Groundwater Report (Appendix E);
  - Rehabilitation Plan (Appendix Q); and
  - Surface Water Report (Appendix D).

11.1.5.1.4 Impact Ratings

The impacts on wetlands during the Construction Phase, as described above, are rated in Table 11-40 and Table 11-41 below.

Table 11-40: Site Clearance Activities

Dimension	Rating	Motivation	Significance
Activity and Interaction 1: Site Clearance, including the removal of topsoil and vegetation, for the construction of mine-related infrastructure and the pit area.			
Impact Description: Loss of wetland habitat (soils and vegetation) totalling 53.3 ha for infrastructure and 201.9 ha associated with the open pit area. This impact will be irreversible and will result in complete loss of wetland ecosystems or part thereof. Although these wetlands are not in pristine condition, they are providing significant ecological services at the local and catchment scale. This is of particular concern due to the link to the NFEPA rank 1 Ramsar listed wetland (Blesbokspruit).			
Prior to Mitigation/Management			
Duration	Permanent (7)	The removal of wetland soils and intact vegetation will be a permanent loss of wetland habitat.	**Major negative (-119)**
Extent	Municipal (4)	Loss of wetland ecosystems that are significant on a catchment scale.	
Intensity	Irreplaceable	Wetlands are sensitive natural ecosystems	

Dimension	Rating	Motivation	Significance
	loss of highly sensitive environment (6)	providing significant ecological services that are experiencing high levels of cumulative loss and damage. Thus, all remaining functional wetlands are even more important and sensitive to impacts that threaten their ecological integrity; directly or indirectly.	
Probability	Definite (7)	According to the given infrastructure layout, this impact will occur.	
Nature	Negative		
Mitigation/Management Actions			
- There are no mitigation measures for loss of habitat, however, it is recommended that the wetland area in question follow the mitigation hierarchy which must be followed, as described below: **Avoidance** includes activities that change or stop actions before they take place, in order to prevent their expected negative impacts on biodiversity and decrease the overall potential impact of an operation. A change in mine plan (particularly the size of the pit) should be investigated further however it is understood that this will impact the feasibility of the mine; **Minimisation** measures are taken to reduce the duration, intensity, extent and/or likelihood of impacts that cannot be completely avoided. This includes the reduction of the size of the wetlands to be disturbed; **Restoration** involves altering an area in such a way as to re-establish an ecosystem's composition, structure and function, usually bringing it back to its original (pre-disturbance) state or to a healthy state close to the original. Project impact on wetlands are remediated; and **Biodiversity offsets** are measurable conservation outcomes resulting from actions designed to compensate for significant residual adverse biodiversity impacts arising from project development and persisting after appropriate avoidance, minimisation and restoration measures have been taken. As a last resort, wetland offsets can be discussed with the DWS as an alternative, however, due to the link to the Blesbokspruit watercourse, this is not preferred.			

Table 11-41: Potential Impacts of Construction Phase on Wetlands: General Construction Activities

Dimension	Rating	Motivation	Significance
Activity and Interaction 2: Construction of mine-related infrastructure and blasting and development of initial box-cut for mining.			

Dimension	Rating	Motivation	Significance
Impact Description: Construction and development activities within a greenfield site are a negative impact to functioning wetlands and catchment. This is realised through habitat fragmentation, spreading of alien and invasive species, soil compaction, increased incidence of erosion, sedimentation from dust and erosion, potential water quality deterioration and disturbance to avifauna and other fauna utilising the wetlands.			
Prior to Mitigation/Management			
Duration	Project Life (5)	The impacts caused during the construction will have a long lasting effect if not mitigated. Impacts must be managed proactively.	**Minor negative (-70)**
Extent	Municipal (4)	The impact could spread beyond the local development boundaries due to the ability of degraded water quality or alien invasive species to travel significant distances; especially downstream. Habitat fragmentation is also a catchment scale impact.	
Intensity	Serious damage to or loss of sensitive environments (5)	These impacts are serious threats to the important and sensitive wetland habitats; especially in an area with high level of cumulative habitat loss and water quality deterioration as well as NFEPA Rank1 status (Blesbokspruit Ramsar Wetland).	
Probability	Likely (5)	These impacts are common of mining and industrial construction sites and project and thus have at least a 65% chance of occurring with some small mitigation measures assumed.	
Nature	Negative		
Mitigation/Management Actions			

Dimension	Rating	Motivation	Significance
▪ The edge of the non-directly impacted wetlands, and at least a 32 m buffer if possible, must be clearly demarcated in the field with wooden stakes painted white as no-go zones that will last for the duration of the construction phase. ▪ Wetland monitoring must be carried out during the construction phase by a wetland specialist to ensure no unnecessary impact to wetlands is realised; and if so that a remedy is put in place as soon as possible. ▪ Refer to the Surface Water Report (Digby Wells, 2016f) for details on a Storm Water Management Plan that is to be carried out. This must be in operation during the construction phase and wetlands must be highlighted as sensitive receptors. ▪ Refer to the Fauna and Flora Report (Digby Wells, 2016c) for mitigation measures relating to floristic impacts as well as faunal species disturbances; for example, o minimal bright lights should be left on at night time and they should not face outwards of the site; and o an alien and invasive plant species management programme must be in place from the construction phase.			
Post-Mitigation			
Duration	Medium term (3)	The potential impacts caused during the construction will remain a threat throughout the project life but the managed impact will have a medium term impact in the ecosystem.	**Negligible negative (-32)**
Extent	Local area (3)	Managing and mitigation measures will prevent the impacts from spreading beyond the local development site.	
Intensity	Minor (2)	With fully functional management, monitoring and mitigation plans, the impact to the ecosystem functioning will be minimal.	
Probability	Probable (4)	Despite all intentions to prevent impacts, it is probable that impacts will still be realised due to the nature of the activity and the proximity to sensitive wetland receptors. These potential residual impacts must be managed accordingly.	
Nature	Negative		

11.1.5.2 Operational Phase Impacts

The operational phase activities that will have an impact on the wetlands are summarised below.

Table 11-42: Operational Phase Interactions with Wetlands

Interaction		Impact
1	Open pit mining to a depth of 60 m, requiring dewatering.	Perforation of rock and groundwater reserves leading to severe hydrological and geomorphological impacts to wetlands and catchment due to draw down cone
2	General operational activities within and around wetland habitats such as the use and maintenance of haul roads, stockpiling of ROM coal, transportation of coal to the washing plant.	Similarly to the construction phase, the operational mining activities occurring within an ecologically sensitive catchment, which pose significant potential negative impacts to functioning wetlands and catchment.

11.1.5.2.1 Impact Description

Mining of coal within and around wetland ecosystems represents significant negative impacts to these ecosystems that function from a combination of surface and groundwater inputs. The open pit mining will result in irreversible loss of wetlands due to blasting of the base rock and puncturing of the aquifers. Furthermore, the mining may cause draw-down into the mining pit that will require dewatering and lead to significant hydrological impacts to the catchment. The surface water runoff from the project area will also not be reporting to the valley bottom and into the hydrological cycle as this will be captured into the dirty water storm water management system.

The handling, stockpiling and transport of the coal will have some impacts to the wetlands, particularly with respect to the haul road that crosses the NFEPA Rank 1 wetland, upstream of Aston Lake. Movement of coal openly through the environment will have some deposition of coal fines that will negatively impact the surrounding environment, particularly the water quality of the water resources. Furthermore, the maintenance of this haul road will require activities within the wetlands to continue through operational phase that may result in soil compaction, erosion and increased sedimentation into the aquatic environment.

11.1.5.2.2 Management Objectives

Wetland management objectives are to inform AOL where there are interactions of the proposed activities with wetlands during the operational phase and how best they can mitigate and manage the impacts if the project is to go ahead. This is important as the naturally occurring habitat and ecosystems play a major role in supporting a range of ecological processes and biodiversity in the region. These objectives are to prevent/minimise the loss of or further damage to natural wetland ecosystems and their buffer areas as protection of wetland ecosystem is a national objective; particularly of NFEPA wetlands.

11.1.5.2.3 Management Actions and Targets

The proposed project will result in significant residual impacts to the wetlands and thus rigorous management will be needed. The Wetland Management Plan must be used to inform mitigation actions, including:

- The edge of the non-directly affected valley bottom wetlands must be clearly demarcated in the field during operation as sensitive receptors and no-go zones. This should also include at least a 32 m buffer if possible.
- Wetland monitoring must be carried out during this phase to ensure no unnecessary impact to wetlands is realised; and if so that a remedy is put in place as soon as possible;
- Mitigation and management actions provided in the following reports done by Digby Wells as part of this project should be used to guide the effective management of the ecological wetland resources affected by the proposed project:
  - Air Quality Report (Appendix I);
  - Aquatic Ecology Report (Appendix H);
  - Fauna and Flora Report (Appendix F);
  - Groundwater Report (Appendix E);
  - Rehabilitation Plan (Appendix Q); and
  - Surface Water Report (Appendix D).

11.1.5.2.4 Impact Ratings

The impacts on wetlands during the Operational Phase, as described above, are rated in Table 11-43 and Table 11-44 below.

Table 11-43: Open pit mining

Dimension	Rating	Motivation	Significance
Activity and Interaction 1: Open pit mining to a depth of 60 m, requiring dewatering.			
Impact Description: Perforation of rock and groundwater reserves leading to severe hydrological and geomorphological impacts to wetlands and catchment due to draw down cone.			
Prior to Mitigation/Management			
Duration	Permanent (7)	Mining of wetlands and adjacent to sensitive wetland receptors (NFEPA Rank 1) may have an irreversible impact to the functioning of these ecosystems. The mining will also be a permanent change to the wetland setting and groundwater functioning.	**Major negative (-119)**
Extent	Municipal (4)	The affected wetlands drain directly into the sensitive Blesbokspruit River and catchment. Whilst these systems are not in pristine condition, further impacts as to the system from the proposed project to this area may have municipal / catchment level significance.	

Dimension	Rating	Motivation	Significance
Intensity	Irreplaceable damage to highly sensitive environments (6)	These rivers and wetlands are important for the ecological services they provide to society; particularly due to the high level of cumulative loss of wetland functioning in the area. Mining of these wetlands may lead to the loss of some of these areas and this is seen as an irreplaceable loss of these highly sensitive systems.	
Probability	Definite (7)	Mining of these wetlands will go ahead according to the proposed project and thus will lead to the impacts described.	
Nature	Negative		
Mitigation/Management Actions			
▪ There are no foreseen mitigation actions that may significantly lessen the impact on the receiving catchment. However, the following should be done: ▪ Dirty water from the storm water system and pollution control dam should be treated and released back into the surrounding wetland systems; downstream of the dewatering cone of depression, this water can also be used for irrigation of surrounding land. ▪ Off-sets must be investigated to mitigate the residual impact, this can be achieved by rehabilitating an impacted wetland system.			
Post-Mitigation			
Duration	Beyond project life (6)	Mining of wetlands and adjacent to sensitive wetland receptors (NFEPA Rank 1) may have an irreversible impact to the functioning of these ecosystems. The mining will also be a permanent change to the wetland setting and groundwater functioning.	**Major negative (-112)**
Extent	Municipal (4)	The affected wetlands drain directly into the sensitive Blesbokspruit River and catchment. Whilst these systems are not in pristine condition, further impacts as to the system from the proposed project to this area may have municipal / catchment level significance.	
Intensity	Irreplaceable damage to highly sensitive environments (6)	These rivers and wetlands are important for the ecological services they provide to society; particularly due to the high level of cumulative loss of wetland functioning in the area. Mining of these wetlands may lead to the loss of some of these areas and this is seen as an irreplaceable loss of these highly sensitive systems.	

Dimension	Rating	Motivation	Significance
Probability	Definite (7)	Mining of these wetlands will go ahead according to the proposed project and thus will lead to the impacts described.	
Nature	Negative		

Table 11-44: Potential Impacts of Operational Phase Interaction 2 on Wetlands: General operational activities

Dimension	Rating	Motivation	Significance
Activity and Interaction 2: General operational activities within and around wetland habitats such as the use and maintenance of haul roads, stockpiling of ROM coal, transportation of coal to the washing plant.			
Impact 1 Description: The operational activities will be occurring within an ecologically sensitive catchment and thus the handling, stockpiling and transport of the coal will have some impacts to the wetlands, particularly with respect to the haul road that crosses the NFEPA Rank 1 wetland, upstream of Aston Lake. Movement of coal openly through the environment will have some deposition of coal fines that will negatively impact the surrounding environment, particularly water quality. Furthermore, the maintenance of this haul road will require activities within the wetlands to continue through operational phase that may result in soil compaction, erosion and increased sedimentation into the aquatic environment			
Prior to Mitigation/Management			
Duration	Beyond Project Life (6)	Carbonaceous material will cause pollution of the water that may reside for a time longer than the operation of the project. Additionally, if erosion occurs from the increased vehicular activity around this area, the impact will last longer the project.	**Moderate negative (-84)**
Extent	Municipal (4)	The affected wetlands drain directly into the sensitive Blesbokspruit River and catchment. Whilst these systems are not in pristine condition, further impacts as to the system from the proposed project to this area may have municipal / catchment level significance.	
Intensity	On-going serious damage to sensitive environments (4)	These wetlands are sensitive receptors and this represents serious ecological damage to the health and functioning.	
Probability	Highly Probable (6)	The activities within and around the wetlands are very likely to lead to the impacts described.	

Dimension	Rating	Motivation	Significance
Nature	Negative		
Mitigation/Management Actions			
▪ The haul roads and servitude must also have well-designed stream crossings and drainage areas, which should be maintained. The wetlands outside of this must be demarcated as no-go areas. ▪ Dust management programme must be in place (Air Quality Report, Digby Wells, 2016a) ▪ The haul roads and servitude must be monitored and maintained to best operating standards. This should be done in the dry season. ▪ The wetland must be monitored on a regular basis (monthly during the construction phase and biannually thereafter) to ensure no residual impact to the wetland and river is realised; and if so that remediation measures are followed. ▪ If possible, truck loads should be covered; particularly in dry and windy seasons (May – August). ▪ Berms must be maintained as a buffer between the coal handling area and the sensitive receiving environment.			
Post-Mitigation			
Duration	Project Life (5)	The activities and potential impacts will be present for the operational life of the project.	**Minor negative (-44)**
Extent	Local (3)	The mitigation measures can ensure the impacts will be limited to the development area.	
Intensity	On-going moderate damage to sensitive environments (3)	These wetlands are sensitive receptors and the activities will still represent a moderate impact to the ecological functioning.	
Probability	Probable (4)	The activities within and around the wetlands are less likely to lead to the impacts described.	
Nature	Negative		

11.1.5.3 Decommissioning, Rehabilitation and Closure Phase

The decommissioning and rehabilitation phase activities that will have an impact on the wetlands are summarised below.

Table 11-45: Decommissioning and rehabilitation phase interactions with wetlands

Interaction	Impact

Interaction		Impact
1	Decommissioning activities within and around remaining wetland habitats, such demolition and removal of all infrastructure, and subsequent final rehabilitation of the final void and area.	Similarly to the construction phase, the decommissioning and rehabilitation activities occurring within an ecologically sensitive catchment pose significant potential negative impacts to functioning wetlands and catchment. Furthermore, the rehabilitated area could cause major negative impacts due to spread of alien invasive vegetation, increased soil compaction erosion and subsequent sedimentation into the wetland ecosystems.
2	Mine closure and post-mining environmental status	Post-mining water decant is predicted to occur once the final void has been rehabilitated and groundwater levels are allowed to return back to natural level. It is anticipated that this decant will be acid forming.

11.1.5.3.1 Impact Description

This phase will require the closure of the final void, removal of the infrastructure and the rehabilitation of the site to an acceptable and sustainable landscape that will be functional in perpetuity. Similarly to the construction phase, this will require large scale activities within and around the wetland of the site and may have negative impacts if not managed correctly. It is particularly important to remediate highly polluted sites such as the PCD, screening and crushing plant and product stockpile areas.

The post-mining landscape will see the groundwater return to its natural level once dewatering stops. It is predicted that there will be decant points into the surrounding environment and it is anticipated that this decant will be acid forming; however this is still to be confirmed. These areas are in direct contact with the sensitive wetlands of the surrounding landscape and are all wetlands drain in into the Aston Lake and surrounding wetlands, a NFEPA Rank 1 wetland and tributary to the Blesbokspruit Ramsar Wetland. This represents major negative impacts to the wetlands and water resources of the local area and catchment.

11.1.5.3.2 Management Objectives

Wetland management objectives are to inform AOL where there are interactions of the proposed activities with wetlands during the decommissioning, rehabilitation and closure phase and how best they can mitigate and manage the impacts if the project is to go ahead. This is important as the naturally occurring habitat and ecosystems play a major role in supporting a range of ecological processes and biodiversity in the region. These objectives are to prevent/minimise the loss of or further damage to natural wetland ecosystems and their buffer areas as protection of wetland ecosystem is a national objective; particularly of NFEPA wetlands.

11.1.5.3.3 Management Actions and Targets

The proposed project will result in significant residual impacts to the wetlands and thus rigorous management will be needed. The Wetland Management Plan detailed in section Plan 46 must be used to inform mitigation actions, including:

- The edge of the non-directly affected wetlands must continue to be clearly demarcated in the field. This should also include a 32 m buffer if possible. The rehabilitation footprint kept as small as possible and all non-impacted wetlands must be avoided;
- Wetland monitoring must be carried out during the decommissioning and rehabilitation phase to ensure no unnecessary impact to wetlands is realised; and if so that a remedy is put in place as soon as possible;
- Mitigation and management actions provided in the following reports done by Digby Wells as part of this project should be used to guide the effective management of the ecological wetland resources affected by the proposed project:
  - Air Quality Report (Appendix I);
  - Aquatic Ecology Report (Appendix H);
  - Fauna and Flora Report (Appendix F);
  - Groundwater Report (Appendix E);
  - Rehabilitation Plan (Appendix Q); and
  - Surface Water Report (Appendix D).

11.1.5.3.4 Impact Ratings

The impacts on wetlands during the Decommissioning and Rehabilitation Phase, as described above, are rated in Table 11-46 and Table 11-47 below

Table 11-46: Removal of infrastructure and surface rehabilitation

Dimension	Rating	Motivation	Significance
Activity and Interaction 1: Demolition and removal of infrastructure, final void filling and surface rehabilitation.			
Impact Description: Similarly to the construction phase, the decommissioning and rehabilitation activities occurring within an ecologically sensitive catchment pose significant potential negative impacts to functioning wetlands and catchment. Furthermore, the rehabilitated area could cause major negative impacts due to spread of alien invasive vegetation, increased soil compaction erosion and subsequent sedimentation into the wetland ecosystems.			
Prior to Mitigation/Management			

<table>
<tr><th>Dimension</th><th>Rating</th><th>Motivation</th><th>Significance</th></tr>
<tr><td>Duration</td><td>Long term (4)</td><td>The impacts caused during the rehabilitation activities will have a long lasting effect if not mitigated.</td><td rowspan="5">Minor negative
(-65)</td></tr>
<tr><td>Extent</td><td>Municipal (4)</td><td>The impact could spread beyond the local development boundaries due to the ability of degraded water quality or alien invasive species to travel significant distances; especially downstream.</td></tr>
<tr><td>Intensity</td><td>Serious damage to or loss of sensitive environments (5)</td><td>These impacts are serious threats to sensitive habitats such as wetlands; especially in an area with high level of cumulative habitat loss and water quality deterioration.</td></tr>
<tr><td>Probability</td><td>Likely (5)</td><td>These impacts are common of mining and industrial construction sites and project and thus have at least a 65% chance of occurring with some small mitigation measures assumed.</td></tr>
<tr><td>Nature</td><td colspan="2">Negative</td></tr>
<tr><td colspan="4">Mitigation/Management Actions</td></tr>
<tr><td colspan="4">
The edge of the wetlands and at least a 32 m buffer must continue to be clearly demarcated as no-go areas and sensitive receptors.
The rehabilitation footprint kept as small as possible and non-impacted wetlands must be avoided.
Careful attention must be given to handling wetland soils, if any.
Wetland monitoring must be carried out during the rehabilitation phase to ensure no unnecessary impact to wetlands is realised; and if so that a remedy is put in place as soon as possible.
Please refer to the full Rehabilitation Plan Report (Digby Wells, 2016) as part of this EIA for full mitigation and management actions.
</td></tr>
<tr><td colspan="4">Post-Mitigation</td></tr>
<tr><td>Duration</td><td>Medium term (3)</td><td>Impacts will last as long as rehabilitation activities are ongoing.</td><td rowspan="3">Minor negative
(-36)</td></tr>
<tr><td>Extent</td><td>Local (3)</td><td>Mitigation will allow impacts to be within the local site.</td></tr>
<tr><td>Intensity</td><td>Moderate damage to sensitive environments (3)</td><td>Rehabilitation activities may still have a moderate effect on the wetlands on the project area. These wetlands are sensitive environments and must be managed with caution.</td></tr>
</table>

Dimension	Rating	Motivation	Significance
Probability	Probable (4)	Negative impacts to the wetlands during rehabilitation could occur given the nature of the task.	
Nature	Negative		

Table 11-47: Mine closure

Dimension	Rating	Motivation	Significance
Activity and Interaction 2: Mine closure and post-mining environmental status			
Impact 1 Description: Post-mining water decant is predicted to occur once the final void has been rehabilitated and groundwater levels are allowed to return back to natural level. It is anticipated that this decant will be acid forming (Acid Mine Drainage -, AMD).			
Prior to Mitigation/Management			
Duration	Permanent (7)	Decant of polluted and acidic groundwater into the catchment will have negative impacts beyond the project life and will be irreversible if not managed or mitigated against.	**Major negative (-114)**
Extent	Regional (5)	The affected wetlands drain directly into the sensitive Ramsar Blesbokspruit Wetlands and catchment. Whilst these systems are not in pristine condition, further impacts as to the system from the proposed project to this area may have regional level significance.	
Intensity	Irreplaceable damage to highly sensitive environments (7)	These wetlands are sensitive receptors and this represents serious impacts to these systems that could lead to irreplaceable damage to and loss of ecological functioning.	
Probability	Highly Probable (6)	It is very likely to lead to the impacts described (65% - 80%).	
Nature	Negative		
Mitigation/Management Actions			
▪ Long-term passive / active water treatment options will need to be investigated by AOL to prevent untreated AMD decant water from entering the catchment. ▪ Groundwater and wetlands must be monitored post-mining for potential decant. ▪ Rehabilitation and remediation actions must be in place to respond to any decant or AMD discharge that is unforeseen.			
Post-Mitigation			

Dimension	Rating	Motivation	Significance
Duration	Permanent (7)	It is likely that the issue of polluted groundwater will be a permanent catchment impact to manage.	**Moderate negative (-84)**
Extent	Local (3)	If adequate water treatment is carried out before discharge, then the impact can be managed at the local area.	
Intensity	On-going serious damage to highly sensitive environments (4)	These wetlands are sensitive receptors and altered water quality represents serious impacts to these systems.	
Probability	Highly Probable (6)	It is very likely to lead to the impacts described.	
Nature	Negative		

11.1.6 Aquatic Ecology Impact Assessment

11.1.6.1 Construction Phase

Based on the Project activities listed above, Table 11-48 listed the various interactions and potential impacts of the activities during the construction phase.

Table 11-48: Interactions and Impacts of the Construction Phase

Interaction	Impact
Removal of vegetation and exposure of soils (Table 11-49)	Direct loss of marginal and riparian habitats. Increased runoff and erosion resulting in habitat change downstream. Increased sedimentation resulting in habitat loss and impairment of sensitive aquatic biota. All abovementioned impacts will result in loss of aquatic biodiversity.
Movement of heavy machinery (Table 11-50)	Compaction of soils causing in lowered rainfall infiltration rates and increased runoff result resulting in reduced baseflow and an alteration of aquatic habitats.
Lay down of impenetrable surfaces (Table 11-51)	Reduced surface water infiltration and alteration of baseflow and surface water drainage patterns.

Interaction	Impact
Alteration to the natural topography for the new boxcut (Table 11-52)	Alteration in surface water drainage patterns resulting in changes to downstream habitat structures.
Construction of stockpiles (Table 11-53)	Runoff from the exposed soils in stockpiles will contain un-weathered soluble and insoluble elements which may alter water chemistry downstream. This is particularly relevant to carboniferous materials. This interaction may result in the loss of sensitive aquatic species due to water chemistry modification.

11.1.6.1.1 Impact Description

The activities and interactions listed above have the potential to degrade water and habitat quality within the considered river systems. Water quality impacts may include increased dissolved/suspended solids, as well as potential persistent pollutants within the water column and sediments of the associated watercourse. In addition, general water chemistry modification may occur as a result of changed salt balances. Habitat quality impacts may include sedimentation, bed, channel and flow modification, as well as the general loss of aquatic habitat through direct modification during watercourse crossings. It is noted that the Aston Lake impoundment will be particularly sensitive due to the sediments of impoundments acting as contaminant sinks.

Although the PES (baseline) of the river reach assessed was derived to be modified from reference conditions, further deterioration is possible and thus a potential decline in the PES could be observed.

11.1.6.1.2 Management Objectives

The objective for management is to preserve the PES and prevent further degradation of local aquatic environments. This objective can be achieved through the management of potential water and habitat quality impacts as listed in the section below.

11.1.6.1.3 Management Actions

General mitigation actions provided in the surface water, wetlands and groundwater studies (Digby Wells, 2016) for this project should be used to guide the effective management of aquatic resources potentially affected by the proposed project. The proposed Stormwater Management Plan is provided below (Plan 66).

The establishment of a clearly marked buffer zone, which is defined as a region of natural vegetation between the rivers/wetlands and the proposed activity, is the primary management action that should take place. Literature suggests that a buffer zone can reduce aquatic habitat and water quality impacts of large developments, making this management action of particular importance (WRC, 2014). According to GDARD 2014, a buffer zone of 32 m (from the 1:100 year floodline or defined wetland/riparian zone) is required in urban and 100 m in non-urban regions. However, according to WRC (2014) the efficacy of a buffer is related to the distance between the river system and the zone of disturbance. Therefore, by increasing the length of a buffer, the potential aquatic modification related to the proposed activity is reduced. Considering this, it is recommended that, if possible, a minimum buffer zone of 32 m is placed between infrastructure and riparian zones or the 1:100 floodline (in this case the wetland delineation). The designated buffer zones should then be demarcated using signage or fences.

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

- Minimise the removal of vegetation in the infrastructure footprint area;
- Re-vegetation of the disturbed areas within the construction footprint area once construction is completed;
- Soils compacted by heavy machinery in areas that are not utilised post construction can be ripped to allow infiltration;
- Ensure that storm water management structures are within good working condition through regular inspection, especially after large storm events;
- Where storm water enters river systems, sediment/silt and debris trapping, as well as energy dissipation control measures must be put in place;
- Storm water must be diverted from construction activities and managed in such a manner to disperse runoff and prevent the concentration of storm water flow;
- The vegetation of unpaved roadsides; and
- Inspection of paved and unpaved roads to monitor for erosion.

11.1.6.1.4 Impact Ratings

The impacts on aquatic ecology during the Construction Phase, as described above, are rated in Table 11-49 - Table 11-53 below.

Table 11-49: Removal of Vegetation and Exposure of Soils

Dimension	Rating	Motivation	Significance
Activity and Interaction: Removal of vegetation and exposure of soils			
Impact Description: Direct loss of marginal and riparian habitats. Increased runoff and erosion resulting in habitat change downstream. Increased sedimentation resulting in habitat loss and impairment of sensitive aquatic biota. All abovementioned impacts will result in loss of aquatic biodiversity.			

<table>
<tr><th>Dimension</th><th>Rating</th><th>Motivation</th><th>Significance</th></tr>
<tr><td colspan="4">Prior to Mitigation/Management</td></tr>
<tr><td>Duration</td><td>Medium term (3)</td><td>Construction phase. More sediment deposition may occur during rainy months.</td><td rowspan="5">Minor (negative) – 40</td></tr>
<tr><td>Extent</td><td>Local (3)</td><td>Downstream of the construction area.</td></tr>
<tr><td>Intensity type of impact</td><td>Medium term (-4)</td><td>Serious loss to moderately sensitive environment limiting ecosystem function.</td></tr>
<tr><td>Probability</td><td>Probable (4)</td><td>It is probable that the impact may occur.</td></tr>
<tr><td>Nature</td><td colspan="2">Negative</td></tr>
<tr><td colspan="4">Mitigation/Management Actions</td></tr>
<tr><td colspan="4">
Minimise the removal of vegetation in the infrastructure footprint area;
Re-vegetation of the disturbed areas within the construction footprint areas once construction is completed;
Soils compacted by heavy machinery in areas that are not utilised post construction can be ripped to allow infiltration;
Ensure that storm water management structures are within good working condition through regular inspection, especially after large storm events;
Where storm water enters river systems, sediment/silt and debris trapping, as well as energy dissipation control measures must be put in place;
Storm water must be diverted from construction activities and managed in such a manner to disperse runoff and prevent the concentration of storm water flow;
The vegetation of unpaved roadsides; and
Inspection of paved and unpaved roads to monitor for erosion.
</td></tr>
<tr><td colspan="4">Post-Mitigation</td></tr>
<tr><td>Duration</td><td>Short term (2)</td><td>Less than a year to reverse the impact reversed if mitigation measures are applied.</td><td rowspan="5">Negligible (negative) – 24</td></tr>
<tr><td>Extent</td><td>Limited (2)</td><td>Storm water management structures will limit sedimentation to the infrastructure site and surrounding areas.</td></tr>
<tr><td>Intensity type of impact</td><td>Medium term (-4)</td><td>Serious loss to moderately sensitive environment limiting ecosystem function.</td></tr>
<tr><td>Probability</td><td>Unlikely (3)</td><td>Unlikely but may happen if mitigation measures are not implemented.</td></tr>
<tr><td>Nature</td><td colspan="2">Negative</td></tr>
</table>

Table 11-50: Potential Impacts of the Movement of Heavy Machinery

<table>
<tr><th>Dimension</th><th>Rating</th><th>Motivation</th><th>Significance</th></tr>
<tr><td colspan="4">Activity and Interaction: Movement of heavy machinery</td></tr>
<tr><td colspan="4">Impact Description: Compaction of soils causing in lowered rainfall infiltration rates and increased runoff resulting in reduced baseflow and an alteration of aquatic habitats.</td></tr>
<tr><td colspan="4">Prior to Mitigation/Management</td></tr>
<tr><td>Duration</td><td>Medium term (3)</td><td>Impacts will occur during the construction phase and can be reversed once construction is completed.</td><td rowspan="5">Minor (negative) – 60</td></tr>
<tr><td>Extent</td><td>Local (3)</td><td>Reduced baseflow may have a minor impact on local streamflow within the Palmietkuilen Farm. However, the impact may extend beyond the site.</td></tr>
<tr><td>Intensity type of impact</td><td>Medium term - negative (4)</td><td>Environmental damage can be reversed in less than a year.</td></tr>
<tr><td>Probability</td><td>Highly Probable (6)</td><td>It is highly probable that the impact may occur.</td></tr>
<tr><td>Nature</td><td colspan="2">Negative</td></tr>
<tr><td colspan="4">Mitigation/Management Actions</td></tr>
<tr><td colspan="4">Minimise the removal of vegetation in the infrastructure footprint area;
Re-vegetation of the disturbed areas within the construction footprint area once construction is completed;
Soils compacted by heavy machinery in areas that are not utilised post construction can be ripped to allow infiltration;
Ensure that storm water management structures are within good working condition through regular inspection, especially after large storm events;
Where storm water enters river systems, sediment/silt and debris trapping, as well as energy dissipation control measures must be put in place;
Storm water must be diverted from construction activities and managed in such a manner to disperse runoff and prevent the concentration of storm water flow;
The vegetation of unpaved roadsides; and
Inspection of paved and unpaved roads to monitor for erosion.</td></tr>
<tr><td colspan="4">Post-Mitigation</td></tr>
<tr><td>Duration</td><td>Short term (2)</td><td>Less than a year to reverse the impact.</td><td>Negligible</td></tr>
</table>

Dimension	Rating	Motivation	Significance
Extent	Limited (2)	Limited to the site.	(negative) – 18
Intensity type of impact	Minor - negative (-2)	Minor effects on the environment.	
Probability	Unlikely (3)	Unlikely but may happen if mitigation measures are not implemented.	
Nature	Negative		

Table 11-51: Potential Impacts of the Placement of Impenetrable Surfaces

Dimension	Rating	Motivation	Significance
Activity and Interaction: Placement of Impenetrable Surfaces			
Impact Description: Reduced surface water infiltration and alteration of baseflow and surface water drainage patterns.			
Prior to Mitigation/Management			
Duration	Project Life (5)	Impacts will occur throughout the project life.	Minor (negative) – 72
Extent	Local (3)	Reduced baseflow may have a minor impact on local streamflow within the Palmeitkuilen Farm. However, the impact may extend beyond the site.	
Intensity type of impact	Serious - negative (4)	Serious impacts to local aquatic ecology due to changes in aquatic habitats.	
Probability	Highly Probable (6)	It is highly probable that the impact may occur.	
Nature	Negative		
Mitigation/Management Actions			

Dimension	Rating	Motivation	Significance
▪ Minimise the removal of vegetation in the infrastructure footprint area; ▪ Re-vegetation of the disturbed areas within the construction footprint areas once construction is completed; ▪ Soils compacted by heavy machinery in areas that are not utilised post construction can be ripped to allow infiltration; ▪ Ensure that storm water management structures are within good working condition through regular inspection, especially after large storm events; ▪ Where storm water enters river systems, sediment/silt and debris trapping, as well as energy dissipation control measures must be put in place; ▪ Storm water must be diverted from construction activities and managed in such a manner to disperse runoff and prevent the concentration of storm water flow; ▪ The vegetation of unpaved roadsides; and ▪ Inspection of paved and unpaved roads to monitor for erosion.			
Post-Mitigation			
Duration	Project Life (5)	Impacts will occur throughout the project life.	Negligible (negative) – 36
Extent	Local (3)	Reduced baseflow may have a minor impact on local streamflow within the Palmeitkuilen Farm. However, the impact may extend beyond the site.	
Intensity type of impact	Serious - negative (4)	Serious impacts to local aquatic ecology due to changes in aquatic habitats.	
Probability	Unlikely (3)	Unlikely but may happen if mitigation measures are not implemented.	
Nature	Negative		

Table 11-52: Potential Impacts of the Alteration of the Natural Topography for the new Boxcut and Stormwater management

Dimension	Rating	Motivation	Significance
Activity and Interaction: Alteration to the natural topography for the new boxcut			
Impact Description: Alteration in surface water drainage patterns resulting in changes to downstream habitat structures.			

<table>
<tr><th>Dimension</th><th>Rating</th><th>Motivation</th><th>Significance</th></tr>
<tr><td colspan="4">Prior to Mitigation/Management</td></tr>
<tr><td>Duration</td><td>Project Life (5)</td><td>Impacts will occur throughout the project life.</td><td rowspan="5">Minor (negative) – 72</td></tr>
<tr><td>Extent</td><td>Local (3)</td><td>Reduced baseflow and runoff reporting to the nearby streams may have a minor impact on local streamflow within the Palmietkuilen Farm. However, the impact may extend beyond the site.</td></tr>
<tr><td>Intensity type of impact</td><td>Serious - negative (4)</td><td>Serious impacts to local aquatic ecology due to changes in aquatic habitats.</td></tr>
<tr><td>Probability</td><td>Highly Probable (6)</td><td>It is highly probable that the impact may occur.</td></tr>
<tr><td>Nature</td><td colspan="2">Negative</td></tr>
<tr><td colspan="4">Mitigation/Management Actions</td></tr>
<tr><td colspan="4">
Minimise the removal of vegetation in the infrastructure footprint area;
Re-vegetation of the disturbed areas within the construction footprint area once construction is completed;
Soils compacted by heavy machinery in areas that are not utilised post construction can be ripped to allow infiltration;
Ensure that storm water management structures are within good working condition through regular inspection, especially after large storm events;
Where storm water enters river systems, sediment/silt and debris trapping, as well as energy dissipation control measures must be put in place;
Storm water must be diverted from construction activities and managed in such a manner to disperse runoff and prevent the concentration of storm water flow;
The vegetation of unpaved roadsides; and
Inspection of paved and unpaved roads to monitor for erosion;
</td></tr>
<tr><td colspan="4">Post-Mitigation</td></tr>
<tr><td>Duration</td><td>Project Life (5)</td><td>Impacts will occur throughout the project life.</td><td rowspan="2">Negligible (negative) – 36</td></tr>
<tr><td>Extent</td><td>Local (3)</td><td>Reduced baseflow and runoff reporting to the nearby streams may have a minor impact on local streamflow within the Palmietkuilen Farm. However, the impact may extend beyond the site.</td></tr>
</table>

Dimension	Rating	Motivation	Significance
Intensity type of impact	Serious - negative (4)	Serious impacts to local aquatic ecology due to changes in aquatic habitats	
Probability	Unlikely (3)	Unlikely but may happen if mitigation measures are not implemented.	
Nature	Negative		

Table 11-53: Potential Impacts of the Construction of Stockpile Areas

Dimension	Rating	Motivation	Significance
Activity and Interaction: Construction of stockpile areas			
Impact Description: Runoff from the exposed soils in stockpiles will contain un-weathered soluble and insoluble elements which may alter water chemistry downstream. This is particularly relevant to carboniferous materials. This interaction may result in the loss of sensitive aquatic species due to water chemistry modification.			
Prior to Mitigation/Management			
Duration	Project Life (5)	Impacts will occur throughout the project life.	Moderate (negative) – 78
Extent	Local (3)	Runoff from stockpiles may enter into local river systems and likely collect in the Aston Lake.	
Intensity type of impact	Serious - negative (5)	Very serious impacts to local aquatic ecology due to changes in aquatic habitats.	
Probability	Highly Probable (6)	It is highly probable that the impact may occur.	
Nature	Negative		
Mitigation/Management Actions			
▪ Effective Stormwater management (refer to Section 8.1.3.1.2 above).			
Post-Mitigation			
Duration	Project Life (5)	Impacts will occur throughout the project life.	Minor (negative) – 39
Extent	Local (3)	Runoff from stockpiles may enter into local river systems and likely collect in the Aston Lake.	

Dimension	Rating	Motivation	Significance
Intensity type of impact	Serious - negative (5)	Very serious impacts to local aquatic ecology due to changes in aquatic habitats.	
Probability	Unlikely (3)	Unlikely but may happen if mitigation measures are not implemented.	
Nature	Negative		

11.1.6.2 Operational Phase

Based on the activities listed above, Table 11-54 listed the various interactions and potential impacts of the activities.

Table 11-54: Interactions and Impacts of the Operation Phase

Interaction	Impact
Runoff from the dirty water areas (waste water dams, crushing plant, conveyors and product stockpile) (Table 11-55).	Runoff reporting into the Aston Lake and the unnamed streams flowing to it resulting in water contamination or the deterioration of the water quality.
Development and operation of surface infrastructure (pollution control dams, stockpiles, workshops & offices, crushing and screening plant) (**Table 11-56**).	Reduction of catchment yield as dirty water runoff within the mine will be contained in the PCD. Groundwater loss and flow from the pit will also contribute toward baseflow reduction.

11.1.6.2.1 Impact Description

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

Containment of dirty water runoff from the mining area will reduce the amount of runoff reporting to the Aston Lake. A decrease in the catchment yield may have an impact on the flow required for the ecological reserve in the Blesbokspruit and downstream river reaches.

According to the Surface Water Report (Digby Wells, 2016) the total provided infrastructure footprint area amounts to approximately 10.72km^2 which approximates to 3.1% the of total catchment are for the Aston Lake of 344 km^2.

The percentage anticipated decrease in Mean Annual Runoff reporting to Aston Lake will be approximately 3%. Water and habitat quality alteration within the river systems will have negative effects on local aquatic ecology resulting in a decrease of the PES.

11.1.6.2.2 Management Objectives

The objective for management is to preserve the PES and prevent further degradation of local aquatic environments. This objective can be achieved through the management of potential water and habitat quality impacts as listed in the section below.

11.1.6.2.3 Management Actions

General mitigation actions provided in the surface water, wetlands and groundwater studies (Digby Wells, 2016) for this project should be used to guide the effective management of aquatic resources potentially affected by the proposed project. It is noted that the DWS should consider the loss of 3% of the catchment Mean Annual Runoff to the ecological reserve in the Blesbokspruit.

In order to prevent this, the use of diversion and containment management is of importance. This can be achieved through effective groundwater and surface water management as per the Digby Wells surface and groundwater studies (2016); however important management actions are briefly listed below:

- Diversion trench and berm systems which diverts clean storm water around pollution sources and convey and contain dirty water to central pollution control impoundments (Plan 66 below);
- Barrier systems, including synthetic, clay and geological or other approved mitigation methods to minimise contaminated seepage and runoff from stockpiles and pollution control facilities from entering the local aquatic systems;
- Where storm water enters river systems from disturbed sites, sediment and debris trapping, as well as energy dissipation control measures must be put in place;
- The planting of indigenous vegetation around pollution control impoundments and structures should be completed as this has been shown to be effective in erosion prevention and nutrient control;
- Ensure that all the dirty water emanating from the dirty water areas be collected in the PCD for re-use within the mine, to prevent unnecessary discharge into the environment;
- The dirty water collection trenches should be cleaned regularly to reduce the build up of washed off coal fines and ensure they are able to accommodate and convey the

1:50 year peak flows. This material should be disposed to an appropriate licenced facility;

- Stockpiling should be monitored so that the side slopes do not encourage erosion of the slopes resulting in silt transported into the trenches from the stockpiles, allowing some silt to settle on the dirty water site rather than in the channels;
- Stockpiles of overburden and topsoil should be vegetated; and
- In addition to the control of storm water, water quality supplemented by aquatic ecology monitoring should form part of the system where water in the PCD's and surrounding streams are monitored for quality. This ensures that pollution sources are monitored during the mining process.

11.1.6.2.4 Impact Ratings

The impacts on aquatic ecology during the Operational Phase, as described above, are rated in Table 11-55 and Table 11-56 below.

Table 11-55: Potential Impacts of Runoff from the Dirty Water Areas

Dimension	Rating	Motivation	Significance
Activity and Interaction: Runoff from the dirty water areas			
Impact Description: Runoff water reporting into the Aston Lake and the unnamed streams flowing to it resulting in water contamination or the deterioration of the water quality.			
Prior to Mitigation/Management			
Duration	Project Life (5)	Due to the nature of the mining activities the contamination of water resources may occur over the project life if mitigation measures are not in place.	Moderate (negative) – 90
Extent	Region (5)	The impacts may affect the Aston Lake. However, soluble pollutants may affect the Blesbokspruit.	
Intensity type of impact	Serious - negative (-5)	This may have serious impacts on the water quality that will be made available to the downstream aquatic ecology.	
Probability	Almost Certain (6)	Without appropriate mitigation, the probability of the impact occurring is almost certain <80 %.	
Nature	Negative		
Mitigation/Management Actions			

<table>
<tr><th>Dimension</th><th>Rating</th><th>Motivation</th><th>Significance</th></tr>
<tr><td colspan="4">
▪ Diversion trench and berm systems which diverts clean storm water around pollution sources and convey and contain dirty water to central pollution control impoundments (Plan 66);
▪ Barrier systems, including synthetic, clay and geological or other approved mitigation methods to minimise contaminated seepage and runoff from stockpiles and pollution control facilities from entering the local aquatic systems;
▪ Where storm water enters river systems from disturbed sites, sediment and debris trapping, as well as energy dissipation control measures must be put in place;
▪ The planting of indigenous vegetation around pollution control impoundments and structures should be completed as this has been shown to be effective in erosion prevention and nutrient control;
▪ Ensure that all the dirty water emanating from the dirty water areas be collected in the PCD for re-use within the mine, to prevent unnecessary discharge into the environment;
▪ The dirty water collection trenches should be cleaned regularly to reduce the build-up of washed off coal fines and ensure they are able to accommodate and convey the 1:50 year peak flows. This material should be disposed to an appropriate licenced facility;
▪ Stockpiling should be monitored so that the side slopes do not encourage erosion of the slopes resulting in silt transported into the trenches from the stockpiles, allowing some silt to settle on the dirty water site rather than in the channels; and
▪ In addition to the control of storm water, water quality supplemented by aquatic ecology monitoring should form part of the system where water in the PCD’s and surrounding streams are monitored for quality. This ensures that pollution sources are monitored during the mining process.
</td></tr>
<tr><td colspan="4">Post-Mitigation</td></tr>
<tr><td>Duration</td><td>Medium term (5)</td><td>Impact may occur over the project life if mitigation measures are not in place.</td><td rowspan="5">Moderate (negative) – 60</td></tr>
<tr><td>Extent</td><td>Region (5)</td><td>The impacts may affect the Aston Lake. However, soluble pollutants may affect the Blesbokspruit.</td></tr>
<tr><td>Intensity type of impact</td><td>Moderate - negative (-5)</td><td>This may have serious impacts on the downstream aquatic ecosystems.</td></tr>
<tr><td>Probability</td><td>Probable (4)</td><td>Has occurred here or elsewhere and could therefore occur. <50% probability.</td></tr>
<tr><td>Nature</td><td colspan="2">Negative</td></tr>
</table>

Table 11-56: Potential Impacts of the Development and Operation of Surface Infrastructure

Dimension	Rating	Motivation	Significance
Activity and Interaction: Development and operation of surface infrastructure			
Impact Description: Reduction of catchment yield as dirty water runoff within the mine will be contained in the PCD. Groundwater loss and flow from the pit will also contribute toward baseflow reduction			
Prior to Mitigation/Management			
Duration	Project Life (5)	Water loss in the catchment will likely occur throughout the project life.	Moderate (negative) – 84
Extent	Region (5)	The impacts of water loss may influence the Blesbokspruit.	
Intensity type of impact	Serious - negative (-4)	This may have serious impacts on the water availability at a local scale.	
Probability	Almost Certain (6)	Without appropriate mitigation, there probability of the impact occurring is almost certain <80 %.	
Nature	Negative		
Mitigation/Management Actions			
▪ Effective surface water management whereby all clean water is diverted into the nearby streams (Plan 66).			
Post-Mitigation			
Duration	Project Life (5)	Water loss in the catchment will likely occur throughout the project life.	Moderate (negative) – 56
Extent	Region (5)	The impacts of water loss may influence the Blesbokspruit.	
Intensity type of impact	Serious - negative (-4)	This may have serious impacts on the water availability at a local scale.	
Probability	Probable (4)	The probability of water loss during the project is reduced if clean water is allowed into the river systems.	
Nature	Negative		

11.1.6.3 Decommissioning and Post Closure Phase

Based on the activities listed above, Table 11-57 listed the various interactions and potential impacts of the activities.

Table 11-57: Interactions and Impacts of the Decommissioning and Closure Phase

Interaction	Impact
Removal of infrastructure and surface rehabilitation (Table 11-58).	Similarly to the construction phase, the removal of the infrastructure will lead to potential negative impacts on the integrity of the associated aquatic ecosystems.
Mine closure and rehabilitation (Table 11-59).	Post-mining decant of mine affected water will have negative impacts on the downstream water quality should it occur.

11.1.6.3.1 Impact Description

Similarly to the construction phase the removal of infrastructure and rehabilitation activities will be a large scale operation and thus has the potential to contaminate surface water. Particular areas which will require attention includes the run of mine stockpiles, screening areas and pollution control facilities. The rehabilitation of these areas will require special attention to avoid contamination of the surrounding aquatic ecosystems.

Typically, following the cessation of mining activities groundwater returns to the voids created by the mining process. This process results in the contamination of the groundwater resource. Following this influx of groundwater, seepage and decant at specific locations can result in the ingress of contaminated water in downstream river systems, thus severely degrading the local PES. It is noted that the groundwater and geochemical studies have not yet been completed and thus it is assumed that contaminated groundwater seepage will occur.

11.1.6.3.2 Management Objectives

The objective for management is to preserve the PES and prevent further degradation of local aquatic environments. This objective can be achieved through the management of potential water and habitat quality impacts as listed in the section below.

11.1.6.3.3 Management Actions

General mitigation actions provided in the surface water, wetlands and groundwater studies (Digby Wells, 2016) for this project should be used to guide the effective management of aquatic resources potentially affected by the proposed project.

As described in the construction phase, a clearly demarcated 100 m buffer zone must be maintained. In order to mitigate against the decant of contaminated water, the actions recommended in the groundwater report of this project should be considered. However, water treatment and the discharge of clean water is an option available to reduce the ingress of contaminated water.

11.1.6.3.4 Impact Ratings

The impacts on aquatic ecology during the Decommissioning and Rehabilitation Phase, as described above, are rated in Table 11-58 and Table 11-59 below.

Table 11-58: Potential Impacts of the Removal of Infrastructure and Surface Rehabilitation

Dimension	Rating	Motivation	Significance
Activity and Interaction: Removal of infrastructure and surface rehabilitation.			
Impact Description: Similarly to the construction phase, the removal of the infrastructure will lead to potential negative impacts on the integrity of the associated aquatic ecosystems due to the clearing of land and thus exposing it to erosion which could lead to further sedimentation of the river systems.			
Prior to Mitigation/Management			
Duration	Medium term (3)	The impact will only occur during the closure and decommissioning phase.	Minor (negative) – 66
Extent	Local (3)	The extent of the impact will likely affect the downstream regions.	
Intensity type of impact	High - Negative (-5)	Aquatic ecosystems are sensitive to disturbance and thus any impact is regarded as serious.	
Probability	Almost Certain (6)	It is highly likely this impact will occur.	
Nature	Negative		
Mitigation/Management Actions			
▪ Established buffer zones; and ▪ Phased approach to clearing with concurrent rehabilitation.			
Post-Mitigation			
Duration	Medium term (3)	The impact will only occur during the decommissioning and closure phase.	Minor (negative) – 44
Extent	Local (3)	The extent of the impact will likely affect the downstream regions.	
Intensity type of impact	High - Negative (-5)	Aquatic ecosystems are sensitive to disturbance and thus any impact is regarded as serious.	
Probability	Probable (4)	The impact could happen.	

Dimension	Rating	Motivation	Significance
Nature	Negative		

Table 11-59: Potential Impacts of the Mine Closure and Rehabilitation

Dimension	Rating	Motivation	Significance
Activity and Interaction: Mine closure and rehabilitation			
Impact Description: Post-mining decant of groundwater will have negative impacts on the downstream water quality			
Prior to Mitigation/Management			
Duration	Permanent (7)	Decant of contaminated water will likely be permanent.	Major (negative) – 126
Extent	Municipal (4)	The impact will change salt balances of the entire upper reach of the river but could affect the Blesbokspruit.	
Intensity type of impact	Serious - negative (-6)	The change of water quality in the headwaters of a river system will seriously affect the functioning of the downstream river reaches.	
Probability	Definite (7)	Should mining occur, there is a very high likelihood of the impact occurring.	
Nature	Negative		
Mitigation/Management Actions			
▪ Long-term passive / active water treatment options will need to be investigated by AOL to prevent untreated AMD decant water from entering the catchment.			
Post-Mitigation			
Duration	Permanent (7)	The decant of contaminated water will likely be permanent.	Minor (negative) – 51
Extent	Municipal (4)	The impact will change salt balances of the entire upper reach of the assessed River.	
Intensity type of impact	Serious - negative (-6)	The change of water quality in the headwaters of a river system will seriously affect the functioning of the downstream river reaches.	
Probability	Unlikely (3)	If water treatment is completed, there will likely be no impact.	
Nature	Negative		

11.1.7 Air Quality Impact Assessment

All relevant averaging periods were modelled for pollutants of concern. In all instances the worst case scenario has been presented to demonstrate the highest predicted impact. It is important to note that highest period-averages (i.e. highest hourly-average and highest 24-hour-average) presented in the maps are indicative of the highest expected concentrations for the period-average for the modelled year at each position in the modelled domain, and must not be interpreted as being representative of general conditions. The intent of the maps present below is to conservatively present the worst case scenario for those averaging periods.

In general, the ground level concentrations follow closely the main wind directions (wind roses generated for the site). Numerical values of maximum depend on the emission rate and the prevailing meteorological condition of the area. Simulations were undertaken to determine concentrations of particulate matter with a particle size of less than 10 µm in size (PM_{10}), particle size of less than 2.5 µm in size ($PM_{2.5}$) and for dust deposition (≥ 30 µm). These simulations were undertaken to determine concentrations without-mitigation.

Isopleth plots of predicted concentrations of pollutants: PM_{10}, $PM_{2.5}$, and dust deposition rates for the worst case scenario (where mitigation measures are not applied for topsoil, overburden dumps and activities like tipping and haulage) were predicted for the respective averaging periods).

The daily average concentrations were calculated as the 4th highest value (99th percentile). Annual mean values were shown as the highest values (100th percentile) according to the NEM: AQA Air Dispersion Regulation (2012). Isopleths of ground level concentrations generated for the different pollutants associated with the proposed Project are generated and presented.

11.1.7.1 Isopleth Plots and Evaluation of Modelling Results

11.1.7.1.1 PM_{10} Predicted Impacts

The predicted highest 4th highest 24-hour (daily) concentration of PM_{10} attributed to the proposed Palmietkuilen Mine is presented in Plan 47 below. The highest concentration predicted at the project boundary, in all four compass directions exceeded 75 µg/m³ (current limit value). The *major contributors are dirt roads and wind erosion*. In terms of spatial impact, much of the area impacted is outside the proposed project area.

The predicted concentrations are the likely additions that can be anticipated from the proposed Project on ambient air quality and not cumulative impact from all the existing sources in the area. *It is therefore possible that the highest daily concentration predicted to occur at a certain location may only be true for one day during the entire period.* Once mitigation measures were applied, exceedances were limit to the project area (Plan 52).

The predicted 1st highest annual concentration for PM_{10} for the area is within the current standard of 40 µg/m³ at the project boundary (Plan 48). Exceedances were observed within the project area without mitigation measures in place. Once mitigation measures were applied, the zone of impact was minimised further (Plan 52). Table 11-60 shows the predicted concentrations for the selected sensitive receptors in the vicinity of the proposed project.

11.1.7.1.2 $PM_{2.5}$ Predicted Impacts

The predicted 4th highest 24-hour (daily) concentration for $PM_{2.5}$ at the proposed Palmietkuilen Mine is presented in Plan 49. This isopleth plot of predicted maximum daily values for $PM_{2.5}$ from all sources without mitigation measures is in exceedance of the standard (65 µg/m³) within the project boundary. The predicted $PM_{2.5}$ concentrations at the mine boundary were mainly in the range 5 µg/m³ - 20 µg/m³. The zones of impact were minimised once mitigation measures were applied (Plan 54)

The predicted 1st highest annual ground level concentration for $PM_{2.5}$ that will be generated by the proposed Palmietkuilen Mine is presented in Plan 50. Exceedances of the current standard of 20 µg/m³ were not observed at the project boundary. Once mitigation measures were applied, the zones of impact were minimised (Plan 55).

11.1.7.1.3 Dust Deposition Predicted Impacts

The predicted dust deposition rates anticipated from the proposed operation shows that dust levels will be a cause for concern without mitigation measures in place. The predicted maximum concentration at the mine boundary is higher than the 1 200 mg/m^2/day (NDCR 2013) recommended standard for industrial areas. Exposure will be higher within the mine boundary (Plan 51). Major contributions are coming from the use of haul roads and from wind erosion of stockpiles respectively. The average dust deposition rates for the (Sep, Oct and Nov) each of the selected receptors – CNC01 01 – CNC03 are taken as the background. The predicted dust deposition rates at these locations were added to the background to assess impacts (Table 11-62).

11.1.7.1.4 Gaseous Emissions

Gaseous emissions from the proposed mining operation were limited to those released from generators stacks. As mentioned previously, the CAT Diesel generator was assumed and reported emissions factor for: NO_2, CO and PM_{10} and $PM_{2.5}$ were used in this assessment. Since SO_2 emission factor was not given in the list of pollutants from this generator, it is assumed that emission from source are negligible.

11.1.7.1.5 Predicted Nitrogen Dioxides (NO_2) Concentrations

The hourly South African standard for NO_2 is (200 µg/m^3) and annual averages (40 µg/m^3). The highest hourly concentration generated was in exceedance of the standard at the project boundary and beyond, with concentrations at the selected sensitive receptors in the vanity all higher than the 200 µg/m^3 (Plan 57). Once mitigation measures were applied, exceedances of the standard were limited to the project boundary (Plan 59).

Annual concentrations predicted for the project area and surrounding residential receptors are all below the current standard of 40 µg/m³ at the project boundary (Plan 58). Once mitigation measures were applied, a further reduction was observed in the pollutant footprint (Plan 60). The predicted ground level concentrations at the selected sensitive receptors are presented in Table 11-61.

11.1.7.1.6 Predicted Carbon Monoxide (CO) Concentrations

The South African standard is adopted. The South African standards for CO is 1 hour limit value of 30 000 µg/m^3 and 8 hourly limit (10 000 µg/m^3) are used in this report. The predicted carbon monoxide concentrations were very low and below the standard within the mine and surrounding residential sites (sensitive receptors) as the model predicted a maximum of ~2 µg/m^3. As a result, the model plots were not generated for CO with and without mitigation.

Table 11-60: Predicted Concentrations of PM_{10}, $PM_{2.5}$ and Dust Deposition Rates at Selected Sensitive Receptors

Pollutants	Averaging Period	Ambient Air Quality Standard (µg/m^3)	Predicted Ground Level Concentration (µg/m^3)					
			Sundra	CNC1_CF NW	Vischkuil	Endicott	CNC2_CF NE	Aston Lake
PM_{10} (No Mitigation)	Daily	75[(1)]	39	115	132	71	63	208
	Annual	40[(1)]	2	6	12	6	4	14
PM_{10} (Mitigated)	Daily	75[(1)]	2.8	7	5	4	4	15
	Annual	40[(1)]	0.14	0.55	0.58	0.27	0.18	1.25
$PM_{2.5}$ (No Mitigation)	Daily	40[(1)], 25[(2)]	3	6	4	3	3	11
	Annual	25[(1)], 15[(2)]	0.13	0.53	0.36	0.21	0.16	1.12
$PM_{2.5}$ (Mitigated)	Daily	40[(1)], 25[(2)]	0.94	1.78	1.95	1.15	1.27	3.22
	Annual	25[(1)], 15[(2)]	0.03	0.11	0.19	0.09	0.07	0.23
Dust Deposition Rates (mg/m^2/day)								
Dust deposition (No Mitigation)	Monthly	600[(3)]	968	1720	4323	2008	953	4288
Dust deposition (Mitigated)	Monthly	600[(3)]	10	18	32	18	21	33

1. National Ambient Air Quality Standards, 2009 (NAAQS)
2. National Ambient Air Quality Standard for Particulate Matter With Aerodynamic Diameter Less Than 2.5 Microns Meter ($PM_{2.5}$).
3. National Dust Control Regulation, 2013 (NDCS)

Table 11-61: Predicted Concentrations of NOx, CO at selected Sensitive Receptors

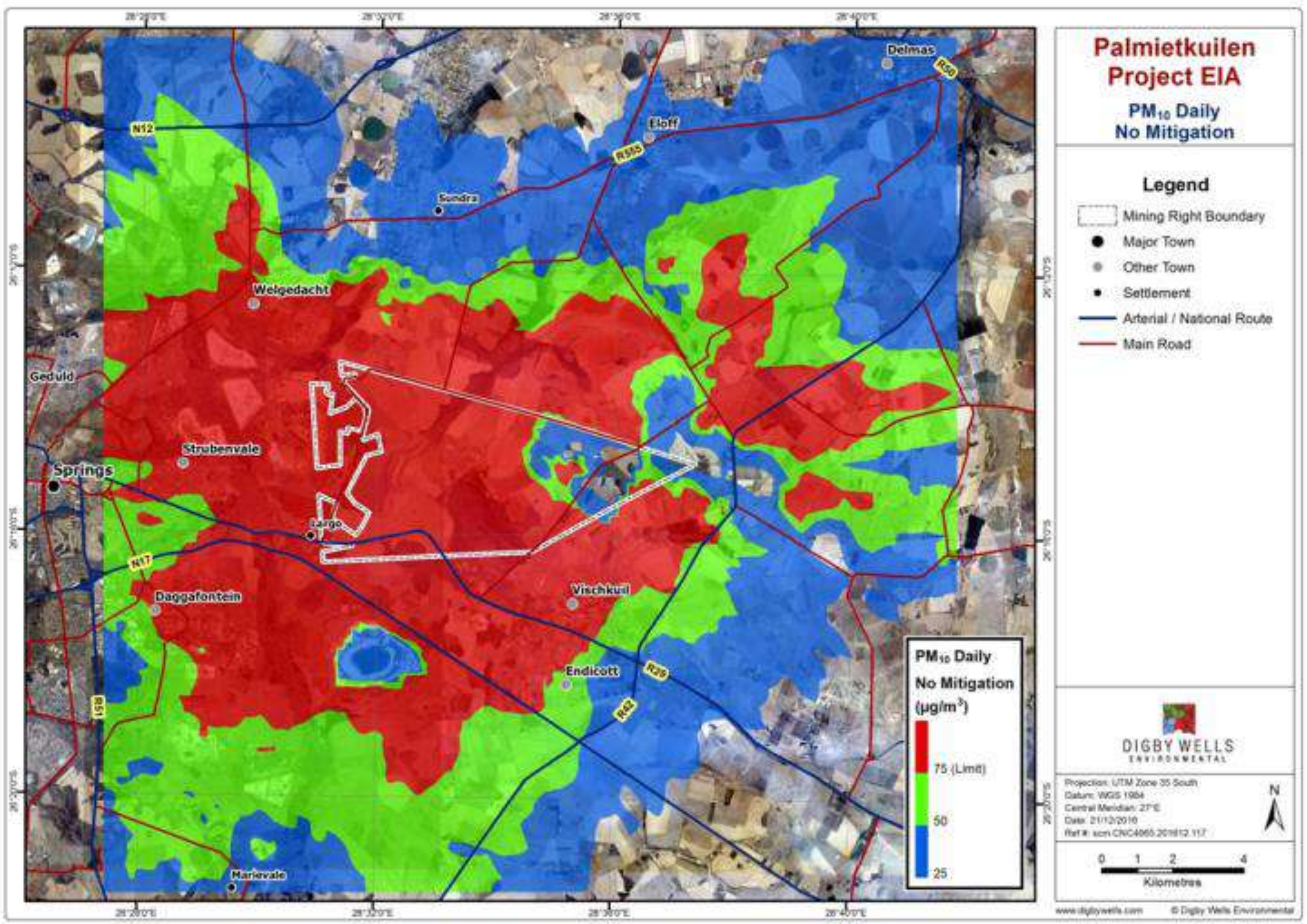
Pollutants	Averaging Period	Ambient Air Quality Standard ($\mu g/m^3$)	Predicted Ground Level Concentration ($\mu g/m^3$)					
			Sundra	CNC1_CF NW	Vischkuil	Endicott	CNC2_CF NE	Aston Lake
NO_2 (No Mitigation)	1 hour	200(1)	565	445	362	287	821	542
	1 year	40(1)	1.25	1.42	1.66	1.23	1.14	3.98
NO_2 (Mitigated)	1 hour	200(1)	33	26	21	17	48	32
	1 year	40(1)	0.07	0.08	0.1	0.07	0.07	0.23
CO (No Mitigation)	1 hour	30(1)	0.03	0.03	0.02	0.02	0.05	0.03
	8 year	10 (1)	-	-	-	-	-	-
CO (Mitigated)	1 hour	30(1)	-	-	-	-	-	-
	8 year	10(1)	-	-	-	-	-	-

1. National Ambient Air Quality Standards, 2009 (NAAQS)
2. National Ambient Air Quality Standard for Particulate Matter With Aerodynamic Diameter Less Than 2.5 Microns Meter ($PM_{2.5}$).
3. National Dust Control Regulation, 2013 (NDCS)

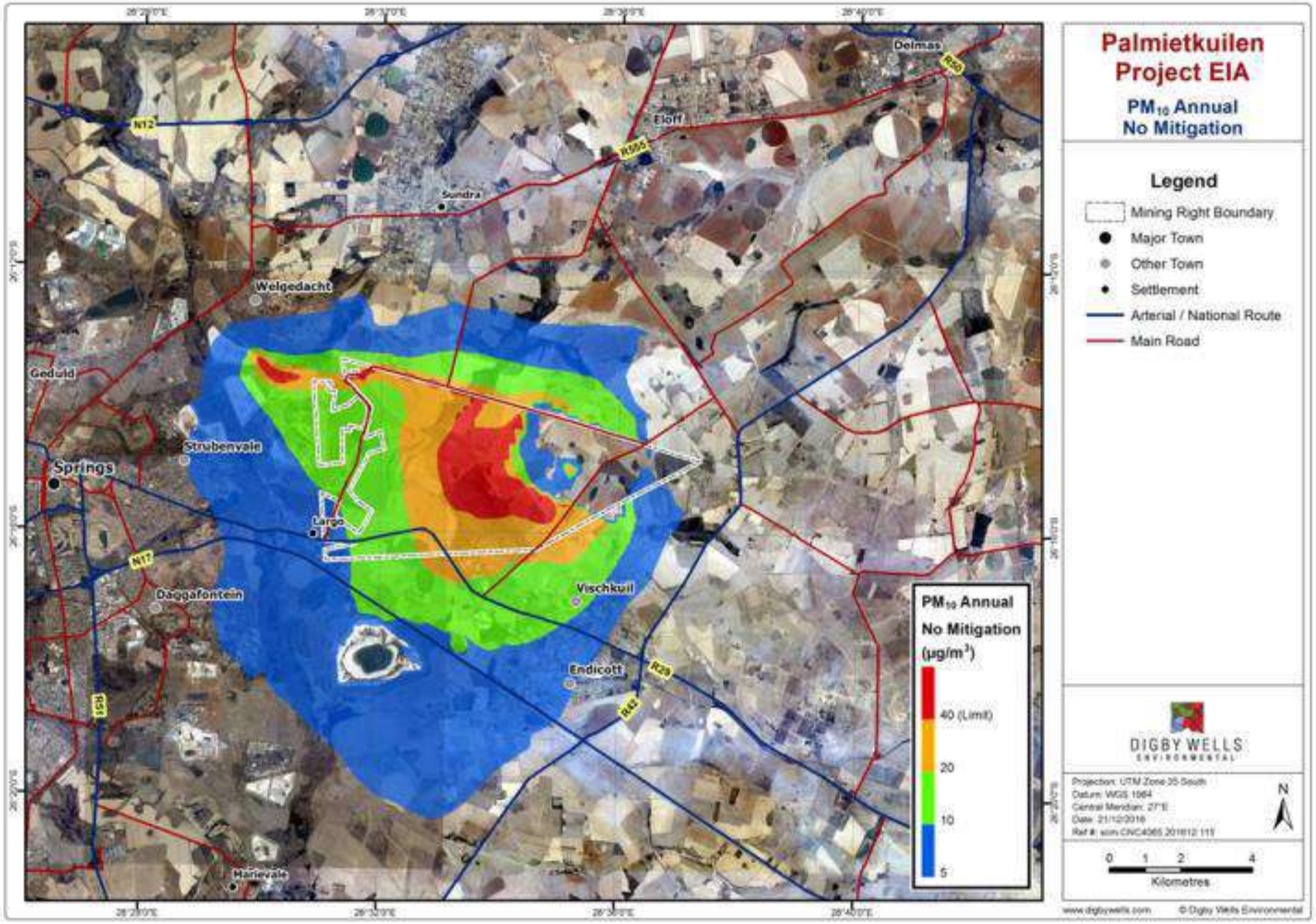
Table 11-62: Evaluation of Measured/Model Dust Deposition Rates at Selected Sites

Emission Specie (TSP)	Averaging period	Average Background deposition rate per site ($mg/m^2/day$)	Background (Background + Modelled) No mitigation ($mg/m^2/day$)	Background + Modeled – with mitigation ($mg/m^2/day$)	Standard ($mg/m^2/day$)
CNC_01	Monthly	735	2455	978	600
CNC_02	Monthly	853	1806	874	600
CNC_03	Monthly	310	4633	342	600
The predicted concentrations at the monitoring sites are in bracket					

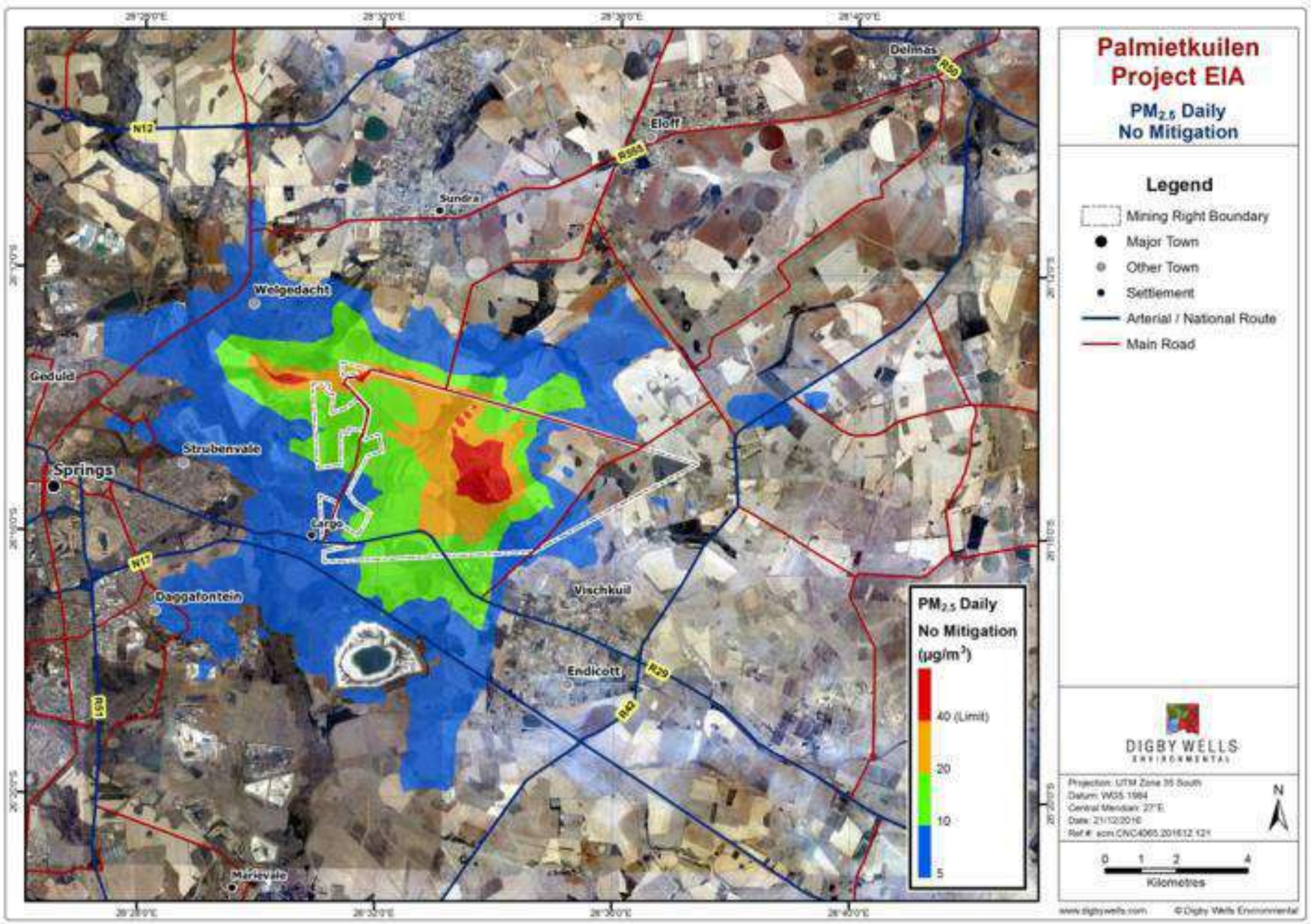
The measured dust deposition data shows that particulate emissions from the proposed Project can exert impacts on ambient air quality of the area. Table 11-62 shows the cumulative impacts of the dust emissions from the mine on ambient dust deposition rates. However, with dust deposition, once mitigation measures were applied the predicted dust deposition rates were reduced considerably.



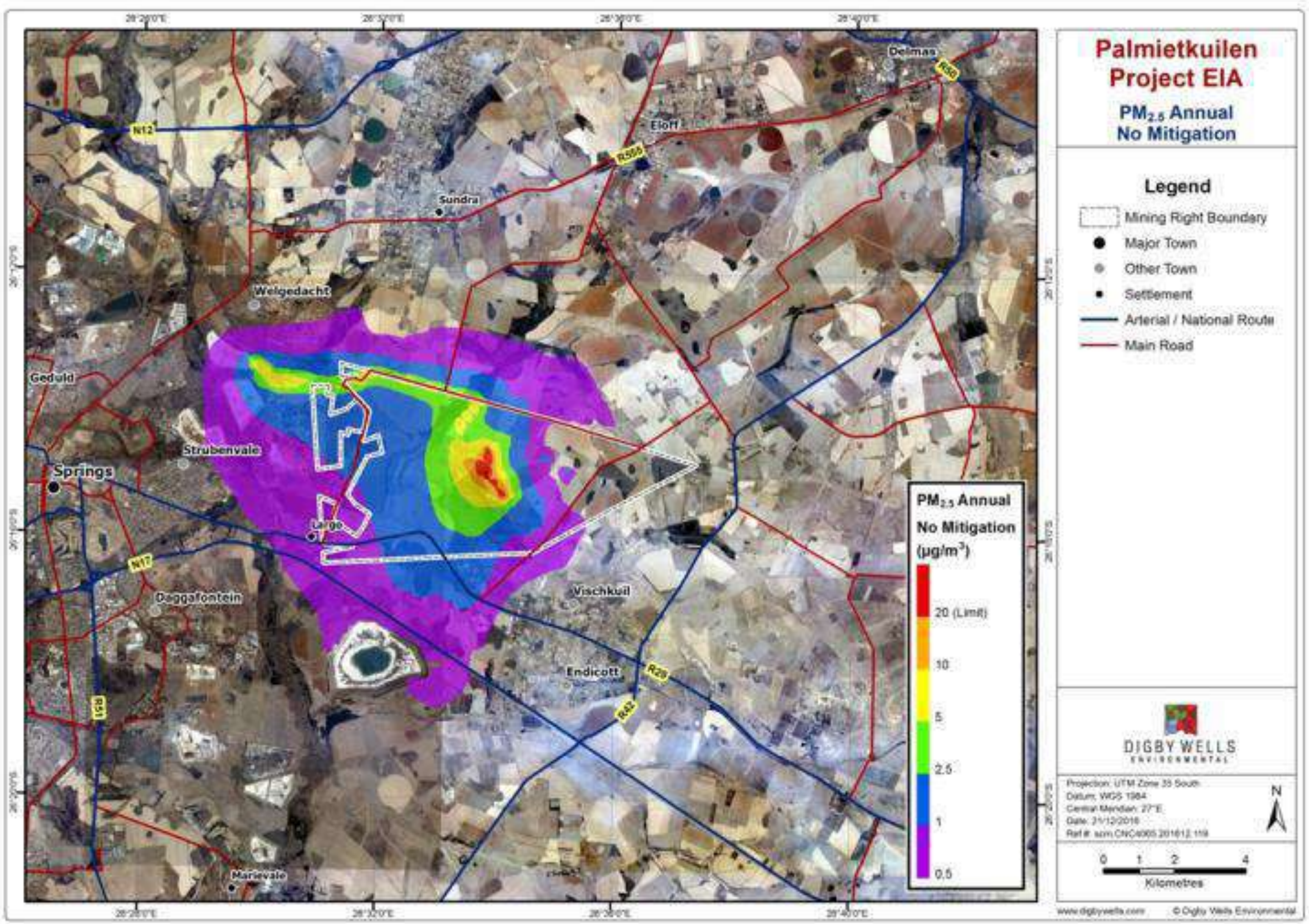
Plan 47: Predicted 4th highest (99th percentile) daily PM10 concentrations (µg/m3)



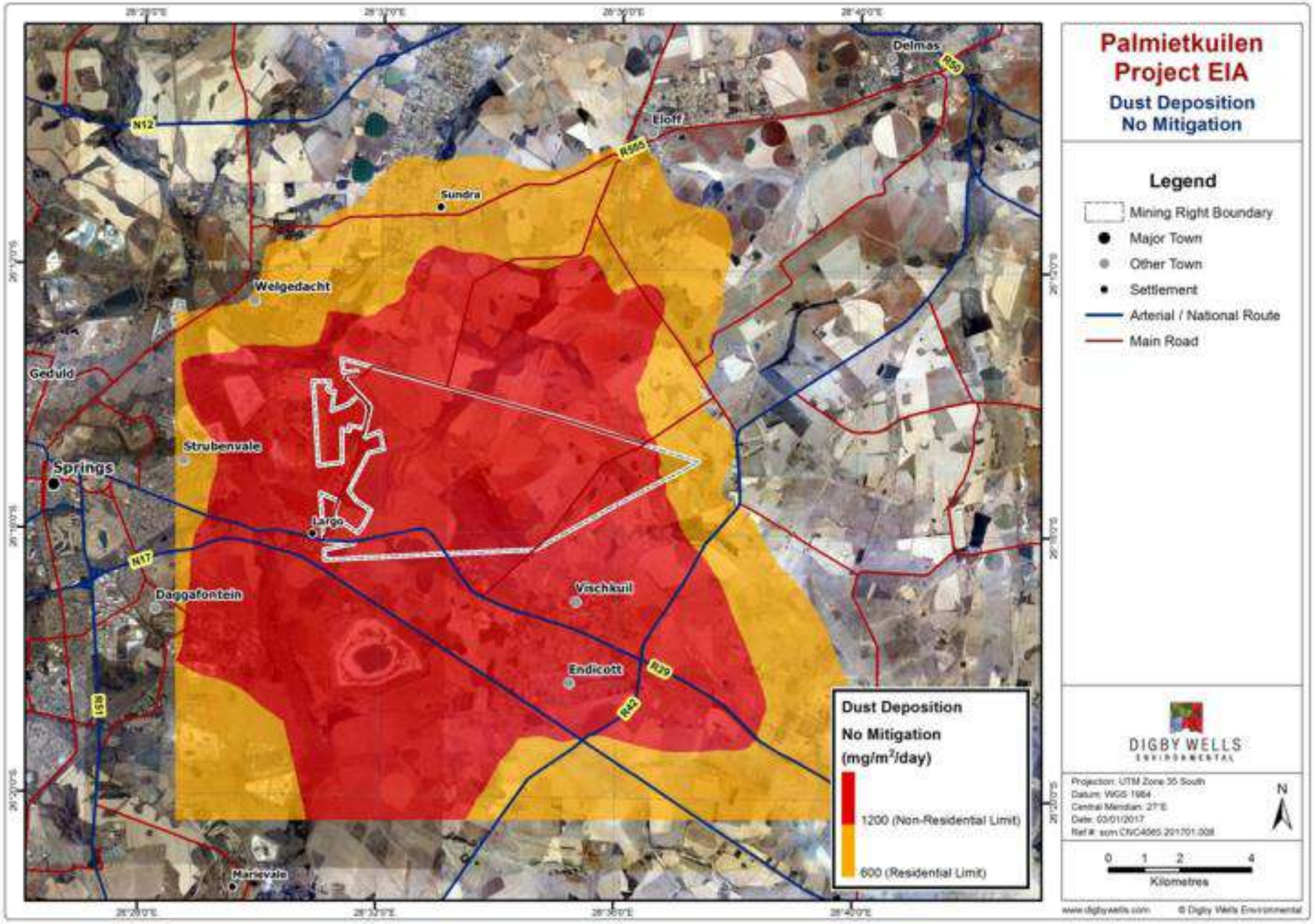
Plan 48: Predicted 1st highest (100th percentile) Annual PM10 concentrations (µg/m3)



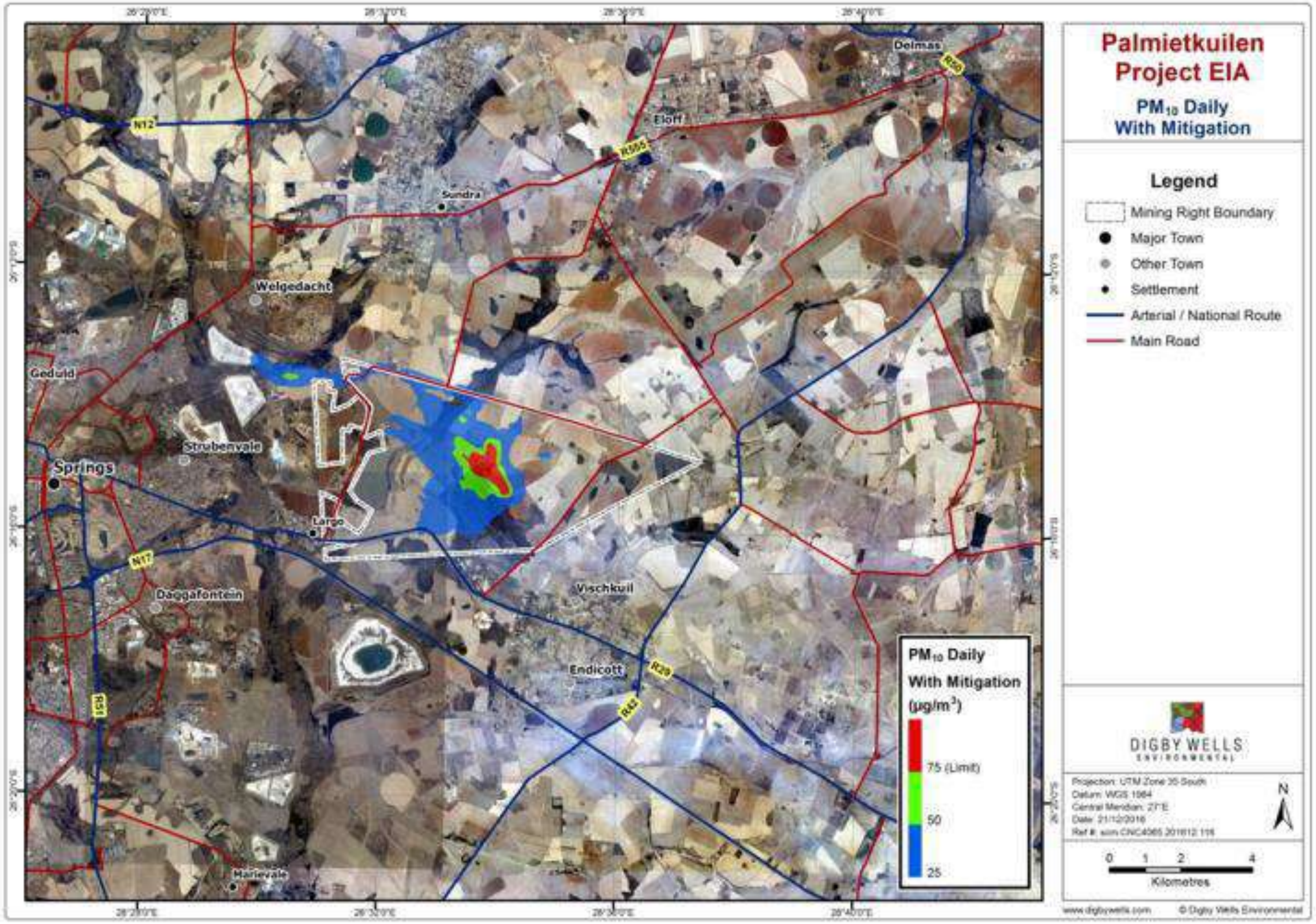
Plan 49: Predicted 4th highest (99th percentile) daily PM2.5 concentrations (µg/m3)



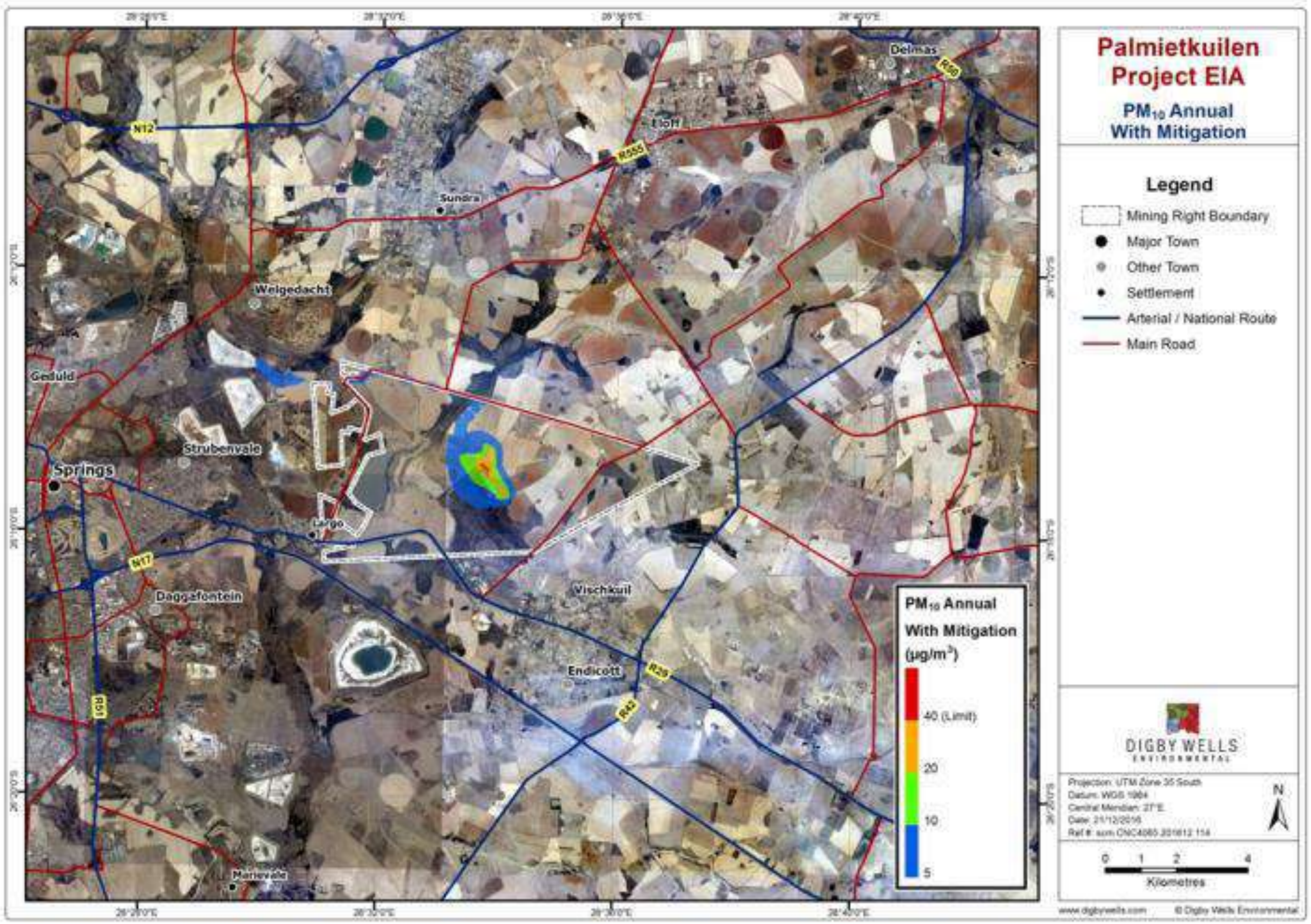
Plan 50: Predicted 1st highest (100th percentile) Annual PM2.5 concentrations (µg/m3)



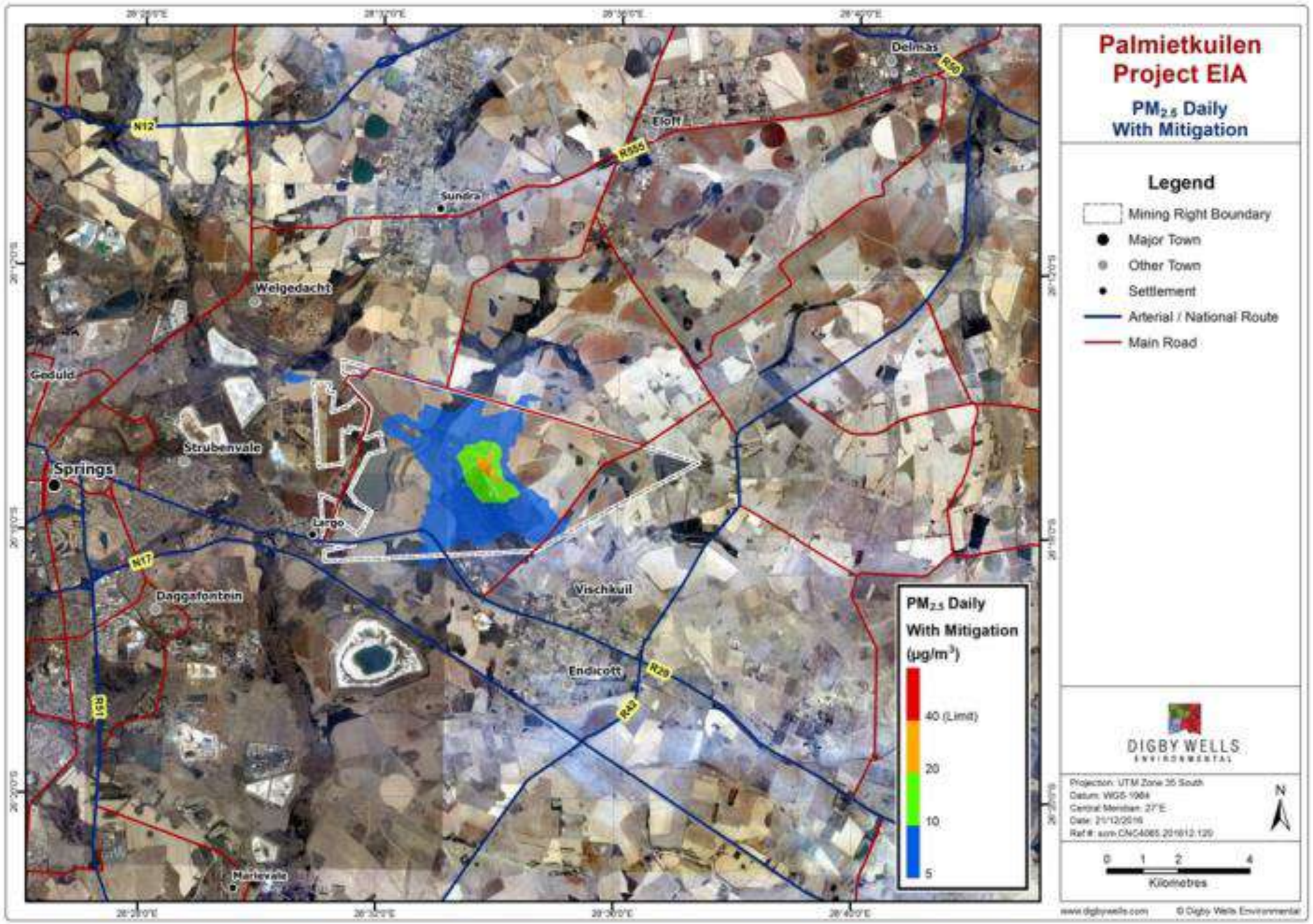
Plan 51: Predicted maximum (100th percentile) dust deposition (mg/m2/day) No mitigation



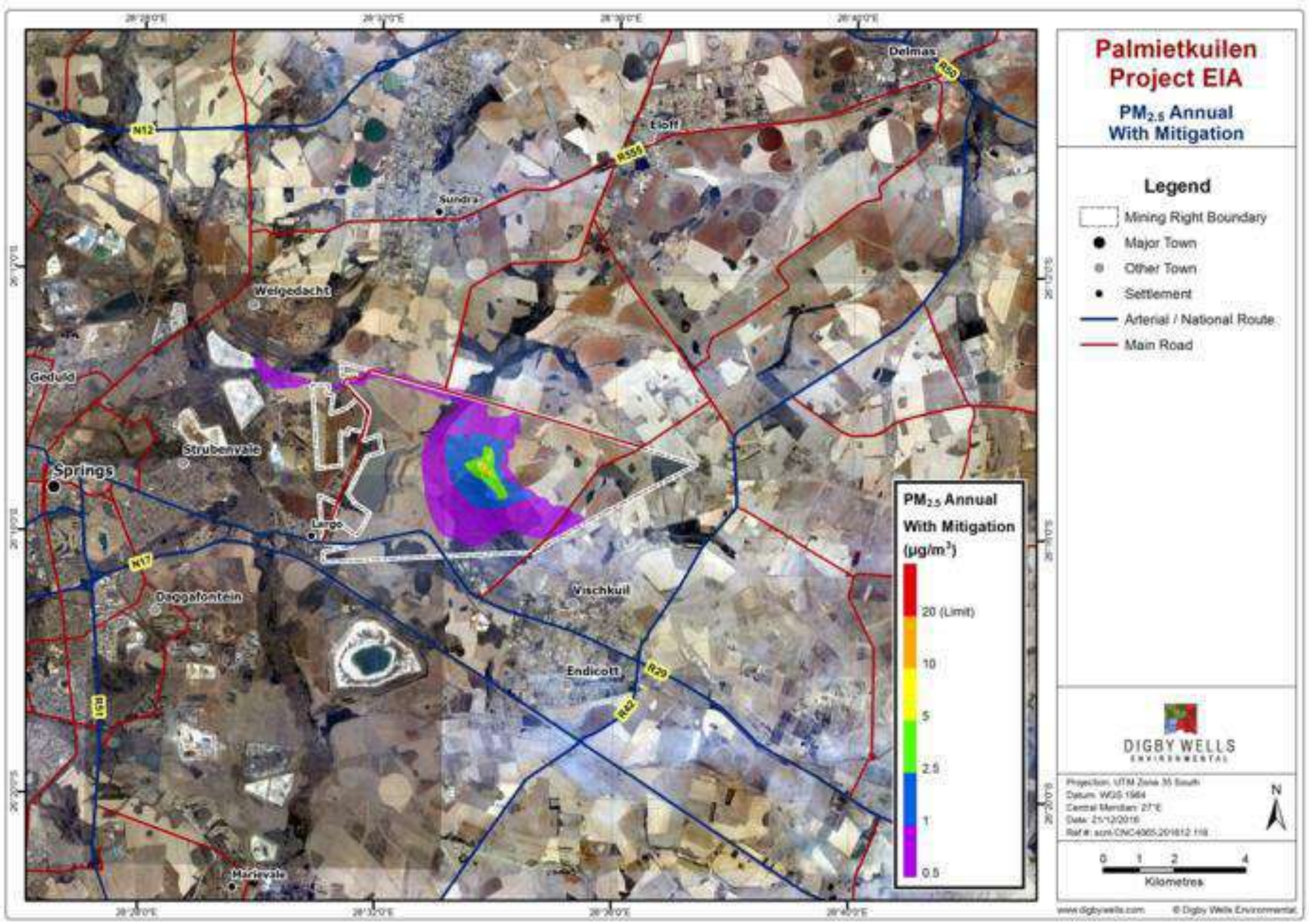
Plan 52: Predicted 4th highest (99th percentile) daily PM10 concentrations (µg/m3) with mitigation



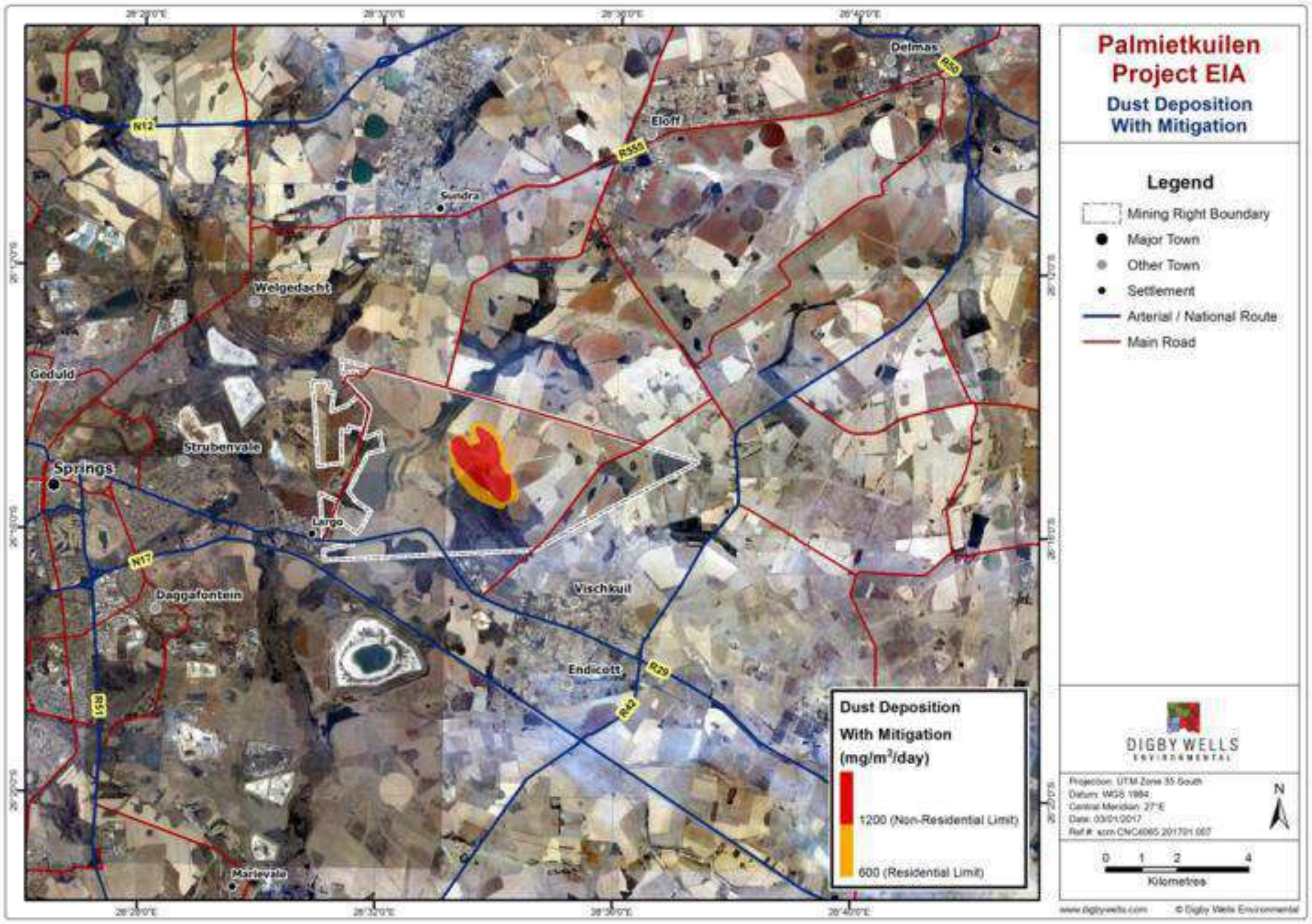
Plan 53: Predicted 1st highest (100th percentile) Annual PM10 concentrations (µg/m3) with mitigation



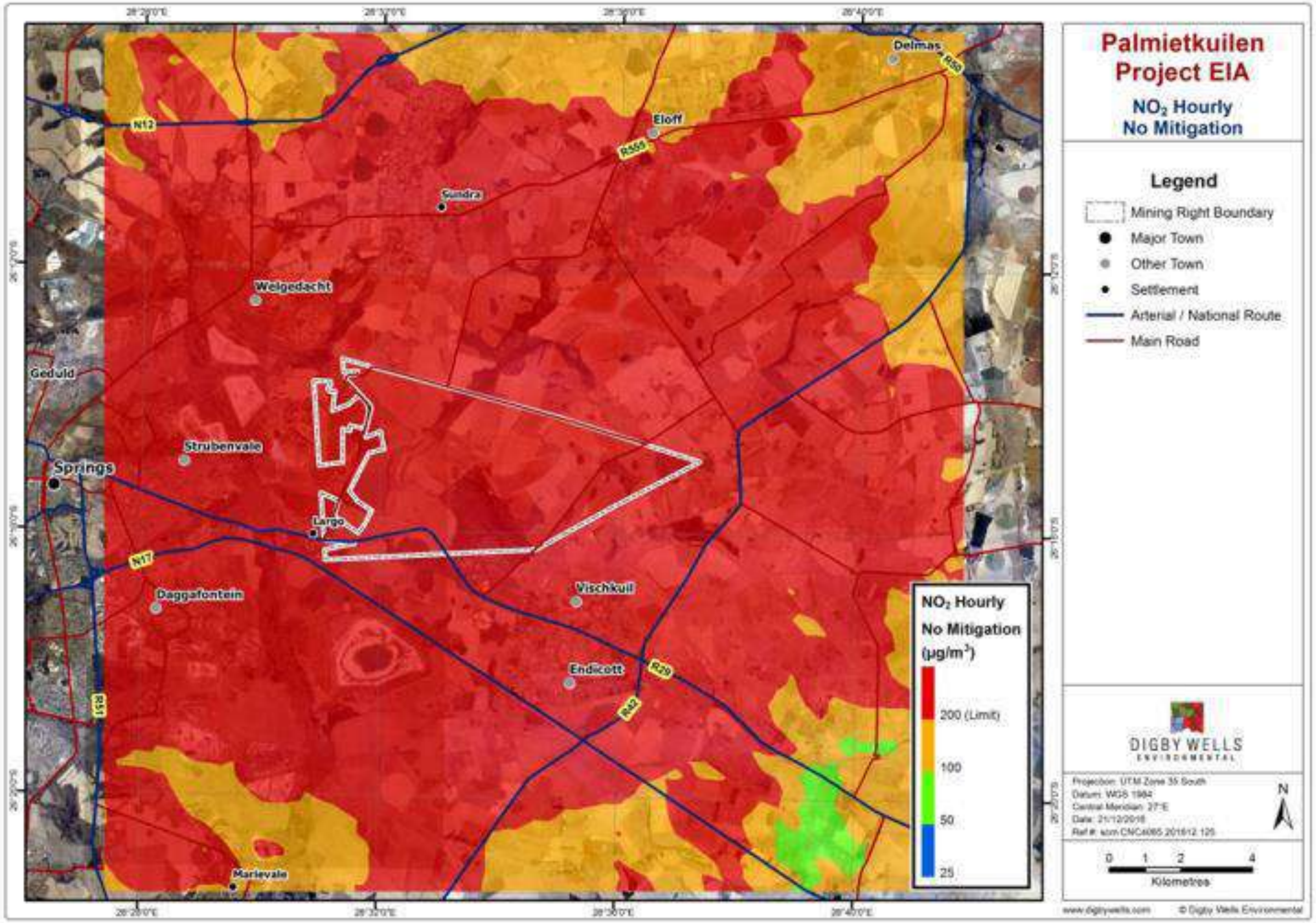
Plan 54: Predicted 4th highest (99th percentile) daily PM2.5 concentrations (µg/m3)



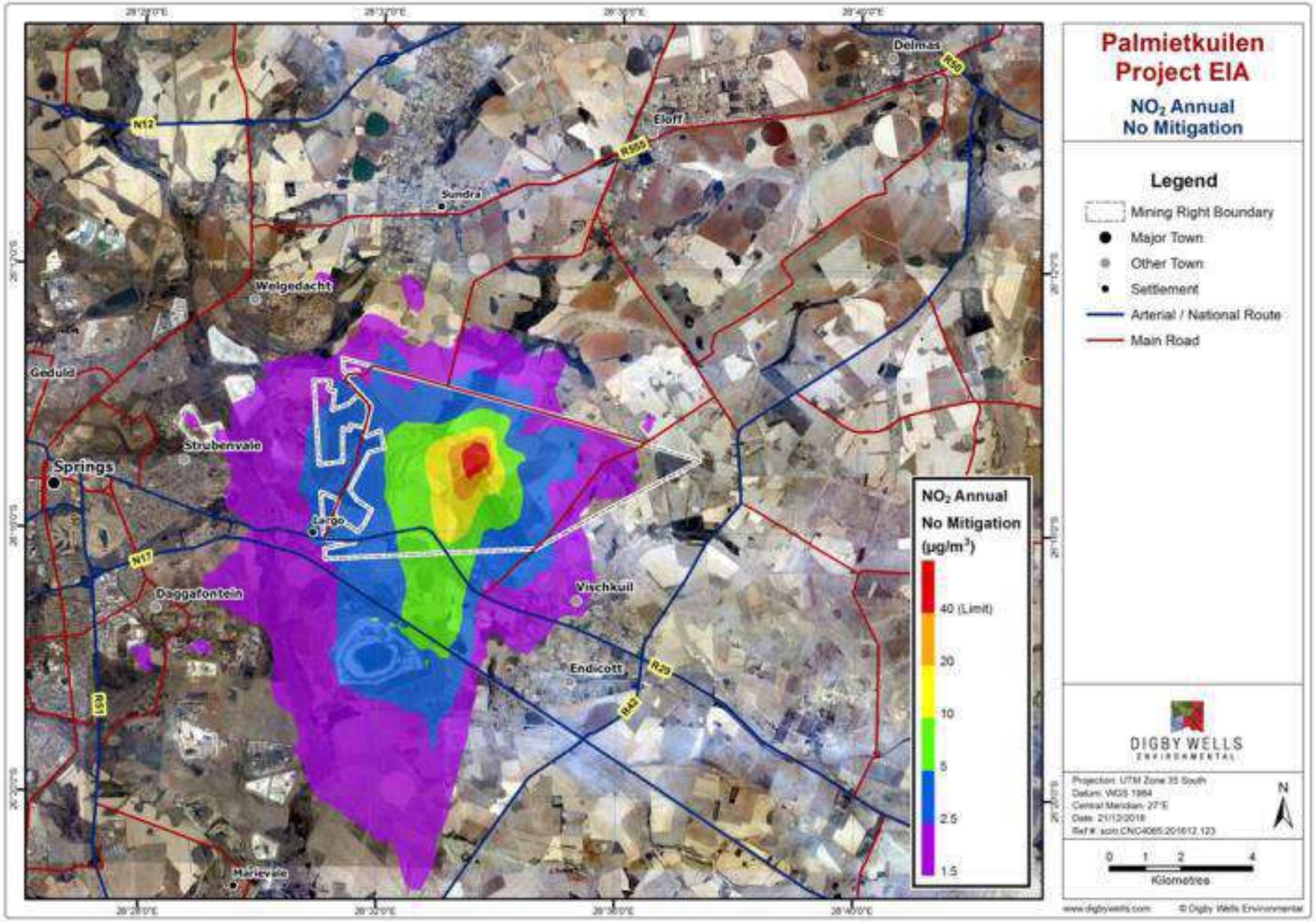
Plan 55: Predicted 1st highest (100th percentile) Annual PM2.5 concentrations (µg/m3)



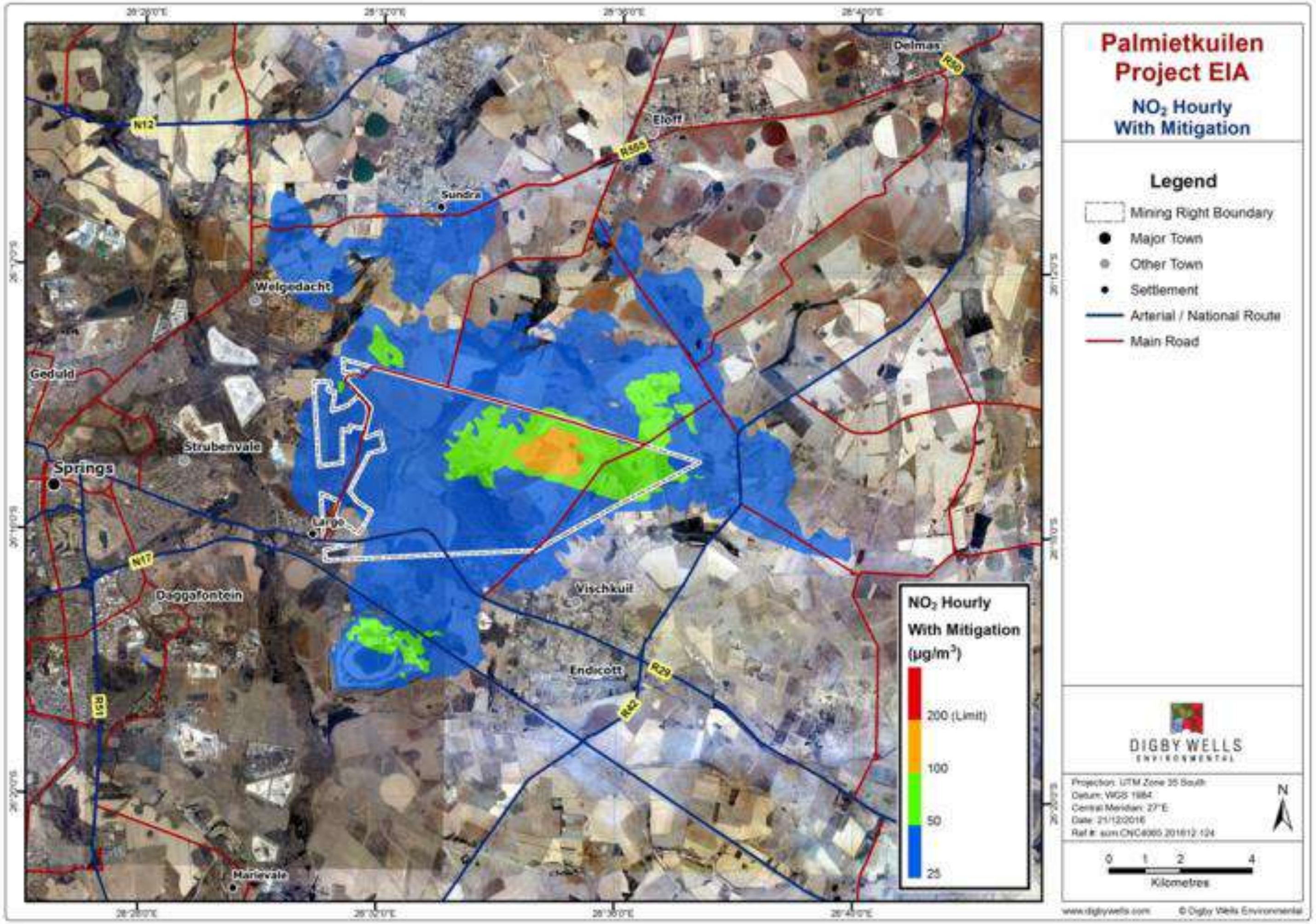
Plan 56: Predicted maximum (100th percentile) dust deposition (mg/m2/day) with mitigation



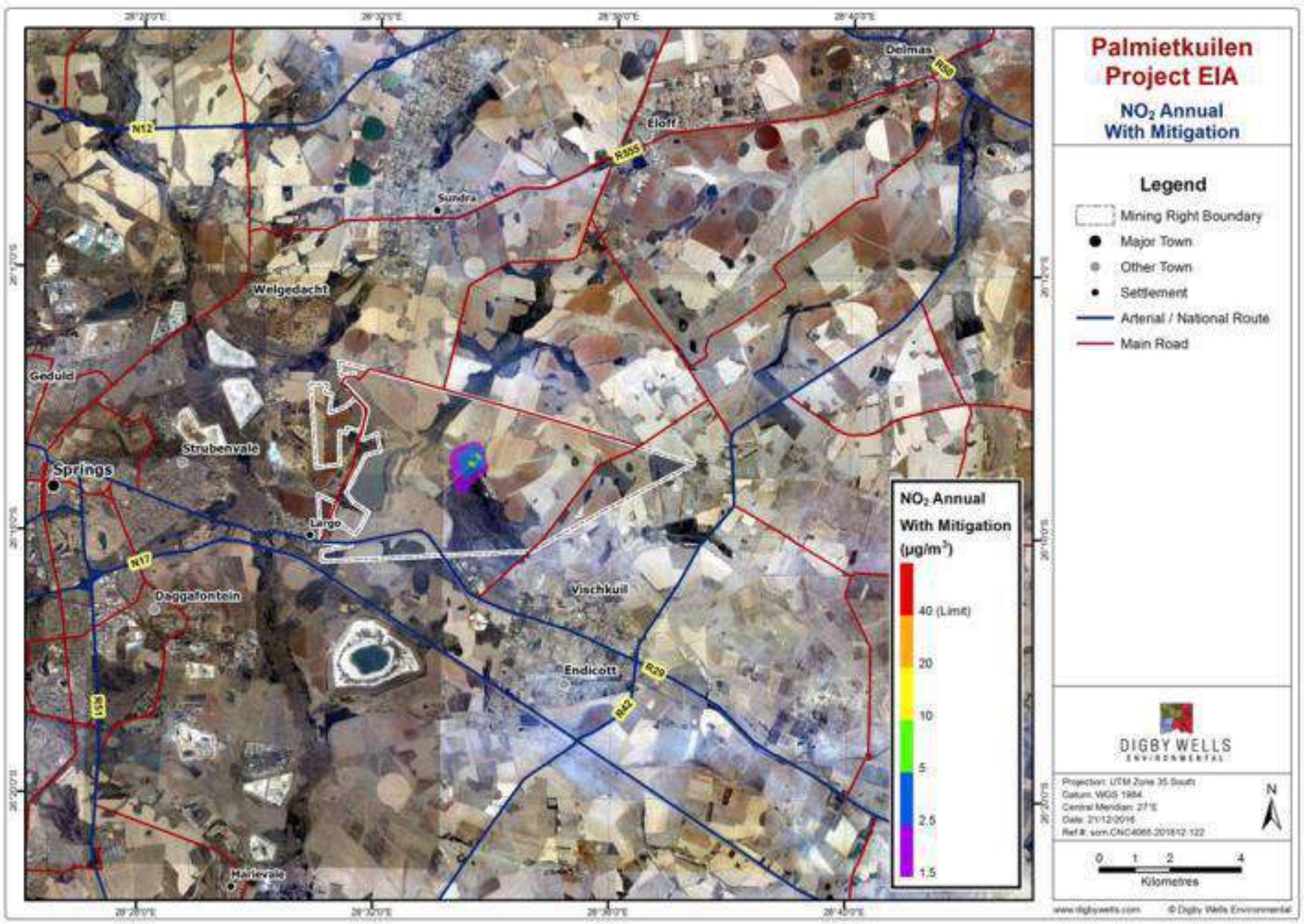
Plan 57: Predicted 4th highest (99th percentile) hourly NO2 concentrations (µg/m3)



Plan 58: Predicted 1st highest (100th percentile) annual average NO2 concentrations (µg/m3)



Plan 59: Predicted 4th highest (99th percentile) hourly NO2 concentrations (µg/m3)



Plan 60: Predicted 1st highest (100th percentile) annual average NO2 concentrations (µg/m3)

11.1.7.2 Construction Phases

As part of the construction phase, the following activities are identified that may impact on the ambient air quality of the area i.e. increasing particulate matter loading in the atmosphere:

- Site clearing;
- Development of surface infrastructure – haul roads, access roads, topsoil area, overburden dump area, ROM tip area; and
- Blasting and development of initial box-cut for mining, including stockpiling from initial box-cuts, etc.

Table 11-63: Interactions and Impacts of Construction Phase

Interaction	Impact
Site clearing	Generation of dust from vehicle wheels
	Direct reduction in the quality of ambient air airborne dust
Exposure of loose soils due to loss of vegetation cover	Wind erosion of loose particulate matter
	Increased particulate matter load in the atmosphere leading to poor air quality
	Soiling of surfaces due to fall out dust

11.1.7.2.1 Impact Description

Site clearing, removal of vegetation and grading, development of surface infrastructure takes place using a range of heavy construction equipment. This will lead to exposure of loose soils due to loss of vegetation cover and generation of fugitive emissions comprising TSP, PM_{10} and $PM_{2.5}$ from vehicle wheels and material handling. There will be clearing prior to the construction of haul roads, access road, overburden dump etc. There is movement of contractor and permanent workforce, vehicle activity on access roads, and the levelling and compacting of surfaces during this activity.

Emissions from the site clearing were based on the projected area to be cleared. The inventory assumed that 50% of the area will be cleared at a time. Impacts associated with this are considered negligible due to the relatively short-term nature (less than one year).

11.1.7.2.2 Management Objectives

- The management objective is to ensure that nuisance and contaminated dust emissions associated with construction phase comply with regulatory standards for the protection of the environment, human health and wellbeing.
- The management objective should ensure that both on-site and off-site airborne emission levels are within compliance.

11.1.7.2.3 Management Actions and Targets

- Particulate monitoring at upwind and downwind of project area at sensitive receptor locations.
- Application of dust suppressants i.e. Dust-A-Side on haul roads and exposed areas to ensure compliance.
- Ensure compliance with the air quality standards within the mine boundary, at the project boundary and beyond i.e. PM_{10} (75 µg/m^3) and dust fallout (1 200 mg/m^2/day).

11.1.7.2.4 Impact Ratings

The impacts on air quality during the Construction Phase, as described above, are rated in Table 11-64 below.

Table 11-64: Significance ratings for impacts on air quality during Site Clearing and Development of Surface Infrastructure

Activity and Interaction (Site Clearing and Development of Surface Infrastructure)			
Dimension	**Rating**	**Motivation**	**Significance**
Impact Description: Reduction in ambient air quality			
Prior to mitigation/ management			
Duration	Short term (1)	Dust will be generated for duration of the construction phase	Negligible (negative) – 30
Extent	Limited (2)	Limited to the project area and immediate surroundings.	
Intensity	Minor (2)	Minor effect on surrounding area is anticipated	
Probability	Almost certain (6)	There is a possibility that generated dust will impact ambient air quality.	
Nature	Negative		
Mitigation/ Management actions			
▪ Application of dust suppressant on the dirt road and exposed areas; ▪ Set maximum speed limits (40 km/h) on dirt roads and to have these limits enforced; ▪ The area of disturbance at all times must be kept to a minimum and no unnecessary clearing, digging or scraping must occur, especially on windy days (with wind speed ≥ 5.4 m/s); ▪ The drop heights when loading onto trucks and at tipping points should be minimised (preferably 0.5 m).			
Post- mitigation			
Duration	Short term (1)	Dust generation will be less than 1 year and is reversible	Negligible (negative) – 12
Extent	Very Limited (1)	After mitigation measures are implemented, It is expected that dust impacts will be limited to isolated parts of the site.	

Activity and Interaction (Site Clearing and Development of Surface Infrastructure)			
Dimension	**Rating**	**Motivation**	**Significance**
Intensity	Minimal (1)	Generated dust will have minimal impacts on air quality after mitigation	
Probability	Probable (4)	Probable that impact on ambient air quality will occur.	
Nature	Negative		
Activity and Interaction (Exposed surfaces due to site clearing will results in the wind erosion of loose soil)			
Impact Description: Wind erosion; Poor air quality			
Prior to mitigation/ management			
Duration	Short term (1)	Wind erosion will occur for the duration of the construction phase (less than 1 year)	Negligible (negative) – 30
Extent	Limited (2)	Wind erosion will be limited to the site and it immediate surroundings	
Intensity	Minor (2)	Airborne dust will have minimal impact on ambient air quality during construction phase	
Probability	Almost certain (6)	It is likely that wind erosion will impact on ambient air quality.	
Nature	Negative		
Mitigation/ Management actions			
▪ Application of wetting agents or dust suppressant on exposed areas; ▪ Set maximum speed limits for vehicles working on exposed areas and have these limits enforced; ▪ The area of disturbance at all times must be kept to a minimum and no unnecessary clearing, digging or scraping must occur, especially on windy days (wind speed ≥ 5.4 m/s).			
Post management			
Duration	Short term (1)	Wind erosion will occur for the duration of the construction phase	Low (negative) – 12
Extent	Very Limited (1)	After mitigation measures are implemented, it is expected that wind erosion will be limited to isolated parts of the site.	
Intensity	Minimal (1)	Minimal impact on ambient air quality during construction phase	
Probability	Probable (4)	Probable that impact on ambient air quality will occur.	
Nature	Negative		

11.1.7.3 Operational Phase

As part of the Operational Phase, the following activities are identified that may impact on the ambient air quality of the area:

- Stripping topsoil and soft overburden;
- Drilling and blasting of coal and overburden;
- Removal of ROM coal and overburden;
- Loading, hauling and stockpiling of ROM coal and overburden
- Generation of power
- Use and maintenance of haul roads for the transportation of coal to the washing plant;
- Storage, handling and treatment of hazardous products (including fuel, explosives and oil) and waste.

Table 11-65: Interactions and Impacts of Operational Phase

Interaction	Impact
Dust emission	Increased pollutant load in air
	Direct reduction in air quality
Wind erosion	Erosion of loose soils
	Direct reduction in air quality

11.1.7.3.1 Impact Description

During the operational phase, series of activities take place simultaneously at the mine, leading to multiple sources of fugitive emissions. Stripping of soils and soft overburden will result in the generation of dust from heavy construction equipment and subsequent erosion of loose soils. Also, drilling and blasting is performed to fragment the coal and overburden for mining. Blasting in particular will result in fugitive dust (containing TSP, PM_{10} and $PM_{2.5}$). Material handling activities such as loading, hauling of ore and overburden, unloading and crushing of ROM are dust generating processes with potential to impact the quality of ambient air. The hauling of ROM and overburden using dirt roads represent the highest dust generating source within a mine. These activities will be conducted for the life of mine and as such represent perennial sources of dust. During the operational phase, waste is produced as the demand and consumption increases. Impacts include evaporation of diesel fuel and heavy fuel from temporary tanks and possible spills during loading of fuel from tanks on site that are used for re-fuelling of heavy machinery and trucks. Some of the waste produced includes waste oils, chemicals and hazardous substances.

11.1.7.3.2 Management Objectives

The management objective is to ensure that both on-site and off-site levels of dust comply with the relevant environmental and health protection criteria.

11.1.7.3.3 Management Actions and Targets

Management will ensure that monitoring data are collected and analyse to ensure compliance with the air quality standards on-site and at off-site locations.

11.1.7.3.4 Impact Ratings

The impacts on air quality during the Construction Phase, as described above, are rated in Table 11-66 to Table 11-71 below.

Table 11-66: Stripping Topsoil and Soft Overburden

Activity and Interaction (Stripping topsoil and soft overburden)			
Dimension	**Rating**	**Motivation**	**Significance**
Impact Description: Stripping activity will result in fugitive dust emissions and reduction in air quality			
Prior to mitigation/ management			
Duration	Project life (5)	Dust will be generated for the project life	Minor (negative) – 66
Extent	Local (3)	Airborne dust may extend across the development site area.	
Intensity	Moderate (3)	Moderate impact on ambient air quality	
Probability	Almost certain (6)	It is highly probable that impact will occur.	
Nature	Negative		
Mitigation/ Management actions			
▪ Application of wetting agents or dust suppressant; ▪ The area of disturbance at all times must be kept to a minimum and no unnecessary stripping must occur, especially on windy days (wind speed ≥ 5.4 m/s) ▪ The drop heights when loading onto trucks and at tipping points should be minimised.			
Post- mitigation			
Duration	Project life (5)	Dust will be generated duration of the operational phase	Minor (negative) – 36
Extent	Limited (2)	Airborne dust will be limited to project site and its immediate surrounding after mitigation.	
Intensity	Minor (2)	Moderate environmental impact is anticipated after mitigation measures are applied	
Probability	Almost certain (6)	Probable that impact will occur.	

Activity and Interaction (Stripping topsoil and soft overburden)			
Dimension	**Rating**	**Motivation**	**Significance**
Nature	Negative		

Table 11-67: Significance ratings for Drilling and Blasting of ROM Coal and Overburden

Activity and Interaction (Drilling and blasting result in fugitive emissions and reduction in air quality)			
Dimension	**Rating**	**Motivation**	**Significance**
Impact Description: Drilling and blasting will result in fugitive emissions and reduction in air quality			
Prior to mitigation/ management			
Duration	Project life (5)	Dust will be generated throughout the project life	Minor (negative) – 60
Extent	Local (3)	Airborne dust may extend across the development site area.	
Intensity	Moderate (3)	Moderate environmental effect is anticipated	
Probability	Almost certain (6)	It is likely that impact will occur.	
Nature	Negative		
Mitigation/ Management actions			
▪ Wet drilling; and ▪ Conduct blasting judiciously by avoid windy days (≥ 5.4 m/s)			
Post- mitigation			
Duration	Project life (5)	Dust will be generated throughout the project life	Minor (negative) – 55
Extent	Limited (2)	Airborne dust limited to the site and its immediate surrounding mitigation measures are applied.	
Intensity	Moderate (3)	Moderate environmental impact	
Probability	Likely (5)	It is likely that impact will occur.	
Nature	Negative		

Table 11-68: Significance ratings for Loading, Hauling and Stockpiling of ROM Coal and Overburden

Activity and Interaction (Loading, hauling and stockpiling of ROM Coal and Overburden result in fugitive emission)			
Dimension	**Rating**	**Motivation**	**Significance**
Impact Description: Loading, Hauling and Stockpiling of ROM Coal and Overburden will result in result in fugitive emissions and reduction in air quality			
Prior to mitigation/ management			
Duration	Project life (5)	Dust will be generated for the project life	Moderate (negative) – 105
Extent	Municipal (4)	Airborne dust may extend across the region.	
Intensity	Very Serious (5)	Very serious long term environmental implications on air quality	
Probability	Certain (7)	Impact will definitely occur.	
Nature	Negative		
Mitigation/ Management actions			
▪ The drop heights when loading onto trucks and at tipping points should be minimised (preferably 0.5 m); ▪ The use of dust suppressants and binders on haul roads to reduce dust generation; ▪ There is need to set maximum speed limits (40 km/h) on haul roads and to have these limits enforced.			
Post- mitigation			
Duration	Project life (5)	Dust will be generated duration the operational life of mine	Minor (negative) – 45
Extent	Limited (2)	Airborne dust will be limited to site and its immediate surroundings after mitigation.	

Intensity	Minimal (2)	Generated dust will have minimal effect after mitigation	
Probability	Likely (5)	Impacts may occur.	
Nature	Negative		

Table 11-69: Significance ratings for Crushing and Screening of ROM Coal

Activity and Interaction (Crushing and screening result in fugitive emissions)			
Dimension	**Rating**	**Motivation**	**Significance**
Impact Description: Crushing and screening lead to fugitive dust emissions and reduction in air quality			
Prior to mitigation/ management			
Duration	Project life (5)	Fugitive emissions will occur throughout the project life	Minor (negative) – 60
Extent	Limited (2)	Fugitive dust will be limited the site and surrounding area.	
Intensity	Moderate (3)	Moderate impact is anticipated	
Probability	Almost certain (6)	It is likely that impact will occur.	
Nature	Negative		
Mitigation/ Management actions			
▪ Enclosure of crushers; and ▪ Application of fogging system at the crusher			
Post- mitigation			
Duration	Project life (5)	Fugitive emissions will occur throughout the project life	Medium-Low (negative) – 21
Extent	Isolated (1)	After mitigation measures are implemented, It is expected that dust impacts will be limited to the crushing site.	
Intensity	Minimal (1)	Generated dust will have minor effect	
Probability	Unlikely (3)	Impacts are unlikely to occur after adequate mitigation.	
Nature	Negative		

Table 11-70: Generation of power using diesel generators

Activity and Interaction (Generation of power leads to gaseous emissions: NOx, CO and particulate matter)			
Dimension	**Rating**	**Motivation**	**Significance**
Impact Description: Reduction in air quality due to gaseous emissions			
Prior to mitigation/ management			
Duration	Project life (5)	Emissions of gases during operational phase will occur for the project life	Moderate (negative) – 91
Extent	Local (3)	Impact can be felt locally, extending outside the mine boundary as gaseous pollutants are easily dispersed.	
Intensity	Very serious (-5)	Significant changes of the ambient air quality baseline	
Probability	Definite (7)	It is certain that emissions will occur	
Nature	Negative		
Mitigation/ Management actions			
▪ Ensure generators are working at optimum conditions; ▪ Fitting of gas scrubbers; and ▪ Fitting electrostatic precipitators or bag house.			
Post- mitigation			
Duration	Project life (5)	Emissions of gases will occur for the operational life or project life	Negligible (negative) – 30
Extent	Limited (2)	Impacts will be limited to the Project site.	
Intensity	Moderate (-3)	The area impacted will be minimised after mitigation measures are applied.	
Probability	Unlikely (3)	It is unlikely that emissions will have considerable impact on air quality after mitigation measures are applied	

Table 11-71: Significance ratings for the Storage, Handling and Treatment of Hazardous products

Activity and Interaction (Spills and evaporation from fuel, heavy fuel oil and used chemical will lead to reduction in air quality)			
Dimension	**Rating**	**Motivation**	**Significance**
Impact Description: Spills and evaporation will lead to fugitive emission and reduce in air quality			
Prior to mitigation/ management			
Duration	Project life (5)	Spills and evaporation will occur throughout the project life	Minor (negative) – 72

Activity and Interaction (Spills and evaporation from fuel, heavy fuel oil and used chemical will lead to reduction in air quality)			
Dimension	**Rating**	**Motivation**	**Significance**
Extent	Local (3)	Emissions will extend as far as the project site	
Intensity	Serious (4)	Serious impact on air quality is anticipated	
Probability	Almost certain (6)	It is most likely that the impact would occur.	
Nature	Negative		
Mitigation/ Management actions			
▪ Strict adherence to products and waste management plan; ▪ Handle, store and dispose of hazardous substances in accordance with the local regulations; ▪ Store hazardous substances in clearly labelled containers; ▪ Deal with emergency situations promptly i.e. spills; ▪ Provision of secondary containment for fuel storage.			
Post- mitigation			
Duration	Project life (5)	Hazardous substances will impact ambient air quality for the project life	Negligible (negative) – 28
Extent	Isolated (1)	Isolated to the site and its immediate surroundings	
Intensity	Minimal (1)	The impact will have minimal effect after mitigation measures	
Probability	Probable (4)	It is probable that impacts will occur.	
Nature	Negative		

11.1.7.4 Decommissioning Phase

As part of the Decommissioning Phase, the following activities are identified that may impact on the ambient air quality of the area:

- Demolition and removal of all infrastructure, including transporting materials off site;
- Rehabilitation, including spreading of soil, re-vegetation and profiling or contouring;
- Storage, handling and treatment of hazardous products (including fuel, explosives and oil) and waste.

Table 11-72: Interactions and Impacts of Decommissioning Phase

Interaction	Impact
Dust generation	Increased pollutant load in air
	Poor air quality
Wind erosion	Erosion of loose material

Interaction	Impact
	Poor air quality

11.1.7.4.1 Impact Description

The dismantling of mine infrastructure and rehabilitation of the project area including the stockpiles will involve the use of heavy machinery and vehicles similar to those used in the construction phase. This will result in the release of fugitive dust containing TSP, PM_{10} and $PM_{2.5}$. During this phase, hazardous products must be handled following operational protocol to avoid spills and evaporation from sources.

11.1.7.4.2 Management Objectives

The management objective is to ensure that emissions on-site and of-site from the dismantling process and subsequent rehabilitation of the project area are not in exceedance of the applicable standards.

11.1.7.4.3 Management Actions and Targets

Monitoring of emission levels pollutants on site, at upwind and downwind locations.

11.1.7.4.4 Impacts Rating

The impacts on air quality during the Construction Phase, as described above, are rated in Table 11-73 to Table 11-75 below

Table 11-73: Significance ratings for the Demolition and Removal of Infrastructure

Activity and Interaction (Demolition of Infrastructure results in fugitive emission and reduction in air quality)			
Dimension	**Rating**	**Motivation**	**Significance**
Impact Description: Reduction in air quality			
Prior to mitigation/ management			
Duration	Short term (2)	Impact on air quality is limited to the duration of the decommissioning phase	Negligible – 24
Extent	Local (3)	Impact can extend to development site	
Intensity	Minor (1)	Minor impact is expected	
Probability	Probable (4)	It is probable that dust impact will occur.	
Nature	Negative		
Mitigation/ Management actions			
▪ The dismantling area disturbed must be kept to a minimum; ▪ Drop heights when offloading materials offsite must be minimised (preferably 0.5 m); and ▪ Limit demolition activities to non-windy days.			
Post- mitigation			
Duration	Short term (2)	Impact on air quality is limited to the	Negligible

Activity and Interaction (Demolition of Infrastructure results in fugitive emission and reduction in air quality)			
Dimension	**Rating**	**Motivation**	**Significance**
		duration of the decommissioning phase	(negative) – 15
Extent	Limited (2)	Impact will be limited to site after mitigation.	
Intensity	Minimal (1)	Minimal dust impact anticipated after mitigation	
Probability	Unlikely (3)	It is unlikely that dust will impact will occur.	
Nature	Negative		

Table 11-74: Significance ratings for Rehabilitation

Activity and Interaction (Rehabilitation of project area results in fugitive emission)			
Dimension	**Rating**	**Motivation**	**Significance**
Impact Description: Reduction in air quality			
Prior to mitigation/ management			
Duration	Short term (2)	Impact on air quality is limited to the duration of the decommissioning phase	Negligible (negative) – 30
Extent	Limited (2)	Impact will be limited to site and surroundings.	
Intensity	Minor (2)	Minor impact is expected	
Probability	Likely (5)	Likely that dust generated from this activity will impact ambient air quality	
Nature	Negative		
Mitigation/ Management actions			
▪ Drop heights when offloading materials for rehabilitation must be minimised (preferably 0.5 m); ▪ Rehabilitated landscape should be vegetated; and ▪ Use of dust suppressant on dirt roads and exposed areas.			
Post- mitigation			
Duration	Short term (2)	Impact on air quality is limited to the duration of the decommissioning phase	Negligible (negative) – 12
Extent	Very Limited (1)	Airborne dust will be limited to the development site area.	
Intensity	Minimal (1)	Minimal dust impact after mitigation measures are applied	
Probability	Unlikely (3)	It is unlikely that the air quality will be impacted on if mitigation measures are applied.	

Activity and Interaction (Rehabilitation of project area results in fugitive emission)			
Dimension	**Rating**	**Motivation**	**Significance**
Nature	Negative		

Table 11-75: Significance ratings for Storage, Handling and Treatment of Hazardous products (including fuel, explosives and oil) and waste.

Activity and Interaction (Spills and evaporation from fuel, heavy fuel oil and used chemical will lead to reduction in air quality)			
Dimension	**Rating**	**Motivation**	**Significance**
Impact Description: Reduction in air quality			
Prior to mitigation/ management			
Duration	Project life (5)	Hazardous substances will impact ambient air quality for the project life	Negligible (negative) – 30
Extent	Limited (2)	Emissions will be limited to site	
Intensity	Minor (2)	Minor impact on air quality is anticipated	
Probability	Almost certain (6)	It is most likely that the impact would occur.	
Nature	Negative		
Mitigation/ Management actions			
▪ Strict adherence to products and waste management plan; ▪ Handled, stored and disposed hazardous substances in accordance with the local regulations; ▪ Store hazardous substances in clearly labelled containers; ▪ Emergency situations must be dealt with promptly i.e. spills. ▪ Provision of secondary containment for fuel storage.			
Post- mitigation			
Duration	Short term (1)	Spills and evaporation will occur for the duration of this phase	Low (negative) – 18
Extent	Isolated (1)	Isolated to the site and its immediate surroundings	
Intensity	Minimal (1)	The impact will have minimal effect after mitigation measures	
Probability	Probable (4)	It is probable that impacts will occur.	
Nature	Negative		

11.1.8 Noise Impact Assessment

11.1.8.1 Construction Phase

The construction phase activities indicated in Table 11-76 below, may cause a noise disturbance at the surrounding rural and suburban receptors such as farmsteads, poultry farms and suburban communities at Aston Lake.

Table 11-76: Interactions and Impacts of Construction Activities

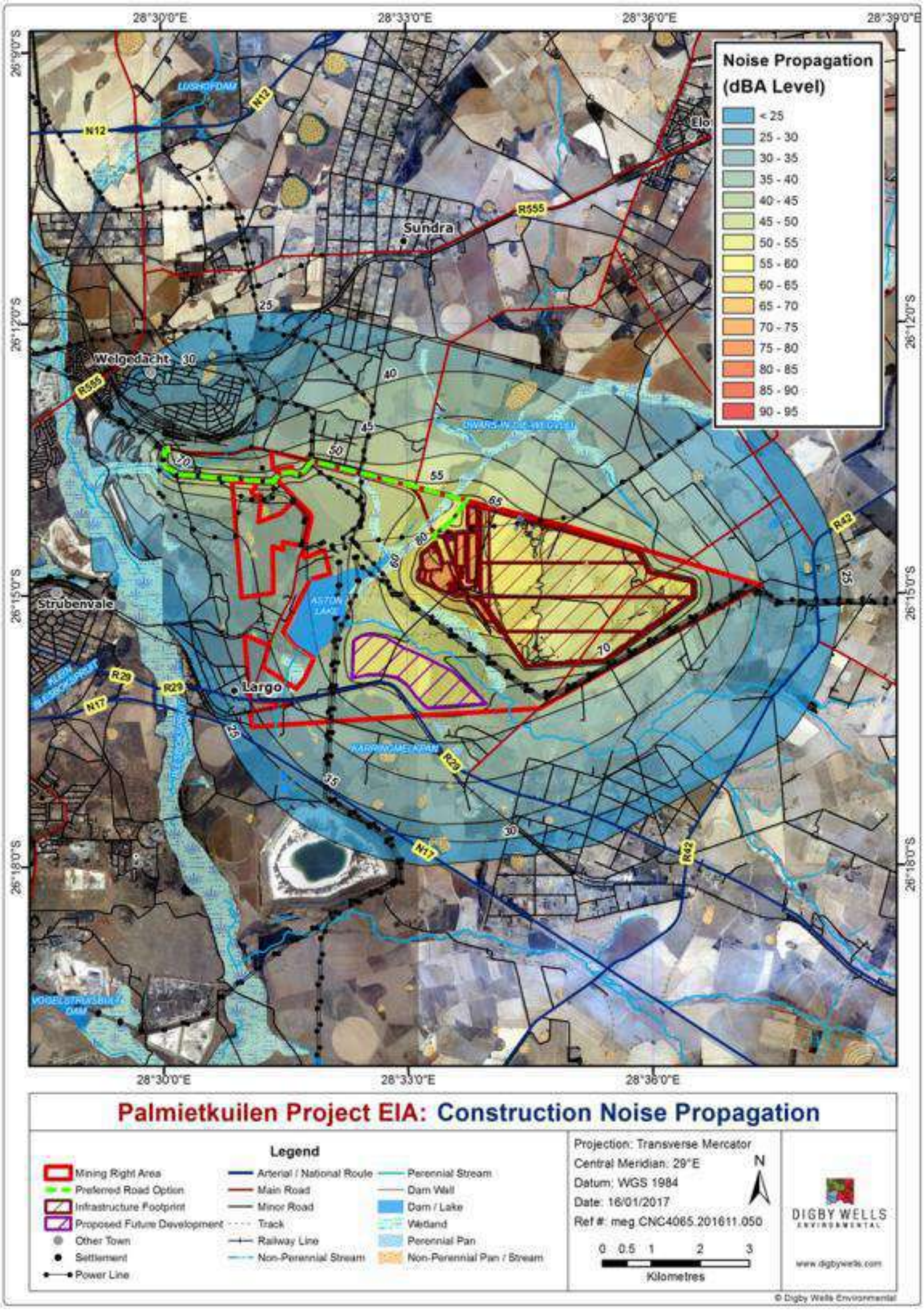
Interaction	Impact
▪ Site establishment; ▪ Site clearing, including the removal of topsoil and vegetation; ▪ Construction of mine related infrastructure, including haul roads, pipes, dams; ▪ Construction of washing plant; ▪ Relocation of Infrastructure (gravel road diversion); and ▪ Development of initial box-cut for mining, including stockpiling of material from initial box-cuts.	Noise disturbance by the construction vehicles and machinery in operation during the construction phase

11.1.8.1.1 Impact Description

The construction noise dispersion model is indicated on Plan 61 below. The results indicate that the expected noise during the construction activities will not likely cause a noise disturbance in terms of the Gauteng Noise Control Regulations at any receptor within the Gauteng Province. The reason for this is that the construction noise is not likely to measure above 45 dBA at any rural receptor nor measure above 50 dBA at any suburban receptor. The construction phase is likely to measure between 25 dBA and 45 dBA to the east and south east towards the rural receptors such as poultry farms and general farmsteads and is likely to measure between 25 dBA and 50 dBA to the south and west towards the suburban receptors.

The results indicate however, that the expected noise during the construction activities will likely cause a noise disturbance in terms of the National Noise Control Regulations at certain receptors within the Mpumalanga Province. The reason for this is that the construction noise is likely to exceed the existing background noise levels by more than 7 dBA.

The specific receptors that will be impacted on include the small holdings residential area called Prosperity AH, due to the close proximity to the proposed haul route towards the siding as well as the farmstead (indicated as monitoring location 2), due to the close proximity of the house to the proposed footprint of the open cast area and overburden dumps. The background noise levels at the small holdings and farmstead in question range from 40 dBA to 42 dBA and the likely construction noise will measure between 50 dBA and 57 dBA.



Plan 61: Construction Noise Dispersion Model

11.1.8.1.2 Management Objectives

To minimise/prevent the noise impact from causing a noise disturbance at the surrounding receptors as a result of the construction activities and subsequently comply with the National and Gauteng Noise Control Regulations.

11.1.8.1.3 Management Actions and Targets

Due to the close proximity of the above mentioned receptors and the subsequent non-compliance that the project's noise levels will have with respect to the National Noise Control Regulations, vigorous mitigation measures need to be implemented to decrease the significance of the impact. The mitigation and management measures for the construction phase are informed by the likely impact from the operational phase during the night time due to this phase being the longest in duration as well as the night time weather conditions being more favourable for the propagation of sound, especially the impact on sleep disturbance.

It is recommended that an alternative location for the northernmost hard overburden dump be considered (to try and avoid noise causing activities at the original proposed location) such as being located just south of the proposed product stockpile. An alternative location for the route towards the siding also needs to also be considered such as being located at least 250 meters south of the current proposed section that follows the existing gravel road running past the mentioned small holdings.

Implementing the recommendations put forward above, it is likely that the construction noise will comply with the National Noise Control Regulations.

11.1.8.1.4 Impact Ratings

The noise related impacts during the Construction Phase, as described above, are rated in Table 11-77 below.

Table 11-77: Noise Emanating from Machinery and Vehicles during Construction

Dimension	Rating	Motivation	Significance
Activity and Interaction (construction phase activities as per Table 11-76)			
Impact Description: Noise will emanate from the machinery and vehicles operating during the construction activities			
Prior to Mitigation/Management			
Duration	Medium term (3)	Noise will be produced for the duration of the construction phase of 12 months	Moderate (negative) – 84

<table>
<tr><th>Dimension</th><th>Rating</th><th>Motivation</th><th>Significance</th></tr>
<tr><td>Extent</td><td>Municipal area (4)</td><td>It is expected that during construction noise will extend beyond the site area with exceedances between 50 dBA and 57 dBA expected at adjacent farmsteads and small holdings in Mpumalanga Province and therefore given the rating of 4. The noise impact however will not affect the entire municipal area.</td><td rowspan="4"></td></tr>
<tr><td>Intensity type of impact</td><td>High - negative (-5)</td><td>It is expected that during construction noise will have a serious impact</td></tr>
<tr><td>Probability</td><td>Definite (7)</td><td>There are sound scientific reasons to expect that that noise will not comply with the National Noise Control Regulations by the likelihood of the proposed project's construction noise exceeding the current background noise levels outside the mining right boundary by more than 7 dBA.</td></tr>
<tr><td>Nature</td><td>Negative</td><td></td></tr>
<tr><td colspan="4">Mitigation/Management Actions</td></tr>
<tr><td colspan="4">
Alternative location of the northernmost hard overburden dump should be considered;
Alternative location of the haul route towards the siding should be considered;
Restricting construction activities to daylight hours (06:00 – 18:00) and not during weekends and public holidays;
Locating of diesel generator away from noise sensitive receptors, as well as placing generators on isolation mounts and installation of secondary silencers;
Mining related machines and vehicles to be serviced to the designed requirements of the machinery/vehicles to ensure noise suppression mechanisms are effective e.g. installed exhaust mufflers;
Reversing alarms on vehicles should be broadband reversing alarms which emit directional, lower, less intrusive sound;
Environmental noise monitoring to establish compliance with the regulations and to verify the predicted noise levels; and
Switching off equipment when not in use.
</td></tr>
<tr><td colspan="4">Post-Mitigation</td></tr>
<tr><td>Duration</td><td>Medium term (3)</td><td>Noise will be produced for the duration of the construction phase of 12 months</td><td rowspan="2">Negligible (negative) – 14</td></tr>
<tr><td>Extent</td><td>Local (3)</td><td>The noise levels are expected to extend only as far as the development site area</td></tr>
</table>

Dimension	Rating	Motivation	Significance
Intensity type of impact	Minimal - negative (-1)	It is expected that during construction noise will have a minimal impact post mitigation	
Probability	Rare (2)	A <10% probability is expected post mitigation.	
Nature	Negative		

11.1.8.2 Operational Phase

The operational phase activities indicated in Table 11-78 below, may cause a noise disturbance at the surrounding rural and suburban receptors such as farmsteads, poultry farms and suburban communities at Aston Lake.

Table 11-78: Interactions and Impacts of Operational Activities

Interaction	Impact
Stripping topsoil and soft overburden; Removal of overburden, including drilling and blasting of hard overburden; Loading, hauling and stockpiling of overburden; Load, haul and stockpiling of ROM coal; and Use and maintenance of haul roads for the transportation of coal to the washing plant.	Noise disturbance by the mining vehicles and machinery in operation during the operational phase.

11.1.8.2.1 Impact Description

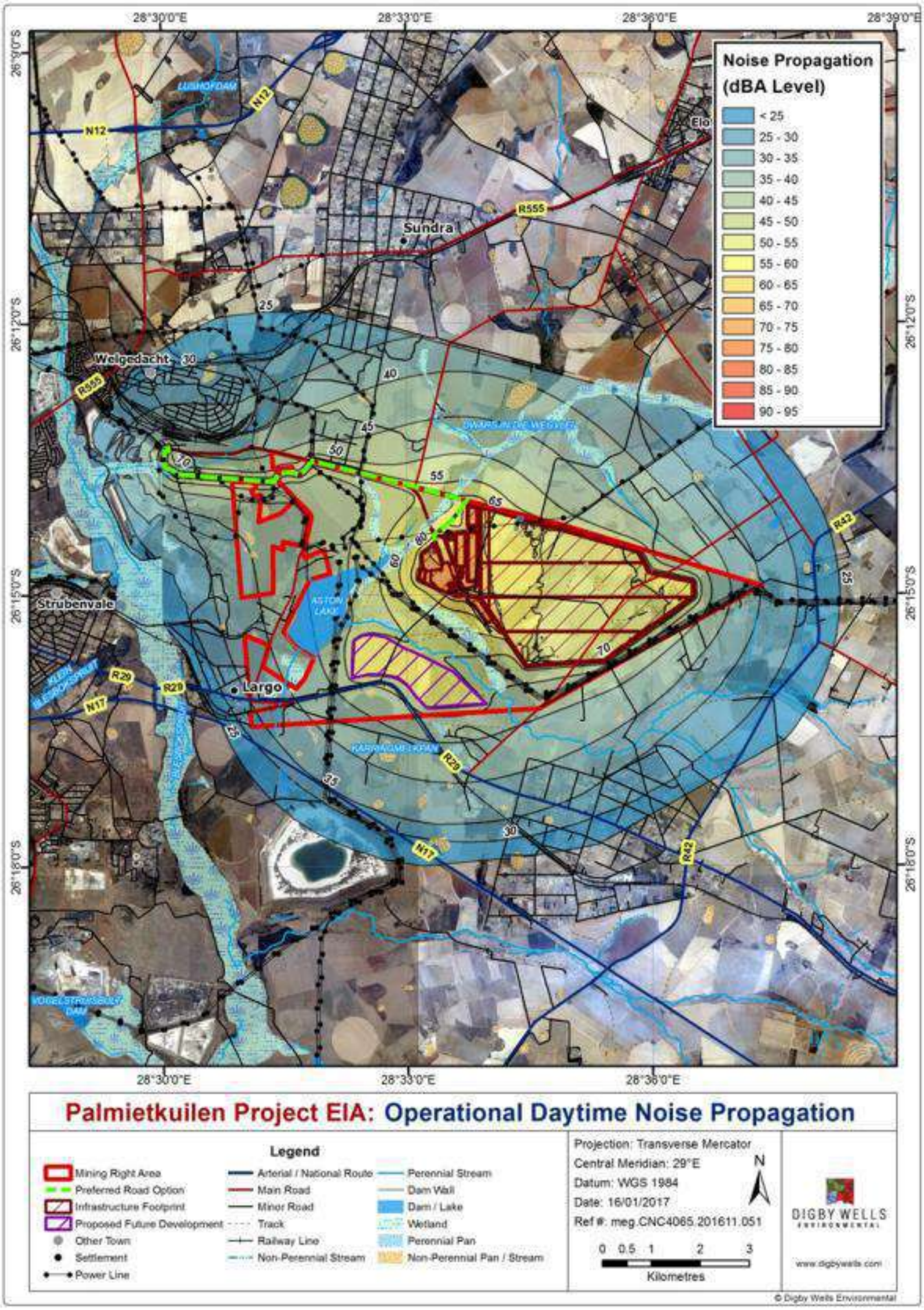
The operational noise dispersion models for the day and night time scenarios are indicated on Plan 62 and Plan 63 below. The daytime results indicate that the expected noise during the operational activities will not likely cause a noise disturbance in terms of the Gauteng Noise Control Regulations at any receptor within the Gauteng Province. The reason for this is that the operational noise is not likely to measure above 45 dBA at any rural receptor and subsequently not measure above 50 dBA at any suburban receptor. The operational phase daytime levels are likely to measure between 25 dBA and 40 dBA to the east and south east towards the rural receptors such as poultry farms and general farmsteads and is likely to measure between 25 dBA and 40 dBA to the south and west towards the suburban receptors.

The night time results with respect to the Gauteng receptors indicates that the operational noise levels will unlikely comply with the Gauteng Noise Control Regulations due to the noise levels likely exceeding the rural guideline level of 35 dBA towards the east and south east. The likely noise level will measure between 40 dBA and 42 dBA at the nearest poultry farm (approximately 650m from the openpit footprint). The specialist/author of this report is of the opinion that the actual impact will be negligible. The reason being that the current background level at this receptor is 40 dBA, which is already exceeding the rural guideline of 35 dBA, with an expected increase of only between 3 dBA and 4d BA to the overall noise level with the impact of the expected noise levels from the mining activities.

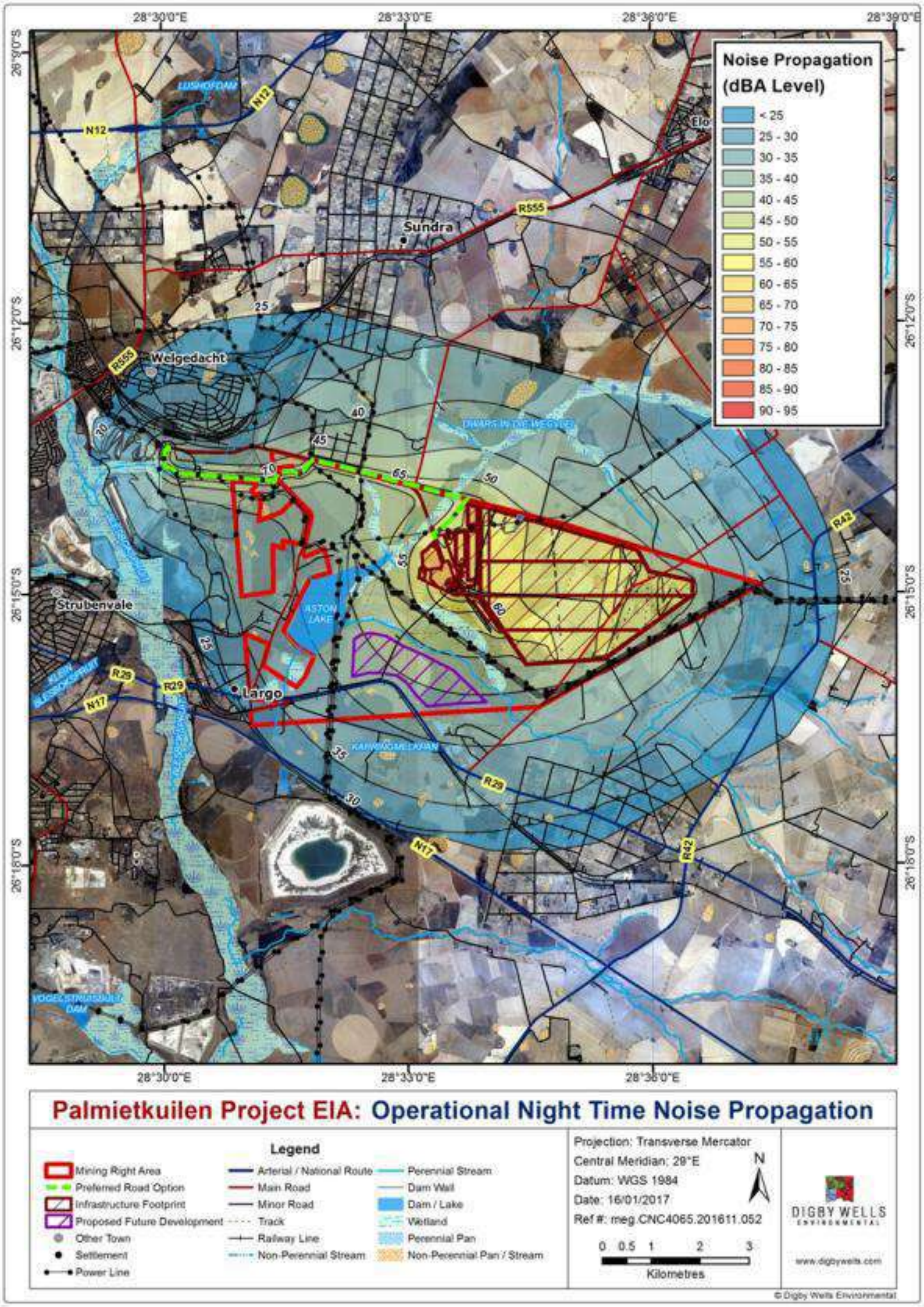
Furthermore the day and night time results indicate that the expected operational levels will likely cause a noise disturbance in terms of the National Noise Control Regulations at certain receptors within the Mpumalanga Province similar to the scenario during the construction phase. The reason for this is that the noise is likely to exceed the existing background noise levels by more than 7 dBA.

The specific receptors that will be impacted are the same as for the construction phase due to the close proximity. The daytime background noise levels at the small holdings and farmstead in question range from 40 dBA to 42 dBA and the night time background noise levels range from 25 dBA to 40 dBA. The most significant increase will be at N2, with the likely operational noise levels exceeding the night time background by 25 dBA, probably causing sleep disturbance at this location.

According to the World Health Organisation (WHO) in terms of adverse health effects of noise, if negative effects on sleep are to be avoided the equivalent sound pressure level should not exceed 30 dBA indoors for continuous noise. If the noise is not continuous, sleep disturbance correlates best with L_{Amax} and effects have been observed at 45 dBA or less. This is particularly true if the background level is low. Noise events exceeding 45 dBA should therefore be limited if possible. For sensitive people an even lower limit would be preferred. It should be noted that it should be possible to sleep with a bedroom window slightly open (a reduction from outside to inside of 15 dBA).



Plan 62: Operational Noise Dispersion Models (Daytime Scenario)



Plan 63: Operational Noise Dispersion Models (Night Time Scenario)

11.1.8.2.2 Management Objectives

To minimise/prevent the noise impact from causing a noise disturbance at the surrounding receptors as a result of the construction activities and subsequently comply with the National and Gauteng Noise Control Regulations.

11.1.8.2.3 Management Actions and Targets

Due to the close proximity of the above mentioned receptors and the subsequent non-compliance that the project's noise levels will have with respect to the National Noise Control Regulations, especially during the night time in terms of sleep disturbance, vigorous mitigation measures need to be implemented to decrease the significance of the impact.

It is recommended that a 20 meter berm is considered along the northern boundary of the open pit footprint to further decrease the noise levels experienced at the N2 to limit the noise from exceeding above 45 dBA. A second 20 m berm should be considered along the diagonal south east boundary of the open pit footprint to decrease the operational noise to below the existing night time background levels at the poultry farms towards the east and south east. An alternative location for the northernmost hard overburden dump needs to be considered (to try and avoid noise causing activities at the original proposed location) such as being located just south of the proposed product stockpile. An alternative location for the route towards the siding also needs to be considered such as being located at least 250 meters south of the current proposed section that follows the existing gravel road running past the mentioned small holdings.

Implementing the recommendations put forward above, it is likely that the operational noise will comply with the National Noise Control Regulations.

11.1.8.2.4 Impact Ratings

The noise related impacts during the Operational Phase, as described above, are rated in Table 11-79 below.

Table 11-79: Noise Emanating from Machinery and Vehicles during Operations

Dimension	Rating	Motivation	Significance
Activity and Interaction (operational activities as per Table 11-78)			
Impact Description: Noise will emanate from the machinery and vehicles operating during the operational activities			
Prior to Mitigation/Management			
Duration	Project life (5)	Noise will be produced for the duration of the operational phase of 47 years	Moderate (negative) – 98

<table>
<tr><th>Dimension</th><th>Rating</th><th>Motivation</th><th>Significance</th></tr>
<tr><td>Extent</td><td>Municipal area (4)</td><td>It is expected that during operations, noise will extend beyond the site area with exceedances between 50dBA and 57dBA expected at adjacent farmsteads and small holdings in Mpumalanga Province and therefore given the rating of 4. The noise impact however will not affect the entire municipal area.</td><td rowspan="4"></td></tr>
<tr><td>Intensity type of impact</td><td>High - negative (-5)</td><td>It is expected that during construction noise will have a serious impact</td></tr>
<tr><td>Probability</td><td>Definite (7)</td><td>There are sound scientific reasons to expect that that noise will not comply with the National Noise Control Regulations by the likelihood of the proposed project’s operational noise exceeding the current background noise levels outside the mining right boundary by more than 7 dBA during the day and night time.</td></tr>
<tr><td>Nature</td><td>negative</td><td></td></tr>
<tr><td colspan="4">Mitigation/Management Actions</td></tr>
<tr><td colspan="4">
The feasibility of constructing 20m berm along the northern boundary of the open pit footprint to act as an additional barrier to sound should be investigated;
The feasibility of constructing Construction 20m berm along the diagonal south east boundary of the open pit footprint should be investigated;
Alternative location of the northernmost hard overburden dump;
Alternative location of the haul route towards the siding;
Locating of diesel generator away from noise sensitive receptors, as well as placing generators on isolation mounts and installation of secondary silencers;
Mining related machines and vehicles to be serviced to the designed requirements of the machinery/vehicles to ensure noise suppression mechanisms are effective e.g. installed exhaust mufflers;
Reversing alarms on vehicles should be broadband reversing alarms which emit directional, lower, less intrusive sound;
Environmental noise monitoring to establish compliance with the regulations and to verify the predicted noise levels; and
Switching off equipment when not in use.
</td></tr>
<tr><td colspan="4">Post-Mitigation</td></tr>
<tr><td>Duration</td><td>Project life (5)</td><td>Noise will be produced for the duration of the operational phase of 47 years</td><td rowspan="2">Minor (negative) – 44</td></tr>
<tr><td>Extent</td><td>Local (3)</td><td>The noise levels are expected to extend only as far as the development site area</td></tr>
</table>

Dimension	Rating	Motivation	Significance
Intensity type of impact	Moderate - negative (-3)	It is expected that during operations, noise will have a moderate impact post mitigation due to the likelihood of the noise still exceeding the night time background noise levels at the N2	
Probability	Probable (4)	A <50% probability is expected post mitigation.	

11.1.8.3 Decommissioning Phase

The following construction phase activities indicated in Table 11-80 below, may cause a noise disturbance at the surrounding rural and suburban receptors such as farmsteads, poultry farms and suburban communities at Aston Lake.

Table 11-80: Interactions and Impacts of Decommissioning Activities

Interaction	Impact
Demolition and removal of all infrastructure, including transporting materials off site; and Rehabilitation, including spreading of soil, re-vegetation and profiling or contouring.	Noise disturbance by the construction vehicles and machinery in operation during the construction phase

11.1.8.3.1 Impact Description

The demolition of the infrastructure and surface rehabilitation activities may cause a noise disturbance at surrounding farmsteads. Due to the relatively small footprint of the infrastructure as well as the concurrent rehabilitation during the operational phase decreasing the overall footprint needed to be rehabilitated, it is expected that the decommissioning activities will have a similar negligible impact as the post-mitigated rating for the construction phase.

11.1.8.3.2 Management Objectives

To minimise/prevent the noise impact from causing a noise disturbance at the surrounding receptors as a result of the construction activities and subsequently comply with the National and Gauteng Noise Control Regulations.

11.1.8.3.3 Management Actions and Targets

Decommissioning activities should be restricted to daylight hours (this will keep the night time noise levels to a minimum) and not be permitted on weekends and public holidays. Mining related machinery and vehicles should be switched off when not in use. Generators should be fitted with silencers and installed on isolation mounts.

11.1.8.3.4 Impact Ratings

The noise related impacts during the Decommissioning Phase, as described above, are rated in Table 11-81 below.

Table 11-81: Potential Impacts of the Decommissioning Phase Activities

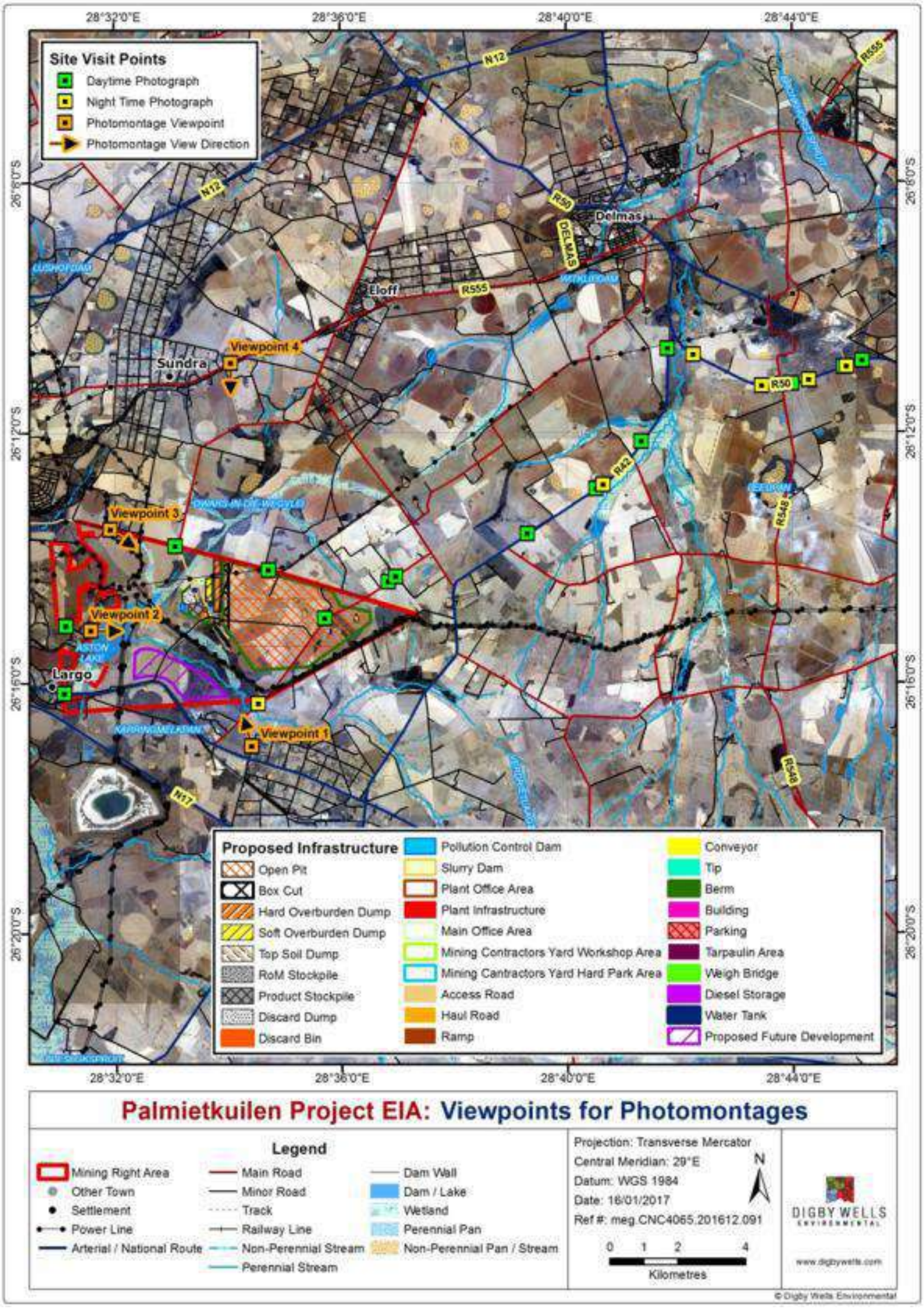
Dimension	Rating	Motivation	Significance
Activity and Interaction (the closure phase requires removal of infrastructure and surface rehabilitation)			
Impact Description: Noise will emanate from the machinery and vehicles operating during the decommissioning activities.			
Prior to Mitigation/Management			
Duration	Medium term (3)	Noise will be produced for the duration of the decommissioning phase of 12 months	
Extent	Local (3)	It is expected that during decommissioning noise will extend only as far as the development site area.	
Intensity type of impact	Minor - negative (-2)	It is expected that during decommissioning noise will have a minor impact due to the project footprint and the closure phase being less machinery intensive than the construction and operational phases.	Negligible (negative) – 24
Probability	Unlikely (3)	It is unlikely that noise will measure above 45 dBA at the surrounding farmsteads.	
Nature	Negative		
Mitigation/Management Actions			
▪ Restricting decommissioning activities to daylight hours (06:00 – 18:00) and not during weekends and public holidays; ▪ Mining related machines and vehicles to be serviced to the designed requirements of the machinery/vehicles to ensure noise suppression mechanisms are effective e.g. installed exhaust mufflers; and ▪ Switching off equipment when not in use.			
Post-Mitigation			
Duration	Medium term (3)	Noise will be produced for the duration of the decommissioning phase of 12 months	Negligible (negative) – 16
Extent	Local (3)	It is expected that during decommissioning noise will extend only as far as the development site area.	

Dimension	Rating	Motivation	Significance
Intensity type of impact	Minimal - negative (-2)	It is expected that during decommissioning noise will have a minor impact due to the project footprint and the closure phase being less machinery intensive than the construction and operational phases.	
Probability	Improbable (2)	It is improbable that noise will measure above 45 dBA at the surrounding farmsteads.	

11.1.9 Visual Impact Assessment

11.1.9.1 Photomontages

This section presents the photomontages created from photographs taken during the site visit on 18th October 2016. Plan 64 indicates the viewpoint (position) and view direction in which the photographs were taken. The photomontages were created using GIMP version 2 software.



Plan 64: Viewpoints for Photomontages

The photomontages were created by adding the proposed infrastructure to photographs of the current views. The scale of the images was measured by comparing the length of an object in the photo to the length of the object in reality. This scale was then used to calculate the size of the proposed infrastructure based on the estimated heights of the proposed infrastructure (Table 11-82).

Table 11-82: Infrastructure Heights for Viewshed Modelling

Infrastructure	Height	Source
Conveyor	20 m	Assumption confirmed by the client
Discard Dump	20 m	Provided by the client
Hard overburden dump	20 m	Provided by the client
Plant infrastructure	20 m	Assumption confirmed by the client
Soft overburden dump	20 m	Provided by the client
Topsoil dump	20 m	Provided by the client
Workshops	20 m	Assumption confirmed by the client
Discard Bin	10 m	Assumption confirmed by the client
Product stockpile	10 m	Assumption confirmed by the client
RoM stockpile	10 m	Assumption confirmed by the client
Tip	10 m	Assumption confirmed by the client
Offices and other buildings	5 m	Assumption confirmed by the client
Water tank	3 m	Assumption confirmed by the client
Berm	2 m	Assumption confirmed by the client
Diesel storage	2 m	Assumption confirmed by the client
Slurry dam	2 m	Assumption confirmed by the client
Pollution control dam (PCD)	1 m	Assumption confirmed by the client
Access road	0 m	Ground level
Haul road	0 m	Ground level
Mining contractors yard	0 m	Ground level
Parking	0 m	Ground level
Tarpaulin area	0 m	Ground level
Weighbridge	0 m	Ground level
Ramp	0 m	Ground level and below ground level
Box-cut	0 m	Below ground level
Open pit	0 m	Below ground level

The infrastructure is then overlaid onto the original photograph in their respective locations (based on the line of sight from the point the photograph was taken) to give an approximation of what the view will look like before and during the operation of the Project. The foreground of the photograph was extracted from the original photograph and replaced on top of the infrastructure to give a realistic representation of the view from the viewpoint.

The infrastructure overlaid on the photographs is an example and does not reflect accurate depictions of the proposed infrastructure, i.e. the plant depicted is not the actual proposed plant but an example of a similar plant and the proposed plant will be of equivalent height and footprint area. The photomontages provide an indication of what the landscape might potentially look like in the future.

Viewpoint 1

Viewpoint 1 is located on the western edge of the Vischkuil Small Holdings on First Avenue just north of the R29 regional road. The photograph was taken looking in a north-north-westerly direction towards the Project. Figure 11-3 illustrates the current view from Viewpoint 1. Figure 11-4 illustrates the potential future view from Viewpoint 1. In this photomontage the infrastructure visible from left to right is as follows: product stockpile (4.1 km), washing plant (4 km), ROM stockpile (3.9 km), soft overburden dump in the background (4.4 km), topsoil dump (3.2 km) and berm around the pit (2.2 km). The proposed infrastructure will dominate the view from Viewpoint 1 and the Project is expected to have a negative visual impact on the residents of the Vischkuil Small Holdings.

Figure 11-3: Current View from Viewpoint 1 in a North-North-Westerly Direction towards the Project

Figure 11-4: Potential Future View from Viewpoint 1 in a North-North-Westerly Direction towards the Project

Viewpoint 2

Viewpoint 2 is located on the eastern edge of the Aston Lake town on Soetdoring Drive overlooking the lake. The photography was taken looking in an easterly direction towards the Project. Figure 11-5 illustrates the current view from Viewpoint 2. Figure 11-6 illustrates the potential future view from Viewpoint 2. In this photomontage the infrastructure visible from left to right is as follows: discard dump (2.9 km), product stockpile (2.9 km), washing plant (3.4 km), ROM stockpile (3.4 km) and topsoil dump (3.6 km). The proposed infrastructure will be clearly visible from Viewpoint 2 and the Project is expected to have a negative visual impact on the residents of the Aston Lake town and the members of the Benoni Angling Society based at Aston Lake.

Figure 11-5: Current View from Viewpoint 2 in an Easterly Direction towards the Project

Figure 11-6: Potential Future View from Viewpoint 2 in an Easterly Direction towards the Project

Viewpoint 3

View point 3 is located on the south-western corner of the Prosperity Agricultural Holdings on an unnamed road. The photography was taken looking in a south-easterly direction towards the Project. Figure 11-7 illustrates the current view from Viewpoint 3. Figure 11-8 illustrates the potential future view from Viewpoint 3. In this photomontage the infrastructure visible from left to right is as follows: hard overburden dump (3.2 km), soft overburden dump (3.2 km), main offices (3 km) and discard dump (2.9 km). The proposed infrastructure will dominate the view from Viewpoint 3 and the Project is expected to have a negative visual impact on the residents of the Prosperity Agricultural Holdings.

Figure 11-7: Current View from Viewpoint 3 in a South-Easterly Direction towards the Project

Figure 11-8: Potential Future View from Viewpoint 3 in a South-Easterly Direction towards the Project

Viewpoint 4

Viewpoint 4 is located on the south-eastern edge of the Sundra town on the R555 regional road. The photography was taken looking in a southerly direction towards the Project. The Project is at a lower elevation than Viewpoint 4. Figure 11-9 illustrates the current view from Viewpoint 4. Figure 11-10 illustrates the potential future view from Viewpoint 4. In this photomontage the infrastructure visible from left to right is as follows: hard overburden dump (5.8 km), soft overburden dump (6.3 km) and discard dump (6.7 km). The proposed infrastructure will be noticeable from Viewpoint 4 and the Project is expected to have a negative visual impact on the residents of the Sundra town.

Figure 11-9: Current View from Viewpoint 4 in a Southerly Direction towards the Project

Figure 11-10: Potential Future View from Viewpoint 4 in a Southerly Direction towards the Project

Discussion

The Project will have a negative visual impact on the receiving environment. The most significant visual impact will be from the open pit, dumps, stockpiles and washing plant. This is due to the height and / or large footprint area of these components of the infrastructure. The construction of other smaller surface infrastructure will have a lesser visual impact.

- Visibility of the Project

The visibility of the project refers to the viewshed area and is also related to the number of receptors affected (Oberholzer, 2005). The Project has a **high visibility** as it is visible from a large area (defined by Oberholzer (2005) as several square kilometres) with numerous visual receptors.

The daytime and night time practical viewshed models cover an area of approximately 275.79 km^2. The potential visual receptors include residents of the towns and settlements within 10 km of the proposed infrastructure (Daggafontein, Eloff, Endicott, Largo, Strubenvale, Sundra, Vischkuil and Welgedacht), residents of the surrounding farms and small holdings (2 022 receptor points), road users of the N17 national route, the R29, R42 and R555 regional roads, secondary roads and farm roads and visitors to the Blesbokspruit Ramsar Site and IBA and the Marievale Nature Reserve and Bird Sanctuary.

- Visual Exposure

Visual exposure is “based on the distance from the infrastructure area to selected viewpoints” and “tends to diminish exponentially with distance” (Oberholzer, 2005). The Project has a **high exposure** as it will be dominant in the landscape and clearly noticeable to receptors within the viewshed area.

- Visual Sensitivity of the Area

The visual sensitivity of the area refers to “the inherent visibility of the landscape, usually determined by a combination of topography, landform, vegetation cover and settlement pattern” (Oberholzer, 2005). The receiving environment of the Project has a **high visual sensitivity** as there are highly visible and potentially sensitive areas in the landscape. This is due to the proximity of the Project to the Blesbokspruit Ramsar Site and IBA and the Marievale Nature Reserve and Bird Sanctuary.

- Visual Sensitivity of Receptors

The visual sensitivity of receptors is dependent on the nature of the receptors (Oberholzer, 2005). Receptors in residential areas or nature reserves have a high sensitivity while receptors in industrial or mining areas have a low sensitivity. The identified receptors (residents of the towns and settlements within 10 km of the proposed infrastructure, residents of the surrounding farms and small holdings, road users and visitors to the Blesbokspruit Ramsar Site and IBA and the Marievale Nature Reserve and Bird Sanctuary) of the Project have a **moderate sensitivity** as they include residential, industrial, agricultural and natural areas.

- Visual Absorption Capacity

The visual absorption capacity (VAC) refers to "the potential of the landscape to conceal the proposed project" (Oberholzer, 2005). The receiving environment of the Project has a **low VAC** because there is little screening provided by the topography and vegetation.

- Visual Intrusion

The visual intrusion of the project refers to "the level of compatibility or congruence of the project with the particular qualities of the area, or its sense of place". Visual intrusion is "related to the idea of context and maintaining the integrity of the landscape or townscape" (Oberholzer, 2005). The Project has a **high visual intrusion** as it results in a noticeable change and is discordant with the surroundings.

11.1.9.2 Construction Phases

The construction phase is characterised by site development and infrastructure construction. This includes site establishment, site clearing, vegetation removal, topsoil removal and stockpiling, surface infrastructure development, blasting and development of the initial box-cut and stockpiling of the overburden from this initial box-cut. The establishment of infrastructure and related site clearing and construction activities will draw attention to the Project area making receptors aware of the Project. The construction phase is expected to have negative visual impacts on the receiving environment.

Based on the Project activities listed above, Table 11-83 lists the various interactions and potential impacts of the activities during the construction phase.

Table 11-83: Interactions and Impacts of Construction Activities

Interaction	Impact
Site clearing and vegetation removal	Site clearing and vegetation removal will have a negative visual impact on the receiving environment. The Project area will become noticeable to nearby receptors as it will contrast the surrounding areas.
Topsoil removal and stockpiling	Topsoil removal and stockpiling will have a negative visual impact on the receiving environment. Dust from the stockpiles will also have a negative visual impact.
Construction of surface infrastructure	The construction of surface infrastructure will have a negative visual impact on the receiving environment. The surface infrastructure will change the sense of place of the Project area from an agricultural sense of place to an industrial / mining sense of place. Construction area lighting at night will have a negative visual impact on the receiving environment. The construction area lighting will be visible from a distance of up to 10 km and will draw attention to the Project area. This will also have a negative impact on the sense of place.
Relocation of infrastructure	Relocation of infrastructure will have a negative visual impact on the receiving environment.

Interaction	Impact
Change of land use from agriculture to mining	Change of land use from agriculture to mining will have a negative visual impact on the receiving environment. This change of land use will change the sense of place of the Project area and surrounds from an agricultural sense of place to an industrial / mining sense of place resulting in a loss of scenic character and increased visual disturbance. The change of land use will contribute to the cumulative impacts of mining on the regional environment.
Blasting and development of the initial box-cut for mining	Blasting and development of the initial box-cut for mining will have a negative visual impact on the receiving environment. Drilling and blasting will result in noise and dust thereby attracting attention to the Project area. Dust from blasting will have a negative visual impact. The box-cut will dramatically contrast the surrounding agricultural area as it will result in a scar on the landscape.
Stockpiling from the initial box-cut	Stockpiling from the initial box-cut will have a negative visual impact on the receiving environment. Dust from the stockpiles will also have a negative visual impact. The impact of the stockpiles will occur for the life of the Project. This impact will be reversed when the material from the stockpiles is used to backfill the open pit during the decommissioning and closure phase however a void will be created.
Stripping of topsoil and soft overburden	Stripping of topsoil and soft overburden will have a negative visual impact on the receiving environment. As the Project area is stripped it will become noticeable to nearby receptors as it will contrast the surrounding area.

11.1.9.2.1 Impact Description

Site Establishment

Site establishment includes securing the site with fencing and constructing temporary laydown areas and facilities for the construction workers. Site establishment is expected to have a negative visual impact on the receiving environment. Site establishment will have a minor negative visual impact on the receiving environment.

Site Clearing

Site clearing including the removal of topsoil and vegetation is expected to have a negative visual impact on the receiving environment. Site clearing will have a moderate negative visual impact on the receiving environment.

Construction of Mine Related Infrastructure

Construction of mine related infrastructure is expected to have a negative visual impact on the receiving environment. Construction of mine related infrastructure will have a moderate negative visual impact on the receiving environment.

Relocation of Infrastructure

Relocation of infrastructure includes moving the existing unnamed public road that currently runs through the open pit of the Project. This road runs in a north-easterly direction from the R29 regional route through the western side of the Project area before joining another unnamed road that runs to the R42 regional road. Relocation of infrastructure is expected to have a negative visual impact on the receiving environment. The location for the relocation of the road is not currently known and for the purposes of this impact assessment it has been assumed that the road will be diverted to the farm road running along the south-eastern boundary of the Project area and that this farm road will be upgraded as required. Should this not be the case, this impact may need to be re-assessed. Relocation of infrastructure will have a minor negative visual impact on the receiving environment.

Blasting and Development of Initial Box-Cut for Mining

Blasting and development of the initial box-cut for mining (including stockpiling from the initial box-cut) is expected to have a negative visual impact on the receiving environment. Change of land use from agriculture to mining will have a major negative visual impact on the receiving environment. Blasting and development of the initial box-cut for mining (including stockpiling from the initial box-cut) will have a moderate negative visual impact on the receiving environment.

11.1.9.2.2 Management Objective

The management objective is to minimise the negative visual impacts caused by site establishment.

11.1.9.2.3 Management Actions

The following management actions are required for site establishment:

- Where possible use fencing that will screen the project area from nearby receptors;
- Limit the height and footprint area of temporary laydown areas and facilities for the construction workers;
- Vegetation should only be removed when and where necessary;
- Topsoil should only be removed when and where necessary;
- Topsoil stockpiles should be vegetated with grasses (Andropogon appendiculatus, Andropogon eucomus, Andropogon huillensis, Aristida congesta subsp. Barbicollis, Arundinella nepalensis, Cynodon dactylon, Eragrostis capensis, Eragrostis curvula, Eragrostis gummiflua, Eragrostis racemose, Fingerhuthia Africana, Hyparrhenia hirta, Hyparrhenia tamba, Imperata cylindrical, Melinis repens, Paspalum dilatatum, Setaria sphacelata, Sporobolus africanus, Sporobolus pyramidalis, Themeda triandra, Trichoneura grandiglumis and Tristachya leucothrix) where possible so as to blend into the surrounding landscape and reduce dust generation;
- Limit the footprint area of topsoil stockpiles where possible;
- Limit the height of the topsoil stockpile to 20 m;
- Apply dust suppression techniques to limit dust generated from topsoil stockpiles;
- Ensure screening vegetation is left intact around the Project area and near receptors;
- Ensure the surface infrastructure does not exceed the proposed heights;

- Surface infrastructure should be painted natural hues so as to blend into the surrounding landscape where possible;
- Pylons and metal structures should be galvanised so as to weather to a matt grey finish rather than be painted silver. If the pylons and metal structures are painted, it is recommended that a neutral matt finish be used;
- Where possible avoid construction activities at night. If construction activities take place at night then down lighting must be implemented to minimise light pollution;
- Limit the footprint area of the road where possible by utilising existing roads for the relocation;
- The road should be wetted frequently by means of a water bowser to suppress dust;
- Ensure screening vegetation is left intact along the sides of the road;
- Use shade cloth / netting to screen the demolition area;
- Limit the quantity and time of rubble stored on site;
- Ensure that the open pit is backfilled with material from the overburden stockpiles;
- Rehabilitate all disturbed areas;
- Ensure that the rehabilitated area is re-contoured and profiled to create a free-draining topography;
- Spread topsoil over the rehabilitated area;
- Ensure that surface water and drainage lines are rehabilitated;
- Ensure all the mitigation / management actions outlined in the Rehabilitation Plan are conducted;
- The following management actions are required for blasting and development of the initial box-cut for mining (including stockpiling from the initial box-cut):
  - Only remove overburden when and where necessary;
  - Ensure the soft overburden and hard overburden stockpiles do not exceed the proposed height of 20 m; and
  - Apply dust suppression techniques to limit the dust generated from the blasting and stockpiles.

11.1.9.2.4 Impact Ratings

The impacts on visual aspects during the Construction Phase, as described above, are rated in Table 11-84 - Table 11-88 below.

Table 11-84: Potential Impacts of Site Establishment on the Visual Aspects

Dimension	Rating	Motivation	Significance
Activity and Interaction (Site Establishment)			
Impact Description: Site establishment will have a negative visual impact on the receiving environment. The Project area will become noticeable to nearby receptors due to the increased levels of activity on the site.			
Prior to Mitigation / Management			
Duration	Short Term (2)	The impact will occur during the construction phase which is expected to last approximately 1 year.	Minor negative (-49)
Extent	Local (3)	The daytime and night time practical viewshed models indicate that the Project will be visible from a distance of up to 10 km. The potential visual receptors include residents of the towns and settlements within 10 km of the proposed infrastructure (Daggafontein, Eloff, Endicott, Largo, Strubenvale, Sundra, Vischkuil and Welgedacht), residents of the surrounding farms and small holdings (2 022 receptor points), road users of the N17 national route, the R29, R42 and R555 regional roads, secondary roads and farm roads and visitors to the Blesbokspruit Ramsar Site and IBA and the Marievale Nature Reserve and Bird Sanctuary.	
Intensity	Minor (2)	Site establishment is expected to cause a minor visual disturbance.	
Probability	Definite (7)	The impact will definitely occur.	
Nature	Negative		
Mitigation / Management Actions			
▪ Where possible use fencing that will screen the project area from nearby receptors; and ▪ Limit the height and footprint area of temporary laydown areas and facilities for construction workers.			
Post-Mitigation			
Duration	Short Term (2)	The impact will occur during the construction phase which is expected to last approximately 1 year.	Negligible negative (-30)
Extent	Limited (2)	The extent of the impact will be reduced by implementing the mitigation / management actions listed above.	
Intensity	Minimal (1)	The visual disturbance will be reduced by implementing the mitigation / management actions listed above.	
Probability	Almost Certain/ Highly Probable (6)	The impact will almost certainly occur.	
Nature	Negative		

Table 11-85: Potential Impacts of Site Clearing on the Visual Aspects

Dimension	Rating	Motivation	Significance
Activity and Interaction (Site Clearing)			
Impact Description: Site clearing will have a negative visual impact on the receiving environment. The Project area will become noticeable to nearby receptors as it will contrast the surrounding areas. Topsoil removal and stockpiling will have a negative visual impact on the receiving environment. Dust from the stockpiles will also have a negative visual impact.			
Prior to Mitigation / Management			
Duration	Project Life (5)	The impact will occur during the construction phase which is expected to last approximately 1 year and remain for the duration of the Project.	Moderate negative (-84)
Extent	Local (3)	The daytime and night time practical viewshed models indicate that the Project will be visible from a distance of up to 10 km. The potential visual receptors include residents of the towns and settlements within 10 km of the proposed infrastructure (Daggafontein, Eloff, Endicott, Largo, Strubenvale, Sundra, Vischkuil and Welgedacht), residents of the surrounding farms and small holdings (2 022 receptor points), road users of the N17 national route, the R29, R42 and R555 regional roads, secondary roads and farm roads and visitors to the Blesbokspruit Ramsar Site and IBA and the Marievale Nature Reserve and Bird Sanctuary.	
Intensity	Serious (4)	Site clearing is expected to cause a serious negative visual disturbance. The Project area will become noticeable to the nearby receptors as it will contrast the surrounding areas. Dust from the stockpiles will have a negative visual impact on the receiving environment.	
Probability	Definite (7)	The impact will definitely occur.	
Nature	Negative		
Mitigation / Management Actions			
▪ Vegetation should only be removed when and where necessary; ▪ Topsoil should only be removed when and where necessary; ▪ Topsoil stockpiles should be vegetated with grasses (Andropogon appendiculatus, Andropogon eucomus, Andropogon huillensis, Aristida congesta subsp. Barbicollis, Arundinella nepalensis, Cynodon dactylon, Eragrostis capensis, Eragrostis curvula, Eragrostis gummiflua, Eragrostis racemose, Fingerhuthia Africana, Hyparrhenia hirta, Hyparrhenia tamba, Imperata cylindrical, Melinis repens, Paspalum dilatatum, Setaria sphacelata, Sporobolus africanus, Sporobolus pyramidalis, Themeda triandra, Trichoneura grandiglumis and Tristachya leucothrix) where possible so as to blend into the surrounding landscape and reduce dust generation; ▪ Limit the footprint area of topsoil stockpiles where possible; ▪ Limit the height of topsoil stockpiles to 20 m; and ▪ Apply dust suppression techniques to limit dust generated from topsoil stockpiles.			
Post-Mitigation			

Dimension	Rating	Motivation	Significance
Duration	Project Life (5)	The impact will occur during the construction phase which is expected to last approximately 1 year and remain for the duration of the Project.	Minor negative (-70)
Extent	Limited (2)	The extent of the impact will be reduced by implementing the mitigation / management actions listed above.	
Intensity	Moderate (3)	The visual disturbance will be reduced by implementing the mitigation / management actions listed above.	
Probability	Definite (7)	The impact will definitely occur.	
Nature	Negative		

Table 11-86: Potential Impacts of the Construction of Mine Related Infrastructure on the Visual Aspects

Dimension	Rating	Motivation	Significance
Activity and Interaction (Construction of Mine Related Infrastructure)			
Impact Description: The construction of surface infrastructure will have a negative visual impact on the receiving environment. The surface infrastructure will change the sense of place of the Project area from an agricultural sense of place to an industrial / mining sense of place. Construction area lighting at night will have a negative visual impact on the receiving environment. The construction area lighting will be visible from a distance of up to 10 km and will draw attention to the Project area. This will also have a negative impact on the sense of place.			
Prior to Mitigation / Management			
Duration	Project Life (5)	The impact will occur for the duration of the Project. The LoM is approximately 47 years.	Moderate negative (-84)
Extent	Local (3)	The daytime and night time practical viewshed models indicate that the Project will be visible from a distance of up to 10 km. The potential visual receptors include residents of the towns and settlements within 10 km of the proposed infrastructure (Daggafontein, Eloff, Endicott, Largo, Strubenvale, Sundra, Vischkuil and Welgedacht), residents of the surrounding farms and small holdings (2 022 receptor points), road users of the N17 national route, the R29, R42 and R555 regional roads, secondary roads and farm roads and visitors to the Blesbokspruit Ramsar Site and IBA and the Marievale Nature Reserve and Bird Sanctuary.	
Intensity	Serious (4)	Construction of mine related infrastructure is expected to cause a serious visual disturbance.	
Probability	Definite (7)	The impact will definitely occur.	
Nature	Negative		
Mitigation / Management Actions			

Dimension	Rating	Motivation	Significance
▪ Ensure screening vegetation is left intact around the Project area and near receptors; ▪ Ensure the surface infrastructure does not exceed the proposed heights; ▪ Surface infrastructure should be painted natural hues so as to blend into the surrounding landscape where possible; ▪ Pylons and metal structures should be galvanised so as to weather to a matt grey finish rather than be painted silver. If the pylons and metal structures are painted, it is recommended that a neutral matt finish be used; and ▪ Where possible avoid construction activities at night. If construction activities take place at night then down lighting must be implemented to minimise light pollution.			
Post-Mitigation			
Duration	Project Life (5)	The impact will occur for the duration of the Project. The LoM is approximately 47 years.	Minor negative (-70)
Extent	Limited (2)	The extent of the impact will be reduced by implementing the mitigation / management actions listed above.	
Intensity	Moderate (3)	The visual disturbance will be reduced by implementing the mitigation / management actions listed above.	
Probability	Definite (7)	The impact will definitely occur.	
Nature	Negative		

Table 11-87: Potential Impacts of Relocation of Infrastructure on the Visual Aspects

Dimension	Rating	Motivation	Significance
Activity and Interaction (Relocation of Infrastructure)			
Impact Description: Relocation of infrastructure will have a negative visual impact on the receiving environment.			
Prior to Mitigation / Management			
Duration	Short Term (2)	The impact will occur during the construction phase which is expected to last approximately 1 year.	Minor negative (-49)
Extent	Local (3)	The daytime and night time practical viewshed models indicate that the Project will be visible from a distance of up to 10 km. The potential visual receptors include residents of the towns and settlements within 10 km of the proposed infrastructure (Daggafontein, Eloff, Endicott, Largo, Strubenvale, Sundra, Vischkuil and Welgedacht), residents of the surrounding farms and small holdings (2 022 receptor points), road users of the N17 national route, the R29, R42 and R555 regional roads, secondary roads and farm roads and visitors to the Blesbokspruit Ramsar Site and IBA and the Marievale Nature Reserve and Bird Sanctuary.	
Intensity	Minor (2)	Relocation of infrastructure is expected to cause a minor visual disturbance.	
Probability	Definite (7)	The impact will definitely occur.	

Dimension	Rating	Motivation	Significance
Nature	Negative		
Mitigation / Management Actions			
▪ Limit the footprint area of the road where possible by utilising existing roads for the relocation; ▪ The road should be wetted frequently by means of a water bowser to suppress dust; and ▪ Ensure screening vegetation is left intact along the sides of the road.			
Post-Mitigation			
Duration	Short Term (2)	The impact will occur during the construction phase which is expected to last approximately 1 year.	Negligible negative (-30)
Extent	Limited (2)	The extent of the impact will be reduced by implementing the mitigation / management actions listed above.	
Intensity	Minimal (1)	The visual disturbance will be reduced by implementing the mitigation / management actions listed above.	
Probability	Almost Certain / Highly Probable (6)	The impact will almost certainly occur.	
Nature	Negative		

Table 11-88: Potential Impacts of Change of Land Use on the Visual Aspects

Dimension	Rating	Motivation	Significance
Activity and Interaction (Change of Land Use from Agriculture to Mining)			
Impact Description: Change of land use from agriculture to mining will have a negative visual impact on the receiving environment. This change of land use will change the sense of place of the Project area and surrounds from an agricultural sense of place to an industrial / mining sense of place resulting in a loss of scenic character and increased visual disturbance.			
Prior to Mitigation / Management			
Duration	Permanent (7)	There will be a permanent and irreversible negative visual impact on the receiving environment. There will be insufficient material to backfill the open pit completely and a void will remain.	Major negative (-119)

Dimension	Rating	Motivation	Significance
Extent	Local (3)	The daytime and night time practical viewshed models indicate that the Project will be visible from a distance of up to 10 km. The potential visual receptors include residents of the towns and settlements within 10 km of the proposed infrastructure (Daggafontein, Eloff, Endicott, Largo, Strubenvale, Sundra, Vischkuil and Welgedacht), residents of the surrounding farms and small holdings (2 022 receptor points), road users of the N17 national route, the R29, R42 and R555 regional roads, secondary roads and farm roads and visitors to the Blesbokspruit Ramsar Site and IBA and the Marievale Nature Reserve and Bird Sanctuary.	
Intensity	Highly Irreplaceable (7)	Change of land use will result in a permanent change in the sense of place of the project area and surrounds.	
Probability	Definite (7)	The impact will definitely occur.	
Nature	Negative		

Mitigation / Management Actions

- Apply dust suppression techniques to limit the dust from the demolition area;
- Use shade cloth / netting to screen the demolition area;
- Ensure all infrastructure is demolished and removed from the site;
- Limit the quantity and time of rubble stored on site;
- Ensure that the open pit is backfilled with material from the overburden stockpiles;
- Rehabilitate all disturbed areas;
- Ensure that the rehabilitated area is re-contoured and profiled to create a free-draining topography;
- Spread topsoil over the rehabilitated area;
- Ensure that surface water and drainage lines are rehabilitated;
- Re-vegetate the rehabilitated areas with grasses (Andropogon appendiculatus, Andropogon eucomus, Andropogon huillensis, Aristida congesta subsp. Barbicollis, Arundinella nepalensis, Cynodon dactylon, Eragrostis capensis, Eragrostis curvula, Eragrostis gummiflua, Eragrostis racemose, Fingerhuthia Africana, Hyparrhenia hirta, Hyparrhenia tamba, Imperata cylindrical, Melinis repens, Paspalum dilatatum, Setaria sphacelata, Sporobolus africanus, Sporobolus pyramidalis, Themeda triandra, Trichoneura grandiglumis and Tristachya leucothrix); and
- Ensure all the mitigation / management actions outlined in the Closure and Rehabilitation reports are conducted.

Post-Mitigation

Dimension	Rating	Motivation	Significance
Duration	Beyond Project Life (6)	The impact will remain until after the Project area has been rehabilitated. The impact will become reversible if the Project area is re-contoured, vegetated and profiled to create a free-draining topography thereby eliminating the void.	Moderate negative (-91)
Extent	Limited (2)	The extent of the impact will be reduced by implementing the mitigation / management actions listed above.	
Intensity	Very Serious (5)	The impact will be reduced by implementing the mitigation / management actions listed above.	

Dimension	Rating	Motivation	Significance
Probability	Definite (7)	The impact will definitely occur.	
Nature	Negative		

11.1.9.3 Operational Phase

The operational phase is characterised mining and stockpiling of ROM coal and operation of the washing plant and discard dump to process the coal. The operational phase is expected to have negative visual impacts on the receiving environment.

Based on the Project activities listed above, Table 11-89 lists the various interactions and potential impacts of the activities during the operational phase.

Table 11-89: Interactions and Impacts of Construction Activities

Interaction	Impact
Stripping of topsoil and soft overburden	Stripping of topsoil and soft overburden will have a negative visual impact on the receiving environment. As the Project area is stripped it will become noticeable to nearby receptors as it will contrast the surrounding area.
Removal of overburden	Removal of overburden (including drilling and blasting of hard overburden) will have a negative visual impact on the receiving environment. Drilling and blasting will result in noise and dust thereby attracting attention to the Project area. Dust from blasting will have a negative visual impact. The open pit will dramatically contrast the surrounding agricultural area as it will result in a scar on the landscape.
Loading and hauling of overburden	Vehicular activity to load and haul overburden (including topsoil, soft overburden and hard overburden) will have a negative visual impact on the receiving environment. Dust from the vehicular activity will also have a negative visual impact.
Stockpiling of overburden	Stockpiling of overburden (including topsoil, soft overburden and hard overburden) will have a negative visual impact on the receiving environment. Dust from the stockpiles will also have a negative visual impact. The impact of the stockpiles will occur for the life of the Project. This impact will be reversed when the material from the stockpiles is used to backfill the open pit (soft overburden and hard overburden) and rehabilitate the Project area (topsoil) during the decommissioning and closure phase.

Interaction	Impact
Drilling and blasting of coal	Drilling and blasting of coal will have a negative visual impact on the receiving environment. Drilling and blasting will result in noise and dust thereby attracting attention to the Project area. Dust from blasting will have a negative visual impact. The open pit will dramatically contrast the surrounding agricultural area as it will result in a scar on the landscape. Once coal is removed from the open pit there will be insufficient material to backfill the open pit completely and a void will remain. This will result in a permanent and irreversible negative visual impact on the receiving environment.
Loading and hauling of ROM coal	Vehicular activity to load and haul ROM coal will have a negative visual impact on the receiving environment. Dust from the vehicular activity will also have a negative visual impact.
Stockpiling of ROM coal	Stockpiling of ROM coal will have a negative visual impact on the receiving environment. Dust from the stockpiles will also have a negative visual impact.
Use of haul roads	Vehicular activity on the haul roads will have a negative visual impact on the receiving environment. Dust from the vehicular activity will also have a negative visual impact.
Maintenance of haul roads	Maintenance of the haul roads may require the acquisition of additional material from other sources which will have a negative visual impact on the receiving environment.
Operation of washing plant	Plant area lighting at night will have a negative visual impact on the receiving environment. The plant area lighting will be visible from a distance of up to 10 km and will draw attention to the Project area. This will also have a negative impact on the sense of place.
Operation of discard dump	Disposal of discard from the washing plant on the discard dump will have a negative visual impact on the receiving environment. The impact of the discard dump will occur for the life of the Project. This impact will be reversed if the material from the discard dump is re-washed or used to backfill the open pit during the decommissioning and closure phase.

11.1.9.3.1 Impacts Description

Stripping Topsoil and Soft Overburden

Stripping topsoil and soft overburden is expected to have a negative visual impact on the receiving environment. Stripping of topsoil and soft overburden will have a moderate negative visual impact on the receiving environment.

Removal of Overburden

Removal of overburden (including drilling and blasting of hard overburden) is expected to have a negative visual impact on the receiving environment. Removal of overburden (including drilling and blasting of hard overburden) will have a moderate negative visual impact on the receiving environment.

Loading, Hauling and Stockpiling of Overburden

Loading, hauling and stockpiling of overburden (including topsoil, soft overburden and hard overburden) is expected to have a negative visual impact on the receiving environment. Loading and hauling of overburden (including topsoil, soft overburden and hard overburden) will have a minor negative visual impact on the receiving environment. Stockpiling of overburden (including topsoil, soft overburden and hard overburden) will have a moderate negative visual impact on the receiving environment. The stockpiles will become visible from a greater distance as they increase in height and will begin to dominate the landscape for nearby receptors.

Drilling and Blasting of Coal

Drilling and blasting of coal is expected to have a negative visual impact on the receiving environment. Drilling and blasting of coal will have a major negative visual impact on the receiving environment.

Loading, Hauling and Stockpiling of ROM Coal

Loading, hauling and stockpiling of ROM coal is expected to have a negative visual impact on the receiving environment. Loading and hauling of ROM coal will have a minor negative visual impact on the receiving environment. Stockpiling of ROM coal will have a moderate negative visual impact on the receiving environment.

Use and Maintenance of Haul Roads

Use and maintenance of the haul roads is expected to have a negative visual impact on the receiving environment. Use and maintenance of the haul roads will have a minor negative visual impact on the receiving environment.

Operation of Washing Plant and Discard Dump

Operation of the washing plant and discard dump is expected to have a negative visual impact on the receiving environment. Operation of the washing plant will have a moderate negative visual impact on the receiving environment at night. The washing plant is the only area of the mine that is lit at night with the exception of security lighting. Operation of the discard dump will have a moderate visual impact on the receiving environment.

11.1.9.3.2 Management Objective

The management objective is to minimise the negative visual impacts caused by during mining operations.

11.1.9.3.3 Management Actions and Targets

The following management actions are required for the operational phase:

- Topsoil should only be removed when and where necessary; and

- Only remove soft overburden when and where necessary.
- Only remove overburden when and where necessary; and
- Apply dust suppression techniques to limit the dust generated from the blasting.
- Limit the speed of vehicles on the haul roads to reduce dust; and
- Haul roads should be wetted frequently by means of a water bowser to suppress dust.
- The following management actions are required for stockpiling of overburden (including topsoil, soft overburden and hard overburden):
- Topsoil stockpiles should be vegetated with grasses (Andropogon appendiculatus, Andropogon eucomus, Andropogon huillensis, Aristida congesta subsp. Barbicollis, Arundinella nepalensis, Cynodon dactylon, Eragrostis capensis, Eragrostis curvula, Eragrostis gummiflua, Eragrostis racemose, Fingerhuthia Africana, Hyparrhenia hirta, Hyparrhenia tamba, Imperata cylindrical, Melinis repens, Paspalum dilatatum, Setaria sphacelata, Sporobolus africanus, Sporobolus pyramidalis, Themeda triandra, Trichoneura grandiglumis and Tristachya leucothrix) where possible so as to blend in with the surrounding landscape and reduce dust generation;
- Limit the footprint area of topsoil stockpiles where possible;
- Limit the height of the topsoil stockpile to 20 m;
- Ensure the soft overburden and hard overburden stockpiles do not exceed the proposed height of 20 m; and
- Apply dust suppression techniques to limit dust generated from stockpiles.
- Apply dust suppression techniques to limit the dust generated from the blasting;
- Ensure that the open pit is backfilled with material from the overburden stockpiles;
- Rehabilitate all disturbed areas;
- Ensure that the rehabilitated area is re-contoured and profiled to create a free-draining topography;
- Spread topsoil over the rehabilitated area;
- Ensure that surface water and drainage lines are rehabilitated;
- Re-vegetate the rehabilitated areas with grasses (Andropogon appendiculatus, Andropogon eucomus, Andropogon huillensis, Aristida congesta subsp. Barbicollis, Arundinella nepalensis, Cynodon dactylon, Eragrostis capensis, Eragrostis curvula, Eragrostis gummiflua, Eragrostis racemose, Fingerhuthia Africana, Hyparrhenia hirta, Hyparrhenia tamba, Imperata cylindrical, Melinis repens, Paspalum dilatatum, Setaria sphacelata, Sporobolus africanus, Sporobolus pyramidalis, Themeda triandra, Trichoneura grandiglumis and Tristachya leucothrix); and

- Ensure all the mitigation / management actions outlined in the Closure and Rehabilitation reports are conducted.
- Limit the speed of vehicles (40 km/h) on the haul roads to reduce dust; and
- Haul roads should be wetted frequently by means of a water bowser to suppress dust.
- The following management actions are required for stockpiling of ROM coal:
- Limit the footprint area of the ROM coal stockpile where possible;
- Ensure the RoM coal stockpile does not exceed the proposed height of 10 m;
- Limit the quantity and time of ROM coal stored on site; and
- Apply dust suppression techniques to limit dust generated from the ROM coal stockpile.
- Limit the speed of vehicles on the haul roads to reduce dust;
- Haul roads should be wetted frequently by means of a water bowser to suppress dust;
- Down lighting must be implemented for operational activities taking place at night to minimise light pollution;
- Ensure the product stockpile does not exceed the proposed height of 10 m; and
- Ensure the discard dump does not exceed the proposed height of 20 m.

11.1.9.3.4 Impact Ratings

The impacts on visual aspects during the Operational Phase, as described above, are rated in Table 11-90 to Table 11-99 below.

Table 11-90: Potential Impacts of Stripping Topsoil and Soft Overburden on the Visual Aspects

Dimension	Rating	Motivation	Significance
Activity and Interaction (Stripping Topsoil and Soft Overburden)			
Impact Description: Stripping of topsoil and soft overburden will have a negative visual impact on the receiving environment. As the Project area is stripped it will become noticeable to nearby receptors as it will contrast the surrounding area.			
Prior to Mitigation / Management			
Duration	Project Life (5)	The impact will occur for the duration of the Project. The LoM is approximately 53 years.	Moderate negative (-84)

Dimension	Rating	Motivation	Significance
Extent	Local (3)	The daytime and night time practical viewshed models indicate that the Project will be visible from a distance of up to 10 km. The potential visual receptors include residents of the towns and settlements within 10 km of the proposed infrastructure (Daggafontein, Eloff, Endicott, Largo, Strubenvale, Sundra, Vischkuil and Welgedacht), residents of the surrounding farms and small holdings (2 022 receptor points), road users of the N17 national route, the R29, R42 and R555 regional roads, secondary roads and farm roads and visitors to the Blesbokspruit Ramsar Site and IBA and the Marievale Nature Reserve and Bird Sanctuary.	
Intensity	Serious (4)	Stripping of topsoil and soft overburden is expected to cause a serious negative visual disturbance. As the Project area is stripped it will become noticeable to the nearby receptors as it will contrast the surrounding areas.	
Probability	Definite (7)	The impact will definitely occur.	
Nature	Negative		
Mitigation / Management Actions			
▪ Topsoil should only be removed when and where necessary; and ▪ Soft overburden should only be removed when and where necessary.			
Post-Mitigation			
Duration	Project Life (5)	The impact will occur for the duration of the Project. The LoM is approximately 53 years.	Minor negative (-70)
Extent	Limited (2)	The extent of the impact will be reduced by implementing the mitigation / management actions listed above.	
Intensity	Moderate (3)	The impact will be reduced by implementing the mitigation / management actions listed above.	
Probability	Definite (7)	The impact will definitely occur.	
Nature	Negative		

Table 11-91: Potential Impacts of Removal of Overburden on the Visual Aspects

Dimension	Rating	Motivation	Significance
Activity and Interaction (Removal of Overburden)			
Impact Description: Removal of overburden (including drilling and blasting of hard overburden) will have a negative visual impact on the receiving environment. Drilling and blasting will result in noise and dust thereby attracting attention to the Project area. Dust from blasting will have a negative visual impact. The open pit will dramatically contrast the surrounding agricultural area as it will result in a scar on the landscape.			
Prior to Mitigation / Management			

Dimension	Rating	Motivation	Significance
Duration	Project Life (5)	The impact will occur for the duration of the Project. The LoM is approximately 53 years.	Moderate negative (-91)
Extent	Local (3)	The daytime and night time practical viewshed models indicate that the Project will be visible from a distance of up to 10 km. The potential visual receptors include residents of the towns and settlements within 10 km of the proposed infrastructure (Daggafontein, Eloff, Endicott, Largo, Strubenvale, Sundra, Vischkuil and Welgedacht), residents of the surrounding farms and small holdings (2 022 receptor points), road users of the N17 national route, the R29, R42 and R555 regional roads, secondary roads and farm roads and visitors to the Blesbokspruit Ramsar Site and IBA and the Marievale Nature Reserve and Bird Sanctuary.	
Intensity	Very Serious (5)	Removal of overburden (including drilling and blasting of hard overburden) and the associated dust from the blasting is expected to cause a very serious visual impact.	
Probability	Definite (7)	The impact will definitely occur.	
Nature	Negative		
Mitigation / Management Actions			
▪ Only remove overburden when and where necessary; and ▪ Apply dust suppression techniques to limit the dust generated from the blasting.			
Post-Mitigation			
Duration	Project Life (5)	The impact will occur for the duration of the Project. The LoM is approximately 53 years.	Moderate negative (-77)
Extent	Limited (2)	The extent of the impact will be reduced by implementing the mitigation / management actions listed above.	
Intensity	Serious (4)	The impact will be reduced by implementing the mitigation / management actions listed above.	
Probability	Definite (7)	The impact will definitely occur.	
Nature	Negative		

Table 11-92: Potential Impacts of Loading and Hauling of Overburden on the Visual Aspects

Dimension	Rating	Motivation	Significance
Activity and Interaction (Loading and Hauling of Overburden)			
Impact Description: Vehicular activity to load and haul overburden (including topsoil, soft overburden and hard overburden) will have a negative visual impact on the receiving environment. Dust from the vehicular activity will also have a negative visual impact.			
Prior to Mitigation / Management			

Dimension	Rating	Motivation	Significance
Duration	Project Life (5)	The impact will occur for the duration of the Project. The LoM is approximately 53 years.	Minor negative (-70)
Extent	Local (3)	The daytime and night time practical viewshed models indicate that the Project will be visible from a distance of up to 10 km. The potential visual receptors include residents of the towns and settlements within 10 km of the proposed infrastructure (Daggafontein, Eloff, Endicott, Largo, Strubenvale, Sundra, Vischkuil and Welgedacht), residents of the surrounding farms and small holdings (2 022 receptor points), road users of the N17 national route, the R29, R42 and R555 regional roads, secondary roads and farm roads and visitors to the Blesbokspruit Ramsar Site and IBA and the Marievale Nature Reserve and Bird Sanctuary.	
Intensity	Minor (2)	Loading and hauling of overburden (including topsoil, soft overburden and hard overburden) and the associated dust is expected to cause a minor visual disturbance.	
Probability	Definite (7)	The impact will definitely occur.	
Nature	Negative		
Mitigation / Management Actions			
▪ Limit the speed of vehicles on the haul roads to reduce dust; and ▪ Haul roads should be wetted frequently by means of a water bowser to suppress dust.			
Post-Mitigation			
Duration	Project Life (5)	The impact will occur for the duration of the Project. The LoM is approximately 53 years.	Minor negative (-48)
Extent	Limited (2)	The extent of the impact will be reduced by implementing the mitigation / management actions listed above.	
Intensity	Minimal (1)	The impact will be reduced by implementing the mitigation / management actions listed above.	
Probability	Almost Certain/ Highly Probable (6)	The impact will almost certainly occur.	
Nature	Negative		

Table 11-93: Potential Impacts of Stockpiling of Overburden on the Visual Aspects

Dimension	Rating	Motivation	Significance
Activity and Interaction (Stockpiling of Overburden)			
Impact Description: Stockpiling of overburden (including topsoil, soft overburden and hard overburden) will have a negative visual impact on the receiving environment. Dust from the stockpiles will also have a negative visual impact. The impact of the stockpiles will occur for the life of the Project. This impact will be reversed when the material from the stockpiles is used to backfill the open pit (soft overburden and hard overburden) and rehabilitate the Project area (topsoil) during the decommissioning and closure phase.			
Prior to Mitigation / Management			
Duration	Project Life (5)	The impact will occur for the duration of the Project. The LoM is approximately 53 years.	Moderate negative (-91)
Extent	Local (3)	The daytime and night time practical viewshed models indicate that the Project will be visible from a distance of up to 10 km. The potential visual receptors include residents of the towns and settlements within 10 km of the proposed infrastructure (Daggafontein, Eloff, Endicott, Largo, Strubenvale, Sundra, Vischkuil and Welgedacht), residents of the surrounding farms and small holdings (2 022 receptor points), road users of the N17 national route, the R29, R42 and R555 regional roads, secondary roads and farm roads and visitors to the Blesbokspruit Ramsar Site and IBA and the Marievale Nature Reserve and Bird Sanctuary.	
Intensity	Very Serious (5)	Stockpiling of overburden (including topsoil, soft overburden and hard overburden) and the associated dust is expected to cause a very serious visual disturbance. The stockpiles will become visible from a greater distance as they increase in height and will begin to dominate the landscape for nearby receptors.	
Probability	Definite (7)	The impact will definitely occur.	
Nature	Negative		
Mitigation / Management Actions			
▪ Topsoil stockpiles should be vegetated with grasses (Andropogon appendiculatus, Andropogon eucomus, Andropogon huillensis, Aristida congesta subsp. Barbicollis, Arundinella nepalensis, Cynodon dactylon, Eragrostis capensis, Eragrostis curvula, Eragrostis gummiflua, Eragrostis racemose, Fingerhuthia Africana, Hyparrhenia hirta, Hyparrhenia tamba, Imperata cylindrical, Melinis repens, Paspalum dilatatum, Setaria sphacelata, Sporobolus africanus, Sporobolus pyramidalis, Themeda triandra, Trichoneura grandiglumis and Tristachya leucothrix) where possible so as to blend in with the surrounding landscape and reduce dust generation; ▪ Limit the footprint area of topsoil stockpiles where possible; ▪ Limit the height of topsoil stockpiles to 20 m; ▪ Ensure the soft overburden and hard overburden stockpiles do not exceed the proposed height of 20 m; and ▪ Apply dust suppression techniques to limit dust generated from stockpiles.			

Dimension	Rating	Motivation	Significance
Post-Mitigation			
Duration	Project Life (5)	The impact will occur for the duration of the Project. The LoM is approximately 53 years.	Moderate negative (-77)
Extent	Limited (2)	The extent of the impact will be reduced by implementing the mitigation / management actions listed above.	
Intensity	Serious (4)	The impact will be reduced by implementing the mitigation / management actions listed above.	
Probability	Definite (7)	The impact will definitely occur.	
Nature	Negative		

Table 11-94: Potential Impacts of Drilling and Blasting of Coal on the Visual Aspects

Dimension	Rating	Motivation	Significance
Activity and Interaction (Drilling and Blasting of Coal)			
Impact Description: Drilling and blasting of coal will have a negative visual impact on the receiving environment. Drilling and blasting will result in noise and dust thereby attracting attention to the Project area. Dust from blasting will have a negative visual impact. The open pit will dramatically contrast the surrounding agricultural area as it will result in a scar on the landscape. Once coal is removed from the open pit there will be insufficient material to backfill the open pit completely and a void will remain. This will result in a permanent and irreversible negative visual impact on the receiving environment.			
Prior to Mitigation / Management			
Duration	Permanent (7)	There will be a permanent and irreversible negative visual impact on the receiving environment. Once coal is removed from the open pit there will be insufficient material to backfill the open pit completely and a void will remain.	Major negative (-119)
Extent	Local (3)	The daytime and night time practical viewshed models indicate that the Project will be visible from a distance of up to 10 km. The potential visual receptors include residents of the towns and settlements within 10 km of the proposed infrastructure (Daggafontein, Eloff, Endicott, Largo, Strubenvale, Sundra, Vischkuil and Welgedacht), residents of the surrounding farms and small holdings (2 022 receptor points), road users of the N17 national route, the R29, R42 and R555 regional roads, secondary roads and farm roads and visitors to the Blesbokspruit Ramsar Site and IBA and the Marievale Nature Reserve and Bird Sanctuary.	

Dimension	Rating	Motivation	Significance
Intensity	Highly Irreplaceable (7)	Drilling and blasting of coal will result in a permanent and irreversible negative visual impact on the receiving environment. Once coal is removed from the open pit there will be insufficient material to backfill the open pit completely and a void will remain.	
Probability	Definite (7)	The impact will definitely occur.	
Nature	Negative		
Mitigation / Management Actions			
▪ Apply dust suppression techniques to limit the dust generated from the blasting; ▪ Ensure that the open pit is backfilled with material from the overburden stockpiles; ▪ Rehabilitate all disturbed areas; ▪ Ensure that the rehabilitated area is re-contoured and profiled to create a free-draining topography; ▪ Spread topsoil over the rehabilitated area; ▪ Ensure that surface water and drainage lines are rehabilitated; ▪ Re-vegetate the rehabilitated areas with grasses (Andropogon appendiculatus, Andropogon eucomus, Andropogon huillensis, Aristida congesta subsp. Barbicollis, Arundinella nepalensis, Cynodon dactylon, Eragrostis capensis, Eragrostis curvula, Eragrostis gummiflua, Eragrostis racemose, Fingerhuthia Africana, Hyparrhenia hirta, Hyparrhenia tamba, Imperata cylindrical, Melinis repens, Paspalum dilatatum, Setaria sphacelata, Sporobolus africanus, Sporobolus pyramidalis, Themeda triandra, Trichoneura grandiglumis and Tristachya leucothrix); and ▪ Ensure all the mitigation / management actions outlined in the Closure and Rehabilitation reports are conducted.			
Post-Mitigation			
Duration	Beyond Project Life (6)	The impact will remain until after the Project area has been rehabilitated. The impact will become reversible if the Project area is re-contoured and profiled to create a free-draining topography thereby eliminating the void.	
Extent	Limited (2)	The extent of the impact will be reduced by implementing the mitigation / management actions listed above.	Moderate negative (-91)
Intensity	Very Serious (5)	The impact will be reduced by implementing the mitigation / management actions listed above.	
Probability	Definite (7)	The impact will definitely occur.	
Nature	Negative		

Table 11-95: Potential Impacts of Loading and Hauling of ROM Coal on the Visual Aspects

Dimension	Rating	Motivation	Significance
Activity and Interaction (Loading and Hauling of ROM Coal)			
Impact Description: Vehicular activity to load and haul ROM coal will have a negative visual impact on the receiving environment. Dust from the vehicular activity will also have a negative visual impact.			

Dimension	Rating	Motivation	Significance
Prior to Mitigation / Management			
Duration	Project Life (5)	The impact will occur for the duration of the Project. The LoM is approximately 53 years.	Minor negative (-70)
Extent	Local (3)	The daytime and night time practical viewshed models indicate that the Project will be visible from a distance of up to 10 km. The potential visual receptors include residents of the towns and settlements within 10 km of the proposed infrastructure (Daggafontein, Eloff, Endicott, Largo, Strubenvale, Sundra, Vischkuil and Welgedacht), residents of the surrounding farms and small holdings (2 022 receptor points), road users of the N17 national route, the R29, R42 and R555 regional roads, secondary roads and farm roads and visitors to the Blesbokspruit Ramsar Site and IBA and the Marievale Nature Reserve and Bird Sanctuary.	
Intensity	Minor (2)	Loading and hauling of ROM coal and the associated dust is expected to cause a minor visual disturbance.	
Probability	Definite (7)	The impact will definitely occur.	
Nature	Negative		
Mitigation / Management Actions			
▪ Limit the speed of vehicles on the haul roads to reduce dust; and ▪ Haul roads should be wetted frequently by means of a water bowser to suppress dust.			
Post-Mitigation			
Duration	Project Life (5)	The impact will occur for the duration of the Project. The LoM is approximately 53 years.	Minor negative (-48)
Extent	Limited (2)	The extent of the impact will be reduced by implementing the mitigation / management actions listed above.	
Intensity	Minimal (1)	The impact will be reduced by implementing the mitigation / management actions listed above.	
Probability	Almost Certain/ Highly Probable (6)	The impact will almost certainly occur.	
Nature	Negative		

Table 11-96: Potential Impacts of Stockpiling of ROM Coal on the Visual Aspects

Dimension	Rating	Motivation	Significance
Activity and Interaction (Stockpiling of ROM Coal)			
Impact Description: Stockpiling of ROM coal will have a negative visual impact on the receiving environment. Dust from the stockpiles will also have a negative visual impact.			
Prior to Mitigation / Management			
Duration	Project Life (5)	The impact will occur for the duration of the Project. The LoM is approximately 53years.	Moderate negative (-77)
Extent	Local (3)	The daytime and night time practical viewshed models indicate that the Project will be visible from a distance of up to 10 km. The potential visual receptors include residents of the towns and settlements within 10 km of the proposed infrastructure (Daggafontein, Eloff, Endicott, Largo, Strubenvale, Sundra, Vischkuil and Welgedacht), residents of the surrounding farms and small holdings (2 022 receptor points), road users of the N17 national route, the R29, R42 and R555 regional roads, secondary roads and farm roads and visitors to the Blesbokspruit Ramsar Site and IBA and the Marievale Nature Reserve and Bird Sanctuary.	
Intensity	Moderate (3)	Stockpiling of ROM coal and the associated dust is expected to cause a moderate visual disturbance.	
Probability	Definite (7)	The impact will definitely occur.	
Nature	Negative		
Mitigation / Management Actions			
▪ Limit the footprint area of the ROM coal stockpile where possible; ▪ Ensure the ROM coal stockpile does not exceed the proposed height of 10 m ▪ Limit the quantity and time of ROM coal stored on site; and ▪ Apply dust suppression techniques to limit dust generated from the ROM coal stockpile.			
Post-Mitigation			
Duration	Project Life (5)	The impact will occur for the duration of the Project. The LoM is approximately 47 years.	Minor negative (-63)
Extent	Limited (2)	The extent of the impact will be reduced by implementing the mitigation / management actions listed above.	
Intensity	Minor (2)	The impact will be reduced by implementing the mitigation / management actions listed above.	
Probability	Definite (7)	The impact will definitely occur.	
Nature	Negative		

Table 11-97: Potential Impacts of Use and Maintenance of Haul Roads on the Visual Aspects

Dimension	Rating	Motivation	Significance
Activity and Interaction (Use and Maintenance of Haul Roads)			
Impact Description: Vehicular activity on the haul roads will have a negative visual impact on the receiving environment. Dust from the vehicular activity will also have a negative visual impact. Maintenance of the haul roads may require the acquisition of additional material such as from borrow pits which will have a negative visual impact on the receiving environment.			
Prior to Mitigation / Management			
Duration	Project Life (5)	The impact will occur for the duration of the Project. The LoM is approximately 53 years.	Minor negative (-70)
Extent	Local (3)	The daytime and night time practical viewshed models indicate that the Project will be visible from a distance of up to 10 km. The potential visual receptors include residents of the towns and settlements within 10 km of the proposed infrastructure (Daggafontein, Eloff, Endicott, Largo, Strubenvale, Sundra, Vischkuil and Welgedacht), residents of the surrounding farms and small holdings (2 022 receptor points), road users of the N17 national route, the R29, R42 and R555 regional roads, secondary roads and farm roads and visitors to the Blesbokspruit Ramsar Site and IBA and the Marievale Nature Reserve and Bird Sanctuary.	
Intensity	Minor (2)	Vehicular activity on the haul roads and the associated dust is expected to cause a minor visual disturbance. Maintenance of the haul roads is expected to cause a minor visual disturbance.	
Probability	Definite (7)	The impact will definitely occur.	
Nature	Negative		
Mitigation / Management Actions			
▪ Limit the speed of vehicles (40 km/h) on the haul roads to reduce dust; ▪ Haul roads should be wetted frequently by means of a water bowser to suppress dust; and			
Post-Mitigation			
Duration	Project Life (5)	The impact will occur for the duration of the Project. The LoM is approximately 47 years.	Minor negative (-48)
Extent	Limited (2)	The extent of the impact will be reduced by implementing the mitigation / management actions listed above.	
Intensity	Minimal (1)	The impact will be reduced by implementing the mitigation / management actions listed above.	
Probability	Almost Certain/ Highly Probable (6)	The impact will almost certainly occur.	

Dimension	Rating	Motivation	Significance
Nature	Negative		

Table 11-98: Potential Impacts of Operation of Washing Plant on the Visual Aspects

Dimension	Rating	Motivation	Significance
Activity and Interaction (Operation of Washing Plant)			
Impact Description: Plant area lighting at night will have a negative visual impact on the receiving environment. The plant area lighting will be visible from a distance of up to 10 km and will draw attention to the Project area. This will also have a negative impact on the sense of place.			
Prior to Mitigation / Management			
Duration	Project Life (5)	The impact will occur for the duration of the Project. The LoM is approximately 53 years.	Moderate negative (-91)
Extent	Local (3)	The daytime and night time practical viewshed models indicate that the Project will be visible from a distance of up to 10 km. The potential visual receptors include residents of the towns and settlements within 10 km of the proposed infrastructure (Daggafontein, Eloff, Endicott, Largo, Strubenvale, Sundra, Vischkuil and Welgedacht), residents of the surrounding farms and small holdings (2 022 receptor points), road users of the N17 national route, the R29, R42 and R555 regional roads, secondary roads and farm roads and visitors to the Blesbokspruit Ramsar Site and IBA and the Marievale Nature Reserve and Bird Sanctuary.	
Intensity	Very Serious (5)	Plant area lighting at night is expected to cause a very serious visual disturbance.	
Probability	Definite (7)	The impact will definitely occur.	
Nature	Negative		
Mitigation / Management Actions			
▪ Down lighting must be implemented for operational activities taking place at night to minimise light pollution.			
Post-Mitigation			
Duration	Project Life (5)	The impact will occur for the duration of the Project. The LoM is approximately 53 years.	Moderate negative (-77)
Extent	Limited (2)	The extent of the impact will be reduced by implementing the mitigation / management actions listed above.	
Intensity	Serious (4)	The impact will be reduced by implementing the mitigation / management actions listed above.	
Probability	Definite (7)	The impact will definitely occur.	
Nature	Negative		

Table 11-99: Potential Impacts of Operation of Discard Dump on the Visual Aspects

Dimension	Rating	Motivation	Significance
Activity and Interaction (Operation of Discard Dump)			
Impact Description: Disposal of discard from the washing plant on the discard dump will have a negative visual impact on the receiving environment. The impact of the discard dump will occur for the life of the Project. This impact will be reversed if the material from the discard dump is re-washed or used to backfill the open pit during the decommissioning and closure phase.			
Prior to Mitigation / Management			
Duration	Project Life (5)	The impact will occur for the duration of the Project. The LoM is approximately 47 years.	Moderate negative (-91)
Extent	Local (3)	The daytime and night time practical viewshed models indicate that the Project will be visible from a distance of up to 10 km. The potential visual receptors include residents of the towns and settlements within 10 km of the proposed infrastructure (Daggafontein, Eloff, Endicott, Largo, Strubenvale, Sundra, Vischkuil and Welgedacht), residents of the surrounding farms and small holdings (2 022 receptor points), road users of the N17 national route, the R29, R42 and R555 regional roads, secondary roads and farm roads and visitors to the Blesbokspruit Ramsar Site and IBA and the Marievale Nature Reserve and Bird Sanctuary.	
Intensity	Very Serious (5)	Operation of the discard dump is expected to cause a very serious visual disturbance. The discard dump will become visible from a greater distance as it increases in height and will begin to dominate the landscape for nearby receptors.	
Probability	Definite (7)	The impact will definitely occur.	
Nature	Negative		
Mitigation / Management Actions			
▪ Ensure the discard dump does not exceed the proposed height of 20 m.			
Post-Mitigation			
Duration	Project Life (5)	The impact will occur for the duration of the Project. The LoM is approximately 53 years.	Moderate negative (-77)
Extent	Limited (2)	The extent of the impact will be reduced by implementing the mitigation / management actions listed above.	
Intensity	Serious (4)	The impact will be reduced by implementing the mitigation / management actions listed above.	
Probability	Definite (7)	The impact will definitely occur.	
Nature	Negative		

11.1.9.4 Decommissioning and Closure Phase

The decommissioning and closure phase is characterised by demolition and removal of infrastructure and rehabilitation of the Project area (including spreading of soil, re-vegetation and profiling or contouring). The decommissioning and closure phase is expected to have negative visual impacts on the receiving environment.

Once coal is removed from the open pit there will be insufficient material to backfill the open pit completely and a void will remain. This will result in a permanent and irreversible negative visual impact on the receiving environment. This impact will become reversible if the Project area is re-contoured and profiled to create a free-draining topography thereby eliminating the void.

Once rehabilitation is complete and the Project area has re-contoured and profiled to create a free-draining topography there will be an overall neutral visual impact on the receiving environment.

Based on the Project activities listed above, Table 11-100 lists the various interactions and potential impacts of the activities during the decommissioning phase.

Table 11-100: Interactions and Impacts of Decommissioning Activities

Interaction	Impact
Demolition and removal of all infrastructure	Demolition and removal of all infrastructure will have a negative visual impact on the receiving environment. Dust from the demolition process will also have a negative visual impact. Once the infrastructure is removed and rehabilitation of the disturbed areas is complete, there will be an overall neutral visual impact on the receiving environment.
Rehabilitation	Rehabilitation (including spreading of soil, re-vegetation and profiling or contouring) will have a negative visual impact on the receiving environment. Once coal is removed from the open pit there will be insufficient material to backfill the open pit completely and a void will remain. This will result in a permanent and irreversible negative visual impact on the receiving environment. This impact will become reversible if the Project area is re-contoured and profiled to create a free-draining topography thereby eliminating the void. Once rehabilitation is complete and the Project area has re-contoured and profiled to create a free-draining topography there will be an overall neutral visual impact on the receiving environment.

11.1.9.4.1 Impacts Description

Demolition and Removal of all Infrastructure

Demolition and removal of all infrastructure is expected to have a negative visual impact on the receiving environment. Demolition and removal of all infrastructure will have a minor negative visual impact on the receiving environment. Once the infrastructure is removed and rehabilitation of the disturbed areas is complete, there will be an overall neutral visual impact on the receiving environment.

Rehabilitation

Rehabilitation (including spreading of soil, re-vegetation and profiling or contouring) is expected to have a negative visual impact on the receiving environment. Rehabilitation (including spreading of soil, re-vegetation and profiling or contouring) will have a moderate negative visual impact on the receiving environment. Once rehabilitation is complete, there will be an overall neutral visual impact on the receiving environment.

11.1.9.4.2 Management Objective

The management objective is to increase the neutral visual impacts caused by demolition and removal of all infrastructure.

11.1.9.4.3 Management Actions

The following management actions are required for demolition and removal of all infrastructure:

- Apply dust suppression techniques to limit the dust from the demolition area;
- Use shade cloth / netting to screen the demolition area;
- Ensure all infrastructure is demolished and removed from the site;
- Limit the quantity and time of rubble stored on site; and
- Rehabilitate all disturbed areas.
- Ensure that the open pit is backfilled with material from the overburden stockpiles;
- Rehabilitate all disturbed areas;
- Ensure that the rehabilitated area is re-contoured and profiled to create a free-draining topography;
- Spread topsoil over the rehabilitated area;
- Ensure that surface water and drainage lines are rehabilitated;
- Re-vegetate the rehabilitated areas with grasses (Andropogon appendiculatus, Andropogon eucomus, Andropogon huillensis, Aristida congesta subsp. Barbicollis, Arundinella nepalensis, Cynodon dactylon, Eragrostis capensis, Eragrostis curvula, Eragrostis gummiflua, Eragrostis racemose, Fingerhuthia Africana, Hyparrhenia hirta, Hyparrhenia tamba, Imperata cylindrical, Melinis repens, Paspalum dilatatum, Setaria sphacelata, Sporobolus africanus, Sporobolus pyramidalis, Themeda triandra, Trichoneura grandiglumis and Tristachya leucothrix); and
- Ensure all the mitigation / management actions outlined in the Closure and Rehabilitation reports are conducted.

11.1.9.4.4 Impact Ratings

The impacts on visual aspects during the Decommissioning Phase, as described above, are rated in Table 11-101 and Table 11-102 below.

Table 11-101: Potential Impacts of Demolition and Removal of All Infrastructure on the Visual Aspects

Dimension	Rating	Motivation	Significance
Activity and Interaction (Demolition and Removal of All Infrastructure)			
Impact Description: Demolition and removal of all infrastructure will have a negative visual impact on the receiving environment. Dust from the demolition process will also have a negative visual impact. Once the infrastructure is removed and rehabilitation of the disturbed areas is complete, there will be an overall neutral visual impact on the receiving environment.			
Prior to Mitigation / Management			
Duration	Medium Term (3)	The impact will occur during the decommissioning and closure phase which is expected to last for 2-5 years.	Minor negative (-56)
Extent	Local (3)	The daytime and night time practical viewshed models indicate that the Project will be visible from a distance of up to 10 km. The potential visual receptors include residents of the towns and settlements within 10 km of the proposed infrastructure (Daggafontein, Eloff, Endicott, Largo, Strubenvale, Sundra, Vischkuil and Welgedacht), residents of the surrounding farms and small holdings (2 022 receptor points), road users of the N17 national route, the R29, R42 and R555 regional roads, secondary roads and farm roads and visitors to the Blesbokspruit Ramsar Site and IBA and the Marievale Nature Reserve and Bird Sanctuary.	
Intensity	Minor (2)	Demolition and removal of all infrastructure is expected to cause a minor visual disturbance.	
Probability	Definite (7)	The impact will definitely occur.	
Nature	Negative		
Mitigation / Management Actions			
▪ Apply dust suppression techniques to limit the dust from the demolition area; ▪ Use shade cloth / netting to screen the demolition area; ▪ Ensure all infrastructure is demolished and removed from the site; ▪ Limit the quantity and time of rubble stored on site; and ▪ Rehabilitate all disturbed areas.			
Post-Mitigation			
Duration	Medium Term (3)	The impact will occur during the decommissioning and closure phase which is expected to last for 2-5 years.	Minor negative (-36)
Extent	Limited (2)	The extent of the impact will be reduced by implementing the mitigation / management actions listed above.	
Intensity	Minimal (1)	The impact will be reduced by implementing the mitigation / management actions listed above.	

Dimension	Rating	Motivation	Significance
Probability	Almost Certain/ Highly Probable (6)	The impact will almost certainly occur.	
Nature	Negative		

Table 11-102: Potential Impacts of Rehabilitation on the Visual Aspects

Dimension	Rating	Motivation	Significance
Activity and Interaction (Rehabilitation)			
Impact Description: Rehabilitation (including spreading of soil, re-vegetation and profiling or contouring) will have a negative visual impact on the receiving environment. Once coal is removed from the open pit there will be insufficient material to backfill the open pit completely and a void will remain. This will result in a permanent and irreversible negative visual impact on the receiving environment. This impact will become reversible if the Project area is re-contoured and profiled to create a free-draining topography thereby eliminating the void. Once rehabilitation is complete and the Project area has re-contoured and profiled to create a free-draining topography there will be an overall neutral visual impact on the receiving environment.			
Prior to Mitigation / Management			
Duration	Medium Term (3)	The impact will occur during the decommissioning and closure phase which is expected to last for 2-5 years.	Minor negative (-70)
Extent	Local (3)	The daytime and night time practical viewshed models indicate that the Project will be visible from a distance of up to 10 km. The potential visual receptors include residents of the towns and settlements within 10 km of the proposed infrastructure (Daggafontein, Eloff, Endicott, Largo, Strubenvale, Sundra, Vischkuil and Welgedacht), residents of the surrounding farms and small holdings (2 022 receptor points), road users of the N17 national route, the R29, R42 and R555 regional roads, secondary roads and farm roads and visitors to the Blesbokspruit Ramsar Site and IBA and the Marievale Nature Reserve and Bird Sanctuary.	
Intensity	Serious (4)	Rehabilitation (including spreading of soil, re-vegetation and profiling or contouring) is expected to cause a serious visual disturbance.	
Probability	Definite (7)	The impact will definitely occur.	
Nature	Negative		
Mitigation / Management Actions			

Dimension	Rating	Motivation	Significance
▪ Ensure that the open pit is backfilled with material from the overburden stockpiles; ▪ Rehabilitate all disturbed areas; ▪ Ensure that the rehabilitated area is re-contoured and profiled to create a free-draining topography; ▪ Spread topsoil over the rehabilitated area; ▪ Ensure that surface water and drainage lines are rehabilitated; ▪ Re-vegetate the rehabilitated areas with grasses (Andropogon appendiculatus, Andropogon eucomus, Andropogon huillensis, Aristida congesta subsp. Barbicollis, Arundinella nepalensis, Cynodon dactylon, Eragrostis capensis, Eragrostis curvula, Eragrostis gummiflua, Eragrostis racemose, Fingerhuthia Africana, Hyparrhenia hirta, Hyparrhenia tamba, Imperata cylindrical, Melinis repens, Paspalum dilatatum, Setaria sphacelata, Sporobolus africanus, Sporobolus pyramidalis, Themeda triandra, Trichoneura grandiglumis and Tristachya leucothrix); and ▪ Ensure all the mitigation / management actions outlined in the Closure and Rehabilitation reports are conducted.			
Post-Mitigation			
Duration	Medium Term (3)	The impact will occur during the decommissioning and closure phase which is expected to last for 2-5 years.	Minor negative (-56)
Extent	Limited (2)	The extent of the impact will be reduced by implementing the mitigation / management actions listed above.	
Intensity	Moderate (3)	The impact will be reduced by implementing the mitigation / management actions listed above.	
Probability	Definite (7)	The impact will definitely occur.	
Nature	Negative		

11.1.9.4.5 Post-Closure Phase

The post-closure phase is characterised by post-closure monitoring and rehabilitation. The monitoring will not have an impact on the visual / aesthetic character of the receiving environment. The rehabilitation activities are expected to have a negative visual impact on the receiving environment.

Once coal is removed from the open pit there will be insufficient material to backfill the open pit completely and a void will remain. This will result in a permanent and irreversible negative visual impact on the receiving environment. This impact will become reversible if the Project area is re-contoured and profiled to create a free-draining topography thereby eliminating the void.

Once rehabilitation is complete and the Project area has re-contoured and profiled to create a free-draining topography there will be an overall neutral visual impact on the receiving environment.

11.1.10 Blasting and Vibration Impact Assessment

11.1.10.1 Construction Phase

No drilling and blasting is anticipated as part of the construction phase. No specific evaluation is therefore required as part of the construction phase.

11.1.10.2 Operational Phase

The area surrounding the proposed mining areas was reviewed for structures, traffic, roads, human interface, animals interface etc. Various installations and structures were observed (please refer to the Blasting and Vibrations Assessment, Appendix L, for a detailed list of structures identified).

The Blast and Vibrations Impact Assessment was based on an evaluation of the following aspects:

- Ground Vibration Modelling Results;
- Ground Vibration and human perception;
- Vibration impact on national and provincial road;
- Vibration will upset adjacent communities;
- Cracking of houses and consequent devaluation;
- Air blast Modelling Results;
- Impact of fly rock; and
- Noxious fumes Influence Results.

Please note that this analysis does not take geology, topography or actual final drill and blast pattern into account. The data is based on good practise applied internationally and considered reasonable estimates based on the information provided and supplied in this document.

11.1.10.2.1 Impact Description

The proposed open pit operations were evaluated for expected levels of ground vibration from future blasting operations. Review of the sites and the surrounding installations / houses / buildings / mine infrastructure showed that structures vary in distances from the open pit area. The evaluation considered a distance up to 3500 m from the mining area.

The distances between structures and the open pit area is the main contributing factor to the levels of ground vibration expected and the subsequent possible influences. It is observed that for the different charge masses evaluated that levels of ground vibration will change as well. In view of the maximum charge specific attention will need to be given to specific areas.

Review of the site shows power lines that pass through the northern part of the open pit as well as the road that runs through the pit area on the southern side. Currently it is uncertain if the power lines or the road will be relocated.

The closest structures to the open pit area are the road, power lines, mine infrastructure and buildings/structures. The planned maximum charge evaluated showed that it could be problematic in terms of potential structural damage and human perception.

The nearest public houses are located 101 m from the open pit boundary. The ground vibration levels predicted ranged between 1.1 mm/s and 4765.4 mm/s for structures surrounding the open pit area. Ground vibration levels at the nearest buildings where people may be present is 375.8 mm/s. The nearest structures considered in the evaluation showed concerns for possible damages and the levels of ground vibration could be experienced as intolerable. The levels predicted also show low levels of ground vibration that could be experienced as intolerable at the maximum charge on the human perception scale at the houses further away from the pit area.

There are structures that are better built and some that are of lesser quality integrity. Only a detailed survey will pin point exactly what type of structure is found where.

In view of the above it is believed that specific mitigations will be required near POIs that have been identified as possible concerns such as possible relocation of relevant households.

Ground Vibration and Human Perception

Considering the effect of ground vibration with regards to human perception, vibration levels calculated were applied to an average of 30Hz frequency and plotted with expected human perceptions on the safe blasting criteria graph (see Figure 11-11below). Data applicable to human response only is plotted. The frequency range selected is the expected average range for frequencies that will be measured for ground vibration when blasting is done. From Figure 11-11 it can be seen that the ground vibration levels predicted is expected to be greater than the perceptible level but mostly less than the unpleasant level. These POI's are found in a distance range between 3470 m and 1548 m from the pit boundary. POI's identified close to the pit area is expected to experience ground vibration levels as intolerable. These installations are found up to distances of 715 m. POI's closer to the pit area could be influenced more aggressively.

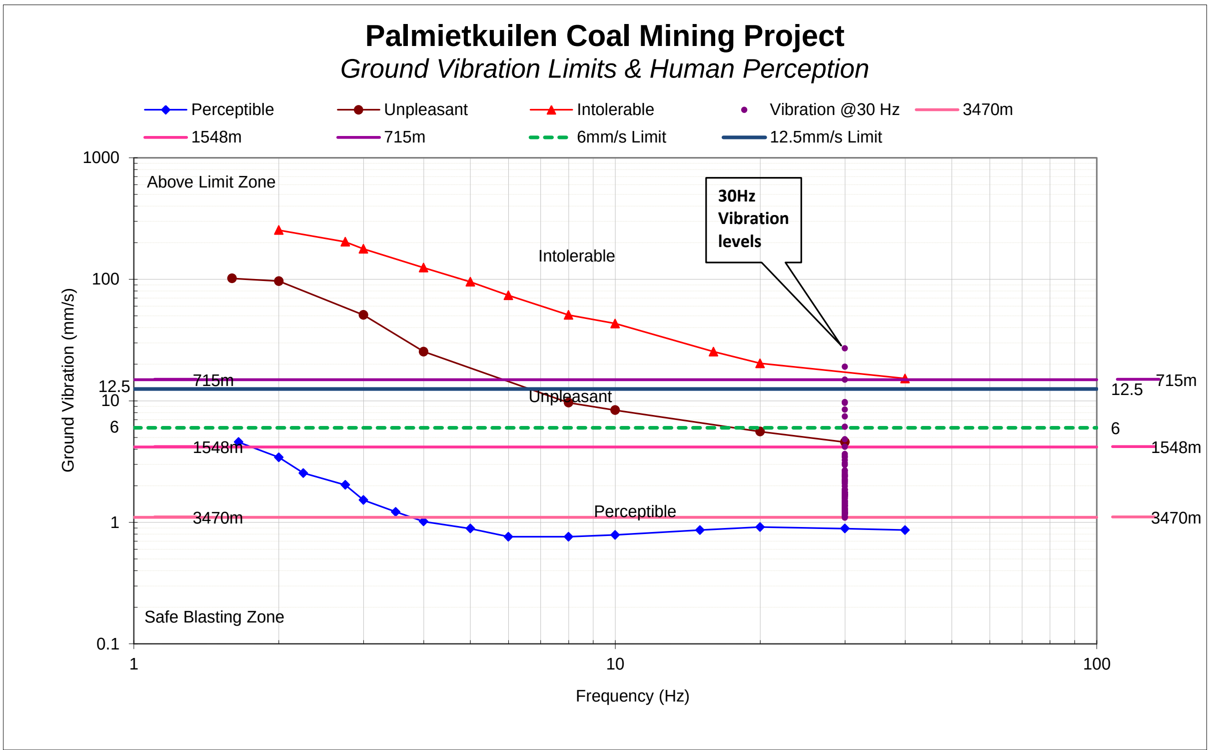


Figure 11-11: The effect of ground vibration with human perception and vibration limits

Potential that Vibration will Upset Adjacent Communities

Ground vibration and air blast generally upset people living in the vicinity of mining operations. There are communities and roads that are within the evaluated area of influence. There are structures in close proximity of the pit area. Structures are in some cases right next to the pit area and in some cases within the pit areas.

Ground vibration levels expected from maximum charge has possibility to be perceptible up to 3470 m. It is certain that lesser charges will reduce this distance for instance at minimum charge this distance is expected to be 1793 m. Within these distance ranges there are a significant number of houses. The anticipated ground vibration levels are certain to have possibility of upsetting the adjacent communities. Intolerable levels are expected up to a distance of 715 m.

The importance of good public relations cannot be under stressed. People tend to react negatively on experiencing of effects from blasting such as ground vibration and air blast. Even at low levels when damage to structures is out of the question it may upset people. Proper and appropriate communication with neighbours about blasting, monitoring and actions done for proper control will be required.

Cracking of houses and consequent devaluation

The structures found in the areas of concern ranges from informal building style to brick and mortar structures, industrial structures and various types of roads. There are various villages and houses found within the 3500 m range from the mining area. Building style and materials will certainly contribute to additional cracking apart from influences such as blasting operations.

Some of the structures i.e. corrugated iron structures are relatively safe from ground vibrations but brick and mortar or traditional built houses or houses in poor state should be considered.

The presence of general vertical cracks, horizontal and diagonal cracks that are found in typical brick structures does not need to indicate devaluation due to blasting operations but rather devaluation due to construction, building material, age, standards of building applied. Thus damage in the form of cracks will be present. Exact costing of devaluation for normal cracks observed is difficult to estimate. Mining operations may not have influence to change the status quo of any property if correct precautions are considered.

Review of structures, distance from pit area and the expected levels of ground vibration from maximum charge, the problematic indicators identified structures up to a distance of 617 m. The structures within this range could possibly be influenced. This distance is reduced to 500m for minimum charge applied.

The proposed limits as applied in this document i.e. 6 mm/s, 12.5 mm/s and 25 mm/s is considered sufficient to ensure that additional damage is not introduced to the different categories of structures. It is expected that, should levels of ground vibration be maintained within these limits, the possibility of inducing damage is limited. Mitigation measures will be required to manage the levels of ground vibration.

<u>Expected Air Blast</u>

Review of the air blast levels indicates a reduced possibility of damage concerns but more complaint concerns than with ground vibration. Air blast predicted for the maximum charge ranges between 110.8 and 134.9 dB for all the POI's considered. This includes the nearest points such as the Farm House Buildings and Informal Housing. These levels may contribute to effects such as rattling of roofs or door or windows but are not expected to be damaging. As indicated above, there is a high probability that influence that could lead to complaints. The current accepted limit on air blast is 134 dBL. Damages are only expected to occur at levels greater than 134 dBL. On maximum charge prediction it is expected that air blast will be greater than 134 dB at a distance of 108 m and closer to the open pit boundary. There is one private structure in this area that are of concern. All other private structures are further away. The nearest buildings are 101 m from the open pit boundary. Evaluation shows that POI's were identified up to a distance of 716 m where possible complaints may be expected. Power lines and the Road are closer but air blast does not have any influence on these installations.

Complaints from air blast are normally based on the actual effects that are experienced due to rattling of roof, windows, doors etc. These effects could startle people and raise concern of possible damage.

The calculations for air blast are based on the use of basic rules for stemming length and stemming material. It is maintained that if stemming control is not exercised this effect could be greater with greater range of complaints or damage. The project area is located such that "free blasting" – meaning no controls on blast preparation – will not be possible. Controls will be required.

Fly-rock Unsafe Zone

The occurrence of fly rock in any form will have a negative impact if found to travel outside the unsafe zone or within the safe boundary. The safe boundary may be anything between 10 m or 1000 m. A general safe boundary is normally considered to be a radius of 500 m or greater from the blast; but needs to be qualified and determined as best possible.

Calculations are used to help and assist determining safe distances. A safe distance from blasting is calculated following rules and guidelines from the International Society of Explosives Engineers (ISEE) Blasters Handbook. Using this calculation the minimum safe distances can be determined that should be cleared of people, animals and equipment. Figure 11-12 shows the results from the ISEE calculations for fly rock range based on a 165 mm diameter blast hole and 3.3 m stemming length. Based on these values a possible fly rock range with a safety factor of 2 was calculated to be 447 m. The absolute minimum unsafe zone is then the 447 m. This calculation is a guideline and any distance cleared should not be less. The occurrence of fly rock can however never be 100 % excluded. Best practices should be implemented at all times. The occurrence of fly rock can be mitigated but the possibility of the occurrence there of can never be eliminated. Review of the calculated safe boundary showed thirty POI's within the unsafe zone for the open pit area within the unsafe zone. This includes mainly the Power lines, closest building/structures and road.

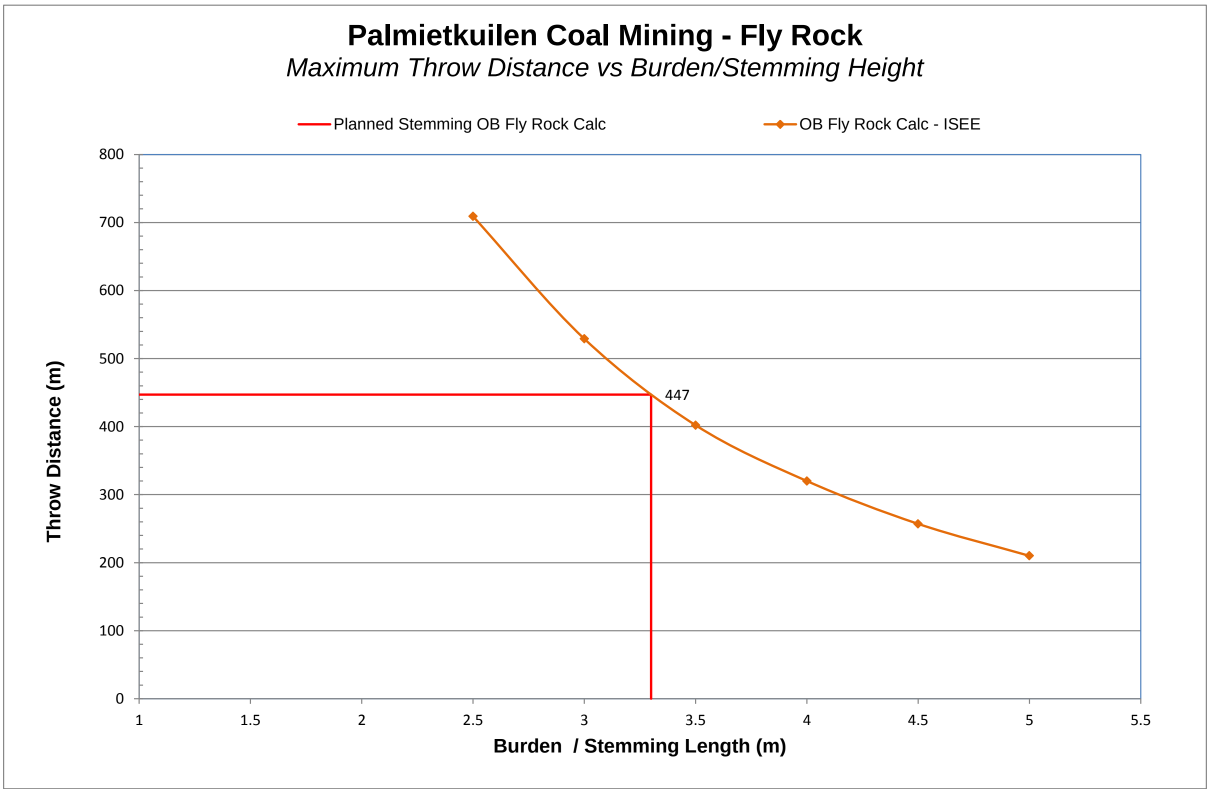


Figure 11-12: Fly-rock Prediction Calculation

<u>Noxious Fumes</u>

The occurrence of fumes in the form the NOx gas is not a given, however, the occurrence of fumes should be closely monitored. Furthermore, nothing can be stated as to fume dispersal to nearby farmsteads, but if anybody is present in the path of the fume cloud, it could be problematic.

11.1.10.2.2 Management Actions and Targets

Mitigation measures will be required for the following:

- Ground vibration;
- Air blast ; and
- Fly rock.

Mitigation of ground vibration for this can be done applying the following methods:

- Do blast design that considers the actual blasting and the ground vibration levels to be adhered too.
- Change the initiating system to facilitate less blast holes detonating simultaneously making using of electronic initiation that allow for single hole firing.
- Do design for smaller diameter blast holes that will use fewer explosives per blasthole.

No specific mitigation detail for air blast and fly rock is provided, it will require adjustments after considering the ground vibration levels. Mitigation for air blast and fly rock control is very similar and is based on the fact that air blast and fly rock can be controlled using proper charging methodology irrespective of the blasthole diameter and patterns used. The most effective way to mitigate air blast is the design of the stemming length and stemming material. This will require changed blast design to ensure energy levels remain as expected but with increased stemming lengths and the use of proper stemming material. The use of a crushed product with size of 10 % of the blasthole diameter is the recommended material.

11.1.10.2.3 Impact Rating

The blasting and vibration related impacts during the Operational Phase, as described above, are rated in Table 11-103 to Table 11-110 below.

Table 11-103: Ground vibration Impact on houses

Dimension	Rating	Motivation	Significance
Activity and Interaction: Blasting during operations			
Impact Description: Ground vibration Impact on houses			
Prior to Mitigation/Management			
Duration	Project Life (5)	Vibrations will occur throughout the operational phase of the Project.	Moderate (negative) (- 84)
Extent	Local (3)	The vibrations are expected to extend as far as the Project area.	
Intensity type of impact	Moderate - negative (-4)	It is expected that during operations, vibrations will have a moderate impact prior to mitigation.	
Probability	Definite (7)	The impact will definitely occur.	
Nature	Negative		
Mitigation/Management Actions			
▪ Reduce Charge Mass/Delay; ▪ Reconsider blast initiation system – electronics; ▪ Relocate POI's of concern at least 650m (refer to Blast and Vibrations Report for full list of POI’s); ▪ A pre-blasting survey must be undertaken to understand the baseline conditions and ensure legitimate claims are followed up; and ▪ Implementation of proper blast design.			
Post-Mitigation			
Duration	Medium term (3)	Vibrations will occur throughout the operational phase of the Project.	Negligible (negative)

Dimension	Rating	Motivation	Significance
Extent	Local (3)	The vibrations are expected to extend only as far as the Project area.	(- 32)
Intensity x type of impact	Minor - negative (-2)	Minor effects on the environment.	
Probability	Probable (4)	The impact will almost certainly occur.	
Nature	Negative		

Table 11-104: Ground vibration Impact on roads

Dimension	Rating	Motivation	Significance
Activity and Interaction: Blasting during operations			
Impact Description: Ground vibration Impact on roads			
Prior to Mitigation/Management			
Duration	Project Life (5)	Vibrations will occur throughout the operational phase of the Project.	Negligible (negative) (- 9)
Extent	Local (3)	The vibrations are expected to extend only as far as the Project area.	
Intensity type of impact	Minimal - negative (-1)	It is expected that ground vibrations will have a minimal impact on nearby roads.	
Probability	Highly unlikely (1)	Ground vibration impacts on nearby roads are highly unlikely.	
Nature	Negative		
Mitigation/Management Actions			
▪ No mitigation measures are proposed.			
Post-Mitigation			
Duration	Medium term (3)	Vibrations will occur throughout the operational phase of the Project.	Negligible (negative) (- 7)
Extent	Local (3)	The vibrations are expected to extend only as far as the Project area.	
Intensity type of impact	Minimal - negative (-1)	It is expected that ground vibrations will have a minimal impact on nearby roads.	

Dimension	Rating	Motivation	Significance
Probability	Highly unlikely (1)	Ground vibration impacts on nearby roads are highly unlikely.	
Nature	Negative		

Table 11-105: Air blast Impact on houses

Dimension	Rating	Motivation	Significance
Activity and Interaction: Blasting during operations			
Impact Description: Air blast Impact on houses			
Prior to Mitigation/Management			
Duration	Project Life (5)	Air blast impacts will occur throughout the operational phase of the Project.	Minor (negative) (- 60)
Extent	Local (3)	Air blast impacts are expected to extend only as far as the Project area.	
Intensity type of impact	Moderate - negative (-4)	It is expected that air blast will have a moderate impact prior to mitigation.	
Probability	Likely (5)	This impact is likely to occur.	
Nature	Negative		
Mitigation/Management Actions			
▪ Reduce Charge Mass/Delay; ▪ Increase stemming length; ▪ Controls need to be put in place for management of stemming lengths and quality stemming material; ▪ Relocate POI's of concern at least 650m (refer to Blast and Vibrations Report for full list of POI's); ▪ A pre-blasting survey must be undertaken to understand the baseline conditions and ensure legitimate claims are followed up; and ▪ Implementation of proper blast design.			
Post-Mitigation			
Duration	Medium term (3)	Air blast impacts will occur throughout the operational phase of the Project.	Negligible (negative) (- 32)
Extent	Local (3)	Air blast impacts are expected to extend only as far as the Project area.	
Intensity type of impact	Minor - negative (-2)	Following mitigation, air blast can be reduced to minor impact.	

Dimension	Rating	Motivation	Significance
Probability	Probable (4)	The impact will almost certainly occur.	
Nature	Negative		

Table 11-106: Air blast Impact on roads

Dimension	Rating	Motivation	Significance
Activity and Interaction: Blasting during operations			
Impact Description: Air blast Impact on roads			
Prior to Mitigation/Management			
Duration	Project Life (5)	Air blast impacts will occur throughout the operational phase of the Project.	Negligible (negative) (- 9)
Extent	Local (3)	Air blast impacts are expected to extend only as far as the Project area.	
Intensity type of impact	Minimal - negative (-1)	Air blast is expected to have minimal negative impact on nearby roads.	
Probability	Highly unlikely (1)	This impact is highly unlikely.	
Nature	Negative		
Mitigation/Management Actions			
▪ No mitigation measures are proposed.			
Post-Mitigation			
Duration	Medium term (3)	Air blast impacts will occur throughout the operational phase of the Project.	Negligible (negative) (- 7)
Extent	Local (3)	Air blast impacts are expected to extend only as far as the Project area.	
Intensity type of impact	Minimal - negative (-1)	Air blast is expected to have minimal negative impact on nearby roads.	
Probability	Highly unlikely (1)	This impact is highly unlikely.	
Nature	Negative		

Table 11-107: Fly Rock Impact on houses

Dimension	Rating	Motivation	Significance
Activity and Interaction: Blasting during operations			
Impact Description: Fly Rock Impact on houses			
Prior to Mitigation/Management			
Duration	Project Life (5)	Fly-rock impacts will occur throughout the operational phase of the Project.	Moderate (negative) (- 84)
Extent	Local (3)	Fly-rock impacts are expected to extend only as far as the Project area.	
Intensity type of impact	Moderate - negative (-4)	It is expected that during operations, fly-rock will have a moderate impact prior to mitigation.	
Probability	Definite (7)	This impact will definitely occur.	
Nature	Negative		
Mitigation/Management Actions			
▪ Increase stemming length; ▪ Use quality stemming material; ▪ Controls put in place for management of stemming lengths; ▪ Relocate POI's of concern at least 650m (refer to Blast and Vibrations Report for full list of POI's); ▪ A pre-blasting survey must be undertaken to understand the baseline conditions and ensure legitimate claims are followed up; and ▪ Implementation of proper blast design.			
Post-Mitigation			
Duration	Medium term (3)	Fly-rock impacts will occur throughout the operational phase of the Project.	Negligible (negative) (- 32)
Extent	Local (3)	Fly-rock impacts are expected to extend only as far as the Project area.	
Intensity type of impact	Minor - negative (-2)	Following the implementation of mitigation measures, the impact of fly-rock on houses is expected to reduce to minor significance.	
Probability	Probable (4)	The impact will almost certainly occur.	
Nature	Negative		

Table 11-108: Fly Rock Impact on roads

Dimension	Rating	Motivation	Significance
Activity and Interaction: Blasting during operations			
Impact Description: Fly Rock Impact on roads			
Prior to Mitigation/Management			
Duration	Project Life (5)	Fly-rock impacts will occur throughout the operational phase of the Project.	Moderate (negative) (- 84)
Extent	Local (3)	Fly-rock impacts are expected to extend only as far as the Project area.	
Intensity type of impact	Moderate - negative (-4)	It is expected that during operations, fly-rock will have a moderate impact prior to mitigation.	
Probability	Definite (7)	This impact will definitely occur.	
Nature	Negative		
Mitigation/Management Actions			
▪ Increase stemming length; ▪ Use quality stemming material; ▪ Controls put in place for management of stemming lengths; ▪ Relocate POI's of concern at least 650m (refer to Blast and Vibrations Report for full list of POI's); ▪ A pre-blasting survey must be undertaken to understand the baseline conditions and ensure legitimate claims are followed up; and ▪ Implementation of proper blast design.			
Post-Mitigation			
Duration	Medium term (3)	Fly-rock impacts will occur throughout the operational phase of the Project.	Negligible (negative) (- 16)
Extent	Local (3)	Fly-rock impacts are expected to extend only as far as the Project area.	
Intensity type of impact	Minor - negative (-2)	Following the implementation of mitigation measures, the impact of fly-rock on houses is expected to reduce to minor significance.	
Probability	Rare (2)	Following the implementation of mitigation measures, the chance of occurrence will be rare.	
Nature	Negative		

Table 11-109: Impact of Fumes - Houses

Dimension	Rating	Motivation	Significance
Activity and Interaction: Blasting during operations			
Impact Description: Impact of Fumes - Houses			
Prior to Mitigation/Management			
Duration	Project Life (5)	Fumes impacts will occur throughout the operational phase of the Project.	Minor (negative) (- 44)
Extent	Local (3)	Impact can be felt locally, extending outside the mine boundary as fumes are easily dispersed.	
Intensity type of impact	Moderate - negative (-3)	It is expected that during operations, noxious fumes will have a moderate impact prior to mitigation.	
Probability	Probable (4)	This impact will almost certainly occur.	
Nature	Negative		
Mitigation/Management Actions			
▪ Use correct product; ▪ Control product quality; ▪ Prevent sleep time for charged blast holes; ▪ Ensure same day charge and blast; and ▪ Implementation of proper blast designs.			
Post-Mitigation			
Duration	Medium term (3)	Fumes impacts will occur throughout the operational phase of the Project.	Negligible (negative) (- 27)
Extent	Local (3)	Fumes impacts are expected to extend only as far as the Project area.	
Intensity type of impact	Moderate - negative (-3)	It is expected that during operations, noxious fumes will still have a moderate impact.	
Probability	Unlikely (3)	Following mitigation measures however, this impact will not be likely to occur.	
Nature	Negative		

Table 11-110: Impact of Fumes - Roads

Dimension	Rating	Motivation	Significance
Activity and Interaction: Blasting during operations			
Impact Description: Impact of Fumes - Roads			
Prior to Mitigation/Management			
Duration	Project Life (5)	Fumes impacts will occur throughout the operational phase of the Project.	Negligible (negative) (- 9)
Extent	Local (3)	Impact can be felt locally, extending outside the mine boundary as fumes are easily dispersed.	
Intensity type of impact	Minimal - negative (-1)	Noxious fumes are expected to have minimal negative impact on nearby roads	
Probability	Highly Unlikely (1)	This impact is not likely to occur.	
Nature	Negative		
Mitigation/Management Actions			
▪ No mitigation measures are proposed.			
Post-Mitigation			
Duration	Medium term (3)	Fumes impacts will occur throughout the operational phase of the Project.	Negligible (negative) (- 7)
Extent	Local (3)	Fumes impacts are expected to extend only as far as the Project area.	
Intensity x type of impact	Minimal - negative (-1)	Noxious fumes are expected to have minimal negative impact on nearby roads	
Probability	Highly Unlikely (1)	This impact is not likely to occur.	
Nature	Negative		

11.1.10.3 Decommissioning Phase

During the decommissioning phase no mining, drilling and blasting operations are expected. It is uncertain if any blasting will be done for demolition. If any demolition blasting will be required it will be reviewed as civil blasting and addressed accordingly.

11.1.11 Cultural Heritage Impact Assessment

The Project specific activities, as provided in Table 11-1, were used to assess the Cultural Significance (CS) and potential impacts to the identified heritage resources within the Project area. The identified heritage resources within the Project area are presented in Table 11-111 below.

Table 11-111: Identified Heritage Resources in the Project Area

Identified Heritage Resources	No.
Burial Grounds & Graves	**3**
BGG-001 Local cemetery comprising more than 150 graves of local community members, most likely associated with farm labourers	1
BGG-002 Local cemetery comprising more than 60 graves of local community members, most likely associated with farm labourers	1
5158/S36-003 Palmietkuil South War Cemetery Memorial – 217 Commonwealth war graves	1
Historical Built Environment	**5**
Ste-001 Eskom sub-station complex and associated infrastructure	1
Ste-007 Ruins of historic structure	1
Wf-008 Farm labourer complex – comprising several structures	1
Wf-009 Farmstead – werf comprising farmhouse and outbuildings	1
Wf-045 Ruins of historic structures	1
Grand Total	**8**

11.1.11.1 Cultural Significance

Two heritage resource categories were identified within the site-specific study area. These comprised:

- Historical built structures, complexes or werfs; and
- Burial grounds and graves, including the Palmietkuil South War Cemetery Memorial.

The CS of identified heritage resources were determined through the methodology presented in the HIA, Appendix M, to assist in providing appropriate management and mitigation measures in accordance with the published SAHRA minimum standards.

The assessment of the CS and Field Ratings demonstrated that the identified heritage resources categories range from very high to negligible. The motivation and assessment for the assigned ratings is summarised in Table 11-112.

Table 11-112: CS assessment for identified heritage resources

Resource ID	Aesthetic	Historic	Scientific	Social	INTEGRITY	Designation	Recommended Field Rating
Historical Built Structures Ste-001 Ste-007 Wf-008 Wf-009 Wf-045	1 Historical built structures within the site specific study area were considered as representing common aesthetic attributes that were well represented throughout various landscapes. Better examples are known to occur.	1 The historic use of the identified historic built structures are common and well represented within the landscape	1 No evidence of unique characteristics of the structures was recorded during the pre-disturbance survey. These structures will provide limited information.	3 The historic built environment will be considered as important to the history of the local study area, especially for specific communities within the region. No association with important events or people have been attributed to the identified structures.	2 Structures identified were either in a state of decay or have been encroached upon where the fabric is poorly preserved. The meaning of these structures, however, remains evident.	Negligible (3)	General Protection IV C
Burial Grounds and Graves BGG-001 BGG-002	- Burial grounds and graves were not assessed against aesthetic criteria as defined in Section 3(3) of the NHRA	- Burial grounds and graves were not assessed against historic criteria as defined in Section 3(3) of the NHRA	- Burial grounds and graves were not assessed against scientific criteria as defined in Section 3(3) of the NHRA	5 Burial grounds and graves have specific connections to communities or groups for spiritual reasons. This was raised by Thabo Sibeko as part of the public comments. The significance is universally accepted	4 The integrity of burial grounds is considered to be excellent with both tangible and intangible fabric preserved.	Very High (20)	**Grade I**

Resource ID	Aesthetic	Historic	Scientific	Social	INTEGRITY	Designation	Recommended Field Rating
Palmietkuil South War Cemetery Memorial 5158/S36-003	5 The memorial demonstrates importance in aesthetic characteristics for a particular period in time that can be universally considered significant	5 The memorial and graves are associated with groups of importance in the history of the country that are considered singular and unique.	4 The memorial can contribute to the academic research in terms of the role of the black population in World War II. This is considered rare, uncommon and of national value.	5 Burial grounds and graves have specific connections to communities or groups for spiritual reasons. The significance is universally accepted	4 The integrity of the public monument and memorial and the associated graves is considered to be excellent with both tangible and intangible fabric preserved.	Very High (19)	

11.1.11.2 Heritage Impact Assessment

This section considers the potential impacts to heritage resources as presented in Table 11-111 that may result due to project related activities summarised in Table 11-113, assuming the preferred mining method will be open pit. Heritage resources with negligible CS have been excluded from additional assessment as these resources have been sufficiently recorded and require no further mitigation[7] based on the definitions as presented in the SAHRA Minimum Standards (SAHRA, 2007).

This section therefore considers the potential impacts to the identified burial grounds and graves within the site-specific study area, including the identified Palmietkuil South War Cemetery Memorial in proximity to the Project. The construction phase commonly presents the greatest likelihood for direct negative impacts on heritage resources. Burial grounds BGG-001 and BGG-002, however, occur within the planned Year 40 – 45 Life of Mine (LoM) area, where project related activities associated with the development footprint of the open pit will only realise well into the operational period.

For the sake of brevity, identified impacts that will occur during both the construction and operational phases have been considered together. Direct impacts to BGG-001 and BGG-002 during the operational phase specifically, are discussed separately.

The *potential* impacts to ***unidentified*** heritage resources are considered below.

Table 11-113: Specified Project Activities Considered in the Assessment of Potential Impacts

Project Phase	Activity
Construction	Blasting and development of initial box-cut, including stock piling
Operational	Stripping of topsoil and soft overburden
	Removal of overburden, including drilling and blasting
	Drilling and blasting

[7] This excludes any permitting requirements that may be applicable to heritage resources afforded general protection in terms of Section 34 of the NHRA, specifically in reference to structures associated with Wf-008 and Wf-009 within the development footprint.

Project Phase	Activity
Decommissioning and closure	Demolition and removal of all infrastructure

11.1.11.2.1 Construction and operational phase

Construction and operational activities that will have a direct negative impact on burial grounds BGG-001 and BGG-002, when conserved in situ, will include

- Blasting and development of the initial box-cut, including stock piling; and
- Drilling and blasting.

Impact description

The identified burial grounds and graves are located within the proposed open pit infrastructure, expected to be directly impacted during years 40 – 45 of the LoM. Conservation of the burial grounds and graves in situ prior to this period however, will result in impacts to the burial grounds that will manifest as changes to the intangible integrity of the resources, i.e. loss of access resulting in degradation of the intrinsic CS of the graves.

Management objectives

The management objectives for the identified potential impacts to heritage resources are to mitigate through a Burial Grounds and Graves Consultation (BGGC) process in accordance with Section 36 of the NHRA and Chapter IX of the Regulations to the Act, and development of a Conservation Management Plan (CMP).

Management actions and targets

For heritage resources with high CS, the project design must aim to avoid change to a resource, promote at least partial conservation, and included within a CMP. Where in situ is possible, a BGGC process must be undertaken aimed at identifying bona fide NoK and affected communities, and reach agreement on the future of and access to the graves.

Impact ratings

The impacts on heritage resources during the Construction Phase, as described above, are rated in Table 11-114 below.

Table 11-114: Summary of direct impact to burial grounds and graves, i.e. destruction

Dimension	Rating	Motivation	Significance
Activity and Interaction (Site Establishment)			
Impact Description: Direct impact to burial grounds and graves			
Prior to Mitigation / Management			
Duration	Project Life (5)	Where conserved in situ, loss of access will continue throughout the project life	Moderate (negative)

Dimension	Rating	Motivation	Significance
Extent	National (6)	Unmitigated alteration of the current status quo of the identified burial grounds will have repercussions to NoK and the reputation of Pandospan. Additionally, unmitigated changes to graves will result in the involvement of local, provincial and national authorities, as well as potentially national media attention.	-96
Intensity	High - negative (-5)	This will be a minor change to a heritage resource with very high CS	
Probability	Highly probable (6)	In the event of in situ conservation, identified impacts will occur if unmitigated	
Nature	Negative		
Mitigation / Management Actions			
In the event of in situ conservation, complete a BGGC process in accordance with Section 36 of the NHRA and Chapter IX of the Regulations to the Act to reach agreement with bona fide NoK on access and conservation of the burial grounds and graves.			
Post-Mitigation			
Duration	Immediate (1)	The implementation of proposed mitigation measures will result in short term access restrictions to comply with health and safety requirements during certain activities.	Negligible (negative) -7
Extent	Very limited (1)	The impacts will be limited to BGG-001 and BGG-002	
Intensity	High - negative (-5)	The intensity is considered a minor change to a heritage resource with very high CS	
Probability	Highly unlikely (1)	The implementation of the proposed BGGC and access to the burial grounds will reduce the consequence of restricted access.	
Nature	Negative		

This assessment of in situ conservation of BGG-001 and BGG-002 notwithstanding, the identified Palmietkuil South War Cemetery Memorial located on the western extent of the project area is considered here briefly in reference to the assessed activities.

The Palmietkuil South War Cemetery Memorial (5158/S36-003) comprises 217 Commonwealth war graves affiliated with soldiers who perished in World War II and a monument in their honour. The site is situated approximately 4.6 km from the open pit in which blasting activities will be undertaken. Conventionally, potential impacts as a result of blasting and vibrations decrease significantly outside of a 500 m buffer. Based on this understanding, no impacts to the Palmietkuil South War Cemetery Memorial are envisaged during the operational phase of the Project.

11.1.11.2.2 Operational phase

Operational activities that will have a direct negative impact on burial grounds BGG-001 and BGG-002 include:

- Stripping of topsoil and soft overburden;
- Removal of overburden, including drilling and blasting; and
- Drilling and blasting.

Impact description

The identified burial grounds and graves are located within the proposed open pit infrastructure and will be directly impacted on. The identified impacts to the burial grounds will manifest as changes to the physical and intangible integrity of the resources, i.e. destruction.

Management objectives

The management objectives for the identified potential impacts to heritage resources are:

- To avoid through project related mitigation measures to reduce the intensity of negative impacts in accordance with requirements contained in the SAHRA Minimum Standards[8]; or
- To mitigate heritage resources through permitted processes (such as grave relocations), where project related mitigation is not possible or feasible.

Management actions and targets

For heritage resources with high CS, the project design must aim to avoid change to a resource, promote at least partial conservation, and included within a Conservation Management Plan (CMP).

The identified burial grounds and graves occur within the proposed open pit location. The positioning of this infrastructure is limited by the location of the mineral resource intended for exploitation. Project related mitigation measures would include the amendment of the design to exclude the burial grounds BGG-001 and BGG-002 and remove identified negative impacts.

Where amendment of the open pit design is not economically viable, and EA for open pit mining is granted, the identified burial grounds and graves will need to be mitigated through a BGGC process and Grave Relocation Plan (GRP). These must be undertaken in accordance with the requirements of Chapters XI and IX of the NHRA Regulations (GN R 548). The BGGC and GRP processes are aimed at identifying bona fide Next-of-Kin (NoK)

[8] It must be noted that these minimum standards serve as a guide, and the recommendations provided in this HIA are project specific.

and affected communities, and reach agreement on the future of the graves and the requirements for relocation.

Impact ratings

The impacts on heritage resources during the Operational Phase, as described above, are rated in Table 11-115 below.

Table 11-115: Summary of direct impact to burial grounds and graves, i.e. loss of access

Dimension	Rating	Motivation	Significance
Activity and Interaction (Mining Operations)			
Impact Description: Direct impact to burial grounds and graves			
Prior to Mitigation / Management			
Duration	Permanent (7)	The destruction of burial grounds and graves through operational activities will be permanent	Major - negative (-140)
Extent	National (6)	Unmitigated alteration of the current status quo of the identified burial grounds will have repercussions to NoK and the reputation of Pandospan. Additionally, unmitigated changes to graves will result in the involvement of local, provincial and national authorities, as well as potentially national media attention.	
Intensity	Extremely high – negative (-7)	This will be a major change to a heritage resource with very high CS	
Probability	Certain (7)	Without appropriate mitigation, the identified impacts will manifest	
Nature	Negative		
Mitigation / Management Actions			
Redesign of the proposed open pit should be considered to exclude and conserve the identified burial grounds and graves in situ. Where this is possible, a BGGC must be completed to reach agreement with bona fide NoK with regards to access and conservation of the burial grounds and graves. The assessor is aware, however, that the location of the open pit is limited by the resource, and redesign of may not be economically viable. Where redesign is not feasible, complete a BGGC and GRP as regulated by Section 36 of the NHRA and Chapters XI and IX of the Regulations to the Act must be implemented to identify as far as possible bona fide NoK to consult and reach agreement as to the appropriate management of the burial grounds through a required GRP.			
Post-Mitigation			
Duration	Beyond project life (6)	The relocation of the burial grounds will result in an immediate change to the burial grounds and graves, the effects of which, such as social issues, may extend beyond the life of the project.	Moderate (negative) (-90)

Dimension	Rating	Motivation	Significance
Extent	Limited (2)	The extent of the impact will be limited to burial grounds and graves within the project boundaries and the identified NoK	
Intensity	Extremely high - negative (-7)	The mitigation will result in a major change to a heritage resource with very high significance. Grave relocation is inherently negative, as the physical and social contexts of graves are destroyed through the act of exhumation and relocation.	
Probability	Highly probable (6)	It is probable that mitigation measures will reduce the consequence of the identified impact.	
Nature	Negative		

11.1.11.2.3 Decommissioning and closure

Although no impacts during the decommissioning and closure phase of the Project have been identified, AOL should be cognisant that if, at the time of decommissioning and closure any infrastructure is older than 60 years, it will be subject to permitting requirements as required under Section 34 of the NHRA and Chapter III of the NHRA Regulations.

11.1.12 Social Impact Assessment

Predicted impacts have been categorised in terms of the Project phase in which it is likely to originate (construction, operation or closure), recognising that many impacts will span over more than one project phase. Within each category, anticipated positive and negative impacts have been grouped together.

11.1.12.1 Construction Phase

Predicted construction phase impacts include three positive and six negative impacts. The majority of these impacts will continue into the operational phase and beyond, and should, therefore, be mitigated or enhanced continuously during the life of the project

11.1.12.1.1 Impact Description

Table 11-116 lists the social impacts that were identified for construction Phase of the Project. Activity/s that will directly or indirectly contribute to triggering the impact is also tabled. It should be noted that the tabled activities includes activities outlined in the Mine Work Programme (MWP), SLP as well as activities generally associated with the identified impact.

Table 11-116: Overview of Potential Impacts – Construction Phase

Type	Impact name	Activities triggering impact
Positive	Employment creation during construction	Most project activities during construction and operation will require a workforce. The following activities are direct trigger of employment: ▪ Employment and capital expenditure; and ▪ Construction of mine related infrastructure, including haul roads, pipes and dams
	Multiplier effects on the local economy	All project activities, which involves expenditure, especially the following ▪ Employment and capital expenditure; ▪ Construction of mine related infrastructure, including haul roads, pipes and dams; and ▪ Implementation of activities outline in the SLP and Social Performance Policies.
	Community development and social upliftment	All project activities which are necessary to sustain the construction and functioning of the Project, as the Project as a whole is obligated to adhere to its SLP and community development commitments, the following activities will be the primary triggers: ▪ Employment and capital expenditure; and ▪ Implementation of SLP commitments and Social Performance Policies.
Negative	Displacement-related impacts	▪ The following activities will be the primary triggers of direct displacement related impacts: ▪ Land acquisition; ▪ Creation of Open pit to access coal reserves; ▪ Site clearing, including removal of topsoil and vegetation; ▪ Construction of surface infrastructure; and ▪ Blasting and development of initial box-cut, including stockpiling
	Disruption of movement patterns	The following activities will disrupt movement: ▪ Relocation of infrastructure, especially planned relocation of roads ▪ Blasting and development of initial box-cut, including stock piling; ▪ Construction of mine related infrastructure, including haul roads, pipes and dams; and ▪ Loading, hauling and stockpiling of overburden, and ROM coal.
	Influx related impacts	▪ All project activities will contribute to this impact, as it is the perception of the entire Project, as opposed to particular activities, which triggers influx. However, the following activities are usually the main drivers of influx: ▪ - Employment and operational expenditure; and

Type	Impact name	Activities triggering impact
		▪ - Construction of mine related infrastructure, including haul roads, pipes and dams.
	Impact on community health and safety	▪ All project activities will have some inherent risk for human health, however the following activities could have the most significant health and safety impacts ▪ Blasting and development of initial box-cut, including stock piling; ▪ Construction of mine related infrastructure, including haul roads, pipes and dams; ▪ Loading, hauling and stockpiling of overburden, ROM coal; ▪ Plant and equipment operations; ▪ Storage, handling and treatment of hazardous products and waste; and ▪ Demolition and removal of all infrastructure ▪ On-site water use and storage
	Impacts on surrounding land users	Most project activities will contribute to impacts on surrounding land users (e.g. noise, blasting, dust, etc.), especially: ▪ Blasting and development of initial box-cut, including stockpiling; ▪ Construction of mine related infrastructure, including haul roads, pipes and dams; ▪ Loading, hauling and stockpiling of overburden, ROM coal; ▪ Plant and equipment operations; ▪ On-site water use and storage ▪ Storage, handling and treatment of hazardous products and waste; and ▪ Demolition and removal of all infrastructure
	Opposition because of perceived negative impacts	All project activities. Stakeholders usually form perceptions on the Project as whole and not individual activities. However it is anticipated that stakeholders would be inclined to submit grievances in relation to the impacts of the following activities: ▪ Blasting and development of initial box-cut, including stockpiling; ▪ Construction of mine related infrastructure, including haul roads, pipes and dams; ▪ Loading, hauling and stockpiling of overburden, ROM coal;

11.1.12.1.2 Impacts Rating

The potential socio-economic impacts during the Construction Phase, as described above, are rated in Table 11-117 to Table 11-125 below.

Table 11-117: Employment creation during construction

Dimension	**Rating**	**Motivation**	**Significance**
Activity and Interaction: Site Establishment			
Impact Description: Employment creation during construction			
Prior to Enhancement / Management			
Duration	Short term (2)	Construction activities will take place during the first 12 months of the life of Mine	Significance: Minor - positive (36)
Extent	Regional (4)	Although a substantial proportion of the workforce will likely originate from within the secondary study area, a considerable number of employees will be from areas located elsewhere in Gauteng and Mpumalanga Province	
Intensity	Moderate - positive (3)	Recruitment policies already promote local employment; however employment numbers expected to be low and for short period. Generally contractors tend to use their existing workforce, thereby sustaining current employment with these companies.	
Probability	Probable (4)	Without appropriate mitigation and regulation, local employment targets might not be achieved and/or maximised.	
Nature	Positive		
Enhancement / Management Actions			
▪ Assign preferred employment status to those experiencing the bulk of the negative project impacts (communities located within and surrounding the Project footprint e.g. Palmietkuilen Community, Vischkuil, Endicott, Welgedacht, Slovo Park, etc.); ▪ Promotion of local, female and youth employment to achieve and where feasible exceed the targets set out by the Mining Charter; ▪ Where possible labour-intensive construction methods should be promoted; ▪ Verification of local residential status through consultation with appropriate authorities (e.g. municipal structures, community leaders, and landowners) ▪ Consult neighbouring businesses/mines to determine if they would be willing to make their skills registers available; ▪ Identify required core skills, expand skills audits to community and align and implement training and skills development initiatives to findings of audit; ▪ Expand skills development programmes, especially ABET programmes, to include surrounding communities; ▪ Recruitment via a registry of job seekers and potentially coordinated through the Department of Labour (DoL); ▪ Provide local employees with reference letters certificates of completion for in-house (on-the-job) training; and ▪ Monitor subcontractors in terms of local employment targets.			

Dimension	Rating	Motivation	Significance
Post-Enhancement			
Duration	Short term (2)	Construction activities will take place during the first 12 months of the life of Mine	Significance: Moderate - positive (84)
Extent	Regional (4)	Although a substantial proportion of the workforce will likely originate from within the secondary study area, a large number of employees will be from areas elsewhere in Gauteng and Mpumalanga Province	
Intensity	Very high - positive (6)	Measures will ensure and potentially increase employment from local labour sending area, which will intensify positive change, especially among economically depressed households.	
Probability	Certain (7)	Monitoring will ensure that local recruitment targets are achieved	
Nature	Positive		

Table 11-118: Multiplier effects on the local economy

Dimension	Rating	Motivation	Significance
Activity and Interaction: Site Establishment			
Impact Description: Multiplier effects on the local economy			
Prior to Enhancement / Management			
Duration	Beyond project life (6)	Will continue throughout the life of mine as per stipulations of MPRDA and will only taper down after closure	Significance: Minor - positive (52)
Extent	Regional (4)	Will include mostly include impacts in the secondary, however some specialised services will, at least initially, be procured from elsewhere in Gauteng or Mpumalanga Province	
Intensity	Moderate - positive (3)	Will derive from increased cash flow, stimulation of economic sectors, procurement, economic growth, increased local markets, and LED and HRD initiatives	
Probability	Probable (4)	Will depend on: proportion of local spending by employees; capacity of local enterprises to supply; effectiveness of LED and HRD initiatives.	
Nature	Positive		
Enhancement / Management Actions			

Dimension	Rating	Motivation	Significance
As for maximising employment benefits. Also: ▪ Give preference first to capable local service providers; ▪ Develop local service provision capacity; ▪ Monitoring of sub-contractors procurement; ▪ Development of a register of local all, Medium and Micro-sized Enterprises (SMMEs); ▪ Linkages with skills development/ SMME development institutions and other mining operations; ▪ SMME skills development as part of mine SLP/LED commitments; and ▪ Local procurement targets should be formalised in AOL's procurement policy.			
Post-Enhancement			
Duration	Beyond project life (6)	Will continue throughout the life of mine as per stipulations of MPRDA and will only taper down after closure	Significance: Moderate - positive (96)
Extent	Regional (4)	Will include mostly include impacts in the secondary, however some specialised services will, at least initially, be procured from elsewhere in Gauteng or Mpumalanga Province	
Intensity	Very high - positive (6)	Mitigation will increase the intensity of multiplier effects substantially as it will concentrate impact to local area; sustainability of initiatives outlined in the SLP will also be increased if aligned with other those of other institutions	
Probability	Highly probable (6)	Increased local employment and procurement as well as skilled SMMEs will enhance likelihood of benefits to local economy	
Nature	Positive		

Table 11-119: Community Development and Social Upliftment

Dimension	Rating	Motivation	Significance
Activity and Interaction: Site Establishment			
Impact Description: Community Development and Social Upliftment			
Prior to Enhancement / Management			
Duration	Project Life (5)	Will continue for the life of mine (43 years)	Significance: Minor - positive (44)
Extent	Local (3)	Will benefit mine workers and some beneficiaries of LED projects, as well as HDSA vendors within local communities	
Intensity	Moderate - positive (3)	A relatively small proportion of population within the primary and secondary study area would be exposed to benefits	
Probability	Probable (4)	Without adequate stakeholder involvement LED and Skills Development projects is unlikely to be sustainable.	
Nature	Positive		

Dimension	Rating	Motivation	Significance
Enhancement / Management Actions			
▪ Liaison with beneficiaries to ensure needs are met; ▪ Collaboration with other developmental role players during implementation; ▪ Expanding skills development and capacity building programmes to non-employees; ▪ Establish external monitoring system to regulate HDSA procurement; ▪ Where feasible, training should be NQF accredited; and ▪ A record of training courses completed per individual should be kept.			
Post-Enhancement			
Duration	Beyond project life (6)	If well managed, benefits could be sustainable beyond project life	Significance: Moderate - positive (84)
Extent	Local (3)	Will benefit mine workers and some beneficiaries of LED projects, as well as HDSA vendors within local communities	
Intensity	High - positive (5)	Recommended measures will result in greater development within surrounding communities	
Probability	Highly probable (6)	Recommended measures will increase probability of socio-economic development initiatives having the desired effect	
Nature	Positive		

Table 11-120: Displacement Related Impacts

Dimension	Rating	Motivation	Significance
Activity and Interaction: Site Establishment			
Impact Description: Displacement Related Impacts			
Prior to Mitigation / Management			
Duration	Permanent (7)	Affected households and economic land uses will be permanently displaced.	Significance: Major - negative (-112)
Extent	Limited (2)	Although a considerable number of households will be directly displaced and a comparatively larger number of people will be exposed to indirect displacement impacts, the impact will be limited to certain areas of the primary study area	
Intensity	Extremely high - negative (-7)	Displacement will have a major impact on the livelihood on a large proportion of the population who currently resides within the primary study area	
Probability	Certain (7)	Nature and location of the Project will inevitably result the displacement of households, agricultural land, grazing and associated livelihoods, if existing mining plan is executed	
Nature	Negative		
Mitigation / Management Actions			

Dimension	Rating	Motivation	Significance
▪ AOL should where possible endeavour to minimise the extent of, displacement through project design, where displacement cannot be minimised the following measures are recommended to alleviate the adverse impacts: ▪ AOL should finalise the Project layout plan and determine its policy and approach to displacement, as this would inform the extent of resettlement, i.e. whether it will recognise both direct and indirect forms of displacement as well as whether they will strive towards international best practice or local standards; ▪ The sales agreement of land should reflect the holistic value (determined by a professional valuer) of the land and should also be inclusive of the potential relocation cost of commercial farms and/or business operations; ▪ The displacement of non-vulnerable households and individuals should be considered on a case-by-case basis; ▪ Areas impacted upon during construction should be rehabilitated upon completion of the construction activities to ensure that the land is returned in the same condition; ▪ Prior to finalising the sales agreement of land, it should be clear who will assume responsibility for the resettlement of vulnerable households, especially households comprising the community residing on Palmietkuilen 241 IR Ptn 2; ▪ If AOL assumes responsibility for displaced households, due process should be followed when these households are relocated. It is recommended that the process be aligned to IFC PS 5 and that a Resettlement Action Plan be developed; and ▪ Consider including employees and other impacted businesses in the aforementioned process.			
Post-Mitigation			
Duration	Permanent (7)	Affected households and economic land uses will be permanently displaced.	Significance: Moderate - negative (-84)
Extent	Limited (2)	The impact will be limited to certain areas of the primary study area	
Intensity	High - negative (-5)	Although adequate mitigation will reduce the adverse effects of displacement, it will not prevent it	
Probability	Highly probable (6)	Measures would decrease the probability of impacts occurring to the intensity predicted	
Nature	Negative		

Table 11-121: Disruption of Movement Patterns

Dimension	Rating	Motivation	Significance
Activity and Interaction: Site Establishment			
Impact Description: Disruption of Movement Patterns			
Prior to Mitigation / Management			
Duration	Project Life (5)	Will be most pronounced during construction phase, but continue into operations as result of operational traffic (e.g. workforce), as well as into decommissioning when infrastructure will be deconstructed	Significance: Minor - negative (-72)
Extent	Local (3)	Will mostly affect road users using the R29, Strijdpan road and affected gravel roadways	

Dimension	Rating	Motivation	Significance
Intensity	Moderately high - negative (-4)	Disruption of movement will impact a considerable number of road users. Traffic impact assessment, predicted a significant impact on traffic loads in the local road network; however some impact will stem from deterioration of local roads due to HMV. It should be noted that the study area is furnished with alternative routes, which will decrease intensity to a certain degree.	
Probability	Highly probable (6)	Construction and operational traffic, road upgrades, and relocation of the Strijdpan road will disrupt travelling on major roads	
Nature	Negative		
Mitigation / Management Actions			
Measures to prevent deterioration of roads suggested in Traffic Impact Assessment; ▪ Regulation of traffic at intersections between the R29 and site-access roads to construction and operational site; ▪ Road upgrading measures should be investigated and implemented in conjunction with the relevant government department; ▪ Inform communities of planned construction activities that would affect vehicle/ pedestrian traffic; and ▪ Ensure that access to key services in areas such as Springs are uninterrupted by providing alternative access routes, especially during relocation of Strijdpan Road.			
Post-Mitigation			
Duration	Project Life (5)	Will be most pronounced during construction phase, but continue into operations as result of operational traffic (e.g. workforce), as well as into decommissioning when infrastructure will be deconstructed	Significance: Minor - negative (-40)
Extent	Local (3)	Will mostly affect road users using the R29, Strijdpan road and affected gravel roadways	
Intensity	Low - negative (-2)	Mitigation measures should be effective in reducing severity of impacts	
Probability	Probable (4)	Mitigation will reduce the likelihood of this impact occurring to the extent predicted	
Nature	Negative		

Table 11-122: Influx Related Impacts

Dimension	Rating	Motivation	Significance
Activity and Interaction: Site Establishment			
Impact Description: Influx Related Impacts			
Prior to Mitigation / Management			
Duration	Beyond project life (6)	Likely to extend into the decommissioning phase, especially if social pathologies such as HIV/AIDs and other communicable diseases are left un-mitigated	Significance: Moderate -

Dimension	Rating	Motivation	Significance
Extent	Local (3)	Will mostly affect settlements within the primary and secondary study area	negative (-90)
Intensity	Very high - negative (-6)	Influx will likely exacerbate existing negative social conditions in several ways: increased social pathologies, pressure on service, conflict between locals and non-locals and establishment of informal settlements	
Probability	Highly probable (6)	Pressure on services and growth of informal settlements is already a problem	
Nature	Negative		
Mitigation / Management Actions			
▪ Develop an Influx management plan together with other industry role players and government; ▪ Discourage influx of job-seekers by prioritising employment of unemployed members of local communities; ▪ Liaise with local municipalities to ensure that expected population influx is taken into account in infrastructure development and spatial development planning; ▪ Create synergies with local government IDP and other companies' SLP/CSR projects to promote infrastructure development; ▪ Extensive HIV/ AIDS awareness and general health campaign; ▪ Identify if recorded criminal activities involved members of the mine's workforce; ▪ Clear identification of workers; prevention of loitering; ▪ Liaison with police, community policing forum; ▪ Promote projects providing housing, especially low cost housing; ▪ Community education; and ▪ Measures to address potential conflict between locals and non-locals			
Post-Mitigation			
Duration	Project Life (5)	Successful mitigation will restrict long-lasting consequences of influx to within the LoM	Significance: Minor - negative (-40)
Extent	Limited (2)	Measures to address influx will limit the extent, especially through proactive spatial development planning	
Intensity	Moderate - negative (-3)	Mitigation measures should be effective in reducing severity of impacts to a limited degree	
Probability	Probable (4)	Mitigation will reduce the likelihood of this impact occurring to the extent and intensity initially predicted	
Nature	Negative		

Table 11-123: Impact on Community Health and Safety

Dimension	Rating	Motivation	Significance
Activity and Interaction: Construction of mine related infrastructure, including haul roads, pipes, dams			
Impact Description: Impact on Community Health and Safety			
Prior to Mitigation / Management			
Duration	Project Life (5)	Will continue for the duration of the project	Significance: Moderate - negative (-78)
Extent	Limited (2)	Will primarily affect those within the primary study area and commuters on local roads	
Intensity	Very high - negative (-6)	Injuries and vehicular accidents could have fatal consequences. Could place the lives of employees, land occupants and road users at risk, especially those travelling on the R29 roadway	
Probability	Highly probable (6)	The nature of the project requires the infrastructure and activities described, which hold an inherent risk	
Nature	Negative		
Mitigation / Management Actions			
▪ Access control to all project elements, including fencing prior to commencing construction; ▪ Notification of blasting activities; ▪ Storage of blasting and hazardous materials should adhere to prescribed regulation; ▪ Measures suggested minimising the impact of fly-rock on surrounding roads and structure (Blast Management and Consulting, Appendix L); ▪ Measures suggested in the Traffic Impact Assessment to minimize traffic related accidents (Traffic Impact Assessment, Appendix P); ▪ Road maintenance; and ▪ Community education			
Post-Mitigation			
Duration	Project Life (5)	Will continue for the duration of the project	Significance: Negligible - negative (-33)
Extent	Limited (2)	Will primarily affect those within the primary study area and commuters on local roads	
Intensity	Moderately high - negative (-4)	Appropriate mitigation will reduce the incidence of this impact; however, fatal accidents will not be entirely prevented	
Probability	Unlikely (3)	Impacts will still occur, albeit not to the degree it was initially expected	
Nature	Negative		

Table 11-124: Impact on Surrounding Land Users

Dimension	Rating	Motivation	Significance
Activity and Interaction: Construction of mine related infrastructure, including haul roads, pipes, dams			
Impact Description: Impact on Surrounding Land Users			

Dimension	Rating	Motivation	Significance
Prior to Mitigation / Management			
Duration	Beyond project life (6)	Residual biophysical impacts could occur beyond the life of mine, especially if rehabilitation is not executed	Significance: Moderate - negative (-84)
Extent	Limited (2)	Project area and neighbouring settlements	
Intensity	Very high - negative (-6)	- Mine could impact on visual character of area and on peoples' sense of place. - Mine could impact on viability of current economic activities on neighbouring properties - Mine may impact on existing water sources.	
Probability	Highly probable (6)	Impacts are largely unavoidable as a result of mining activities	
Nature	Negative		
Mitigation / Management Actions			
▪ Refer to recommendations of specialist studies (see Visual Impact Assessment, Surface-and Ground Water Impact Assessment, Noise Impact Assessment, Air Quality Impact Assessment, Blasting and Vibration Impact Assessment and Traffic Impact Assessment); ▪ Optimise mine plan/infrastructure placement to avoid/minimise negative impacts, especially in terms of visual intrusion, displacement, air quality and disruptions of traffic; ▪ Undertake continuous information sharing and consultation with adjacent/affected farm owners; and ▪ Implement communication mechanisms to report changes in water quality/quantity, air quality or vibrations.			
Post-Mitigation			
Duration	Project Life (5)	Adequate mitigation of bio-physical impacts and successful decommissioning will likely limit duration of impacts	Significance: Minor - negative (-44)
Extent	Limited (2)	Project area and neighbouring settlements	
Intensity	Moderately high - negative (-4)	Mitigation will slightly lessen physical impacts.	
Probability	Probable (4)	Impacts will still occur, albeit not to the degree it was initially expected. Affected people will likely adapt over time	
Nature	Negative		

Table 11-125: Opposition because of Perceived Negative Impacts

Dimension	Rating	Motivation	Significance
Activity and Interaction: Site Establishment			
Impact Description: Opposition because of Perceived Negative Impacts			
Prior to Mitigation / Management			
Duration	Beyond project life (6)	May continue throughout the life of the operation, and potentially beyond affecting AOL's Social Licence to Operate neighbouring mines	Significance: Minor - negative (-56)
Extent	Local (3)	Will not only elicit opposition from primary study area, but stakeholders in the broader area (e.g. activist groups)	
Intensity	High - negative (-5)	Could lead to negative publicity for the company; community mobilisation against the project and stoppages in construction and operation	
Probability	Probable (4)	Stakeholders, especially private landowners, are sensitive towards many possible impacts that may result from development	
Nature	Negative		
Mitigation / Management Actions			
▪ Communicate commitments regarding LED; ▪ Transparency regarding employment practices; ▪ Presentation of EIA findings in clear and understandable manner; ▪ Monitor community attitudes to anticipate/prevent active opposition; ▪ Establish a community forum which meets quarterly; and ▪ Appointment of a CLO to enhance communication.			
Post-Mitigation			
Duration	Beyond project life (6)	May continue throughout the life of the operation, and potentially beyond affecting AOL's Social Licence to Operate neighbouring mines	Significance: Negligible - negative (-33)
Extent	Local (3)	Will not only elicit opposition from primary study area, but stakeholders in the broader area (e.g. activist groups)	
Intensity	Low - negative (-2)	Widespread awareness of project benefits will decrease negative perceptions and offset some negative sentiments towards the applicant.	
Probability	Unlikely (3)	Mitigation will reduce the probability of the impact occurring as opposed to reversing the nature of the impact.	
Nature	Negative		

11.1.12.2 Operational Phase

This section deals with the socio-economic impacts that will be triggered by activities that will commence during the operational phase of the proposed Project. The only impact identified in the construction phase impacts above that will not continue into the operational phase is construction-related employment creation. Additional impacts expected to arise during the operational phase include two positive impacts (operational employment, and stimulation and growth of the local and regional economy). Each of the aforementioned impacts is discussed in greater detail below.

11.1.12.2.1 Impact Description

Table 11-126 lists the social impacts that were identified for operational phase of the Project. Activity/s that will directly or indirectly contribute to triggering the impact is also tabled. As with the construction phase impacts, the tabled activities include activities outlined in the Mine Work Programme (MWP), SLP as well as activities generally associated with the identified impacts.

Table 11-126: Overview of Potential Impacts – Operational Phase

Type	Impact name	Activities triggering impact
Positive	Employment creation during operational phase	Most project activities during operation will require a workforce.
	Stimulation and growth of the local and regional economy	The following activities will be the primary triggers of economic growth: ▪ Employment and project expenditure; ▪ Payment of royalties and taxes; ▪ Successful implementation of SLP; and ▪ Plant and equipment operations.

11.1.12.2.2 Impacts Rating

The potential socio-economic impacts during the Operational Phase, as described above, are rated in Table 11-127 and Table 11-128 below.

Table 11-127: Employment creation during operation

Dimension	Rating	Motivation	Significance
Activity and Interaction: Mining Operations			
Impact Description: Employment creation during operation			
Prior to Enhancement / Management			
Duration	Project Life (5)	Equal to the duration of the operational phase	Significance: Minor - positive (55)
Extent	Regional (4)	Many positions will be filled by persons living in the municipal wards and regional municipal area; however some will be recruited from elsewhere in the Province	

Dimension	Rating	Motivation	Significance
Intensity	Low - positive (2)	Limited employment opportunities will be available for un- and semi-skilled individuals	
Probability	Likely (5)	Without appropriate mitigation, forecasts of majority local recruitment will likely not be achieved	
Nature	Positive		
Enhancement / Management Actions			
▪ Measures to enhance local employment during construction (see measures to enhance employment during construction); ▪ Provide focused training to construction phase employees from the host communities to increase their chances for employment during the operations; ▪ Measures recommended to maximise benefits from local employment, and economic multiplier effects; and ▪ The Project's database of the local labour pool should be updated to include people who were employed by the Project during the construction phase.			
Post-Enhancement			
Duration	Project Life (5)	Equal to the duration of the operational phase	Significance: Moderate - positive (90)
Extent	Regional (4)	Many positions will be filled by persons living in the municipal wards and regional municipal area; however some will be recruited from elsewhere in the Province	
Intensity	Very high - positive (6)	Mitigation will maximise local job creation	
Probability	Highly probable (6)	Mitigation will maximise probability that local recruitment targets are achieved and local benefits optimised	
Nature	Positive		

Table 11-128: Stimulation and growth of the local and regional economies

Dimension	Rating	Motivation	Significance
Activity and Interaction: Mining Operations			
Impact Description: Stimulation and growth of the local and regional economies			
Prior to Enhancement / Management			
Duration	Project Life (5)	Expenditure on procurement, wages and royalties will continue for the entire life of Mine	Significance: Minor - positive (44)
Extent	Regional (4)	Royalties and taxes will aid regional development - culmination of positive economic effects will stimulate economic growth	
Intensity	Low - positive (2)	Economic growth will have positive outcomes for a substantial number of businesses and households	

Dimension	Rating	Motivation	Significance
Probability	Probable (4)	AOL is obliged by law to pay royalties and taxes, and some economic multiplier effects will spill-over into regional economic development	
Nature	Positive		
Enhancement / Management Actions			
▪ Measures recommended to maximise benefits from local employment, economic multiplier effects, as well as community, economic and skills development; ▪ Procure from local HDSA suppliers throughout the life of the mine; and ▪ Establish a monitoring system to ensure that the mine and its contractors comply with government regulations			
Post-Enhancement			
Duration	Beyond project life (6)	Successful mitigation will prolong benefits of economic development beyond life of mine	Significance: Moderate - positive (84)
Extent	Regional (4)	Royalties and taxes will aid regional development - culmination of positive economic effects will stimulate economic growth	
Intensity	Moderately high - positive (4)	Successful mitigation will promote an environment conducive for economic growth	
Probability	Highly probable (6)	Mitigation will increase the chance of the manifestation of this impact	
Nature	Positive		

11.1.12.3 Decommissioning Phase

The eventual termination of a Mine's operating life inevitably result in several socio-economic consequences (IFC, 2002; United Nations Environment Programme, 2005). It should be noted that any predictions concerning the characteristics of the receiving socio-economic environment at the time of decommissioning are subject to a large margin of error, thus significantly reducing the accuracy of impact assessment. Several socio-economic impacts could arise when the Mine is decommissioned and should therefore form part of the scope of study when the EIA for decommissioning the Project is planned.

Most socio-economic impacts related to decommissioning are related to dependencies created by the Project throughout its operations.

11.1.12.3.1 Impact Description

Table 11-129 lists the social impact identified for the decommissioning phase of the Project.

Table 11-129: Overview of Impacts – Decommissioning Phase

Phase	Type	Impact name	Activities triggering impact
Decommissioning/ closure	Negative	Dependency on mine for	Activities triggering impact: ▪ Employment and operational

Phase	Type	Impact name	Activities triggering impact
		sustaining the local economy, including	expenditure; and ▪ Dismantling of major equipment and infrastructure.

11.1.12.3.2 Impact Rating

The potential socio-economic impacts during the Decommissioning Phase, as described above, are rated in Table 11-130 below.

Table 11-130: Dependency on mine for sustaining local economy

Dimension	Rating	Motivation	Significance
Activity and Interaction: Site Decommissioning			
Impact Description: Dependency on mine for sustaining local economy			
Prior to Mitigation / Management			
Duration	Long term (4)	Effects of retrenchments/ decommissioning will be long-lasting	Significance: Moderate - negative (-78)
Extent	Local (3)	Will most severely affect employees and service providers from the secondary study area	
Intensity	Very high - negative (-6)	Local economy may become increasingly dependent on mining	
Probability	Highly probable (6)	The project will come to an end, and retrenchments are likely due to duration of operational phase	
Nature	Positive		
Mitigation / Management Actions			
▪ Develop alternative and sustainable livelihoods; ▪ Collaborate with other industries to support the diversification of the local economy; ▪ The Mine's SLP should provide strategies and measures that prevent job loss; ▪ Alternatives to save jobs/avoid downscaling should be investigated beforehand; ▪ Develop a Mine Closure Plan; ▪ Proactively assess and manage the social and economic impacts on individuals, regions and economies where retrenchment and/or closure of the mine are certain; and ▪ Partner with the relevant government departments, to jointly manage Closure process			
Post-Mitigation			
Duration	Medium term (3)	Successful mitigation will reduce the duration of the impact	Significance: Minor - negative (-50)
Extent	Local (3)	Will most severely affect employees and service providers from the secondary study area	
Intensity	Moderately high - negative (-4)	Mitigation will reduce the impact of retrenchment on a considerable number of households	

Dimension	Rating	Motivation	Significance
Probability	Likely (5)	Mitigation will reduce severity of impact on retrenched workers	
Nature	Positive		

11.1.13 Macro-Economic Impact Assessment

11.1.13.1 Construction Phase

During the construction phase, activities such as engineering and design, site and infrastructure development, construction of buildings and facilities, installation of machinery and equipment, civil engineering works, and other business activities related to the construction of the mine.

11.1.13.1.1 Impacts Description

Impact on Production

As indicated in Table 11-131 the direct effect will be experienced in the mining sector as this phase is not solely inclusive of construction but dominantly the accumulation and preparation of mining operations. In addition, the construction phase encompasses capital expenditure into mining equipment and services, process equipment, and infrastructure.

The economic benefits of the investment into the proposed mine will spread throughout the national economy and will positively impact all economic sectors. The effect is categorised according to direct, indirect and induced impacts, together forming the multiplier effect. These various impacts spread throughout the economy, contributing to heightened production levels.

The initial construction-related activities required for the proposed mine establishment will take place over one year, although some of the capital expenditure will continue into the second and third years of the mine's lifespan. The R476 million (2016 prices) of investment planned to be spent during this stage, over a period of three years, will increase the production output of the national economy by R814.0 million (2016 prices). This denotes that for every R1 spent, a R1.71 increase in production within the South African economy will ensue.

Approximately R207.7 million (2016 prices) of the production output generated, as a result of the construction activities, will be triggered by indirect effects of production-prompted effects; i.e. by companies that will be supplying inputs and services to the contractors and engineering firms operating on site. The indirect effects during the construction period will be distributed throughout the country depending on the location of the suppliers.

Mining preparations and construction activities will stimulate the creation of new temporary employment opportunities through both direct and indirect effects that will resultantly increase household income. This will in turn stimulate sales in a variety of sectors through an increased household's consumption. About R130.2 million (2016 prices), or 16%, of the production output generated by the project will be as a result of consumption induced effects. The sectors benefitting the most from induced effects are the manufacturing sector, real estate and business services, and trade and accommodation. Although the majority of new business sales stimulated through consumption induced effects will be distributed throughout the country, a portion of it will be captured by the local economy.

Table 11-131: Impact on Production during construction (R million) (2016 prices)

Sector	Direct	Indirect	Induced	Total	Percentage (Total)
Agriculture	-	R0.0	R1.3	R1.3	0.2%
Mining	R476.0	R56.7	R0.6	R533.3	65.5%
Manufacturing	-	R36.9	R50.8	R87.7	10.8%
Electricity	-	R2.0	R3.2	R5.2	0.6%
Water	-	R0.0	R1.4	R1.4	0.2%
Building and Construction	-	R20.3	R2.3	R22.6	2.8%
Trade and accommodation	-	R27.3	R15.5	R42.8	5.3%
Transport and storage	-	R20.5	R11.1	R31.7	3.9%
Financing	-	R5.6	R14.0	R19.6	2.4%
Real estate and business services	-	R33.6	R19.2	R52.9	6.5%
Government services	-	R3.9	R7.3	R11.1	1.4%
Other	-	R0.9	R3.5	R4.4	0.5%
Total	R476.0	R207.7	R130.2	R814.0	100.0%

Urban-Econ Modelling based on data supplied by Canyon Coal

Impact on GDP

Table 11-132 indicates that the direct expenditure into the establishment of Proposed Palmietkuilen Coal Mining Project will generate a direct R48.5 million worth of growth within the mining sector. Overall, the initial investment for the construction of the Project will inflate the South African GDP by R195.3 million. This is a lower than expected figure, due to the fact that:

- A large volume of mining equipment that will be procured for the establishment of the mine will be bought from a local representative of the global Original Equipment Manufacturer, i.e. it will be imported into the country and not manufactured locally; and

- Almost 22% of the total capital expenditure during the first three years will be directed towards land acquisition; such transactions have limited effect on value added creation.

In general, for every R1 spent on the establishment of the mine, approximately R0.41 will be generated in value added within the South African economy. The Gauteng Province is expected to realise the largest effect on GDP due to the specialised goods and services related to mining requirements offered within the province.

The indirect-impact is projected to create R93.9 million in value added within the national economy. Sectors forecast to greatly benefit from the indirect impacts include the Mining Sector, Trade and Accommodation, Real Estate, and Business Services. As encountered within production, the growth resulting from the production induced impact will cause employment numbers and the related salary costs to increase throughout the economy. The consequent consumer-induced effect will offer stimulus sector-wide; the induced impact is projected to create approximately R52.9 million in value added within the national economy. The Manufacturing Sector will experience the greatest value added due to consumption stimulation.

Table 11-132: Impact on GDP during construction (R' million) (2016 prices)

Sector	Direct	Indirect	Induced	Total	Percentage (Total)
Agriculture	-	R0.0	R0.7	R0.7	0.3%
Mining	R 48.5	R31.3	R0.3	R80.1	41.0%
Manufacturing	-	R9.3	R13.3	R22.6	11.6%
Electricity	-	R1.1	R1.7	R2.8	1.4%
Water	-	R0.0	R0.5	R0.5	0.2%
Building and Construction	-	R6.3	R0.6	R6.9	3.5%
Trade and accommodation	-	R13.9	R7.5	R21.4	11.0%
Transport and storage	-	R8.8	R4.7	R13.6	6.9%
Financing	-	R3.4	R8.5	R11.8	6.1%
Real estate and business services	-	R17.0	R9.6	R26.6	13.6%
Government services	-	R2.1	R3.6	R5.6	2.9%
Other	-	R0.6	R2.0	R2.6	1.3%
Total	R 48.5	R93.9	R52.9	R195.3	100.0%

Urban-Econ Modelling based on data supplied by client

Impact on Economy

The municipality perceives mining as an opportunity sector in terms of the notable potential employment it can create. Approximately 6 985 people in the LLM are unemployed (Urban-Econ calculations based on Quantec, 2016). However, unemployment has been lessening over the past five years in the LLM. This is attested by the constant decrease in the number of unemployed working-age individuals and the increase of the number of employed working age individuals, annually. The proposed project will also consequently assist in the continuation of this trend.

The establishment of the proposed mine is expected to create 695 Full Time Equivalent (FTE) man-years over the construction period, most of which will be created during the first year of the mine's project lifespan:

- About 136 FTE man-years or 19% will be created on site itself during the first year of construction. Due to the nature of the work involved in the construction of the mine, the majority of positions made available on site are expected to be of a semi-skilled nature, which can be occupied by individuals with limited skills and experience. Therefore, these direct jobs are expected to be made available for the local community during mine establishment.
- In addition, 321 FTE man-years will be established through indirect impacts during the construction phase, while the rest (238 FTE man-years) will be created through consumption induced impacts. Real Estate and Business Services are expected to incur the highest increase in labour through indirect and induced effects.

Table 11-133: Impact on employment during construction (R million) (2016 prices)

Sector	Direct	Indirect	Induced	Total	Percentage (Total)
Agriculture	-	0	10	10	1.5%
Mining	136	26	0	162	23.4%
Manufacturing	-	15	20	34	4.9%
Electricity	-	1	1	2	0.2%
Water	-	0	0	0	0.1%
Building and Construction	-	19	2	21	3.0%
Trade and accommodation	-	59	33	92	13.2%
Transport and storage	-	25	11	36	5.2%
Financing	-	26	66	92	13.2%
Real estate and business services	-	146	83	229	32.9%
Government services	-	4	8	13	1.8%

Sector	Direct	Indirect	Induced	Total	Percentage (Total)
Other	-	1	3	4	0.6%
Total	136	321	238	695	100.0%

Urban-Econ Modelling based on data supplied by client

Impact on Skills development

A third of the employed people in the LLM are semi-skilled, just under a quarter are low-skilled and 14% are skilled. The Proposed mine will provide a platform for low-skilled and semi-skilled people to develop and attain new skills. The construction of the proposed mine will require general construction experience as well as some mining-related expert knowledge. Workers already adept in particular skills will sharpen their abilities. Although the construction phase will be temporary, the impact on skills development is sustainable and has a positive impact on the employability of the affected individuals in the future.

Impact on Household Income

Household earnings are closely associated with trends in employment and as such will be positively affected by the increase in FTE person-years resulting from the investment into the mine's establishment, as discussed. The creation of 695 direct, indirect and induced FTE man-years during the construction period will temporarily increase affected households' income to the value of R101.5 million in 2016 prices. Approximately 43% of this will be earned by households whose members will be working at the project site itself. It is anticipated that most of this direct income earned by households will remain in the local communities. Additionally, an improvement in the standard of living of the benefiting households will occur, albeit temporarily.

Businesses supplying inputs to the mine's establishment are expected to indirectly benefit and earn R34.5 million in household income (2016 prices). Due to increased household consumption induced through the creation of direct and indirect employment opportunities, an additional R23 million will be earned by households in South Africa. Overall, trade and accommodation, mining, and the manufacturing sectors will have the greatest gains in household income.

Table 11-134: Impact on Household Income (R million) (2016 prices)

Sector	Direct	Indirect	Induced	Total	Percentage (Total)
Agriculture	R0.0	R0.0	R0.2	R0.2	0.2%
Mining	R44.0	R8.2	R0.1	R52.3	51.6%
Manufacturing	R0.0	R4.7	R6.0	R10.7	10.6%
Electricity	R0.0	R0.4	R0.7	R1.1	1.0%

Water	R0.0	R0.0	R0.1	R0.1	0.1%
Building and Construction	R0.0	R2.7	R0.3	R3.0	2.9%
Trade and accommodation	R0.0	R6.5	R3.5	R10.0	9.9%
Transport and storage	R0.0	R3.5	R1.7	R5.2	5.1%
Financing	R0.0	R1.5	R3.7	R5.2	5.1%
Real estate and business services	R0.0	R5.1	R3.1	R8.2	8.1%
Government services	R0.0	R1.4	R2.2	R3.7	3.6%
Other	R0.0	R0.4	R1.5	R1.9	1.9%
Total	R44.0	R34.5	R23.0	R101.5	100.0%

Urban-Econ Modelling based on data supplied by Canyon Coal

Impact on Government Revenue

The construction phase of the Proposed Palmietkuilen Coal Mine will span for a period of one year, although some capital equipment will be purchased during the second and third year of the mine's ramp up period. Regardless of the duration of the construction phase, as a result of capital expenditure on the project, companies will be generating a revenue and employ people. From this, companies are obliged to pay the government income taxes and payroll taxes. Additionally, increased spending power will translate into more purchases, which would increase the Value Added Tax base for government. The various tax received by government improves government's ability to deliver services.

Impact on Agricultural Production due to Sterilisation of Productive Agricultural Land

The Project area and surrounding areas are dominantly characterised by agricultural activity, non-operational and operational mining activity and agricultural holdings, with pockets of industrial activity. The main agricultural activities are maize farming, soya bean farming, as well as chicken farming. The agricultural dominance can be attributed to the high land capability. One municipal official stated that the municipality is working towards developing local agro-processing sector; thus, accentuating the importance of having access to local agricultural land now, and in the near future.

The proposed project will sterilise all surface areas that will be affected by the footprint of the mine and its infrastructure as indicated in Plan 2 above. This will have adverse effects on the agricultural activity taking place in the area and in the municipality. A loss of 140 Ha of land for irrigated crops and 1 749 Ha of land for dry land crops is envisaged to ensue.

The Gauteng Province contributes 5% to national maize production and 7% to soya bean production. Thus, at a national scale, the Gauteng Province is not a key producing province for maize and soya beans. However, collectively, farms in the LLM make a notable contribution towards the above-mentioned productions in the province.

It should be noted that productive utilisation of agricultural land is key to the food security in the country. However, in the past few years, the areas under maize has seen large upward and downward fluctuations, while the area under soya and dry beans, for example, has been steadily increasing. Production of soya beans, as a result, has seen a staggering increase of 50% between 2010/2011 and 2014/2015 (from 710 000 t to 1 070 000 t); while production of dry beans almost doubled, and grew from 46 000 t in 2010/2011 to 81 000 in 2014/2015. The situation with maize production has seen a somewhat different trend, but when compared to 2010/2011, the area under maize was slightly bigger but the production was slightly smaller.

One of the biggest threats to the retention of productive agricultural land is the conflict between agriculture and mining land uses. An analysis of the Mpumalanga area, adjacent to the current Project area, has revealed a trend of mining developments taking over agricultural land (BFAP, 2012). In the long term, therefore, food security may be under threat if the trend continues and large-scale cumulative effects ensue.

According to the owner of the land, where the proposed project is to be established, there is no alternative location for the continuation of agricultural activity. Inherently, the supply of agricultural produce derived from the land currently used for agricultural activities, but sterilised once the mine is established, to the provincial grain market and exports will cease. As indicated in the next table, it is estimated that the losses will equate to the following volumes in the context of 2014/2015 yields:

- About 0.07% and 1.5% of maize production in South African and Gauteng, respectively;
- Approximately 0.1% and 1.6% of production of soya beans in South African and Gauteng, respectively; and
- About 1.1% and 19.7% of dry beans production in in South African and Gauteng, respectively.

Overall it is clear that the sterilisation of land due to the mining activity will have a minor negative effect on production of maize and soya beans in the Gauteng Provinces, but will be significant in the context of the current production of dry beans in Gauteng. In the context of the South African economy, though, the production losses will be small and should not pose an immediate threat to food security in the country. However, the consideration of the loses on the proposed site together with the losses observed in the other parts of the country, the risks do exist, particularly if the affected land is considered to be a high productive arable land.

Table 11-135: Loss of agricultural land and production in the context of SA and Gauteng agricultural land and production

Indicator	Maize	Soya beans	Dry beans
Site related information			
Area (ha)	945	472	472
Yield (t/ha)	7.5	2.3	2

Indicator	Maize	Soya beans	Dry beans
Estimated production (t)	7 088	1 086	944
Loss in the context of SA			
Area planted in SA (2014/2015, ha)	3 048 000	687 000	64 000
Production in SA (2014/2015, t)	10 629 000	1 070 000	81 000
Sterilised land in %	0.03%	0.06%	0.7%
Lost production/yields in %	0.07%	0.1%	1.1%
Loss in the context of Gauteng			
Production in Gauteng (2014/2015, t)	486 000	69 000	4 800
Lost production/yields in %	1.5%	1.6%	19.7%

(Urban-Econ calculations based on interviews with the land owners and DAFF, 2016)

One landowner raised a concern over the spill-over effects on the local economy where land sterilisation will lead to the unsustainability of affected businesses in the area, leading some businesses to close and thus exacerbate unemployment. Overall, considering the agricultural area that will be subjected to the sterilisation as a result of the proposed project, approximately R38 000 000 in annual agricultural production will be forfeited, which is equivalent of 10.7% of agricultural production in the LLM and 0.02% of agricultural production in the country. The loss of direct agricultural production will have some negative effect on the businesses that supply inputs to the farmers, i.e. fuel, seeds, pesticides, fertilisers, utilities, etc., which will increase the footprint of the impact to the regional scale.

Potential Negative Impact on Property Values

The quality of life sought by rural residents reflects the many desirable attributes of rural settings including peace, solitude and proximity to nature. Farmers in particular, prefer arable land, adequate access to water, and access to transport routes amongst others. A mining development may alter this state of environment. Landowners raised concerns that the development of the mine will reduce the marketability of farms and diminish their land values. The general perception is that open pit mining is undesirable as it requires the removal of virtually all vegetation, topsoil and subsoil to access resource. As a result, natural habitats and pre-existing stream flows are disrupted (Hui, 2007).

Studies indicate that an open pit mine, like landfills and other disamenities may lower the market value of properties (Neelawala, 2012; Williams, 2011; Hui et al, 2007; Chicoine, 1981). The distance from the disamenities is a key factor, given that the closer a property is to an undesirable land use, the lower the property value may be (Williams, 2011). Map 4-2 below demonstrates that most receptors in the immediate surrounding areas will have moderate visual exposure to the mine. The receptors with high visual exposure and thus potentially lower property values are located on Farms Vischkuil, Geigerle and portions of Strydpan.

In addition, the negative attributes associated with disamenities creates negative perceptions about the area and deters potential buyers. In this case, the pre-construction awareness currently being spread about the proposed coal mine has shifted perceptions about the area and likely discouraged prospective buyers.

An additional concern raised by landowners has been water availability. Many of the farms rely on irrigation to derive their primary income and any impact on water availability for these farms would most likely reduce their value to potential buyers. Water scarcity on agricultural land, renders an area less attractive to existing and potential future farmers.

Real estate agents have revealed that the property market in the area surrounding the project site has been relatively down due to numerous factors such as the distance from town, the unwillingness of banks to offer 100% loans for plots, water availability and poor infrastructure. One of the real estate agents also argued that the establishment of the mine may not have a greater negative impact on property values than the squatter settlement in Vischkuil.

Overall, the establishment of the mine may prolong the low activity in the property market in the area, but considering the analysis of property value presented earlier in the report, it can be argued that only the farms with irrigated land in the direct proximity to the project site and Aston Lake land portions are likely to be slightly negatively impacted by the development of the mine.

Contrary to the issues discussed above, one of the real estate agents perceived an increase in the property market activity due to the influx of people into the area as a result of the mine. He argued that long term and short term accommodation will be a necessity for migrant labour.

<u>Potential Negative Impact on the Egg Industry and Its Value Chain due do Potential Environmental Effects Exerted by the Mine during both Construction and Operations</u>

The proposed mine is surrounded by a large activity of chicken farming. There are 19 chicken farms within a 10km radius around the Project area, represented by the small green points on Figure 11-13. The nearest five chicken farms to the mining footprint have been analysed, due to their close proximity to the proposed open pit coal mine. These farms are all within 3.5km from the project footprint, and are demonstrated with large green points on Figure 11-13. It is assumed that these facilities are likely to be subject to negative externalities from mining activities and environmental factors.

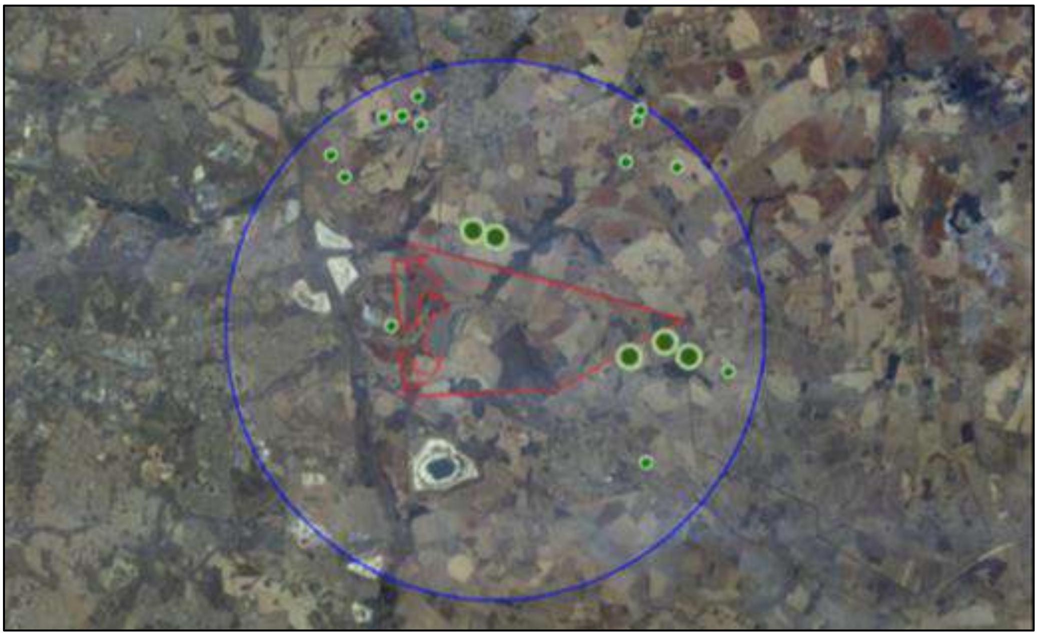


Figure 11-13: Chicken Farms within 10km radius of proposed project area

The proposed Project is considered a causative source of noise pollution. The selected chicken farms are located in the region where noise propagation is between 30 and 45 dBA during construction and operations. The Noise Impact Assessment deduced that the expected noise as a result of construction and operation activities will not likely cause a noise disturbance in terms of the Gauteng Noise Control Regulations at any receptor within the Gauteng Province. Noise propagation is most extreme at the infrastructure footprint and decreases outward.

In terms of air quality, dust deposition will deteriorate the current air quality and may affect chicken farming. However, the AQIA showed that with mitigation measures applied, the dust effects will be solely constrained to the mining footprint and Umbila Township. Therefore, chicken farming may not be affected if mitigation measures are adequately implemented.

An additional environmental factor that may affect chicken farming is the light intrusion during night time. According to Plan 36, the chicken farms are situated in areas of moderate to high visual exposure. This may have negative impacts on the chicken farming.

It is imperative to note that mining activity is not set to take place in one area for the LOM; thus, the continuation of chicken farming may not be affected for the entire construction and operation phase but will be affected during certain periods. Mining operations are set to expand in an easterly direction. Therefore, the mining impact will increase towards Farm Vischkuil and away from Farm Droogefontein, on an annual basis. This insinuates that mining impacts will lessen for chicken farms on the Farm Droogefontein and worsen for Farm Vischkuil over time. In this case, chicken farming will not cease but may need mitigation measures for periods of highest impact.

Numerous attempts have been made to obtain the economic activity information from the adjacent landowners of the five closest chicken farms; however, these telephonic and email interactions have not yielded any success. Due to this lack of primary information, estimations were made based on the assumptions derived from South African Poultry Association (SAPA) reports and statistics, as well as Department of Agriculture, Forestry and Fishery (DAFF) and Stats SA data.

The following estimates of economic activities could be determined for the chicken farms located in the immediate zone of influence of the project:

Table 11-136: Estimations of chicken farming production, revenue and employment in the zone of influence

Farm Portion	Number of layers and layer facilities	Dozens of eggs produced per week	Revenue		Number of Employees
			Weekly	Annual	
Portion 5 and 6 of Farm Vischkuil 274	188 188 (7 layer facilities)	109 776	1.4	74.8	49-63
Portion 8 of Farm Vischkuil 274 (north)	214 500 (6 layer facilities)	125 125	1.6	85.2	56-72
Portion 2 of Farm Vischkuil (south)	165 000 (4 layer facilities)	96 250	1.3	65.6	43-55
Portion 39 of Farm Droogfontein 242	211 068 (6 layer facilities)	123 123	1.6	83.9	55-71
Portion 33 of Farm Droogfontein 242	211 068 (6 layer facilities)	123 123	1.6	83.9	55-71
TOTAL	989 824 (29 layer facilities)	577 397	7.6	393.3	260-332

(Urban-Econ Estimations based on aforementioned assumptions)

From the estimated findings above, it is evident that the commercial chicken farming taking place on the adjacent properties is at a large scale and includes egg production. Over 100 000 layers are present at each chicken farm, producing total of over 570 000 dozens of eggs per week. It is also estimated that about R393 million is earned in turnover by the egg laying farms located in the zone of influence. Thus, collectively and separately, the chicken farms generate notable revenue. Lastly, between 260 and 332 employees are estimated to work on the above-mentioned farms and benefit from income earnings.

In the case of a complete shutdown of operations due to any negative effects of mining establishment and activity during operations, a loss of all aforementioned chicken farming attributes will take place. More specifically:

- The local agricultural sector will sharply contract losing R393 million in production output. Considering the number of hens and egg production observed in 2015 (refer to the earlier sections in the report), the loss will represent 4.0% of the total number of hens in the country and 4.6% of the eggs produced in South African in 2015;
- Rossgro has operations on the farm portions in Vischkuil, where 60% of their egg produce is supplied to major supermarkets such as Checkers, Shoprite, Spar and Pick and Pay and 40% is supplied to smaller retailers and informal traders (Rossgro, 2014). This supply chain will be discontinued;
- A loss of income and employment for between 260 and 332 individuals and their families will occur. This entails the termination of once sustainable earnings for numerous households and a possible deterioration in their standard of living; and
- Fourthly, the Rossgro website states that their operations are strategically located, and this enables the business to have low input costs. The relocation of chicken farming, if possible in this case, will need to take cognisance of these locational advantages and ensure that they are not lost.

11.1.13.1.2 Impacts Rating

The impacts on Macro-Economic aspects during the Construction Phase, as described above, are rated in Table 11-137 to Table 11-145 below.

Table 11-137: Increase in Production

Dimension	**Rating**	**Motivation**	**Significance**
Activity: Temporary increase in production during construction			
Impact Description: The impact takes place due to the investment on the project that will be spent in the country. Besides the direct impact, it involves the indirect and induced effects that are created when either suppliers of goods and services to the project experience an increase in demand, or when businesses servicing households experience an increase in demand for their products.			
Prior to Mitigation			
Duration	Medium-term (3)	The construction phase will last for one year	Moderate Positive (+78)
Extent	National (6)	Production increase will affect the entire country	
Intensity × type of impact	Average to Intense (+4)	The national economy's output will increase by R814.0 million	
Probability	Highly Probable (6)	It is most likely that there will be a temporary increase in production during construction	
Enhancement Measures			
The impact is positive; measures to maximise the stimulation of the economy may include procurement of goods and services from local business where feasible.			
Post Enhancement Measures: Enhancement measures will not change the rating.			
Duration	Medium-term (3)	The construction phase will be for one year	Moderate Positive (+78)
Extent	National (6)	Production increase will affect	

		the entire country	
Intensity × type of impact	Average to Intense (+4)	The national economy's output will increase by R814.0 million	
Probability	Highly Probable (6)	It is most likely that there will be a temporary increase in production during construction	

Table 11-138: Impact on GDP

Dimension	**Rating**	**Motivation**	**Significance**
Temporary increase in the country's GDP during construction			
Impact Description: The impact is generated through capital expenditure that heightens activity in the economy. It results in growth of sectors that include businesses supplying goods and services necessary for the development of the mine and businesses that benefit from the increased consumer expenditure.			
Prior to Mitigation			
Duration	Medium-term (3)	The construction phase will span for a year.	Minor Positive (+72)
Extent	National (6)	Increase in GDP will have an impact across the country	
Intensity × type of impact	Average but not widely spread (+3)	The national economy's GDP will increase by R195 million	
Probability	Highly Probable (6)	It is most likely that there will be a temporary increase in GDP during construction	
Enhancement Measures			
▪ Recruit local labour; ▪ Sub-contract to local construction companies; and ▪ Use local suppliers where viable and arrange with the local Small and Medium and Micro Enterprises to provide transport, catering and other services for the construction crew.			
Post Enhancement Measures: Enhancement measures will not increase the significance rating but will assist with increasing the benefits felt by the local economy.			
Duration	Medium-term (3)	The construction phase will span for a year.	Minor Positive (+78)
Extent	National (6)	Increase in GDP will have an impact across the country	
Intensity × type of impact	Average but not widely spread (+3)	The national economy's GDP will increase by R195 million	
Probability	Highly Probable (6)	It is most likely that there will be a temporary increase in GDP during construction	

Table 11-139: Impact on Employment

Dimension	Rating	Motivation	Significance
Creation of employment opportunities during construction			
Impact Description: The impact is generated through capital expenditure that shocks the economy. It involves the creation of direct new job opportunities related to the construction of the proposed development and employment opportunities that will be indirectly created through the increased expenditure in sectors supplying goods and services for the construction of the mine and in sectors benefiting from the increase of consumer expenditure.			
Prior to Mitigation			
Duration	Medium-term (3)	Individuals will be employed over a one year construction period	Minor Positive (+72)
Extent	National (6)	Increase in employment will affect the entire country	
Intensity × type of impact	Average but not widely spread (+3)	Will create about 695 FTE man-years	
Probability	Highly Probable (6)	It is most likely that there will be a temporary increase in employment during construction	
Enhancement Measures			
▪ Use labour intensive construction methods, where feasible; ▪ Sub-contract to local construction companies; ▪ Use local suppliers; and ▪ Set-up a skills desk at the local municipal office and in the nearby communities to identify skills available in the community and assist in recruiting local labour during both construction and operation.			
Post Enhancement Measures: Enhancement measures could increase the impact on the local economy but would not change the total impact. Therefore, the weights assigned for the impact before improvement will not be affected.			
Duration	Medium-term (3)	Individuals will be employed over a one year construction period	Minor Positive (+78)
Extent	National (6)	Increase in employment will affect the entire country	
Intensity × type of impact	Average but not widely spread (+3)	Will create about 716 FTE man-years	
Probability	Highly Probable (6)	It is most likely that there will be a temporary increase in employment during construction	

Table 11-140: Impact on Skills Development

Dimension	Rating	Motivation	Significance
Activity: Skills development during construction			
Impact Description: The impact takes place during the creation of new employment opportunities, and unlike the actual employment created, is sustainable.			
Prior to Mitigation			
Duration	Medium-term (3)	Skills development will result from employment opportunities generated during the one year period	Minor Positive (+40)
Extent	Municipal Area (4)	Skills will be transferred to workers sourced from the municipality	
Intensity × type of impact	Average but not widely spread (+3)	Average impact on local employees' skills	
Probability	Probable (4)	It is likely that there will be skills transfer during construction	
Enhancement Measures			
▪ Ensure that the main contractor shares knowledge with the sub-contracting companies during the construction period; and ▪ Encourage the main contractor to offer internships and learnerships, especially to those coming from the local communities.			
Post Enhancement Measures			
Duration	Medium-term (3)	Skills development will result from employment opportunities generated during the one year period	Minor Positive (+50)
Extent	Municipal Area (4)	Skills will be transferred to workers sourced from the municipality	
Intensity × type of impact	Average but not widely spread (+3)	Notable impact on local employees' skills	
Probability	Likely (5)	It is likely that there will be skills transfer during construction	

Table 11-141: Impact on Household Income

Dimension	Rating	Motivation	Significance
Temporary increase in household income during construction			
Impact Description: Household income will result due to jobs created through direct, indirect and induced effects.			
Prior to Mitigation			
Duration	Medium-term (3)	Household earnings will be attained by employees for duration of one year	Minor Positive (+72)
Extent	National (6)	Increase in income will affect	

		households of local workers as well as workers benefitting through multiplier effect throughout the country	
Intensity × type of impact	Average but not widely spread (+3)	Household earnings will be derived by individuals involved in the mine establishment	
Probability	Highly Probable (6)	It is most likely that household income will temporarily increase	
Enhancement Measures			
▪ Employ labour intensive methods in construction; ▪ Sub-contract to local construction companies; and ▪ Use local suppliers where viable and arrange with the local Small and Medium Enterprises to provide transport, catering, and other services for the construction crew.			
Post Enhancement Measures: improvement measures could increase the impact on the local economy but would not change the total impact. Therefore, the weights assigned for the impact before improvements will not be affected.			
Duration	Medium-term (3)	Household earnings will be attained by employees for the duration of one year	Minor Positive (+72)
Extent	National (6)	Increase in income will affect households of local workers as well as workers benefitting through multiplier effects throughout the country	
Intensity × type of impact	Average but not widely spread (+3)	Household earnings will be derived by individuals involved in the mine establishment	
Probability	Highly Probable (6)	It is most likely that household income will temporarily increase	

Table 11-142: Impact on Government Revenue

Dimension	Rating	Motivation	Significance
Increase in Government Revenue during construction			
Impact Description: The impact will occur due to local expenditure on construction and will be acquired by government through indirect and direct taxes.			
Prior to Mitigation			
Duration	Medium-term (3)	Government Revenue due to construction activities will be derived for a period of one year.	Minor Positive (+72)
Extent	National (6)	Government Revenue may filter through the three spheres of government.	
Intensity × type of impact	Average but not widely spread (+3)	Increase in government revenue will remain in the domain of	

		government.	
Probability	Highly Probable (6)	It is most likely that tax will be paid.	
Enhancement Measures			
No enhancement.			
Post Enhancement Measures			
Duration	Medium-term (3)	Government Revenue due to construction activities will be derived for a period of one year.	Minor Positive (+72)
Extent	National (6)	Government Revenue may filter through the three spheres of government.	
Intensity × type of impact	Average but not widely spread (+3)	Increase in government revenue will remain in the domain of government.	
Probability	Highly Probable (6)	It is most likely that tax will be paid.	

Table 11-143: Impact on Agricultural Production due to Sterilisation of Productive Agricultural Land

Dimension	Rating	Motivation	Significance
Impact on agricultural production due to sterilisation of productive agricultural land			
Impact Description: The impact will take place as a result of land sterilisation thus, halting agricultural production that is taking place on site at the moment. It should be noted that the land is currently considered as high potential arable land and is used for crop cultivation.			
Prior to Mitigation			
Duration	Permanent (7)	Land sterilisation and specifically unavailability of productive arable land will continue beyond the project life	Major Negative (-112)
Extent	Regional (5)	Although the direct losses will be local, a region-wide effect is expected due to spill over effects.	
Intensity × type of impact	Moderate loss (-4)	Loss of agricultural production to the value of R38 million or 10.7% of the province's agricultural sector output.	
Probability	Definite (7)	A loss of agricultural activity is definite.	
Mitigation Measures			
▪ The establishment of the mine should be done with a minimal impact on the agricultural land and on the footprint of the properties ▪ Engage with directly affected farmers and landowners on alternative farming locations and investigate ways to minimise loss of agricultural production. ▪ Off-set impact by training local small-scale farmers as stated in SLP in order to have no net			

loss. ▪ If feasible, continue utilising land not affected by the mine's footprint for agricultural production. ▪ Where possible, ensure that land preparation and rehabilitation activities implemented during various staged of the mine's lifecycle allow for restoration of land to above-grazing capacity, i.e. suitable for crop production.			
Post Mitigation Measures			
Duration	Beyond project life (6)	Proposed management mitigations could allow the land to be returned to agricultural land post-mining activity; although possibly not to the same productive potential.	Moderate Negative (-98)
Extent	Region (5)	Loss of agricultural production will remain on the regional scale.	
Intensity × type of impact	Moderate loss (-3)	Off-setting the impact could reduce the intensity, but will continue to impact negatively on agricultural production.	
Probability	Definite (7)	A loss of agricultural activity is definite.	

Table 11-144: Potential Negative Impact on Property Value

Dimension	Rating	Motivation	Significance
Potential Negative Impact on Property Values			
Impact Description: The impact will take place as a result of the change in the state of environment which may reduce the property market activity and make some of the properties less desirable/attractive for selected buyers.			
Prior to Mitigation			
Duration	Project life (5)	The impacts will span beyond the construction phase and throughout operations.	Minor Negative (-65)
Extent	Municipal area (4)	Impact will occur on development site and affect surrounding premises, i.e. beyond the project site.	
Intensity × type of impact	Moderate Negative (-4)	Moderate disturbance of state of environment.	
Probability	Likely (5)	The impact will likely take place.	
Mitigation Measures			
▪ Mitigation measures proposed by visual and noise specialists should be strictly adhered to, to minimise the probability and intensity of the visual exposure in the area; ▪ Independent appraisals of properties and land values in the area adjacent to the site to determine the baseline before the project's implementation is advisable; and ▪ Educate and inform the affected parties on the potential environmental impacts that could ensue and the activities to adequately manage perceptions regarding potential effects of the project on the surrounding land uses.			

Post Mitigation Measures			
Duration	Project life (5)	The impacts will span beyond the construction phase and throughout operations.	Minor Negative (-48)
Extent	Municipal area (4)	Impact will occur on development site and affect surrounding premises, i.e. beyond the project site.	
Intensity × type of impact	Moderate Negative (-3)	Moderate disturbance of state of environment.	
Probability	Probable (4)	The impact will likely take place.	

Table 11-145: Potential Negative Impact on Egg Industry

Dimension	Rating	Motivation	Significance
Potential Negative Impact on the egg industry and its value chain			
Impact Description: The impact will take place as a result of mining activity externalities negatively affecting egg farming in the zone of influence.			
Prior to Mitigation			
Duration	Project life (5)	The effects will span beyond the construction phase, but will cease after closure.	Minor Negative (-60)
Extent	Regional (4)	Impact will not only be limited to the farms but will spill over the entire value chain of the egg industry, which is deemed to be spatially spread over the region	
Intensity × type of impact	Serious loss (-5)	Loss of over R393 million in agricultural output alone and potential shedding of between 260 and 332 jobs.	
Probability	Likely (5)	The impact may occur.	
Mitigation Measures			
▪ Engage with respective researchers and specialists to determine with greater certainty the effect that any negative environmental impacts could affect the production of eggs on the nearby egg farms; ▪ Engage with adjacent landowners and compile the baseline, as well as monitor the effects of the mining activity on the production at the potentially affected farms; ▪ In the event that the production is affected and proven to be the result of mining activity, engage with adjacent landowners and investigate appropriate alternatives suitable for all the parties to ensure overall production is not affected (relocation, expansion of other facilities, etc.); and ▪ Strictly adhere to environmental specialists recommendations.			
Post Mitigation Measures:			
Duration	Short-term (2)	The effects will be experienced for a short period or may be eliminated altogether.	Negligible Negative (-24)
Extent	Regional (4)	Impact will not only be limited	

		to the farms but will spill over the entire value chain of the egg industry, which is deemed to be spatially spread over the region	
Intensity × type of impact	Minor loss (-2)	Could affect the strategic location of operations, however chicken farming continues.	
Probability	Unlikely (3)	Impact on the egg industry is unlikely.	

11.1.13.2 Operational Phase

11.1.13.2.1 Impacts Description

Impact on Production

The operations of the proposed Project mine will produce on average 125.9 MT of coal, which will yield R540.3 million (2016 prices) of business sales per annum. Due to the backward linkages and the multiplier effect associated with the consumption induced impacts, for every R1 of revenue generated by the mine directly, it will create an additional R1.15 in the rest of the South African economy Therefore, the total annual impact on the production in the country will amount to R1 161 million per annum.

- The mine will have to acquire inputs from a variety of sectors such as trade and accommodation, transport and storage, and government services. These additional new business sales averaging R343.8 million (2016 prices) per year, will be created as a result of the indirect multiplier effect stimulated by operating activities of the mine. According to Table 4-5, manufacturing followed by trade and accommodation will experience the largest increase in production due to stimulus.
- The upsurge in household expenditure in the country, induced by the mine's activities, will further generate R 277.5 million (2016 prices) per annum. This expenditure pattern of households in South Africa will cause the manufacturing and real estate and business services to experience the largest increase in demand for their products and services. Considering that the mine will be located in the Lesedi LM and assuming that the entire production value will be accounted as part of the output of the municipality, the size of the Lesedi LM economy is expected to increase significantly.

Table 11-146: Impact on production during operations – per annum during steady state (R' million) (2016 prices)

Sector	Direct	Indirect	Induced	Total	Percentage (Total)
Agriculture	-	R 0.1	R 2.7	R 2.8	0.2%

Mining	R 540.3	R 52.6	R 1.3	R 594.1	51.2%
Manufacturing	-	R 93.8	R 108.4	R 202.2	17.4%
Electricity	-	R 8.8	R 6.9	R 15.7	1.4%
Water	-	R 0.8	R 2.9	R 3.7	0.3%
Building and Construction	-	R 2.9	R 4.9	R 7.8	0.7%
Trade and accommodation	-	R 61.2	R 33.1	R 94.2	8.1%
Transport and storage	-	R 39.5	R 23.9	R 63.4	5.5%
Financing	-	R 9.1	R 29.7	R 38.7	3.3%
Real estate and business services	-	R 37.4	R 40.8	R 78.2	6.7%
Government services	-	R 36.1	R 15.6	R 51.7	4.5%
Other	-	R 1.5	R 7.3	R 8.9	0.8%
Total	R 540.3	R 343.8	R 277.5	R 1 161.5	100.0%

Urban-Econ Modelling based on data supplied by Canyon Coal

The mine will operate for 51 years, with the ramp up period lasting for the first two years. Considering that the steady state production will last for 49 years, the mine will produce 60.7 million tons of coal over its lifespan and generate the revenue of R24.9 billion (2016 prices) in the process. Considering the multiplier effects, the total impact on the South African economy during the 51-year of the LOM will account to R53.6 billion in 2016 prices.

Impact on GDP

The revenue generated by the mine, as discussed under production, will translate into R430.6 million (2016 prices) of value added annually and R19.9 billion (2016 prices) of GDP over the lifespan of the project. Assuming that the direct impact on GDP, i.e. R164.2 million, to be created on an annual basis will be registered within the municipal boundaries, it can be suggested that the Palmietkuilen Coal Mine operations will expand the current LLM GDP economy by 2.3%, while the mining sector's GDP increase by about 70%.

Through procurement expenditure, the operation of the mine will create an additional R153.7 million (2016 prices) of value added. The mining and manufacturing sectors will experience the greatest increase in this instance. In the case of increased household income and subsequent growth in household expenditure, a further stimulation will create R112.7 million of value added. Here, manufacturing, real estate and business services, and financing will experience the largest increase in value added. From Table 11-147, it is evident that the mining and manufacturing sectors are the dominant beneficiaries of the project's operations, and will comprise of 56.9% of all value added stimulated by the project through its direct and multiplier effects. In summation, the greater the value of goods and services procured by the mine during its operations from the local economy, the greater the overall economic benefit for the local municipality.

Table 11-147: Impact on GDP during operations (R' million) (2016 prices)

Sector	Direct	Indirect	Induced	Total	Percentage (Total)
Agriculture	-	R 0.1	R 1.4	R 1.5	0.3%
Mining	R 164.2	R 29.1	R 0.7	R 194.0	45.0%
Manufacturing	-	R 22.9	R 28.3	R 51.3	11.9%
Electricity	-	R 4.7	R 3.7	R 8.4	2.0%
Water	-	R 0.3	R 1.0	R 1.3	0.3%
Building and Construction	-	R 0.8	R 1.3	R 2.1	0.5%
Trade and accommodation	-	R 31.3	R 16.0	R 47.3	11.0%
Transport and storage	-	R 16.8	R 10.1	R 26.9	6.3%
Financing	-	R 5.5	R 17.9	R 23.4	5.4%
Real estate and business services	-	R 19.0	R 20.3	R 39.3	9.1%
Government services	-	R 22.4	R 7.7	R 30.0	7.0%
Other	-	R 1.0	R 4.3	R 5.2	1.2%
Total	R 164.2	R 153.7	R 112.7	R 430.6	100.0%

Urban-Econ Modelling based on data supplied by Canyon Coal

Impact on Employment

The proposed Project will create 320 employment opportunities once steady state operations are reached. Approximately 30% of this labour will be sourced from LLM, 35% will be obtained from Gauteng, whilst the remaining 35% will be sourced from the rest of South Africa. The current number of unemployed people of working age in the Lesedi LM are 6 985. The local employment of 96 people by the mine will reduce the number of unemployed by 1.4%. The mining sector currently absorbs 1% (384 people) of the total employed; therefore, the created employment opportunities at the mine will assist in almost doubling the labour absorption capacity of the mining sector in the municipality.

In addition to the direct jobs created on site, the mine will also stimulate the creation of 985 sustainable employment opportunities through production and consumption induced impacts. Some of these employment opportunities will be created also in the mining sector through the employment of mining subcontractors. Overall, a total contribution of the project towards sustainable employment creation in South Africa will be 1 305. Jobs created during operations through direct and multiplier effects will be distributed among all economic sectors. Table 4-7 indicates that the largest number of jobs will be created in the mining, real estate and business services, and trade and accommodation sectors.

Table 11-148: Impact on employment (R' million) (2016 prices)

Sector	Direct	Indirect	Induced	Total	Percentage (Total)
Agriculture	-	1	21	22	1.7%
Mining	320	24	1	345	26.4%
Manufacturing	-	29	42	71	5.4%
Electricity	-	3	2	5	0.3%
Water	-	0	1	1	0.1%
Building and Construction	-	3	5	7	0.6%
Trade and accommodation	-	131	71	202	15.5%
Transport and storage	-	49	24	73	5.6%
Financing	-	42	138	181	13.8%
Real estate and business services	-	162	176	338	25.9%
Government services	-	34	18	52	4.0%
Other	-	1	7	9	0.7%
Total	320	480	505	1 305	100.0%

Urban-Econ calculations based on data supplied by Canyon Coal

Impact on Skills Development

The Workplace Skills Plan for the proposed mine aims to equip employees with skills that will aid their progression in the minerals industry. The plan seeks to continuously identify skills gaps in employees of the mining operation. Similarly, the purpose of the Skills Development Plan for the proposed mine is to improve access to quality education and offer skills that will increase the sustainable employability, self-employability or mobility in the workplace (Canyon Resources, 2016). The Skills Development Plan for the proposed mine is founded on the following targets (Canyon Resources, 2016):

- To provide all employees with the opportunity to obtain a minimum education level equivalent to ABET Level 4;
- To ensure that the operation has the required skills and competencies within the workforce to achieve the business and operating mandate; and
- To provide an enabling environment for employees to develop and pursue clear career paths within the organisation as a whole.

Over the first five years, R5 596 166 will be spent on Human Resource Development, including 15 internships (three per annum), three bursaries, and five learnerships. Bursary programmes, study assistance schemes, and the provision of Learnerships and skills programmes will be provided to address skills shortage and hard-to-fill vacancies (Canyon Resources, 2016).

In cases of retrenchment, the following mechanisms will be applied:

- Assessment and counselling;
- Self-employment training and kick-start programmes; and
- Re-employment (with specific training) programmes (Canyon Resources, 2016).

Overall, it is clear that the skills programmes to be applied during mining operations are holistic, given that they cover qualification attainment, basic education provision, on the job training, and retrenchment impact reductions. If implemented accordingly, the skills levels particularly of the local community will improve and thus enable employees to acquire future employment.

Impact on Household Income

Over half of the population of the LLM is classified as low-income earners. Household earnings are significant for advancing living standards and the proposed mine will assist in achieving this as a result of the 320 FTE man-year opportunities created. It is estimated that households benefitting directly from the mine's operation will earn R49.6 million on average annually, and R2 281.6 million (2016 prices) in sum over the lifespan of the project. Considering that the average household size in the region is between 3.1 and 3.3 people, it can be suggested that over 1 000 people will benefit from the salaries and wages paid by the mine directly. Nationally, however, over 4 600 people are to benefit from the mine's operations directly and through multiplier effects, as household income levels are set to rise by R168.5 million throughout the country. Household income will have a positive impact and will be sustainable over a long period of time.

Table 11-149: Impact on Household income during operations

Sectors	Direct	Indirect	Induced	Total	Percentage (Total)
Agriculture	-	R 0.0	R 0.3	R 0.3	0.2%
Mining	R49.6	R 7.7	R 0.2	R 57.5	34%
Manufacturing	-	R 11.4	R 12.8	R 24.2	14.3%
Electricity	-	R 1.8	R 1.4	R 3.2	2%
Water	-	R 0.1	R 0.3	R 0.4	0.2%
Building and Construction	-	R 0.4	R 0.6	R 1.0	0.6%
Trade and accommodation	-	R 14.6	R 7.4	R 22.1	13%
Transport and storage	-	R 6.6	R 3.7	R 10.3	6%
Financing	-	R 2.4	R 7.8	R 10.2	6%
Real estate and business	-	R 5.7	R 6.5	R 12.2	7%

Sectors	Direct	Indirect	Induced	Total	Percentage (Total)
services					
Government services	-	R 18.6	R 4.8	R 23.4	14%
Other	-	R 0.7	R 3.1	R 3.8	2%
Total	R49.6	R 70.0	R 48.9	R 168.5	100%

Urban-Econ calculations based on data supplied by Canyon Coal

Impact on Government Revenue

A significant amount of government revenue will be derived from payments of income taxes, royalties, contributions towards national skills fund, fee payments in line with respective regulations, and payroll taxes as a result of mining operations. Overall, the mine will contribute over R50 million towards government revenue. It is estimated that R20.9 million is expected to be paid in royalties alone. The main source for rest of the payments will mainly be personal income taxes. Increase in government revenue allows the public sector to maintain the existing infrastructure and improve on its service delivery.

11.1.13.2.2 Impacts Rating

The impacts on Macro-Economic aspects during the Operational Phase, as described above, are rated in Table 11-150 to Table 11-155 below.

Table 11-150: Impact on Production

Dimension	Rating	Motivation	Significance
Temporary increase in production during operations			
Impact Description: The impact occurs due to the sustainable production of the mine, as well as procurement of goods and services for its operations and creation of employment opportunities through direct and indirect effects.			
Prior to Mitigation			
Duration	Project-life (5)	Production will cease after 47 years.	Moderate (positive) (+102)
Extent	National (6)	Production increase will affect the entire country due to direct and spill over effects.	
Intensity type of impact	High Positive (+6)	The national economy's output will increase by R1 161.5 million per annum.	
Probability	Highly Probable (6)	It is most likely that there will be a sustainable increase in production during operations.	
Nature	Positive		
Enhancement Measures			
Procurement of goods and services from local business where feasible, will increase benefits to the local economy, but will not change the rating.			

Post Enhancement Measures: Improvement measures will not change the significance of rating.			
Duration	Project-life (5)	Production will cease after 47 years.	Moderate (positive) (+102)
Extent	National (6)	Production increase will affect the entire country.	
Intensity × type of impact	High Positive (+6)	The national economy's output will increase by R1 161.5 million.	
Probability	Highly Probable (6)	It is most likely that there will be a sustainable increase in production during operations.	

Table 11-151: Impact on GDP

Dimension	Rating	Motivation	Significance
Temporary increase in the country's GDP during operations			
Impact Description: The impact is created through the continuous operation of the mine. This stimulates economic activities of directly and indirectly affected businesses. Subsequently, production is increased and value added is created. An additional value added is further created through household expenditure**.**			
Prior to Mitigation			
Duration	Project-life (5)	Value added due to production will cease after 47 years	Moderate (positive) (+96)
Extent	National (6)	GDP increase will affect the entire country	
Intensity × type of impact	Medium Positive (+5)	The national economy's value added will increase by R430.6 million pa and LM's GDP grow by 2.3%	
Probability	Highly Probable (6)	It is most likely that there will be a sustainable increase in production during operations	
Nature	Positive		
Enhancement Measures			
Explore local procurement prospects.			
Post Enhancement Measures: augmentation though will not increase the significance rating but will assist with increasing the benefits felt by the local economy.			
Duration	Project-life (5)	Value added due to production will cease after 47 years	Moderate (positive) (+96)
Extent	National (6)	GDP increase will affect the entire country	
Intensity × type of impact	Medium Positive (+5)	The national economy's value added will increase by R430.6 million pa and LM's GDP grow by 2.3%	
Probability	Highly Probable	It is most likely that there will	

	(6)	be a sustainable increase in production during operations	
Nature	Positive		

Table 11-152: Impact on Employment

Dimension	**Rating**	**Motivation**	**Significance**
Creation of employment opportunities during operations			
Impact Description: The impact takes place throughout the operational phase and is translated into the creation of new employment opportunities at the mine and businesses that are affected through indirect and induced effects.			
Prior to Mitigation			
Duration	Project Life (5)	Individuals will be employed for the lifespan of the mine (46 years)	Moderate Positive (+90)
Extent	National (6)	Increase in employment will affect the entire country	
Intensity × type of impact	Average to intense Positive (+4)	The project will provide over 1 000 sustainable employment opportunities throughout the country and increase the local economy's labour absorption capacity by a minimum of 320 jobs	
Probability	Highly Probable (6)	It is most likely that there will be a temporary increase in employment during operations	
Nature	Positive		
Enhancement Measures			
Employ local labour to increase benefit to the local community.			
Post Enhancement Measures: improvement measures could increase the impact on the local economy but would not change the total impact. Therefore, the weights assigned for the impact before improvements will not be affected.			
Duration	Project Life (5)	Individuals will be employed for the lifespan of the mine (46 years)	Moderate Positive (+90)
Extent	National (6)	Increase in employment will affect the entire country	
Intensity × type of impact	Average to intense Positive (+4)	The project will provide over 1 000 sustainable employment opportunities throughout the country and increase the local economy's labour absorption capacity by a minimum of 320 jobs	
Probability	Highly Probable (6)	It is most likely that there will be a temporary increase in employment during operations	

Table 11-153: Impact on Skills Development

Dimension	Rating	Motivation	Significance
Skills development during operations			
Impact Description: The impact results from the mine's investment in skills development of the local communities and mine's employees during its operations			
Prior to Mitigation			
Duration	Permanent (7)	Skills will be retained beyond the project life	Moderate Positive (+90)
Extent	Municipal area (4)	Skills will be transferred to mine's workers and other beneficiaries from the local communities.	
Intensity × type of impact	Moderate Positive (+4)	Notable improvement in local labour's and employees' skills	
Probability	Highly probable (6)	It is most likely that there will be skills transfer during operations	
Nature	Positive		
Enhancement Measures			
The mine is required by law to adhere to the provisions detailed in the Social and Labour Plan – no augmentation measures required			
Post Enhancement Measures			
Duration	Permanent (7)	Skills will be retained beyond the project life	Moderate Positive (+90)
Extent	Municipal area (4)	Skills will be transferred to mine's workers and other beneficiaries from the local communities.	
Intensity × type of impact	Moderate Positive (+4)	Notable improvement in local labour's and employees' skills	
Probability	Highly probable (6)	It is most likely that there will be skills transfer during operations	

Table 11-154: Impact on Household Income

Dimension	Rating	Motivation	Significance
Increase in household income during operations			
Impact Description: Household income will be earned due to jobs created through direct, indirect and induced effects; this will allow some of the beneficiaries to improve their living standards.			
Prior to Mitigation			
Duration	Project Life (5)	Household earnings will be attained by employees for the lifespan of the project	Moderate Positive (+90)

Extent	National (6)	Increase in income will affect households of local workers as well as workers benefitting through multiplier effects throughout the country	
Intensity × type of impact	Average to intense (+4)	Household earnings will be derived by employees during this phase	
Probability	Highly Probable (6)	It is most likely that household income will increase	
Nature	Positive		
Enhancement Measures			
▪ Investigate opportunities to increase local procurement and localise mine's expenditure; and ▪ Explore opportunities to employ as many people from the local communities as possible.			
Post Enhancement Measures: improvement measures could increase the impact on the local economy but would not change the total impact. Therefore, the weights assigned for the impact before improvements will not be affected.			
Duration	Project Life (5)	Household earnings will be attained by employees for the lifespan of the project	Moderate Positive (+90)
Extent	National (6)	Increase in income will affect households of local workers as well as workers benefitting through multiplier effects throughout the country	
Intensity × type of impact	Average to intense (+4)	Household earnings will be derived by employees during this phase	
Probability	Highly Probable (6)	It is most likely that household income will increase	

Table 11-155: Impact on Government Revenue

Dimension	Rating	Motivation	Significance
Increase in government revenue during operations			
Impact Description: The impact takes place mostly with payment of royalties and corporates taxes, as well as a result of payment of salaries and wages and declaration of dividends.			
Prior to Mitigation			
Duration	Project Life (5)	Government Revenue due to mining operations will be derived for the project life	Moderate Positive (+90)
Extent	National (6)	Government revenue increase will be experienced nationally	
Intensity × type of impact	Moderate Positive (+4)	Increase in revenue is not widespread but is felt by government	
Probability	Highly Probable (6)	It is most likely that tax will be paid	
Nature	Positive		

Enhancement Measures			
No enhancement.			
Post Enhancement Measures			
Duration	Project life (5)	Government Revenue due to mining operations will be derived for the project life	Moderate Positive (+90)
Extent	National (6)	Government revenue increase will be experienced nationally	
Intensity × type of impact	Moderate positive (+4)	Increase in revenue is not widespread but is felt by government	
Probability	Highly probable (6)	It is most likely that tax will be paid	

11.1.13.2.3 Decommissioning Phase

The LOM of the proposed project is planned to for 51 years. Thereafter, the termination of the project will occur. It is envisaged that R232.7 million will be allocated by the mine towards the closure and rehabilitation activities throughout its project life. Most of these funds will be spent at the end of the project. This expenditure on closure activities will generate positive impacts on production, GDP, employment and household income, albeit relatively small and for a temporary period. Resultantly, the local economy will be stimulated for the duration of the decommissioning phase. Decommissioning expenditure such as the disassembly of buildings and machinery and rehabilitation of land will increase the demand for construction services and services offered by other industries.

The decommissioning process will inform the land restoration process. Infrastructure such as roads and service-related facilities (building), water, and storm water systems may be utilised for future activities. It can be assumed that the existence of the project in the community will create a significant stimulus, leading to industry development in the area and the availabilities of opportunities even after decommissioning of the mine. Nonetheless, most impacts will cease to exist succeeding the project.

11.2 Unplanned Events and Low Risks

The planned activities will have known impacts as discussed in Section 11.1 above; however, unplanned events may happen during the Project that may have potential impacts which will need mitigation and management. Table 11-156 below is a summary of the identified Project activities that may pose a risk (an impact at low probabilities). Please note not all potential unplanned events may be captured herein and this must therefore be managed throughout all phases.

Table 11-156: Unplanned Events, Low Risks and their Management Measures

Potential Project Risk (Unplanned Occurrences)	Aspect Potentially Impacted	Mitigation / Management / Monitoring
Hydrocarbon spills from vehicles and heavy machinery or hazardous materials or waste storage facilities. Spills during decommissioning and removal of infrastructure will also add to water contamination.	Surface water; Groundwater; Wetlands; and Soil contamination.	▪ Hydrocarbons and hazardous materials must be stored in bounded areas and refuelling should take place in contained areas; ▪ Ensure that oil and silt traps are well maintained; ▪ Vehicles and heavy machinery should be serviced and checked in a demarcated area on a regularly basis to prevent leakages and spills; ▪ Hydrocarbon spill kits must be available on site at all locations where hydrocarbon spills could take place; ▪ Monitoring boreholes, particularly those located within the construction area, have to be monitored for both water level and quality to detect any changes; and ▪ If a considerable amount of fluid is accidentally spilled, the contaminated soil should be scraped off and disposed of at an acceptable dumping facility. The excavation should be backfilled with soil of good quality.
Spills/leaks from the dewatering pipeline or surface water berms.	Surface water; Groundwater; Wetlands; and Soil contamination.	▪ Regular inspections of the pipeline for any leaks; and ▪ Ensure that storm water management structures are put in place to capture all spills and to convey to the PCD.
Blockage of storm water management structures and silt trap.	Surface water; Groundwater; and Wetlands.	▪ Inspect storm water management structures and silt trap after large storm events; and ▪ Regular inspections of the silt trap.
Contamination from the ROM,	Runoff from the ROM	▪ Ensure that storm water management structures are put in place to capture all

Potential Project Risk (Unplanned Occurrences)	Aspect Potentially Impacted	Mitigation / Management / Monitoring
overburden and discard dump.	and overburden dump has the potential to pollute the surface water environment.	runoff from the ROM and overburden dumps and to convey to the PCD; ▪ Overburden and topsoil stockpiles should be managed to minimise infiltration of contaminants to the groundwater; ▪ The stockpile shape should be managed to control the ease with which water can run off from the facility; and ▪ Ensure that storm water management structures are put in place to capture all runoff from the ROM and overburden dumps and to convey to the PCD.
PCD overflow	Surface water; Groundwater; Wetlands; and Soil contamination.	▪ The overflow must be stopped immediately and the impacted area remediated. Spill protection berms must be in place as well. If necessary, a wetland specialist must investigate the extent of the impact and provide rehabilitation recommendations.
Uncontrolled erosion	Wetland; and Soils.	▪ Erosion control measures must be put in place and if necessary a wetland specialist must investigate the extent of the impact and provide rehabilitation recommendations.
Airborne coal dust settling in wetlands	Wetlands	▪ Wetland monitoring must be done throughout the life of the project to ensure that this impact is not reaching a critical level. Dust suppression will need to be improved and the wetland rehabilitated as far as possible. If necessary, a wetland specialist must investigate the extent of the impact and provide rehabilitation recommendations.
Poaching of animal species on site due to increase activity on site.	Fauna	▪ Ensure continuous environmental awareness training takes place. This needs to be monitored and reported on and the appropriate actions should take place dependant on the results.
Ineffectiveness or failure of fitted	Noise	▪ Implement monitoring programme to assess effectiveness of noise abatement

Potential Project Risk (Unplanned Occurrences)	Aspect Potentially Impacted	Mitigation / Management / Monitoring
silencers on generators and ventilation fans.		measures; and ▪ Regular servicing of generators as per maintenance manual.
Throughout the SIA process, the specialist identified a number of risks that warrant particular attention and close monitoring and management, namely: ▪ Community expectations regarding employment and socio-economic development; ▪ Physical and economic displacement as a result of land acquisition; and ▪ Failure to acquire a social licence to operate.	Social	▪ Expectations of communities must be managed by informing them what to expect from the Project in terms of LED and/or community development projects; ▪ Continuously involve community and municipal structures in the development of any LED or community development projects; ▪ Appoint CLOs to provide communities with an accessible communication mechanism; ▪ Establish grievance mechanism which is accessible to aggrieved members of the surrounding communities; ▪ Use public media to inform and enlighten stakeholders with regard to project limitations, progress and outcomes; ▪ Follow a transparent consultation and negotiation process; ▪ Adequately compensate landowners as well as displacement-affected people; ▪ Ensure on-going, transparent communications and mutual trust; ▪ Regularly assess if/how/why stakeholder opinions and perceptions change; and ▪ Invest in host communities through LED and CSI projects.
Accidental exposure of previously unidentified heritage resources during the construction of the Project.	Heritage	▪ Project specific Chance Find Protocols (CFPs) must be developed and included in the EMP as a condition of authorisation. ▪ The CFPs must clearly describe the type of heritage resources that may occur within the site specific project area, the protocol to follow in the event of accidental exposure of previously unidentified heritage resources, and the appropriate management measures and reporting structures to be adhered to. ▪ The CFPs must be defined and established prior to the construction phase of the proposed Project.
Accidental exposure of human remains during the construction phase of the Project.	Heritage	

Potential Project Risk (Unplanned Occurrences)	Aspect Potentially Impacted	Mitigation / Management / Monitoring

Blasting will create vibrations that may compromise the integrity of Palmietkuil South War Cemetery Memorial protected under Sections 36 of the NHRA, and the Commonwealth War Graves Act (Act No. 8 of 1992).	Heritage; and Blasting	▪ A Heritage Site Management Plan (HSMP) must be developed to monitor and gauge any potential negative impact to the public monument and memorial during the construction and operational phases of the Project. This should include as a minimum:
		  ▪ A detailed baseline record of the condition of the Palmietkuil South War Cemetery Memorial;
		  ▪ A roles and responsibility matrix; and
		  ▪ A monitoring process and schedule.
		▪ The HSMP must be defined and established prior to the pre-construction phase of the proposed Project; and
		▪ A detailed geotechnical investigation, focussing mainly on dolomitc areas, should be undertaken prior to construction. Findings of this study must be used to inform the blasting procedure.

Blasting will create vibrations that may result in the collapse of voids associated with the Malmani Dolomites that could result in subsidence or destruction of the Public Monument and Memorial protected under Sections 36 of the NHRA, and the Commonwealth War Graves Act (Act No. 8 of 1992)	Heritage; and Blasting	

11.3 Cumulative Impacts

Cumulative effects are caused by the accumulation and interaction of multiple stresses affecting the parts and the functions of ecosystems. Of particular concern is the knowledge that ecological systems sometimes change abruptly and unexpectedly in response to apparently small incremental stresses. For purposes of this report, cumulative impacts have been defined as “the changes to the environment caused by an activity in combination with other past, present, and reasonably foreseeable human activities”.

11.3.1 Soil, Land Use and Land Capability

Soil quality will deteriorate during stockpiling and replacement of the soil materials into soil profiles during rehabilitation cannot imitate pre-mining soil quality properties. The cumulative impact on regional land capability and land use is high because there is commercial agriculture that is practiced within surrounding and the contribution to regional agriculture will reduce to low as the project area has 72% of arable land under cultivation (maize and beans). Food security is impacted on because the available arable land will be lost to mining and rehabilitation cannot emulate pre-mining land capability in the short term. Maize and bean production has been continuing for decades and can continue for decades more on the same soils. However, mining will change the high agricultural potential soils resulting in yield losses.

In addition, several mines and mining activities occur in the vicinity of the Project area. These include the Ergo Grootvlei and Marievale old dump clusters as well as the Daggafontein gold tailings deposition site to the west and south-west of the Project area. There are three operational open pit coal mines near the Project. The Manungu Colliery is located 5.7 km east of the Project area and the Universal Coal Plc Kangala Coal Mine and the Exxaro Leeuwpan Coal Mine are located 6 km and 12 km north-east of the Project area respectively. The nearest power station is the Kendal power station located 39.4 km north-east of the Project area which contribute to the regional impacts to land capability and land use changes.

11.3.2 Flora and Fauna

The cumulative impacts that are considered from a perspective of terrestrial biodiversity include the following:

- Loss of habitat on a national scale – the threatened ecosystems programme outlines the most significant habitats that are important for conserving on a national scale. Minimal loss of the Eastern Highveld Grassland (correlating to the Eragrostis-dominated grassland in this report) is expected and the impact of this is regarded as minor;
- Loss of diversity on a regional scale – the Eragrostis Grassland is a broad habitat that encompasses many smaller plant communities. Due to the loss of 280 ha of this unit, the regional impact will be minor; and

- Loss of diversity on a regional scale – the Riparian vegetation type is a broad habitat that encompasses wetlands and pans plant and habitat communities. Due to the loss of 52 ha of this unit, the regional impact will be minor.

11.3.3 Surface Water

Negative water quality impacts result in the deterioration of surface water resources. All runoff from the project area drains to the Aston Lake, and when it overspills or seeps, flows downstream to the Blesbokspruit. The baseline water quality indicated poor quality with parameters of concern being pH, EC, Ca, Mg, Na, Cl, and Turbidity at SW01 and Al, Fe, Turbidity and pH for Aston Lake when benchmarked against the SWQG Agriculture: Irrigation, SWQG Agriculture: Domestic Use limit, the SANS 241-2015 drinking water quality standards and Blesbokspruit WQO. These impacts could spread downstream to the Blesbokspruit which is already deteriorated in water quality based on the scoping report findings (Digby Wells, 2016). The report concluded that the overall water quality in the Blesbokspruit and its tributaries has been contaminated and the pollution sources are likely to be anthropogenic activities.

Mining has been attributed to increase in turbidity and salts in the surface water resources and cumulative surface water quality impacts will be anticipated in the Aston Lake and potentially the Blesbokspruit. The deteriorated water quality could then imply further restricted water use for domestic, agricultural and drinking water purposes and increased costs of treatment should there be no option but to use the water.

11.3.4 Groundwater

Various mining related operations located within a 10 km radius of the Project area. The nearest operation is located southwest of the proposed Project area (DRD Gold Infrastructure) and in addition unknown mining infrastructure located south.

As discussed in the Groundwater Impact Assessment, the maximum water level drawdown at the Project site will occur at the end of the operational phase and will predominantly be contained within the Project area.

Depending on the mine size, depth, life of mine and mining method, the cone of dewatering of existing and/ or future mining operations within the area cumulative groundwater quality and quantity impacts could occur. However, when considering the groundwater flow direction and limited rock permeability this is an unlikely scenario.

Decanting is also possible to occur at any of thefrom other mines in the catchment. The Grootvlei mine is pumping out and treating mine water at the rate of 80-120 Ml/day. This water is discharged to the Blesbokspruit and is a much larger impact than the proposed mine would have. There are plans to treat this water to a potable standard and thus a large flow could be removed from the catchment. Potentially the Palmietkuilen water could also be added to this treated water. All the mines within this catchment could potentially have a cumulative impact on the streams and surface water bodies. Surface water bodies are essential for water supply and the ecological well-being of the environment. Cumulative impacts that could occur include:

- Deterioration of water quality of the Blesbokspruit; and
- Decrease in the catchment yield, hence the total runoff flow.

Depending on the decant quality, each of the mining operations are recommended to treat the decant water before joining the streams to minimise the cumulative impact on a regional scale.

11.3.5 Wetlands

Some of the major contributing factors to the decline of wetlands in South Africa include mining, industrial and agricultural activities as well as poor treatment of waste water from industry and mining (Oberholster et al., 2011). Coal mining causes destruction of wetlands via direct impacts such as removal of habitat, alteration of flow and contamination of water, but also indirectly through the drawdown of groundwater resources during the dewatering process (van Der Walt, 2011). Dewatering has cumulative impacts on wetlands, which are complex, interlinked systems in the Highveld. Mining has frequently resulted ground and surface water contamination due to acidification and salinisation of nearby aquifers. The Witwatersrand area, where this project is located, is most certainly an area that has undergone significant cumulative impacts to the wetlands and their catchment. Due to the major impacts that will be caused by the proposed activities, this project will directly and significantly contribute to the cumulative negative impacts on wetland ecosystems in the local, municipal and regional area.

11.3.6 Aquatic Ecology

The PES of the river course assessed was observed to be class D/E or largely/seriously modified as a result of the absence of sensitive aquatic ecology. This is largely attributed to habitat level impacts. Based on the results of the impact assessment, limited impacts are anticipated in the catchment should mitigation actions take place.

The following cumulative impacts have therefore been identified, and can occur due to the proposed development:

- Cumulative temporary deterioration of water quality within the river systems. This will likely be a significant cumulative impact should Acid Mine Drainage occur; and
- Cumulative deterioration of aquatic habitat. There will potentially be a loss should stormwater management mitigation actions prove to be ineffective. However, the likelihood of this impact is low.

11.3.7 Air Quality

Air quality data from the existing dust monitoring network in the vicinity of the proposed project area was used to assess the baseline environment. The dust deposition rates measured in the area have shown that the potential is there exceed regulatory limit. After mitigation measures were factored into the model simulations, the predicted deposition rates at the Project area and surroundings were reduced considerably. A similar pattern will be seen in the levels of PM_{10} and $PM_{2.5}$ if background data was available for assessment.

The operational phase of the proposed Project will impact the ambient air quality of the area. However, if adequate mitigation measures are in place, the potential impacts might be reduced to within regulatory requirements. It is not envisaged that the proposed project will exacerbate the current ambient air quality scenario if mitigation is factored into the day to day operation at the mine.

11.3.8 Noise

Cumulative impacts should be considered for the overall improvement of ambient noise levels. The proposed project is considered a causative source of noise pollution of a moderate significance, meaning that the impact could potentially hamper 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 due to the close proximity of certain receptors to the proposed mine infrastructure layout and haul route.

The existing anthropogenic noise sources in the area of the proposed project are typical rural agricultural, power substations and other mining operations noise sources such as intermittent vehicle activity on the surrounding district and farm roads and the farming activities such as ploughing and harvesting machinery. The insects and birds are the natural noise sources. The existing background noise levels range from 25 dBA to 40 dBA which is typical for rural areas.

With the low ambient soundscape the proposed project's operational noise will dominate at certain receptors. However, if the recommendations with regards to the mitigation and managements measures are followed, the impact significance can be decreased to a minor significance.

11.3.9 Visual

The Project area and surrounds are characterised by residential settlements, small holdings, agriculture and open land interspersed with areas disturbed by mining activities and little of the natural Grassland vegetation remains. The receiving environment consists of agricultural land interspersed with farm residences, farm workers houses and the Daggafontein, Eloff, Endicott, Largo, Strubenvale, Sundra, Vischkuil and Welgedacht towns.

Several mines and mining activities occur in the vicinity of the Project area. These include the Ergo Grootvlei and Marievale old dump clusters as well as the Daggafontein gold tailings deposition site to the west and south-west of the Project area. There are three operational open pit coal mines near the Project. The Manungu Colliery is located 5.7 km east of the Project area and the Universal Coal Plc Kangala Coal Mine and the Exxaro Leeuwpan Coal

Mine are located 6 km and 12 km north-east of the Project area respectively. The nearest power station is the Kendal power station located 39.4 km north-east of the Project area.

The Project area and surrounds have a largely agricultural sense of place with the exception of the urban areas to the west of the Project area. Land uses in the region include agriculture, residential areas, businesses, industries and recreational areas. The Project is expected to have a visual impact on the less industrial activities, i.e. agriculture, residential and recreational areas. As more mining projects are developed in the region the sense of place will change from agricultural to industrial/ mining. This will result in a loss of scenic character and increased visual disturbance. Over time the receiving environment will change from one dominated by agriculture and residential areas to one dominated by mining and industry.

11.3.10 Cultural Heritage

Within the local area, the Project will have an additive effect on the cultural landscape as it will contribute to the change from an historical, agricultural landscape with archaeological components into an industrialised mining landscape associated with several operations to the west of the site-specific study area.

At the Project site, the synergistic effects of the Project and other operations in proximity, and repetitive impacts on archaeological resources may manifest as regular blasting activities that threaten the physical integrity historic built environment.

11.3.11 Social

The cumulative impacts that are considered from a social perspective include the following:

- Improved standard of living through increased employment, local business development and improved public infrastructure and community services and facilities (the latter will be dependent on government and private-sector contributions) at a local and regional level;
- Urban sprawl, housing backlog and/or growth of informal settlements at a local and regional level;
- Added pressure on local public service delivery and infrastructure, including housing, roads, water and sewage treatment works, schools, police services and waste management facilities;
- Community disruption and impact on social cohesion as a result of population influx, the presence of a non-local workforce, lack of services and facilities;
- The use of non-local labour, due to unavailability of local skilled workers causing tension in local communities as a result of the expectation that the Project should provide local employment; and
- Increased sterilisation of agricultural land and decrease in food security.

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 12-1. 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 EIA report. The significance of an impact is then determined and categorised into one of eight categories (The descriptions of the significance ratings are presented 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/Replacability		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.	<u>International</u> 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 definitely 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.	<u>National</u> 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/Replacability		Extent	Duration/Reversibility	Probability
	Negative Impacts (Nature = -1)	**Positive Impacts (Nature = +1)**			
5	Serious loss and/or damage to physical or biological resources or **highly** sensitive environments, limiting ecosystem function. Very serious widespread social impacts. Irreparable damage to highly valued items.	On-going and widespread benefits to local communities and natural features of the landscape.	Province/ Region Will affect the entire province or region.	Project Life (>15 years): The impact will cease after the operational life span of the project and can be reversed with sufficient management.	Likely: The impact may occur. <65% probability.
4	Serious loss and/or damage to physical or biological resources or **moderately** sensitive environments, limiting ecosystem function. On-going serious social issues. Significant damage to structures / items of cultural significance.	Average to intense natural and / or social benefits to some elements of the baseline.	Municipal Area Will affect the whole municipal area.	Long term: 6-15 years and impact can be reversed with management.	Probable: Has occurred here or elsewhere and could therefore occur. <50% probability.

Rating	Intensity/Replacability		Extent	Duration/Reversibility	Probability
	Negative Impacts (Nature = -1)	Positive Impacts (Nature = +1)			
3	Moderate loss and/or damage to biological or physical resources of **low to moderately** sensitive environments and, limiting ecosystem function. On-going social issues. Damage to items of cultural significance.	Average, on-going positive benefits, not widespread but felt by some elements of the baseline.	Local Local 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.	Limited 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 as a result of design, historic experience or implementation of adequate mitigation measures. <10% probability.

Rating	Intensity/Replacability		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

-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
-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
-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
-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
-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
-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
-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 **Error! Reference source not found.** provides an explanation of the site layout and he sensitivity analysis, alternatives and aspects that were considered during the finalisation of the layout. Section 11 describes all the expected impacts from the various project activities. Table 12-4 provides a summary of the overall positive and negative impacts associated with the main alternatives considered for the Project.

Table 12-4: Alternatives and Impacts

Alternative	Option	Positive Impact	Negative Impact
Design and Layout	No alternatives yet identified	-	Several pans / wetlands will be removed in the current pit location; however, the location of the coal dictates the location of the pit.
Mining Method	Underground	Pans on site will be preserved.	The depth of the coal seam does not warrant underground mining and can pose a safety risk.
	Open pit	-	The pans and wetlands located in the proposed pit area will be removed.
Transportation of Coal	By rail	No additional impact to the road network	-
	By road	Transportation of the coal product will be more direct.	The surrounding road network will be impacted by coal trucks.
The No-Go Option	-	The ecologically sensitive areas on site will not be impacted.	The economic benefits of the Project will not be realised.

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 **Error! Reference source not found.** below.

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 sensitivity analyses undertaken for each specialist study were used to inform the preferred infrastructure. Identified wetlands were excluded from the pit and infrastructure as far as possible. Five pans will however will be directly affected by the proposed mine development. The layout has also considered the proximity of surrounding residential areas and a buffer between the mining footprint and the residential areas as well as surrounding major watercourses (Blesbokspruit and Aston Lake).

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 mine layout was informed by various environmental and technical specialist studies. The initial site layout that was presented during the scoping phase was not changed substantially during the EIA phase. The impacts and risks discussed in Section 11 are applicable to the final site layout plan shown in Plan 2 above.

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

The potential impacts per activity and per phase are detailed in Table 14-1 below.

Table 14-1: Assessment of each Identified Impact as per each Activity

Activity	Potential Impact	Aspects Affected	Phase	Prior to Mitigation Significance	Mitigation / Enhancement Type	Post-Mitigation Significance
Site Establishment (incl. site clearing - the removal of topsoil and vegetation);	Loss of topsoil as a resource and soil compaction from heavy machinery and vehicles during site clearance	Soil, Land Use and Land Capability	Construction Phase	Moderate (negative)	▪ Follow adequate stripping guidelines (refer to Section 14 of the Soil, Land Use and Land Capability Assessment report, Appendix C); ▪ Topsoil should be stripped by means of an excavator bucket and loaded onto dump trucks; ▪ If possible topsoil should be stripped during dry months, as to reduce compaction ▪ Only clear vegetation when and where necessary; ▪ Only remove topsoil when and where necessary ; ▪ Ensure topsoil is stored in one dedicated stockpile, 10 m high and away from drainages lines and surface water; ▪ Only the designated access routes are to be used; ▪ If erosion occurs, corrective actions must be taken to minimise any further erosion from taking place; ▪ Soils to be stripped according to the soil stripping ratios and stockpiled accordingly; ▪ Stockpiles are to be maintained in a fertile and erosion free state by sampling and analysing annually for nutrients and soil pH, and vegetating the stockpiles to reduce erosion; ▪ Compaction of the removed topsoil should be avoided by prohibiting traffic on stockpiles; ▪ Prevent unauthorised borrowing of stockpiled soil; and ▪ Ensure proper storm water management designs are in place.	Minor (negative)
	Loss of land capability	Soil, Land Use and Land Capability	Construction Phase	Major (negative)	▪ No land capability mitigation measures are possible during the construction and operational phases because the land use is changed from intensive cultivation (agriculture) to open pit mining.	Major (negative)
	Loss of *Eragrostis* – dominated Grassland	Flora and Fauna	Construction Phase	Moderate (negative)	▪ Rehabilitation of the disturbed area should take place after construction, whereby a mixture of native grass species harvested from climax Themeda grassland and native grass species (such as Cynodon dactylon) are planted immediately to prevent erosion; and ▪ A pre-construction survey must be undertaken to verify the site conditions; and ▪ The footprint area should be limited as far as possible.	Minor (negative)
	Loss of Riparian areas, Wetlands and Pans	Flora and Fauna	Construction Phase	Moderate (negative)	▪ Rehabilitation of the disturbed area should take place after construction, whereby a mixture of native grass species harvested from wetland areas are planted immediately to prevent erosion; and ▪ The footprint area should be limited as far as possible	Minor (negative)
	Habitat fragmentation and edge effects resulting in alien plant invasion	Flora and Fauna	Construction Phase	Minor (negative)	▪ An alien plant species management plan should be compiled and implemented.	Minor (negative)
	Sedimentation of surface water resources resulting in the deterioration of water quality	Surface Water	Construction Phase	Minor (negative)	▪ Development of the storm water management structures to ensure that sediment generated during the construction phase is conveyed to the silt trap, and clean water is diverted away from the boxcut and dirty water areas ▪ Soils compacted by heavy machinery in areas that are not utilised post construction	Negligible (negative)

					can be ripped to allow infiltration ▪ Roads should be maintained regularly to ensure that surface water drains freely off the road preventing erosion ▪ Ensure that storm water management structures are within good working condition through regular inspection, especially after large storm events. ▪ The silt trap and storm water management structures should be inspected after large storm events to ensure that there are no blockages or breaches. Should blockages or breaches occur, then immediate action should be undertaken to remove debris or to repair breached areas; and ▪ Vegetation clearing should be limited as much as possible to areas where it is absolutely needed.	
	Movement of heavy machine and vehicles for sit clearing resulting in reduced surface water infiltration as well as an alteration in surface water drainage patterns as a result of soil compaction.	Surface Water	Construction Phase	Minor (negative)	▪ Vegetation clearing should be limited as much as possible to areas where it is absolutely needed; ▪ Implementation of the storm water management plan to capture sediment and convey it to the silt trap; and ▪ Compact soils can be loosened through soil ripping in areas where compact areas are not in use post construction.	Negligible (negative)
	Site clearing for the development of surface infrastructure through the removal of the top soil and weathered rocks resulting in the lowering of the groundwater table	Groundwater	Construction Phase	Negligible (negative)	▪ Restrict areas that must be cleared of vegetation for construction activities to those absolutely necessary. ▪ Avoid or minimise construction activities to a depth of below the water table. ▪ Apply a liner underneath the PCD to minimise or avoid infiltration. ▪ Avoid placement of the pollution control dams on areas with the potential for increased infiltration to groundwater, such as over fault zones. ▪ Pollution control dams should be lined to pro-actively prevent infiltration of contaminated seepage water. ▪ If that is not possible, dewatering of the aquifer to locally lower the water table can be considered to ensure that the construction takes place above the groundwater level and the water quality remains acceptable. The abstracted water can be utilised for dust suppression, vegetation or discharged to pollution control dams for evaporation. Since the groundwater is not expected to be polluted at this stage, the utilisation of the water for activities such as dust suppression or irrigation (if applicable) is not expected to cause environmental impacts. ▪ Adequate storm water management should be implemented to contain all waste water and/or volatile organic compounds, for treatment and recycling. ▪ Install groundwater monitoring boreholes to assess the time series water level and quality impacts and trends.	Negligible (negative)
	Loss of wetland habitat (soils and vegetation) totalling 53.3 ha for infrastructure and 201.9 ha associated with the open pit area.	Wetlands	Construction Phase	Major (negative)	▪ There are no mitigation measures for loss of habitat, however, it is recommended that the wetland area in question follow the mitigation hierarchy which must be followed, as described below: ▪ Avoidance includes activities that change or stop actions before they take place, in order to prevent their expected negative impacts on biodiversity and decrease the overall potential impact of an operation. A change in mine plan (particularly the size of the pit) should be investigated further however it is understood that this will impact the feasibility of the mine; ▪ Minimisation measures are taken to reduce the duration, intensity, extent and/or likelihood of impacts that cannot be completely avoided. This includes the reduction of the size of the wetlands to be disturbed;	Major (negative)

					▪ Restoration involves altering an area in such a way as to re-establish an ecosystem's composition, structure and function, usually bringing it back to its original (pre-disturbance) state or to a healthy state close to the original. Project impact on wetlands are remediated; and ▪ Biodiversity offsets are measurable conservation outcomes resulting from actions designed to compensate for significant residual adverse biodiversity impacts arising from project development and persisting after appropriate avoidance, minimisation and restoration measures have been taken. As a last resort, wetland offsets can be discussed with the DWS as an alternative, however, due to the link to the Blesbokspruit watercourse, this is not preferred.	
	Direct loss of marginal and riparian habitats. Increased runoff and erosion resulting in habitat change downstream	Aquatic Ecology	Construction Phase	Minor (negative)	▪ Minimise the removal of vegetation in the infrastructure footprint area; ▪ Re-vegetation of the disturbed areas within the construction footprint areas once construction is completed; ▪ Soils compacted by heavy machinery in areas that are not utilised post construction can be ripped to allow infiltration; ▪ Ensure that storm water management structures are within good working condition through regular inspection, especially after large storm events; ▪ Where storm water enters river systems, sediment/silt and debris trapping, as well as energy dissipation control measures must be put in place; ▪ Storm water must be diverted from construction activities and managed in such a manner to disperse runoff and prevent the concentration of storm water flow; ▪ The vegetation of unpaved roadsides; and ▪ Inspection of paved and unpaved roads to monitor for erosion.	Negligible (negative)
	Compaction of soils during site clearance causing in lowered rainfall infiltration rates and increased runoff resulting in reduced baseflow and an alteration of aquatic habitats	Aquatic Ecology	Construction Phase	Minor (negative)	▪ Minimise the removal of vegetation in the infrastructure footprint area; ▪ Re-vegetation of the disturbed areas within the construction footprint area once construction is completed; ▪ Soils compacted by heavy machinery in areas that are not utilised post construction can be ripped to allow infiltration; ▪ Ensure that storm water management structures are within good working condition through regular inspection, especially after large storm events; ▪ Where storm water enters river systems, sediment/silt and debris trapping, as well as energy dissipation control measures must be put in place; ▪ Storm water must be diverted from construction activities and managed in such a manner to disperse runoff and prevent the concentration of storm water flow; ▪ The vegetation of unpaved roadsides; and ▪ Inspection of paved and unpaved roads to monitor for erosion.	Negligible (negative)
	Reduction in ambient air quality	Air Quality	Construction	Negligible (negative)	▪ Application dust suppressant on the dirt road and exposed areas; ▪ Limit activity to non-windy days; ▪ Set maximum speed limits on dirt roads and to have these limits enforced; ▪ The area of disturbance at all times must be kept to a minimum and no unnecessary clearing, digging or scraping must occur, especially on windy days (with wind speed ≥ 5.4 m/s); ▪ The drop heights when loading onto trucks and at tipping points should be minimised.	Negligible (negative)
	Exposed surfaces due to site clearing will results in the wind erosion of loose soil	Air Quality	Construction	Negligible (negative)	▪ Application of wetting agents or dust suppressant on exposed areas; ▪ Set maximum speed limits for vehicles working on exposed areas and have these limits enforced; ▪ The area of disturbance at all times must be kept to a minimum and no unnecessary	Negligible (negative)

					clearing, digging or scraping must occur, especially on windy days (wind speed ≥ 5.4 m/s).	
	The Project area will become noticeable to nearby receptors as it will contrast the surrounding areas.	Visual	Construction Phase	Moderate (negative)	▪ Vegetation should only be removed when and where necessary; ▪ Topsoil should only be removed when and where necessary; ▪ Topsoil stockpiles should be vegetated with grasses (Andropogon appendiculatus, Andropogon eucomus, Andropogon huillensis, Aristida congesta subsp. Barbicollis, Arundinella nepalensis, Cynodon dactylon, Eragrostis capensis, Eragrostis curvula, Eragrostis gummiflua, Eragrostis racemose, Fingerhuthia Africana, Hyparrhenia hirta, Hyparrhenia tamba, Imperata cylindrical, Melinis repens, Paspalum dilatatum, Setaria sphacelata, Sporobolus africanus, Sporobolus pyramidalis, Themeda triandra, Trichoneura grandiglumis and Tristachya leucothrix) where possible so as to blend into the surrounding landscape and reduce dust generation; ▪ Limit the footprint area of topsoil stockpiles where possible; ▪ Limit the height of topsoil stockpiles to 20 m; and ▪ Apply dust suppression techniques to limit dust generated from topsoil stockpiles.	Minor (negative)
	The Project area will become noticeable to nearby receptors due to the increased levels of activity on the site.	Visual	Construction Phase	Minor (negative)	▪ Where possible use fencing that will screen the project area from nearby receptors; and ▪ Limit the height and footprint area of temporary laydown areas and facilities for construction workers.	Negligible (negative)
	Direct impact to burial grounds and graves	Heritage	Operational Phase	Moderate (negative)	▪ In the event of in situ conservation, complete a BGGC process in accordance with Section 36 of the NHRA and Chapter IX of the Regulations to the Act to reach agreement with bona fide NoK on access and conservation of the burial grounds and graves.	Negligible (negative)
	Employment creation during construction	Social	Construction Phase	Minor (positive)	▪ Assign preferred employment status to those experiencing the bulk of the negative project impacts (communities located within and surrounding the Project footprint e.g. Palmietkuilen Community, Vischkuil, Endicott, Welgedacht, Slovo Park, etc.); ▪ Promotion of local, female and youth employment to achieve and where feasible exceed the targets set out by the Mining Charter; ▪ Where possible labour-intensive construction methods should be promoted; ▪ Verification of local residential status through consultation with appropriate authorities (e.g. municipal structures, community leaders, and landowners) ▪ Consult neighbouring businesses/mines to determine if they would be willing to make their skills registers available; ▪ Identify required core skills, expand skills audits to community and align and implement training and skills development initiatives to findings of audit; ▪ Expand skills development programmes, especially ABET programmes, to include surrounding communities; ▪ Recruitment via a registry of job seekers and potentially coordinated through the DoL; ▪ Provide local employees with reference letters certificates of completion for in-house (on-the-job) training; and ▪ Monitor subcontractors in terms of local employment targets.	Moderate (positive)
	Multiplier effects on the local economy	Social	Construction Phase	Minor (positive)	▪ Give preference first to capable local service providers; ▪ Develop local service provision capacity; ▪ Monitoring of sub-contractors procurement; ▪ Development of a register of local SMMEs; ▪ Linkages with skills development/ SMME development institutions and other mining operations;	Moderate (positive)

					▪ SMME skills development as part of mine SLP/LED commitments; and ▪ Local procurement targets should be formalised in AOL's procurement policy.	
	Community development and social upliftment	Social	Construction Phase	Minor (positive)	▪ Liaison with beneficiaries to ensure needs are met; ▪ Collaboration with other developmental role players during implementation; ▪ Expanding skills development and capacity building programmes to non-employees; ▪ Establish external monitoring system to regulate HDSA procurement; ▪ Where feasible, training should be NQF accredited; and ▪ A record of training courses completed per individual should be kept.	Moderate (positive)
	Displacement as a result of site clearance	Social	Construction Phase	Major (negative)	▪ AOL should where possible endeavour to minimise the extent of, displacement through project design, where displacement cannot be minimised the following measures are recommended to alleviate the adverse impacts: ▪ AOL should finalise the Project layout plan and determine its policy and approach to displacement, as this would inform the extent of resettlement, i.e. whether it will recognise both direct and indirect forms of displacement as well as whether they will strive towards international best practice or local standards; ▪ The sales agreement of land should reflect the holistic value (determined by a professional valuer) of the land and should also be inclusive of the potential relocation cost of commercial farms and/or business operations; ▪ The displacement of non-vulnerable households and individuals should be considered on a case-by-case basis; ▪ Areas impacted upon during construction should be rehabilitated upon completion of the construction activities to ensure that the land is returned in the same condition; ▪ Prior to finalising the sales agreement of land, it should be clear who will assume responsibility for the resettlement of vulnerable households, especially households comprising the community residing on Palmietkuilen 241 IR Ptn 2; ▪ If AOL assumes responsibility for displaced households, due process should be followed when these households are relocated. It is recommended that the process be aligned to IFC PS 5 and that a Resettlement Action Plan be developed; and ▪ Consider including employees and other impacted businesses in the aforementioned process.	Moderate (negative)
	Disruption of movement patterns	Social	Construction Phase	Minor (negative)	▪ Measures to prevent deterioration of roads suggested in Traffic Impact Assessment; ▪ Regulation of traffic at intersections between the R29 and site-access roads to construction and operational site; ▪ Road upgrading measures should be investigated and implemented in conjunction with the relevant government department; ▪ Inform communities of planned construction activities that would affect vehicle/ pedestrian traffic; and ▪ Ensure that access to key services in areas such as Springs are uninterrupted by providing alternative access routes, especially during relocation of Strijdpan Road.	Minor (negative)
	Influx of job seekers in area	Social	Construction Phase	Moderate (negative)	▪ Discourage influx of job-seekers by prioritising employment of unemployed members of local communities; ▪ Liaise with local municipalities to ensure that expected population influx is taken into account in infrastructure development and spatial development planning; ▪ Create synergies with local government IDP and other companies' SLP/CSR projects to promote infrastructure development; ▪ Extensive HIV/ AIDS awareness and general health campaign; ▪ Identify if recorded criminal activities involved members of the mine's workforce;	Minor (negative)

					▪ Clear identification of workers; prevention of loitering; ▪ Liaison with police, community policing forum; ▪ Promote projects providing housing, especially low cost housing; ▪ Community education; and ▪ Measures to address potential conflict between locals and non-locals	
	Opposition because of perceived negative impacts	Social	Construction Phase	Minor (negative)	▪ Communicate commitments regarding LED; ▪ Transparency regarding employment practices; ▪ Presentation of EIA findings in clear and understandable manner; ▪ Monitor community attitudes to anticipate/prevent active opposition; ▪ Establish a community forum which meets quarterly; and ▪ Appointment of a CLO to enhance communication.	Negligible (negative)
	Increase in Production	Macro-Economic	Construction Phase	Moderate (positive)	▪ The impact is positive; measures to maximise the stimulation of the economy may include procurement of goods and services from local business where feasible.	Moderate (positive)
	Impact on GDP	Macro-Economic	Construction Phase	Minor (positive)	▪ Recruit local labour; ▪ Sub-contract to local construction companies; and ▪ Use local suppliers where viable and arrange with the local Small and Medium and Micro Enterprises to provide transport, catering and other services for the construction crew.	Minor (positive)
	Impact on Employment	Macro-Economic	Construction Phase	Minor (positive)	▪ Use labour intensive construction methods, where feasible; ▪ Sub-contract to local construction companies; ▪ Use local suppliers; and ▪ Set-up a skills desk at the local municipal office and in the nearby communities to identify skills available in the community and assist in recruiting local labour during both construction and operation.	Minor (positive)
	Impact on Skills Development	Macro-Economic	Construction Phase	Minor (positive)	▪ Ensure that the main contractor shares knowledge with the sub-contracting companies during the construction period; and ▪ Encourage the main contractor to offer internships and learnerships, especially to those coming from the local communities.	Minor (positive)
	Impact on Household Income	Macro-Economic	Construction Phase	Minor (positive)	▪ Employ labour intensive methods in construction; ▪ Sub-contract to local construction companies; and ▪ Use local suppliers where viable and arrange with the local Small and Medium Enterprises to provide transport, catering, and other services for the construction crew.	Minor (positive)
	Impact on Government Revenue	Macro-Economic	Construction Phase	Minor (positive)	▪ No enhancement.	Minor (positive)
	Impact on Agricultural Production due to Sterilisation of Productive Agricultural Land	Macro-Economic	Construction Phase	Major (negative)	▪ The establishment of the mine should be done with a minimal impact on the agricultural land and on the footprint of the properties ▪ Engage with directly affected farmers and landowners on alternative farming locations and investigate ways to minimise loss of agricultural production. ▪ Off-set impact by training local small-scale farmers as stated in SLP in order to have no net loss. ▪ If feasible, continue utilising land not affected by the mine’s footprint for agricultural production. ▪ Where possible, ensure that land preparation and rehabilitation activities implemented during various staged of the mine’s lifecycle allow for restoration of land to above-grazing capacity, i.e. suitable for crop production.	Moderate (negative)

	Potential Negative Impact on Property Value	Macro-Economic	Construction Phase	Minor (negative)	▪ Mitigation measures proposed by visual and noise specialists should be strictly adhered to, to minimise the probability and intensity of the visual exposure in the area; ▪ Independent appraisals of properties and land values in the area adjacent to the site to determine the baseline before the project's implementation is advisable; and ▪ Educate and inform the affected parties on the potential environmental impacts that could ensue and the activities to adequately manage perceptions regarding potential effects of the project on the surrounding land uses.	Minor (negative)
	Potential Negative Impact on Egg Industry	Macro-Economic	Construction Phase	Minor (negative)	▪ Engage with respective researchers and specialists to determine with greater certainty the effect that any negative environmental impacts could affect the production of eggs on the nearby egg farms; ▪ Engage with adjacent landowners and compile the baseline, as well as monitor the effects of the mining activity on the production at the potentially affected farms; ▪ In the event that the production is affected and proven to be the result of mining activity, engage with adjacent landowners and investigate appropriate alternatives suitable for all the parties to ensure overall production is not affected (relocation, expansion of other facilities, etc.); and ▪ Strictly adhere to environmental specialists recommendations.	Negligible (negative)
	Construction and development activities within a greenfield site are a negative impact to functioning wetlands and catchment	Wetlands	Construction Phase	Minor (negative)	▪ The edge of the non-directly impacted wetlands, and at least a 32 m buffer if possible, must be clearly demarcated in the field with wooden stakes painted white as no-go zones that will last for the duration of the construction phase. ▪ Wetland monitoring must be carried out during the construction phase by a wetland specialist to ensure no unnecessary impact to wetlands is realised; and if so that a remedy is put in place as soon as possible. ▪ Refer to the Surface Water Report (Digby Wells, 2016f) for details on a Storm Water Management Plan that is to be carried out. This must be in operation during the construction phase and wetlands must be highlighted as sensitive receptors. ▪ Refer to the Fauna and Flora Report (Digby Wells, 2016c) for mitigation measures relating to floristic impacts as well as faunal species disturbances; for example, ▪ minimal bright lights should be left on at night time and they should not face outwards of the site; and ▪ An alien and invasive plant species management programme must be in place from the construction phase.	Negligible (negative)
	Placement of impenetrable surfaces resulting in reduced surface water infiltration and alteration of baseflow and surface water drainage patterns.	Aquatic Ecology	Construction Phase	Minor (negative)	▪ Minimise the removal of vegetation in the infrastructure footprint area; ▪ Re-vegetation of the disturbed areas within the construction footprint areas once construction is completed; ▪ Soils compacted by heavy machinery in areas that are not utilised post construction can be ripped to allow infiltration; ▪ Ensure that storm water management structures are within good working condition through regular inspection, especially after large storm events; ▪ Where storm water enters river systems, sediment/silt and debris trapping, as well as energy dissipation control measures must be put in place; ▪ Storm water must be diverted from construction activities and managed in such a manner to disperse runoff and prevent the concentration of storm water flow; ▪ The vegetation of unpaved roadsides; and	Negligible (negative)

					▪ Inspection of paved and unpaved roads to monitor for erosion.	
	Noise emanating from the machinery and vehicles operating during the construction activities	Noise	Construction Phase	Moderate (negative)	▪ Alternative location of the northernmost hard overburden dump; ▪ Alternative location of the haul route towards the siding; ▪ Restricting construction activities to daylight hours (06:00 – 18:00) and not during weekends and public holidays; ▪ Locating of diesel generator away from noise sensitive receptors, as well as placing generators on isolation mounts and installation of secondary silencers; ▪ Mining related machines and vehicles to be serviced to the designed requirements of the machinery/vehicles to ensure noise suppression mechanisms are effective e.g. installed exhaust mufflers; ▪ Reversing alarms on vehicles should be broadband reversing alarms which emit directional, lower, less intrusive sound; ▪ Environmental noise monitoring to establish compliance with the regulations and to verify the predicted noise levels; and ▪ Switching off equipment when not in use.	Negligible (negative)
	The surface infrastructure will change the sense of place of the Project area from an agricultural sense of place to an industrial / mining sense of place. Construction area lighting at night will have a negative visual impact on the receiving environment. The construction area lighting will be visible from a distance of up to 10 km and will draw attention to the Project area.	Visual	Construction Phase	Moderate (negative)	▪ Ensure screening vegetation is left intact around the Project area and near receptors; ▪ Ensure the surface infrastructure does not exceed the proposed heights; ▪ Surface infrastructure should be painted natural hues so as to blend into the surrounding landscape where possible; ▪ Pylons and metal structures should be galvanised so as to weather to a matt grey finish rather than be painted silver. If the pylons and metal structures are painted, it is recommended that a neutral matt finish be used; and ▪ Where possible avoid construction activities at night. If construction activities take place at night then down lighting must be implemented to minimise light pollution.	Minor (negative)
	Relocation of infrastructure is expected to have a negative visual impact on the receiving environment. The location for the relocation of the road is not currently known and for the purposes of this impact assessment it has been assumed that the road will be diverted to the farm road running along the south-eastern boundary of the Project area and that this farm road will be upgraded as required	Visual	Construction Phase	Minor (negative)	▪ Limit the footprint area of the road where possible by utilising existing roads for the relocation; ▪ The road should be wetted frequently by means of a water bowser to suppress dust; and ▪ Ensure screening vegetation is left intact along the sides of the road.	Negligible (negative)
	Nuisance impacts on surrounding land users (mainly noise, blasting, dust etc.)	Social	Construction Phase	Moderate (negative)	▪ Refer to recommendations of specialist studies (see Visual Impact Assessment, Surface-and Ground Water Impact Assessment, Noise Impact Assessment, Air Quality Impact Assessment, Blasting and Vibration Impact Assessment and Traffic Impact Assessment); ▪ Optimise mine plan/infrastructure placement to avoid/minimise negative impacts, especially in terms of visual intrusion, displacement, air quality and disruptions of traffic; ▪ Undertake continuous information sharing and consultation with adjacent/affected farm owners; and ▪ Implement communication mechanisms to report changes in water quality/quantity, air quality or vibrations.	Minor (negative)

	Inherent risk on community health and safety	Social	Construction Phase	Moderate (negative)	▪ Access control to all project elements, including fencing prior to commencing construction; ▪ Notification of blasting activities; ▪ Storage of blasting and hazardous materials should adhere to prescribed regulation; ▪ Measures suggested minimising the impact of fly-rock on surrounding roads and structure (Blast Management and Consulting, Appendix L); ▪ Measures suggested in the Traffic Impact Assessment to minimize traffic related accidents (Traffic Impact Assessment, Appendix P); ▪ Road maintenance; and ▪ Community education	Negligible (negative)
Blasting and development of initial box-cut for mining, including stockpiling from initial box-cuts	Alteration in surface water drainage patterns and a reduction in the amount of water reaching the Aston Lake and reduced flow to Blesbokspruit	Surface Water	Construction Phase	Moderate (negative)	▪ Implementation of the storm water management plan to prevent clean water from flowing into the boxcut. Unfortunately, there are no mitigation measures for direct rainfall falling into the boxcut. ▪ As much as is possible, water should be reused and any treated storm flows released downstream ▪ Backfilling and rehabilitation of old boxcuts as mining progresses	Minor (negative)
	Alteration in surface water drainage patterns resulting in changes to downstream habitat structures.	Aquatic Ecology	Construction Phase	Minor (negative)	▪ Minimise the removal of vegetation in the infrastructure footprint area; ▪ Re-vegetation of the disturbed areas within the construction footprint area once construction is completed; ▪ Soils compacted by heavy machinery in areas that are not utilised post construction can be ripped to allow infiltration; ▪ Ensure that storm water management structures are within good working condition through regular inspection, especially after large storm events; ▪ Where storm water enters river systems, sediment/silt and debris trapping, as well as energy dissipation control measures must be put in place; ▪ Storm water must be diverted from construction activities and managed in such a manner to disperse runoff and prevent the concentration of storm water flow; ▪ The vegetation of unpaved roadsides; and ▪ Inspection of paved and unpaved roads to monitor for erosion;	Negligible (negative)
Temporary storage of hazardous products, including fuel and explosives	▪ No specific impacts were identified for the temporary storage of hazardous products during the construction phase.					
Storage of as waste, sewage and slurry	▪ No specific impacts were identified for the storage of waste products during the construction phase.					
Stripping topsoil and soft overburden	Topsoil losses can occur during the operational phase as a result of rainwater runoff and wind erosion from roads and soil stockpiles.	Soil, Land Use and Land Capability	Operational Phase	Moderate (negative)	▪ Follow adequate stripping guidelines in Section 14; ▪ Topsoil should be stripped by means of an excavator bucket and loaded onto dump trucks; ▪ If possible topsoil should be stripped when soil is dry, as to reduce compaction ▪ Ensure topsoil is stored in one dedicated stockpile, 10 m high and away from drainages lines and surface water; ▪ Only the designated access routes are to be used; ▪ If erosion occurs, corrective actions must be taken to minimise any further erosion from taking place; ▪ Stockpiles are to be maintained in a fertile and erosion free state by sampling and analysing annually for nutrients and soil pH, and vegetating the stockpiles to reduce	Minor (negative)

					erosion; ▪ Compaction of the removed topsoil should be avoided by prohibiting traffic on stockpiles; ▪ Prevent unauthorised borrowing of stockpiled soil; and ▪ Ensure proper storm water management designs are in place.	
	When topsoil is removed from the open pit, land capability is reduced to nothing. The land use will be change from intensive cultivation to mining	Soil, Land Use and Land Capability	Operational Phase	Major (negative)	▪ No land capability mitigation is possible during the operational phase because the land use is changed from agriculture to open pit mining.	Moderate (negative)
	Stripping activity will result in fugitive dust emissions and reduction in air quality	Air Quality	Operational Phase	Minor (negative)	▪ Application of wetting agents or dust suppressant; ▪ The area of disturbance at all times must be kept to a minimum and no unnecessary stripping must occur, especially on windy days (wind speed ≥ 5.4 m/s) ▪ The drop heights when loading onto trucks and at tipping points should be minimised.	Minor (negative)
	As the Project area is stripped it will become noticeable to nearby receptors as it will contrast the surrounding area.	Visual	Operational Phase	Moderate (negative)	▪ Topsoil should only be removed when and where necessary; and ▪ Soft overburden should only be removed when and where necessary.	Minor (negative)
Removal of overburden, including drilling and blasting of hard overburden	Removal of overburden (including drilling and blasting of hard overburden) will have a negative visual impact on the receiving environment. Drilling and blasting will result in noise and dust thereby attracting attention to the Project area. Dust from blasting will have a negative visual impact. The open pit will dramatically contrast the surrounding agricultural area as it will result in a scar on the landscape.	Visual	Operational Phase	Moderate (negative)	▪ Only remove overburden when and where necessary; and ▪ Apply dust suppression techniques to limit the dust generated from the blasting.	Moderate (negative)
Loading, hauling and stockpiling of overburden	Increased vehicular movement and noise on site resulting in disturbance to fauna on site (noise, road-kills)	Flora and Fauna	Operational Phase	Minor (negative)	▪ Erect signage on site; ▪ Adhere to speed limits; ▪ Make use of internal fencing; and ▪ Avoid vehicle movement at night.	Negligible (negative)
	Vehicular activity to load and haul overburden (including topsoil, soft overburden and hard overburden) will have a negative visual impact on the receiving environment. Dust from the vehicular activity will also have a negative visual impact.	Visual	Operational Phase	Minor (negative)	▪ Limit the speed of vehicles on the haul roads to reduce dust; and ▪ Haul roads should be wetted frequently by means of a water bowser to suppress dust.	Minor (negative)
	Stockpiling of overburden (including topsoil, soft overburden and hard overburden) will have a negative visual impact on the receiving environment. Dust from the stockpiles will also have a negative visual impact. The impact of the stockpiles will occur for the life of the Project. This impact will be reversed when the material from the	Visual	Operational Phase	Moderate (negative)	▪ Topsoil stockpiles should be vegetated with grasses (Andropogon appendiculatus, Andropogon eucomus, Andropogon huillensis, Aristida congesta subsp. Barbicollis, Arundinella nepalensis, Cynodon dactylon, Eragrostis capensis, Eragrostis curvula, Eragrostis gummiflua, Eragrostis racemose, Fingerhuthia Africana, Hyparrhenia hirta, Hyparrhenia tamba, Imperata cylindrical, Melinis repens, Paspalum dilatatum, Setaria sphacelata, Sporobolus africanus, Sporobolus pyramidalis, Themeda triandra, Trichoneura grandiglumis and Tristachya leucothrix) where possible so as to blend in with the surrounding landscape and reduce dust generation;	Moderate (negative)

	stockpiles is used to backfill the open pit (soft overburden and hard overburden) and rehabilitate the Project area (topsoil) during the decommissioning and closure phase.				▪ Limit the footprint area of topsoil stockpiles where possible; ▪ Limit the height of topsoil stockpiles to 20 m; ▪ Ensure the soft overburden and hard overburden stockpiles do not exceed the proposed height of 20 m; and ▪ Apply dust suppression techniques to limit dust generated from stockpiles.	
Development and operation of surface infrastructure	Mine dewatering and creation of cone of depression	Groundwater	Operational Phase	Moderate (negative)	▪ Store the dewatered water in pollution control dam and ensure that the dam will have sufficient storage volume and utilise this water in the process. If that is not possible, re-introduce treated water into the streams after ensuring that it meets the required river quality objectives. ▪ If impact is confirmed through monitoring, management solutions should be implemented acceptable to the authorities such as the purchase of impacted land or the provision of alternate sources of water. ▪ Groundwater monitoring should be conducted.	Minor (negative)
	Groundwater contamination as a result of open pit mining	Groundwater	Operational Phase	Minor (negative)	▪ Concurrent rehabilitation should be conducted to minimise water and oxygen inflow from the atmosphere. ▪ The pit should be enclosed with berms to contain surface water runoffs from entering. ▪ If impact is confirmed through monitoring, management solutions should be sought for upon agreement with the farmers or communities with impacted groundwater or mine purchase land. ▪ Contaminated water should be utilised by the mine, instead of using freshwater (if practical).	Negligible (negative)
	Groundwater contamination as a result of seepage from the waste stockpiles and slurry dam	Groundwater	Operational Phase	Minor (negative)	▪ Slurry dam, overburden and topsoil stockpiles should be managed to minimise infiltration of contaminants to the groundwater. Mitigation methods that should be considered include the correct placement of the stockpile and covering them with soil to minimise rainfall infiltration and mobilisation of dissolved metals and vegetate them. The shape of the stockpile should be managed to control the ease with which water can run off from the facility. ▪ Implement the required prevention mechanisms at the discard and slurry stockpiles to prevent pollution migration. ▪ Discard being placed back into the pit should be put on the coal seam floor or as low as possible and definitely below the water table in areas where there will be no oxygenation and water throughflow.	Negligible (negative)
	Groundwater contamination due to seepage from PCD	Groundwater	Operational Phase	Minor (negative)	▪ Apply a liner underneath the PCDs to minimise or avoid infiltration; and ▪ Monitor the groundwater quality for impact detection.	Negligible (negative)
	Development and operation of surface infrastructure resulting in water contamination leading to deterioration of water quality	Surface Water	Operational Phase	Moderate (negative)	▪ Ensure that all the dirty water emanating from the dirty water areas be collected via silt traps before entering the PCD for re-use within the mine, to prevent unnecessary discharge into the environment; ▪ The dirty water collection trenches should be cleaned regularly to reduce the build up of washed off coal fines and ensure they are able to accommodate and convey the 1:50 year peak flows. This material should be disposed to an appropriate licenced facility; ▪ Stockpiling should be monitored so that the side slopes do not encourage erosion of the slopes resulting in silt transported into the trenches from the stockpiles, allowing some silt to settle on the dirty water site rather than in the channels; ▪ In addition to the control of storm water, water quality monitoring should form part of the system where water in the PCD's are monitored for quality. This ensures that	Minor (negative)

					pollution sources are monitored during the mining operational process and in the unlikely event of any spillages the downstream impacts can be estimated. The main constituents to check would be the TSS, EC, Salts and some chemical parameters that such as (pH, SO4 and other metals).	
	Runoff from the dirty water areas reporting into the Aston Lake and the unnamed streams flowing to it resulting in water contamination or the deterioration of the water quality.	Aquatic Ecology	Operational Phase	Moderate (negative)	▪ Diversion trench and berm systems which diverts clean storm water around pollution sources and convey and contain dirty water to central pollution control impoundments (Plan 66); ▪ Barrier systems, including synthetic, clay and geological or other approved mitigation methods to minimise contaminated seepage and runoff from stockpiles and pollution control facilities from entering the local aquatic systems; ▪ Where storm water enters river systems from disturbed sites, sediment and debris trapping, as well as energy dissipation control measures must be put in place; ▪ The planting of indigenous vegetation around pollution control impoundments and structures should be completed as this has been shown to be effective in erosion prevention and nutrient control; ▪ Ensure that all the dirty water emanating from the dirty water areas be collected in the PCD for re-use within the mine, to prevent unnecessary discharge into the environment; ▪ The dirty water collection trenches should be cleaned regularly to reduce the build up of washed off coal fines and ensure they are able to accommodate and convey the 1:50 year peak flows. This material should be disposed to an appropriate licenced facility; ▪ Stockpiling should be monitored so that the side slopes do not encourage erosion of the slopes resulting in silt transported into the trenches from the stockpiles, allowing some silt to settle on the dirty water site rather than in the channels; and ▪ In addition to the control of storm water, water quality supplemented by aquatic ecology monitoring should form part of the system where water in the PCD's and surrounding streams are monitored for quality. This ensures that pollution sources are monitored during the mining process.	Moderate (negative)
	Reduction of catchment yield as dirty water runoff within the mine will be contained in the PCD. Groundwater loss and flow from the pit will also contribute toward baseflow reduction	Aquatic Ecology	Operational Phase	Moderate (negative)	▪ Effective surface water management whereby all clean water is diverted into the nearby streams (Plan 66).	Moderate (negative)
	Impact on Production	Macro-Economic	Operational Phase	Moderate (positive)	▪ Procurement of goods and services from local business where feasible, will increase benefits to the local economy, but will not change the rating.	Moderate (positive)
	Impact on GDP	Macro-Economic	Operational Phase	Moderate (positive)	▪ Explore local procurement prospects.	Moderate (positive)
	Impact on Employment	Macro-Economic	Operational Phase	Moderate (positive)	▪ Employ local labour to increase benefit to the local community.	Moderate (positive)
	Impact on Skills Development	Macro-Economic	Operational Phase	Moderate (positive)	▪ The mine is required by law to adhere to the provisions detailed in the Social and Labour Plan – no augmentation measures required	Moderate (positive)

	Impact on Household Income	Macro-Economic	Operational Phase	Moderate (positive)	▪ Investigate opportunities to increase local procurement and localise mine's expenditure; and ▪ Explore opportunities to employ as many people from the local communities as possible.	Moderate (positive)
	Impact on Government Revenue	Macro-Economic	Operational Phase	Moderate (positive)	▪ No enhancement.	Moderate (positive)
Drilling and blasting of coal.	Perforation of rock and groundwater reserves leading to severe hydrological and geomorphological impacts to wetlands and catchment due to draw down cone.	Wetlands	Operational Phase	Major (negative)	▪ There are no foreseen mitigation actions that may significantly lessen the impact on the receiving catchment. However, the following should be done: ▪ Dirty water from the storm water system and pollution control dam should be treated and released back into the surrounding wetland systems; downstream of the dewatering cone of depression.	Major (negative)
	Reduction of groundwater quantity as a result of mine dewatering	Groundwater	Operational Phase	Moderate (negative)	▪ Dewatering efficiently. ▪ Providing affected receptors with water. ▪ Groundwater monitoring.	Moderate (negative)
	Drilling and blasting will result in fugitive emissions and reduction in air quality	Air Quality	Operational Phase	Minor (negative)	▪ Wet drilling; and ▪ Conduct blasting judiciously by avoid windy days (≥ 5.4 m/s)	Minor (negative)
	Drilling and blasting of coal will have a negative visual impact on the receiving environment. Drilling and blasting will result in noise and dust thereby attracting attention to the Project area. Dust from blasting will have a negative visual impact. The open pit will dramatically contrast the surrounding agricultural area as it will result in a scar on the landscape. Once coal is removed from the open pit there will be insufficient material to backfill the open pit completely and a void will remain. This will result in a permanent and irreversible negative visual impact on the receiving environment.	Visual	Operational Phase	Major (negative)	▪ Apply dust suppression techniques to limit the dust generated from the blasting; ▪ Ensure that the open pit is backfilled with material from the overburden stockpiles; ▪ Rehabilitate all disturbed areas; ▪ Ensure that the rehabilitated area is re-contoured and profiled to create a free-draining topography; ▪ Spread topsoil over the rehabilitated area; ▪ Ensure that surface water and drainage lines are rehabilitated; ▪ Re-vegetate the rehabilitated areas with grasses (Andropogon appendiculatus, Andropogon eucomus, Andropogon huillensis, Aristida congesta subsp. Barbicollis, Arundinella nepalensis, Cynodon dactylon, Eragrostis capensis, Eragrostis curvula, Eragrostis gummiflua, Eragrostis racemose, Fingerhuthia Africana, Hyparrhenia hirta, Hyparrhenia tamba, Imperata cylindrical, Melinis repens, Paspalum dilatatum, Setaria sphacelata, Sporobolus africanus, Sporobolus pyramidalis, Themeda triandra, Trichoneura grandiglumis and Tristachya leucothrix); and ▪ Ensure all the mitigation / management actions outlined in the Closure and Rehabilitation reports are conducted.	Moderate (negative)
	Ground vibration at surrounding houses	Blast and Vibrations	Operational Phase	Moderate (negative)	▪ Reduce Charge Mass/Delay; ▪ Reconsider blast initiation system – electronics; ▪ Relocate POI's of concern at least 650m; and ▪ Implementation of proper blast design.	Negligible (negative)
	Ground vibration on surrounding roads	Blast and Vibrations	Operational Phase	Negligible (negative)	▪ No mitigation measures are proposed.	Negligible (negative)
	Air blast impact on houses	Blast and Vibrations	Operational Phase	Minor (negative)	▪ Reduce Charge Mass/Delay; ▪ Increase stemming length; ▪ Controls need to be put in place for management of stemming lengths and quality stemming material; ▪ Relocate POI's of concern at least 650m; and ▪ Implementation of proper blast design.	Negligible (negative)

	Air blast impact on roads	Blast and Vibrations	Operational Phase	Negligible (negative)	▪ No mitigation measures are proposed.	Negligible (negative)
	Fly Rock impact on houses	Blast and Vibrations	Operational Phase	Moderate (negative)	▪ Increase stemming length; ▪ Use quality stemming material; ▪ Controls put in place for management of stemming lengths; ▪ Relocate POI's of concern at least 650m; and ▪ Implementation of proper blast designs.	Negligible (negative)
	Fly Rock impact on roads	Blast and Vibrations	Operational Phase	Moderate (negative)	▪ Increase stemming length; ▪ Use quality stemming material; ▪ Controls put in place for management of stemming lengths; ▪ Relocate POI's of concern at least 650m; and ▪ Implementation of proper blast designs.	Negligible (negative)
	Impact of Fumes - Houses	Blast and Vibrations	Operational Phase	Minor (negative)	▪ Use correct product; ▪ Control product quality; ▪ Prevent sleep time for charged blast holes; ▪ Ensure same day charge and blast; and ▪ Implementation of proper blast designs.	Negligible (negative)
	Impact of Fumes - Roads	Blast and Vibrations	Operational Phase	Negligible (negative)	▪ No mitigation measures are proposed.	Negligible (negative)
	Direct impact to burial grounds and graves	Heritage	Construction Phase	Major (negative)	▪ Redesign of the proposed open pit should be considered to exclude and conserve the identified burial grounds and graves in situ. Where this is possible, a BGGC must be completed to reach agreement with bona fide NoK with regards to access and conservation of the burial grounds and graves. The assessor is aware, however, that the location of the open pit is limited by the resource, and redesign of may not be economically viable. ▪ Where redesign is not feasible, complete a BGGC and GRP as regulated by Section 36 of the NHRA and Chapters XI and IX of the Regulations to the Act must be implemented to identify as far as possible bona fide NoK to consult and reach agreement as to the appropriate management of the burial grounds through a required GRP.	Moderate (negative)
	Employment creation during operation	Social	Operational Phase	Minor (positive)	▪ Measures to enhance local employment during construction (see measures to enhance employment during construction); ▪ Provide focused training to construction phase employees from the host communities to increase their chances for employment during the operations; ▪ Measures recommended to maximise benefits from local employment, and economic multiplier effects; and ▪ The Project's database of the local labour pool should be updated to include people who were employed by the Project during the construction phase.	Moderate (positive)
	Stimulation and growth of the local and regional economies	Social	Operational Phase	Minor (positive)	▪ Measures recommended to maximise benefits from local employment, economic multiplier effects, as well as community, economic and skills development; ▪ Procure from local HDSA suppliers throughout the life of the mine; and ▪ Establish a monitoring system to ensure that the mine and its contractors comply with government regulations	Moderate (positive)
Crushing and Screening of	Crushing and screening lead to fugitive dust	Air Quality	Operational	Minor	▪ Enclosure of crushers; and ▪ Application of fogging system at the crusher	Negligible

ROM Coal	emissions and reduction in air quality		Phase	(negative)		(negative)
Generation of power using diesel generators	Reduction in air quality due to gaseous emissions	Air Quality	Operational Phase	Moderate (negative)	▪ Ensure generators are working at optimum conditions; ▪ Fitting of gas scrubbers; and ▪ Fitting electrostatic precipitators or bag house.	Negligible (negative)
Load, haul and stockpiling of ROM coal; and Use and maintenance of haul roads for the transportation of coal to the washing plant	Operational activities will be occurring within an ecologically sensitive catchment and thus the handling, stockpiling and transport of the coal will have some impacts to the wetlands, particularly with respect to the haul road that crosses the NFEPA Rank 1 wetland, upstream of Aston Lake. Movement of coal openly through the environment will have some deposition of coal fines that will negatively impact the surrounding environment, particularly water quality.	Wetlands	Operational Phase	Moderate (negative)	▪ The haul roads and servitude must also have well-designed stream crossings and drainage areas, which should be maintained. The wetlands outside of this must be demarcated as no-go areas. ▪ Dust management programme must be in place (Air Quality Report, Digby Wells, 2016a) ▪ The haul roads and servitude must be monitored and maintained to best operating standards. This should be done in the dry season. ▪ The wetland must be monitored on a regular basis to ensure no residual impact to the wetland and river is realised; and if so that remediation measures are followed. ▪ If possible, truck loads should be covered; particularly in dry and windy seasons. ▪ Berms must be maintained as a buffer between the coal handling area and the sensitive receiving environment.	Minor (negative)
	Loading, Hauling and Stockpiling of ROM Coal and Overburden will result in result in fugitive emissions and reduction in air quality	Air Quality	Operational Phase	Moderate (negative)	▪ The drop heights when loading onto trucks and at tipping points should be minimised; ▪ The use of dust suppressants and binders on haul roads to reduce dust generation; ▪ There is need to set maximum speed limits on haul roads and to have these limits enforced.	Minor (negative)
	Noise will emanate from the machinery and vehicles operating during the operational activities	Noise	Operational Phase	Moderate (negative)	▪ The feasibility of constructing 20m berm along the northern boundary of the opencast pit footprint to act as an additional barrier to sound should be investigated; ▪ The feasibility of constructing 20m berm along the diagonal south east boundary of the opencast pit footprint should be investigated; ▪ Alternative location of the northernmost hard overburden dump; ▪ Alternative location of the haul route towards the siding; ▪ Locating of diesel generator away from noise sensitive receptors, as well as placing generators on isolation mounts and installation of secondary silencers; ▪ Mining related machines and vehicles to be serviced to the designed requirements of the machinery/vehicles to ensure noise suppression mechanisms are effective e.g. installed exhaust mufflers; ▪ Reversing alarms on vehicles should be broadband reversing alarms which emit directional, lower, less intrusive sound; ▪ Environmental noise monitoring to establish compliance with the regulations and to verify the predicted noise levels; and ▪ Switching off equipment when not in use.	Minor (negative)
	Vehicular activity to load and haul ROM coal will have a negative visual impact on the receiving environment. Dust from the vehicular activity will also have a negative visual impact	Visual	Operational Phase	Minor (negative)	▪ Limit the speed of vehicles on the haul roads to reduce dust; and ▪ Haul roads should be wetted frequently by means of a water bowser to suppress dust.	Minor (negative)
	Vehicular activity on the haul roads will have a negative visual impact on the receiving environment. Dust from the vehicular activity will also have a negative visual impact.	Visual	Operational Phase	Minor (negative)	▪ Limit the speed of vehicles on the haul roads to reduce dust; and ▪ Haul roads should be wetted frequently by means of a water bowser to suppress dust	Minor (negative)

	Maintenance of the haul roads may require the acquisition of additional material from borrow pits which will have a negative visual impact on the receiving environment.					
	Plant area lighting at night will have a negative visual impact on the receiving environment. The plant area lighting will be visible from a distance of up to 10 km and will draw attention to the Project area. This will also have a negative impact on the sense of place.	Visual	Operational Phase	Moderate (negative)	▪ Down lighting must be implemented for operational activities taking place at night to minimise light pollution; and ▪ Ensure the product stockpile does not exceed the proposed height of 10 m	Moderate (negative)
Water use and storage on-site	No specific impacts have been identified for water use and storage on site.					
Storage, handling and treatment of hazardous products (including fuel, explosives and oil) and waste	Spills and evaporation will lead to fugitive emission and reduce in air quality	Air Quality	Operational Phase	Minor (negative)	▪ Strict adherence to products and waste management plan; ▪ Handled, stored and disposed hazardous substances in accordance with the local regulations; ▪ Store hazardous substances in clearly labelled containers; ▪ Deal with emergency situations promptly i.e. spills; and ▪ Provision of secondary containment for fuel storage.	Negligible (negative)
	Disposal of discard from the washing plant on the discard dump will have a negative visual impact on the receiving environment that will occur for the life of the Project.	Visual	Operational Phase	Moderate (negative)	▪ Ensure the discard dump does not exceed the proposed height of 20 m	Moderate (negative)
Demolition and removal of all infrastructure, including transporting materials off site	Alien plant invasion may take place	Flora and Fauna	Decommissioning Phase	Minor (negative)	▪ An alien plant species management plan should be implemented for two years.	Negligible (negative)
	Reduced surface water infiltration as well as an alteration in surface water drainage patterns as a result of soil compaction from the movement of heavy machinery and vehicles	Surface Water	Decommissioning Phase	Minor (negative)	▪ Compact soils should be loosened through soil ripping.	Negligible (negative)
	The decommissioning and rehabilitation activities occurring within an ecologically sensitive catchment pose significant potential negative impacts to functioning wetlands and catchment. Furthermore, the rehabilitated area could cause major negative impacts due to spread of alien invasive vegetation, increased soil compaction erosion and subsequent sedimentation into the wetland ecosystems	Wetlands	Decommissioning Phase	Minor (negative)	▪ The edge of the wetlands and at least a 32 m buffer must continue to be clearly demarcated as no-go areas and sensitive receptors. ▪ The rehabilitation footprint kept as small as possible and non-impacted wetlands must be avoided. ▪ Careful attention must be given to handling wetland soils, if any. ▪ Wetland monitoring must be carried out during the rehabilitation phase to ensure no unnecessary impact to wetlands is realised; and if so that a remedy is put in place as soon as possible. ▪ Please refer to the full Rehabilitation Plan Report (Digby Wells, 2016) as part of this EIA for full mitigation and management actions.	Minor (negative)
	The removal of the infrastructure will lead to potential negative impacts on the integrity of the associated aquatic ecosystems due to	Aquatic Ecology	Decommissioning Phase	Minor (negative)	▪ Established buffer zones; and ▪ Phased approach to clearing with concurrent rehabilitation.	Minor (negative)

	the clearing of land and thus exposing it to erosion which could lead to further sedimentation of the river systems.					
	Reduction in air quality	Air Quality	Decommissioning Phase	Negligible (negative)	▪ The dismantling area disturbed must be kept to a minimum; ▪ Drop heights when offloading materials offsite must be minimised; and ▪ Limit demolition activities to non-windy days.	Negligible (negative)
	Noise will emanate from the machinery and vehicles operating during the decommissioning activities.	Noise	Decommissioning Phase	Negligible (negative)	▪ Restricting decommissioning activities to daylight hours (06:00 – 18:00) and not during weekends and public holidays; ▪ Mining related machines and vehicles to be serviced to the designed requirements of the machinery/vehicles to ensure noise suppression mechanisms are effective e.g. installed exhaust mufflers; and ▪ Switching off equipment when not in use.	Negligible (negative)
	Demolition and removal of all infrastructure will have a negative visual impact on the receiving environment. Dust from the demolition process will also have a negative visual impact. Once the infrastructure is removed and rehabilitation of the disturbed areas is complete, there will be an overall neutral visual impact on the receiving environment.	Visual	Decommissioning Phase	Minor (negative)	▪ Apply dust suppression techniques to limit the dust from the demolition area; ▪ Use shade cloth / netting to screen the demolition area; ▪ Ensure all infrastructure is demolished and removed from the site; ▪ Limit the quantity and time of rubble stored on site; and ▪ Rehabilitate all disturbed areas.	Minor (negative)
	Dependency on mine for sustaining local economy	Social	Decommissioning Phase	Moderate (negative)	▪ Develop alternative and sustainable livelihoods; ▪ Collaborate with other industries to support the diversification of the local economy; ▪ The Mine's SLP should provide strategies and measures that prevent job loss; ▪ Alternatives to save jobs/avoid downscaling should be investigated beforehand; ▪ Develop a Mine Closure Plan; ▪ Proactively assess and manage the social and economic impacts on individuals, regions and economies where retrenchment and/or closure of the mine are certain; and ▪ Partner with the relevant government departments, to jointly manage Closure process	Minor (negative)
Rehabilitation, including spreading of soil, re-vegetation and profiling or contouring	Restoration of land capability to its pre-mining state or agreed upon alternative	Soil, Land Use and Land Capability	Decommissioning Phase	Moderate (negative)	▪ Rehabilitate according to the rehabilitation plan; ▪ Return the land conditions capable of supporting prior land use or uses equal or better than prior land use to the extent feasible or practical; and ▪ Contour slopes to minimise erosion and run-off.	Moderate (positive)
	Restoration of vegetation and habitat types.	Flora and Fauna	Decommissioning Phase	Minor (positive)	▪ No enhancement measures are proposed.	Minor (positive)
	Rehabilitation of infrastructure footprint areas	Flora and Fauna	Decommissioning Phase	Moderate (positive)	▪ No enhancement measures are proposed.	Moderate (positive)
	Loosening of soil during rehabilitation processes resulting in the sedimentation of surface water resources resulting in reduced water quality	Surface Water	Decommissioning Phase	Minor (negative)	▪ Storm water management structures should be left in place until rehabilitation is complete; and ▪ Storm water management structures should be inspected after large storm events to ensure that there are no blockages or breaches. Should blockages or breaches occur, then immediate action should be undertaken to remove debris or to repair breached	Negligible (negative)

					areas.	
	Reduction in air quality	Air Quality	Decommissioning Phase	Negligible (negative)	▪ Drop heights when offloading materials for rehabilitation must be minimised; ▪ Limit rehabilitation activities to non-windy days; ▪ Rehabilitated landscape should be vegetated; and ▪ Use of dust suppressant on dirt roads and exposed areas.	Negligible (negative)
	Spills and evaporation from fuel, heavy fuel oil and used chemical will lead to reduction in air quality	Air Quality	Decommissioning Phase	Negligible (negative)	▪ Strict adherence to products and waste management plan; ▪ Handled, stored and disposed hazardous substances in accordance with the local regulations; ▪ Store hazardous substances in clearly labelled containers; ▪ Emergency situations must be dealt with promptly i.e. spills. ▪ Provision of secondary containment for fuel storage.	Negligible (negative)
	Rehabilitation (including spreading of soil, re-vegetation and profiling or contouring) will have a negative visual impact on the receiving environment. Once coal is removed from the open pit there will be insufficient material to backfill the open pit completely and a void will remain. This will result in a permanent and irreversible negative visual impact on the receiving environment. This impact will become reversible if the Project area is re-contoured and profiled to create a free-draining topography thereby eliminating the void. Once rehabilitation is complete and the Project area has re-contoured and profiled to create a free-draining topography there will be an overall neutral visual impact on the receiving environment.	Visual	Decommissioning Phase	Minor (negative)	▪ Ensure that the open pit is backfilled with material from the overburden stockpiles; ▪ Rehabilitate all disturbed areas; ▪ Ensure that the rehabilitated area is re-contoured and profiled to create a free-draining topography; ▪ Spread topsoil over the rehabilitated area; ▪ Ensure that surface water and drainage lines are rehabilitated; ▪ Re-vegetate the rehabilitated areas with grasses (Andropogon appendiculatus, Andropogon eucomus, Andropogon huillensis, Aristida congesta subsp. Barbicollis, Arundinella nepalensis, Cynodon dactylon, Eragrostis capensis, Eragrostis curvula, Eragrostis gummiflua, Eragrostis racemose, Fingerhuthia Africana, Hyparrhenia hirta, Hyparrhenia tamba, Imperata cylindrical, Melinis repens, Paspalum dilatatum, Setaria sphacelata, Sporobolus africanus, Sporobolus pyramidalis, Themeda triandra, Trichoneura grandiglumis and Tristachya leucothrix); and ▪ Ensure all the mitigation / management actions outlined in the Closure and Rehabilitation reports are conducted.	Minor (negative)
Environmental monitoring of decommissioning activities	No specific impacts have been identified for environmental monitoring during the decommissioning phase.					
Storage, handling and treatment of hazardous products (including fuel, explosives and oil) and waste	No specific impacts have been identified for storage, handling and treatment of hazardous products during the decommissioning phase.					
Post-closure monitoring and rehabilitation	Groundwater contamination as a result of mining operations - Contamination plume in the groundwater	Groundwater	Post Closure	Minor (negative)	▪ Groundwater will flow away from the mine footprint if the hydraulic head within the mine is higher than the surrounding elevation. Ensure that water quality is not poor by placement of leachate generating materials in a position where they will not adversely affect water quality. ▪ If impact is confirmed through monitoring, management solutions should be sought for upon agreement with the farmers or communities with impacted groundwater or mine purchase land. ▪ Monitoring of groundwater water levels and mine inflow rates should be conducted.	Negligible (negative)

	Mine decanting and contamination of surface water bodies	Groundwater	Post Closure	Moderate (negative)	▪ The decant should be captured before joining the streams. It should be treated, passively if possible using wetlands, and re-introduced into the streams. As experienced from other coal mines, the decant quality could be up to 2500 mg/L of sulfate. ▪ If an impact is confirmed through monitoring, management solutions should be implemented to an acceptable level to the authorities such as the purchase of impacted land or the provision of alternate sources of water. ▪ The pit should be backfilled and rehabilitated after closure to minimise water and oxygen inflow from the atmosphere. ▪ The potentially leachate generating material should be placed at the bottom of the mining pits; ▪ Decant rate and quality should be monitored as part of the regular groundwater monitoring. ▪ The numerical model should be updated annually for the first 2 years with the monitoring data. There after the model can be updated once in 5 years.	Negligible (negative)
	Post-mining water decant is predicted to occur once the final void has been rehabilitated and groundwater levels are allowed to return back to natural level. It is anticipated that this decant will be acid forming (acid mine draining, AMD).	Wetlands	Post Closure	Major (negative)	▪ Long-term passive water treatment options will need to be investigated by AOL to prevent untreated AMD decant water from entering the catchment. ▪ Groundwater and wetlands must be monitored post-mining for potential decant. ▪ Rehabilitation and remediation actions must be in place to respond to any decant or AMD discharge that is unforeseen.	Moderate (negative)
	Post-mining decant of groundwater will have negative impacts on the downstream water quality	Aquatic Ecology	Post Closure	Major (negative)	▪ Water treatment options.	Minor (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 Proposed Palmietkuilen Mining Project

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 Use and Land Capability Impact Assessment	▪ All soils if possible should be stripped during dry months; ▪ It is recommended to stockpile to a maximum height of 10 m to reduce the impacts on soil chemical and physical properties; ▪ Soils should be reconstructed to pre-mining arable land capabilities on the planned opencast and infrastructure area following the closure of the project; ▪ Soil fertility should be established through representative soil sampling and analyses; and ▪ Soils must be stripped according to the soil stripping guideline.	X - All recommendations have been considered and included in the EIA report.	Mitigation and management measures included in this report were recommended by the Soil Specialist, as well as the monitoring programmes. This includes the impact assessment and mitigation measures as discussed in Section 11, as well as the recommendations provided in Part B Sections 5, 6, 7 and the monitoring provided in Section 8.
Flora and Fauna Impact Assessment	▪ The site should be screened prior to construction, preferably between the months of November to March, for any plant SSC; ▪ If any plant SSC are recorded, these should be translocated with the involvement of a qualified botanist. The donor habitat should resemble the receiving habitat and the species/populations should be monitored monthly after translocation for up to one year; ▪ If any important fauna species (SSC) are identified (as listed in the expected species lists) that have not been included in the site-specific species lists, this should be reported to the Environmental Control Officer on site and the provincial authority (MPTA) for their reference. Further to this, measures should be undertaken to ensure that negative impacts to the species in question are not imposed due to the development; and ▪ The mine has an opportunity to reduce their overall liability in terms of spread of alien plant species. It is recommended that all alien plant species are controlled throughout the site as far as possible.	X - All recommendations have been considered and included in the EIA report.	Mitigation and management measures included in this report were recommended by the Flora and Fauna Specialist, as well as the monitoring programmes. This includes the impact assessment and mitigation measures as discussed in Section 11, as well as the recommendations provided in Part B Sections 5, 6, 7 and the monitoring provided in Section 8.

Surface Water Impact Assessment	▪ The Baseline water quality should be sampled in wet months before construction can commence to ensure that the baseline water quality can be captured for all streams, in both seasons.
	▪ Based on the determined floodlines, adequate designs need to be implemented for the haul road that crosses the floodlines through the use of well-constructed culverts to allow flood flow through and to minimise or avoid erosion. To improve the accuracy of the flood model, it is recommended that the use of measured flood levels and discharge over the spillway be undertaken to calibrate the determined discharge through the level pool reservoir routing method and the flood peaks.
	▪ A summary of the recommendations associated with the SWMP is listed below:
	    ▪ Overburden and topsoil stockpiles should be vegetated to prevent erosion of occurring;
	    ▪ The dirty water collection trenches should be cleaned regularly to reduce silt build up and ensure they are able to accommodate and convey the 1:50 year peak flows;
	    ▪ Stockpiling of materials should be monitored so that the side slopes do not encourage erosion of the slopes, resulting in silt transported into the trenches from the stockpiles, allowing silt to settle on the dirty water site rather than in the channels;
	    ▪ Sediment control is necessary during the process and this could be achieved by setting up flow impeding structures such as silt traps on the downstream of the potential silt generating infrastructure like stockpiles; and
		X - All recommendations have been considered and included in the EIA report.	Mitigation and management measures included in this report were recommended by the Surface Water Specialist, as well as the monitoring programmes. This includes the impact assessment and mitigation measures as discussed in Section 11, as well as the recommendations provided in Part B Sections 5, 6, 7 and the monitoring provided in Section 8.

	▪ In addition to the control of storm water, water quality monitoring should form part of this system where water in the PCDs is monitored for quality. This ensures that pollution sources are monitored during the mining operational process and in the unlikely event of any spillages the downstream impacts can be estimated. The main constituents to monitor should include but not limited to Total Suspended Solids (TSS, pH, SO4, Salinity, EC and other metals). ▪ The feasiblity of an emergency dam should be investigated for the operational phase, adjacent to the PCD, preferably downstream to hold overflows and bypass in times when the primary PCD is being cleaned. ▪ Mitigation measures include Implementation of the SWMP and additional measures such as ▪ To ensure that the topography of disturbed areas is returned to a pre-mining state to allow free draining topography; ▪ Soils compacted by heavy machinery in areas that are not utilised post construction can be ripped to allow infiltration ▪ Roads should be maintained regularly to ensure that surface water drains freely off the road preventing erosion; and ▪ Re-vegetation of disturbed areas.		
Groundwater Impact Assessment	The following recommendation is made after the field investigation: ▪ No boreholes were found during the hydrocensus in the northern section of the project area. As a result, there is information gap in terms of the current groundwater usage, baseline water quality and water level. More investigation is recommended to be conducted in the north of the project area for baseline hydrogeological understanding; ▪ Quarterly monitoring of water quality and levels is recommended with continuous refining and updating of the monitoring network based on the results obtained; ▪ It is recommended that the mine should supply equal/better amount of water to interested and affected parties that rely on groundwater in the receiving environment, if proven that there is impact on specific users; ▪ Organic solvents, diesel or other organic fluids may be spilled on the ground surface or leak from storage tanks during mine operation. Proper or good handling methodology should be applied to minimax the contamination; ▪ Refine the conceptual and numerical models every two years in the first four years and thereafter every five years based on groundwater monitoring results; and ▪ Annual audits of monitoring and management systems should be conducted by environmental consultants. ▪ The following recommendation is made after the impact assessment: ▪ Dewatering efficiently, according to the expected inflows, enough to provide for dry conditions at required locations; ▪ Geostratum Groundwater and Geochemistry Consult (2016) identified that the waste rock material has a significant potential to generate acid. These materials should be deposited at the base of the rehabilitated pit in such a way that it will be completely flooded with groundwater; ▪ Capture of decant if the quality is below the standards before joining the tributaries, treating it and re-introducing it into the tributaries; ▪ If impact is confirmed through monitoring, management solutions should be sought for upon agreement with the farmers or communities with impacted groundwater or mine purchase land; ▪ Groundwater monitoring, to assess the time series water level and quality impacts and trends; and	X - All recommendations have been considered and included in the EIA report.	Mitigation and management measures included in this report were recommended by the Groundwater Specialist, as well as the monitoring programmes. This includes the impact assessment and mitigation measures as discussed in Section 11, as well as the recommendations provided in Part B Sections 5, 6, 7 and the monitoring provided in Section 8.

	▪ The decant predictions, conceptual and numerical models should be refined every two years in the first four years and thereafter every five years based on groundwater monitoring results.		
Wetlands Impact Assessment	The predicted negative impacts as a result of the project to the local wetlands and to the catchment area are major. The proposed mine will lead to the permanent loss of 255 ha of wetland from active soil and vegetation removal. In addition, surrounding wetlands will be damaged by the operational drawdown; and potential continuous water quality deterioration is likely to occur due to post-mining AMD. There is no feasible mitigation possible for the loss of wetland habitat and thus these wetlands will need to be offset if the project is to go ahead, however this can only be implemented after the mitigation hierarchy has been followed. All other residual impacts to surrounding wetlands must be mitigated as far as possible and long-term passive water treatment options will need to be investigated by Palmietkuilen mining project to prevent untreated AMD decant water from entering the catchment.	X - All recommendations have been considered and included in the EIA report.	Mitigation and management measures included in this report were recommended by the Wetlands Specialist, as well as the monitoring programmes. This includes the impact assessment and mitigation measures as discussed in Section 11, as well as the recommendations provided in Part B Sections 5, 6, 7 and the monitoring provided in Section 8.
Aquatic Ecology Impact Assessment	Considering the potential impacts identified in 11.1.6, provision should be made to mitigate against the contamination of surface water during the closure phase. It is further recommended that the Department of Water and Sanitation assess the impact of a loss of 3% Mean Annual Runoff on the ecological reserve of the Blesbokspruit. Recommended monitoring conditions have been provided in this report along with various mitigation actions. However, it is noted that this report should not be considered in isolation and that other specialist reports should be reviewed including surface water, groundwater and wetland studies	X - All recommendations have been considered and included in the EIA report.	Mitigation and management measures included in this report were recommended by the Aquatic Ecology Specialist, as well as the monitoring programmes. This includes the impact assessment and mitigation measures as discussed in Section 11, as well as the recommendations provided in Part B Sections 5, 6, 7 and the monitoring provided in Section 8.
Air Quality Impact Assessment	▪ Continue operation of the dust fallout monitoring network for life of mine; ▪ Designate a qualified person to act as the Air Quality Officer as required in terms of the Act; ▪ Ensure air quality information is incorporated into the environmental management information system. Establish an annual reporting structure to the DEA as required by regulations currently in force; ▪ Procure and operate water spray trucks to spray the haul roads on a regular schedule; ▪ Invest in fixed water sprays at all coal tipping and transfer points in line with current best engineering practice; ▪ Adopt measures for demarcating roadways and boundaries of dormant areas not to be used by vehicles; ▪ Establish codes of practice for good housekeeping with respect to dust management and mitigation, including regular cleaning of spillage and runways, spraying of stockpiles, open areas and roads, appropriate restrictions on vehicle movements and speeds; ▪ Housing of crushers and screens to contain emissions; and ▪ Monitor the air quality management measures and information to ensure that adopted measures are sufficient to achieve current air quality standards at the closest receptors for the duration of the project.	X - All recommendations have been considered and included in the EIA report.	Mitigation and management measures included in this report were recommended by the Air Quality Specialist, as well as the monitoring programmes. This includes the impact assessment and mitigation measures as discussed in Section 11, as well as the recommendations provided in Part B Sections 5, 6, 7 and the monitoring provided in Section 8.
Noise Impact Assessment	▪ Alternative location of the northernmost hard overburden dump should be considered; ▪ Alternative location of the haul route towards the siding should be considered; ▪ Restricting construction activities to daylight hours (06:00 – 18:00) and not during weekends and public holidays; ▪ Locating of diesel generator away from noise sensitive receptors, as well as placing generators on isolation mounts and installation of secondary silencers; ▪ Mining related machines and vehicles to be serviced to the designed requirements of the machinery/vehicles to ensure noise suppression mechanisms are effective e.g. installed exhaust	X - All recommendations have been considered and included in the EIA report.	Mitigation and management measures included in this report were recommended by the Noise Specialist, as well as the monitoring programmes. This includes the impact assessment and mitigation measures as discussed in Section 11, as well as the recommendations provided in Part B Sections 5, 6, 7 and the monitoring provided

	mufflers; ▪ Reversing alarms on vehicles should be broadband reversing alarms which emit directional, lower, less intrusive sound; ▪ Environmental noise monitoring to establish compliance with the regulations and to verify the predicted noise levels; ▪ Switching off equipment when not in use; and ▪ It is recommended furthermore a noise monitoring plan be implemented to validate determine whether the post mitigation activities are with in compliance of the National Noise Control Regulations as well as to validate the noise modelling results.		in Section 8.
Visual Impact Assessment	▪ Where possible use fencing that will screen the project area from nearby receptors; ▪ Vegetation should only be removed when and where necessary; ▪ Topsoil should only be removed when and where necessary; ▪ Topsoil stockpiles should be vegetated with grasses (Andropogon appendiculatus, Andropogon eucomus, Andropogon huillensis, Aristida congesta subsp. Barbicollis, Arundinella nepalensis, Cynodon dactylon, Eragrostis capensis, Eragrostis curvula, Eragrostis gummiflua, Eragrostis racemose, Fingerhuthia Africana, Hyparrhenia hirta, Hyparrhenia tamba, Imperata cylindrical, Melinis repens, Paspalum dilatatum, Setaria sphacelata, Sporobolus africanus, Sporobolus pyramidalis, Themeda triandra, Trichoneura grandiglumis and Tristachya leucothrix) where possible so as to blend into the surrounding landscape and reduce dust generation; ▪ Ensure the surface infrastructure does not exceed the proposed heights; ▪ Surface infrastructure should be painted natural hues so as to blend into the surrounding landscape where possible; ▪ Ensure all infrastructure is demolished and removed from the site; ▪ Limit the quantity and time of rubble stored on site; ▪ Ensure that the open pit is backfilled with material from the overburden stockpiles; ▪ Ensure that the rehabilitated area is re-contoured and profiled to create a free-draining topography; and ▪ Ensure all the mitigation/management actions outlined in the Closure and Rehabilitation reports are conducted.	X - All recommendations have been considered and included in the EIA report.	Mitigation and management measures included in this report were recommended by the Visual Specialist, as well as the monitoring programmes. This includes the impact assessment and mitigation measures as discussed in Section 11, as well as the recommendations provided in Part B Sections 5, 6, 7 and the monitoring provided in Section 8.
Blast and Vibrations Impact Assessment	▪ Regulatory requirements indicate specific requirements for all non-mining structures and installations within 500 m from the mining operation. The mine will have to apply for the necessary authorisations as prescribed in the various acts; ▪ Blast designs should be reviewed prior to first blast planned and done. Consideration must also be given structures surrounding the blast intended; ▪ The blaster has a legal obligation concerning the safe distance and he needs to determine this distance prior to blasting; ▪ There are gravel roads that link the different farming areas. These routes are specifically of concern when blasting is done. There may be people and animals on these routes and will require careful planning to main safe blasting radius; ▪ A first test blast should be conducted, as good practice, to confirm levels and ground vibration and air blast.; ▪ The current proposed stemming lengths at least must be maintained to ensure control on fly rock; ▪ A specific design will be required to address the powerlines inside the pit area. Blasting within 500 m from any of the powerlines in and outside of the pit area will also require specific permissions from Eskom and application; ▪ The option of photographic survey of all structures up to 2000 m from the pit areas is	X - All recommendations have been considered and included in the EIA report.	Mitigation and management measures included in this report were recommended by the Blasting and Vibrations Specialist, as well as the monitoring programmes. This includes the impact assessment and mitigation measures as discussed in Section 11, as well as the recommendations provided in Part B Sections 5, 6, 7 and the monitoring provided in Section 8.

	recommended;
	▪ A further consideration of blasting times must be taken when weather conditions could influence the effects yielded by blasting operations;
	▪ A monitoring programme for recording blasting operations is recommended. This process will be mainly for the development of the different decline shafts. 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
	  ▪ Fly rock observations
	▪ Third party consultation and monitoring should be considered for all ground vibration and air blast monitoring work;
	▪ Video of each blast will help to define if fly rock occurred and from where. Immediate mitigation measure can then be applied if necessary; and
	▪ There are various public houses and installations in close proximity of the pit area. The greatest concerns originate from houses that are located up to 617 m from the pit area. A relocation program should be considered for all households within this distance. This is a process that will require careful planning and execution.		

Heritage Impact Assessment	Within the local study area, a total of 158 heritage resources were identified ranging from the LFC through to historical period. Of these, seven occur within the site-specific study area. To avoid the identified direct impact, recommended project related mitigations include the amendment of the infrastructure design to exclude the identified burial grounds from the development footprint that will allow for the in situ conservation of the graves. Where in situ conservation of the burial grounds and graves is implemented, the graves will be directly impacted through the loss of access and degradation of the intrinsic value of the graves. In this instance, a BGGC process in accordance with Chapter XI of the Regulations to the Act, aimed at identifying bona fide NoK, must be undertaken to reach agreement on the continued conservation of the burial grounds, and access to the site to minimise the identified impact. Where the recommended project design amendment is not feasible, and EA and a mining right for the Project is granted, a BGGC and GRP must be undertaken in accordance with the requirements of Chapters XI and IX of the Regulations to the Act.	X - All recommendations have been considered and included in the EIA report.	Mitigation and management measures included in this report were recommended by the Heritage Specialist, as well as the monitoring programmes. This includes the impact assessment and mitigation measures as discussed in Section 11, as well as the recommendations provided in Part B Sections 5, 6, 7 and the monitoring provided in Section 8.
Social Impact Assessment	▪ Promotion of local, female and youth employment to achieve and where feasible exceed the targets set out by the Mining Charter; ▪ Identify required core skills, expand skills audits to community and align and implement training and skills development initiatives to findings of audit; ▪ Expand skills development programmes, especially ABET programmes, to include surrounding communities; ▪ Monitor subcontractors in terms of local employment targets; ▪ Give preference first to capable local service providers; ▪ Develop local service provision capacity; ▪ Monitoring of sub-contractors procurement; ▪ SMME skills development as part of mine SLP/LED commitments; ▪ Expanding skills development and capacity building programmes to non-employees;	X - All recommendations have been considered and included in the EIA report.	Mitigation and management measures included in this report were recommended by the Social Specialist, as well as the monitoring programmes. This includes the impact assessment and mitigation measures as discussed in Section 11, as well as the recommendations provided in Part B Sections 5, 6, 7 and the monitoring provided in Section 8.

<table>
<tr><td></td><td>Where feasible, training should be NQF accredited;
AOL should where possible endeavour to minimise the extent of, displacement through project design, where displacement cannot be minimised the following measures are recommended to alleviate the adverse impacts;
AOL should finalise the Project layout plan and determine its policy and approach to displacement, as this would inform the extent of resettlement, i.e. whether it will recognise both direct and indirect forms of displacement as well as whether they will strive towards international best practice or local standards;
The displacement of non-vulnerable households and individuals should be considered on a case-by-case basis;
Areas impacted upon during construction should be rehabilitated upon completion of the construction activities to ensure that the land is returned in the same condition;
If AOL assumes responsibility for displaced households, due process should be followed when these households are relocated. It is recommended that the process be aligned to IFC PS 5 and that a Resettlement Action Plan be developed; and
Refer to recommendations of specialist studies (see Visual Impact Assessment, Surface-and Ground Water Impact Assessment, Noise Impact Assessment, Air Quality Impact Assessment, Blasting and Vibration Impact Assessment and Traffic Impact Assessment).</td><td></td><td></td></tr>
<tr><td>Macro-Economic Impact Assessment</td><td>Strictly adhere to environmental specialists recommendations.</td><td>X - All recommendations have been considered and included in the EIA report.</td><td>Mitigation and management measures included in this report were recommended by the Economic Specialist, as well as the monitoring programmes. This includes the impact assessment and mitigation measures as discussed in Section 11, as well as the recommendations provided in Part B Sections 5, 6, 7 and the monitoring provided in Section 8.</td></tr>
<tr><td>Traffic Impact Assessment</td><td>Based on the traffic impact study, it is recommended that the proposed Palmietkuilen Open Pit Coal Mine, on Portions 1, 2, 4, 9, 13 and 19 of the farm Palmietkuilen 241-JR, be approved for:
Zoning: Open pit coal mine
The approval is subject to the following:
The applicant site is affected by several existing and future provincial roads. The final access arrangements are subject to Gautrans approval and general conditions.
Reserve one parking bay at the office as a taxi bay.
A registered professional civil engineer to confirm the final pavement design for Road D1225.
The open cast mining activities will be affected by the alignment of Road D1133. The provision of crossing points along the road will have to be discussed with Gautrans.
The road reserve required for the provincial roads (K134, PWV 19, Road D1133 & Road D1255) to be excluded from the approval of this application. No mining activities may take place in the future road reserves.
crossing of The following access arrangements are proposed for the applicant site and will have to be finalised at site development phase:
The site access is proposed approximately 1 100m east of the future Palmietkuilen Access</td><td>X - All recommendations have been considered and included in the EIA report.</td><td>Mitigation and management measures included in this report were recommended by the Traffic Specialist, as well as the monitoring programmes. This includes the impact assessment and mitigation measures as discussed in Section 11, as well as the recommendations provided in Part B Sections 5, 6, 7 and the monitoring provided in Section 8.</td></tr>
</table>

	Interchange. The final position is subject the approval of the Gauteng Provincial Administration (Gautrans). ▪ Two inbound lanes and two outbound lanes. One lane is for hauling trucks and the second lane for general public and worker traffic. ▪ Minimum lane width of 3.7m, with a clearance of 4.2m. ▪ Any access control system to be setback a minimum distance of 60m from the road reserve of Road D1125 and the centre of the access control boom/gate. ▪ Minimum vertical clearance of 5.2m. ▪ Bellmouth radii at the intersection on Road D1255 to be a minimum of 12.5m. The final radii to be used are subject to a detail design of the road network. ▪ Surfacing of Road D1255: A professional civil engineer need to determine the pavement design requirements for the road. ▪		
Rehabilitation Plan (incl. Closure Cost Assessment)	▪ A topsoil balance must be done to ensure enough material is available to rehabilitate all the disturbed areas; ▪ Calculate accurate pit depths for each year of mining. This will assist in potentially refining the financial provision estimate; and ▪ The liability figures need to be updated on an annual basis as a requirement by the NEMA. This will ensure that all costs become more accurate over time and will reflect current market conditions.	X - All recommendations have been considered and included in the EIA report.	All mitigation and management measures included in this report were recommended by the Rehabilitation and Closure Specialist.

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 in Table 16-1, Table 16-2 and Table 16-3.

Table 16-1: Summary of the Potential Impacts during the Construction Phase

Aspects Affected	Potential Impact	Prior to Mitigation Significance	Post-Mitigation Significance
Soil, Land Use and Land Capability	Loss of topsoil as a resource and soil compaction from heavy machinery and vehicles during site clearance	Moderate (negative)	Minor (negative)
	Loss of land capability	Major (negative)	Major (negative)
Flora and Fauna	Loss of *Eragrostis* – dominated Grassland	Moderate (negative)	Minor (negative)
	Loss of Riparian areas, Wetlands and Pans	Moderate (negative)	Minor (negative)
	Habitat fragmentation and edge effects resulting in alien plant invasion	Minor (negative)	Minor (negative)
Surface Water	Sedimentation of surface water resources resulting in the deterioration of water quality	Minor (negative)	Negligible (negative)
	Movement of heavy machine and vehicles for sit clearing resulting in reduced surface water infiltration as well as an alteration in surface water drainage patterns as a result of soil compaction.	Minor (negative)	Negligible (negative)
	Alteration in surface water drainage patterns and a reduction in the amount of water reaching the Aston Lake and reduced flow to Blesbokspruit	Moderate (negative)	Minor (negative)
Groundwater	Removal of topsoil and site clearing may have an impact on the groundwater provided that the area affected by this activity extends beyond the local water table	Negligible (negative)	Negligible (negative)
Wetlands	Loss of wetland habitat (soils and vegetation) totalling 53.3 ha for infrastructure and 201.9 ha associated with the open pit area.	Major (negative)	Major (negative)
	Construction and development activities within a greenfield site are a negative impact to functioning wetlands and catchment	Minor (negative)	Negligible (negative)
Aquatic Ecology	Direct loss of marginal and riparian habitats. Increased runoff and erosion resulting in habitat change downstream	Minor (negative)	Negligible (negative)
	Compaction of soils during site clearance causing in lowered rainfall infiltration rates and increased runoff resulting in reduced baseflow and an alteration of aquatic habitats	Minor (negative)	Negligible (negative)
	Placement of impenetrable surfaces resulting in reduced surface water infiltration and alteration of baseflow and surface water drainage patterns.	Minor (negative)	Negligible (negative)
	Alteration in surface water drainage patterns resulting in changes to downstream habitat structures.	Minor (negative)	Negligible (negative)
Air Quality	Reduction in ambient air quality	Negligible (negative)	Negligible (negative)
	Exposed surfaces due to site clearing will results in the wind erosion of loose soil	Negligible (negative)	Negligible (negative)

Noise	Noise emanating from the machinery and vehicles operating during the construction activities	Moderate (negative)	Negligible (negative)
Visual	The Project area will become noticeable to nearby receptors as it will contrast the surrounding areas.	Moderate (negative)	Minor (negative)
	The Project area will become noticeable to nearby receptors due to the increased levels of activity on the site.	Minor (negative)	Negligible (negative)
	The surface infrastructure will change the sense of place of the Project area from an agricultural sense of place to an industrial / mining sense of place. Construction area lighting at night will have a negative visual impact on the receiving environment. The construction area lighting will be visible from a distance of up to 10 km and will draw attention to the Project area.	Moderate (negative)	Minor (negative)
	Relocation of infrastructure is expected to have a negative visual impact on the receiving environment. The location for the relocation of the road is not currently known and for the purposes of this impact assessment it has been assumed that the road will be diverted to the farm road running along the south-eastern boundary of the Project area and that this farm road will be upgraded as required	Minor (negative)	Negligible (negative)
Heritage	Direct impact to burial grounds and graves	Moderate (negative)	Negligible (negative)
Social	Employment creation during construction	Minor (positive)	Moderate (positive)
	Multiplier effects on the local economy	Minor (positive)	Moderate (positive)
	Community development and social upliftment	Minor (positive)	Moderate (positive)
	Displacement as a result of site clearance	Major (negative)	Moderate (negative)
	Disruption of movement patterns	Minor (negative)	Minor (negative)
	Influx of job seekers in area	Moderate (negative)	Minor (negative)
	Opposition because of perceived negative impacts	Minor (negative)	Negligible (negative)
	Nuisance impacts on surrounding land users (mainly noise, blasting, dust etc.)	Moderate (negative)	Minor (negative)
	Inherent risk on community health and safety	Moderate (negative)	Negligible (negative)
-Economic	Increase in Production	Moderate (positive)	Moderate (positive)
	Impact on GDP	Minor (positive)	Minor (positive)
	Impact on Employment	Minor	Minor (positive)

		(positive)	
	Impact on Skills Development	Minor (positive)	Minor (positive)
	Impact on Household Income	Minor (positive)	Minor (positive)
	Impact on Government Revenue	Minor (positive)	Minor (positive)
	Impact on Agricultural Production due to Sterilisation of Productive Agricultural Land	Major (negative)	Moderate (negative)
	Potential Negative Impact on Property Value	Minor (negative)	Minor (negative)
	Potential Negative Impact on Egg Industry	Minor (negative)	Negligible (negative)

Table 16-2: Summary of the Potential Impacts during the Operational Phase

Aspects Affected	Potential Impact	Prior to Mitigation Significance	Post-Mitigation Significance
Soil, Land Use and Land Capability	Topsoil losses can occur during the operational phase as a result of rainwater runoff and wind erosion from roads and soil stockpiles.	Moderate (negative)	Minor (negative)
	When topsoil is removed from the open pit, land capability is reduced to nothing. The land use will be change from intensive cultivation to mining	Major (negative)	Moderate (negative)
Flora and Fauna	Increased vehicular movement and noise on site resulting in disturbance to fauna on site (noise, road-kills)	Minor (negative)	Negligible (negative)
Surface Water	Development and operation of surface infrastructure resulting in water contamination leading to deterioration of water quality	Moderate (negative)	Minor (negative)
Groundwater	Mine dewatering and creation of cone of depression	Moderate (negative)	Minor (negative)
	Groundwater contamination as a result of open pit mining - contamination plume in the groundwater	Minor (negative)	Negligible (negative)
	Groundwater contamination as a result of seepage from the waste stockpiles and slurry dam	Minor (negative)	Negligible (negative)
	Groundwater contamination due to seepage from PCD	Minor (negative)	Negligible (negative)
Wetlands	Operational activities will be occurring within an ecologically sensitive catchment and thus the handling, stockpiling and transport of the coal will have some impacts to the wetlands, particularly with respect to the haul road that crosses the NFEPA Rank 1 wetland, upstream of Aston Lake. Movement of coal openly through the environment will have some deposition of coal fines that will negatively impact the surrounding environment, particularly	Moderate (negative)	Minor (negative)

	water quality.		
	Perforation of rock and groundwater reserves leading to severe hydrological and geomorphological impacts to wetlands and catchment due to draw down cone.	Major (negative)	Major (negative)
Aquatic Ecology	Runoff from the dirty water areas reporting into the Aston Lake and the unnamed streams flowing to it resulting in water contamination or the deterioration of the water quality.	Moderate (negative)	Moderate (negative)
	Reduction of catchment yield as dirty water runoff within the mine will be contained in the PCD. Groundwater loss and flow from the pit will also contribute toward baseflow reduction	Moderate (negative)	Moderate (negative)
Air Quality	Stripping activity will result in fugitive dust emissions and reduction in air quality	Minor (negative)	Minor (negative)
	Drilling and blasting will result in fugitive emissions and reduction in air quality	Minor (negative)	Minor (negative)
	Crushing and screening lead to fugitive dust emissions and reduction in air quality	Minor (negative)	Negligible (negative)
	Reduction in air quality due to gaseous emissions	Moderate (negative)	Negligible (negative)
	Loading, Hauling and Stockpiling of ROM Coal and Overburden will result in result in fugitive emissions and reduction in air quality	Moderate (negative)	Minor (negative)
Noise	Noise will emanate from the machinery and vehicles operating during the operational activities	Moderate (negative)	Minor (negative)
Visual	As the Project area is stripped it will become noticeable to nearby receptors as it will contrast the surrounding area.	Moderate (negative)	Minor (negative)
	Removal of overburden (including drilling and blasting of hard overburden) will have a negative visual impact on the receiving environment. Drilling and blasting will result in noise and dust thereby attracting attention to the Project area. Dust from blasting will have a negative visual impact. The open pit will dramatically contrast the surrounding agricultural area as it will result in a scar on the landscape.	Moderate (negative)	Moderate (negative)
	Vehicular activity to load and haul overburden (including topsoil, soft overburden and hard overburden) will have a negative visual impact on the receiving environment. Dust from the vehicular activity will also have a negative visual impact.	Minor (negative)	Minor (negative)
	Stockpiling of overburden (including topsoil, soft overburden and hard overburden) will have a negative visual impact on the receiving environment. Dust from the stockpiles will also have a negative visual impact. The impact of the stockpiles will occur for the life of the Project. This impact will be reversed when the material from the stockpiles is used to backfill the open pit (soft overburden and hard overburden) and rehabilitate the Project area (topsoil) during the decommissioning and closure phase.	Moderate (negative)	Moderate (negative)
	Vehicular activity to load and haul ROM coal will have a negative visual impact on the receiving environment. Dust from the vehicular activity will also have a negative visual impact	Minor (negative)	Minor (negative)
	Vehicular activity on the haul roads will have a negative visual impact on the receiving environment. Dust from the vehicular activity will also have a negative visual impact. Maintenance of the haul roads may require the acquisition of additional material such as from borrow pits which will have a negative visual impact on the receiving environment.	Minor (negative)	Minor (negative)
	Plant area lighting at night will have a negative visual impact on the receiving environment. The plant area lighting will be visible from a distance of up to 10 km and will draw attention to the Project area. This will also have a negative impact on the sense of place.	Moderate (negative)	Moderate (negative)
	Drilling and blasting of coal will have a negative visual impact on the receiving environment. Drilling and blasting will result in noise and dust thereby	Major	Moderate

	attracting attention to the Project area. Dust from blasting will have a negative visual impact. The open pit will dramatically contrast the surrounding agricultural area as it will result in a scar on the landscape. Once coal is removed from the open pit there will be insufficient material to backfill the open pit completely and a void will remain. This will result in a permanent and irreversible negative visual impact on the receiving environment.	(negative)	(negative)
	Disposal of discard from the washing plant on the discard dump will have a negative visual impact on the receiving environment that will occur for the life of the Project.	Moderate (negative)	Moderate (negative)
Blast and Vibrations	Ground vibration at surrounding houses	Moderate (negative)	Negligible (negative)
	Ground vibration on surrounding roads	Negligible (negative)	Negligible (negative)
	Air blast impact on houses	Minor (negative)	Negligible (negative)
	Air blast impact on roads	Negligible (negative)	Negligible (negative)
	Fly Rock impact on houses	Moderate (negative)	Negligible (negative)
	Fly Rock impact on roads	Moderate (negative)	Negligible (negative)
	Impact of Fumes - Houses	Minor (negative)	Negligible (negative)
	Impact of Fumes - Roads	Negligible (negative)	Negligible (negative)
Heritage	Direct impact to burial grounds and graves	Major (negative)	Moderate (negative)
Social	Employment creation during operation	Minor (positive)	Moderate (positive)
	Stimulation and growth of the local and regional economies	Minor (positive)	Moderate (positive)
Macro-Economic	Impact on Production	Moderate (positive)	Moderate (positive)
	Impact on GDP	Moderate (positive)	Moderate (positive)
	Impact on Employment	Moderate (positive)	Moderate (positive)
	Impact on Skills Development	Moderate (positive)	Moderate (positive)
	Impact on Household Income	Moderate (positive)	Moderate (positive)
	Impact on Government Revenue	Moderate	Moderate

		(positive)	(positive)
Traffic			

Table 16-3: Summary of the Potential Impacts during the Decommissioning and Post Closure Phase

Aspects Affected	Potential Impact	Prior to Mitigation Significance	Post-Mitigation Significance
Soil, Land Use and Land Capability	Decommissioning and rehabilitation of the infrastructure and open pit areas could cause erosion and compaction if rehabilitation is not done correctly. Heavy machinery driving continuously over rehabilitated areas may result in compaction which could impact on plant rooting depth which then would have an impact to vegetation establishment.	Moderate (negative)	Minor (negative)
	Backfilling of soil material layers will impact on land capability and land use. Infrastructure area will be rehabilitated and the land capability may be restoring to pre-mining land capability.	Moderate (negative)	Minor (negative)
	Restoration of land capability to its pre-mining state or agreed upon alternative	Minor (positive)	Moderate (positive)
Flora and Fauna	Alien plant invasion may take place	Minor (negative)	Negligible (negative)
	Restoration of vegetation and habitat types.	Minor (positive)	Minor (positive)
	Rehabilitation of infrastructure footprint areas	Moderate (positive)	Moderate (positive)
Surface Water	Reduced surface water infiltration as well as an alteration in surface water drainage patterns as a result of soil compaction from the movement of heavy machinery and vehicles	Minor (negative)	Negligible (negative)
	Loosening of soil during rehabilitation processes resulting in the sedimentation of surface water resources resulting in reduced water quality	Minor (negative)	Negligible (negative)
Groundwater	Groundwater contamination as a result of mining operations	Minor (negative)	Negligible (negative)
	Mine decanting and contamination of surface water bodies	Moderate (negative)	Negligible (negative)
Wetlands	The decommissioning and rehabilitation activities occurring within an ecologically sensitive catchment pose significant potential negative impacts to functioning wetlands and catchment. Furthermore, the rehabilitated area could cause major negative impacts due to spread of alien invasive vegetation, increased soil compaction erosion and subsequent sedimentation into the wetland ecosystems	Minor (negative)	Minor (negative)
	Post-mining water decant is predicted to occur once the final void has been rehabilitated and groundwater levels are allowed to return back to natural level. It is anticipated that this decant will be acid forming (acid mine draining, AMD).	Major (negative)	Moderate (negative)
Aquatic Ecology	The removal of the infrastructure will lead to potential negative impacts on the integrity of the associated aquatic ecosystems due to the clearing of land and thus exposing it to erosion which could lead to further sedimentation of the river systems.	Minor (negative)	Minor (negative)
	Post-mining decant of groundwater will have negative impacts on the downstream water quality	Major (negative)	Minor (negative)

Noise	Noise will emanate from the machinery and vehicles operating during the decommissioning activities.	Negligible (negative)	Negligible (negative)
Air Quality	Reduction in air quality	Negligible (negative)	Negligible (negative)
	Spills and evaporation from fuel, heavy fuel oil and used chemical will lead to reduction in air quality	Negligible (negative)	Negligible (negative)
Visual	Demolition and removal of all infrastructure will have a negative visual impact on the receiving environment. Dust from the demolition process will also have a negative visual impact. Once the infrastructure is removed and rehabilitation of the disturbed areas is complete, there will be an overall neutral visual impact on the receiving environment.	Minor (negative)	Minor (negative)
	Rehabilitation (including spreading of soil, re-vegetation and profiling or contouring) will have a negative visual impact on the receiving environment. Once coal is removed from the open pit there will be insufficient material to backfill the open pit completely and a void will remain. This will result in a permanent and irreversible negative visual impact on the receiving environment. This impact will become reversible if the Project area is re-contoured and profiled to create a free-draining topography thereby eliminating the void. Once rehabilitation is complete and the Project area has re-contoured and profiled to create a free-draining topography there will be an overall neutral visual impact on the receiving environment.	Minor (negative)	Minor (negative)
Social	Dependency on mine for sustaining local economy	Moderate (negative)	Minor (negative)
Traffic			

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

The final proposed infrastructure layout plan is provided in Plan 2 above.

16.3 Item 3(k)(iii): Summary of the positive and negative implications and risks of the proposed activity and identified alternatives

The positive and negative implications were assessed according to the construction, operational and decommissioning phases of the proposed Project. A summary of the main (major and moderate) impacts are provided for each phase below.

16.3.1 Construction Phase

During the construction phase of the proposed Project the majority of the negative impacts are associated with site clearance and vegetation removal activities. The establishment of the proposed Project will result in loss of 254.4 ha of wetland habitat. Although the wetlands are not considered pristine, they provide significant ecological services due to their linkage to a NPEFA rank 1 Ramsar listed site (Blesbokspruit) thus the loss of these wetland habitats is an irreversible negative implication of major significance associated with the Project. Site clearance and vegetation removal will result in a loss in land capability which was classified to be 72% to a non-classifiable status. The affected land will transform from agricultural use (measured at 63%) to mining use which is an irreversible negative impact. Vegetation removal will also result in a significant (moderate negative) alteration of the two subcatchments of Aston Lake and the subsequent amount of water reporting to Aston Lake as well as increased sedimentation of surface water resources which may also impact aquatic biota. The implementation of mitigation measures such as commencing rehabilitation activities immediately following construction will however reduce the impact to be of minor negative significance. The main negative implications associated with other general construction activities that are of moderate negative significance are nuisance noise, dust and visual impacts.

According to the Social Impact Assessment (Appendix N) the development of the mine will have a (minor) positive impact on employment creation, economic and social upliftment and community development. An increase in employment opportunities, household income and skills development will contribute to a positive growth in the local economy. Major negative social impacts are expected due to the displacement of households in the proposed footprint area.

16.3.2 Operational Phase

The majority of the impacts identified for the operational phase are associated open pit mining to a depth of 60 m. Mining will result in the perforation of rock and groundwater reserves leading to severe hydrological and geomorphological impacts to wetlands and catchment due to draw down cone. Blasting activities associated with open pit mining may have significant implications (moderate negative impact) namely of ground vibration and fly-rock impacts at surrounding houses. The implementation of mitigation measures and proper blast designs these impacts can be reduced to be of minor negative significance. Furthermore, the operation of surface infrastructure may lead to deterioration of water quality. Stormwater management measures will be in place to ensure clean and dirty water separation. Runoff emanating from surface infrastructure will be contained in the PCD as far as possible, however, this in turn will result in the reduction in catchment yield. Topsoil loss has been identified as a potential impact of moderate significance during the operational phase as a result of rainwater runoff and wind erosion from roads and soil stockpiles.

Similar to the construction phase, nuisance noise, dust and visual impacts of moderate negative significance are expected from general operation activities such as loading, hauling and stockpiling overburden and ROM. Employment creation during operation as well as stimulation and growth of the local and regional economies will be a continued and more positive social impact during the operational phase.

16.3.3 Decommissioning Phase

During the decommissioning phase positive impacts will occur from rehabilitation activities including the restoration of land capability to its pre-mining state or agreed upon alternative, the restoration of vegetation and habitat types as well as the rehabilitation of infrastructure footprint areas. The expected negative impacts are associated with the movement of machinery to dismantle and remove equipment and infrastructure and rehabilitate the disturbed areas. Negligible to moderately negative impacts resulting from soil loss, erosion and dust emissions were identified. Moderate negative social impacts are expected when mining operations cease as a dependency on the mine for sustaining local economy would have been established.

Post closure monitoring is essential to determine if rehabilitation was successful and sustainable. The most significant impact includes the potential for decant of groundwater which may result in AMD which could potentially have a major negative impact of water quality of surface and groundwater resources.

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 contractor maintains 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 location of the Project has been decided upon based on the location of the identified coal seams. Alternatives were therefore assessed for the layout of the Project with consideration given to the environmental and technical assessments undertaken. The final proposed layout (Plan 2 above) aimed to ensure that the placement of infrastructure in such a manner as to avoid and minimise potential environmental impacts as detailed in Section 8 above.

Although the mine design has been altered to avoid certain sensitivities it should be noted that some wetland areas could not be avoided and will be lost. Where impacts cannot be avoided, mitigation and management measures have been provide to lessen the significance of the adverse impacts.

If the mining project is to go ahead, the mine will need to make provision for long term water quality impacts and remediation of this. This is particularly related to potential decant of acidic underground water post-mining. It can be concluded that the project will have a residual negative impact to the wetlands and their catchment areas. AOL will need to take this into consideration and manage the residual impact with adequate rehabilitation actions and, if need be, with an offsetting strategy to ensure no nett loss of wetland functionality is realised.

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.

20 Item 3(o): Description of any assumptions, uncertainties and gaps in knowledge

The subsections below highlight the assumptions, uncertainties, limitations and knowledge gaps relevant to the various specialist studies undertaken.

It has been assumed that the community currently residing on the farm will be moved (due to their location within the proposed pit area) either by the farmer/landowner or by the applicant and therefore have not been included as receptors in the specialist studies.

20.1 Soils, Land Use and Land Capability

The following limitations and assumptions have been made:

- The information provided in this report is based on information gathered from site visit undertaken on the 31st August to 2nd September 2016;
- The information contained in this report is based on auger points taken and observations on site; and
- The area surveyed was based on the infrastructure layout presented by the Canyon Coal.

20.2 Flora and Fauna

Whilst every effort is made to cover as much of the site as possible, representative sampling is done and it is possible that some plant and animal species that are present on site were not recorded during the field investigations, due to seasonality.

20.3 Surface Water

The following assumptions and limitations applicable to the Surface Water Impact Assessment:

- The surface water impact assessment was done based on the provided mine layout plans and the proposed mining activities. Any changes to the mine plans after completion of this report may require an update of this report; and
- The determined floodlines and SWMP should only be used for indicative and environmental purposes, and not for detailed engineering design. Should they need to be used for designs, civil engineering drawings will need to be undertaken based on these;
- It should be noted that the sizing and design of the PCD and channels as well as dirty water sumps within the open pits do not form part of this conceptual SWMP;
- Part of this hydrological study was the development of a mine wide water balance , due to the limited information at compilation of this study, the water balance will only be carried out once all designs have been finalised and capacities and alternatives of water discharge and sources have been finalised during the Water Use Licence Application phase; and
- In line with the development of the floodlines the following specific assumptions were made:
  - The flood extents were determined for environmental purposes only and not for engineering design;
  - It is assumed that the survey data provided by the client is an accurate and up-to-date representation of the terrain of the modelled streams and floodplains;
  - Calibration of the hydrological and hydraulic models was not possible as there was no existing information available for the modelled streams. Conservative

guideline values for parameters have been used based on observed site conditions. This is a standard approach for determining indicative flood lines

- No abstractions from the river section or discharges into the river section were taken into account during the modelling;
- The Aston Lake was modelled using level pool routing approach, which uses an elevation versus volume curve to define a storage area instead of the use of cross sections as elevation information was not immediately available for the Aston Lake itself (it was excluded in the 1m contour surveys);
- The vertical wall effect was prevented by extending the cross sections long so as to and prevent the flood water elevation falling outside the cross sections;
- Steady state hydraulic modelling was undertaken, which assumes the flow is continuous at the peak rate; and
- A mixed flow regime which is tailored to both subcritical and supercritical flows was selected for running of the steady state model.

20.4 Groundwater

It is important to note that a numerical groundwater model is a representation of the real system. It is therefore, at most, an approximation and the level of accuracy depends on the quality of the data that is available. This implies that there are always errors associated with groundwater models due to uncertainty in the data and the capability of numerical methods to describe natural physical processes.

The following assumptions were made to develop the Groundwater Numerical Model and uncertainties associated with the model:

- No boreholes were found during the hydrocensus in the northern section of the project area. As a result, there is information gap in terms of the current groundwater usage and site hydrogeological conditions;
- There are uncertainties associated with the hydraulic conductivity at the pit area. This was brought about by the obstacles encountered that did not allow for aquifer tests to be conducted at the boreholes located at the pit area (BH5 and BH5A, section 2.4);
- Private boreholes located within the mining right boundary are not regarded as potential receptors as it is assumed that the mine will then own them as soon as it acquired the mining right; and
- The model accuracy is expected to be around 60% and this needs to be taken into consideration when assessing the model results.

20.5 Wetlands

Fieldwork was undertaken in late winter and early spring of 2016. Grasses and forbs were not in flower and therefore most of them were not identifiable. Field assessments were completed to assess as much of the site as possible with focus on the proposed directly impacted areas; however it was not possible to ground-truth every wetland boundary and thus some extrapolation was required.

20.6 Aquatic Ecology

The methods outlined in the Aquatic Ecology Impact Assessment assume that aquatic ecology within the associated river courses is evenly distributed. The surveys were completed during a severe drought and therefore the PES trends may have been affected by the drought conditions. The naming of the fish species belong to Barbus (Skelton, 2001) have been updated to Enteromius. However, for this report the species will be referred to as Barbus.

20.7 Air Quality

The following assumptions and limitations applicable to the AQIA:

- The impact assessment was limited to the emissions generated from the construction and operational phases with emphasis on particulates ($PM_{2.5}$, PM_{10}, and dust fallout) and some gases from the generators, such as oxides of nitrogen (NOx), carbon monoxide (CO) and hydrocarbons (HC) based on manufacturer's specification. Although the proposed construction and operational phases and associated activities will result in the emissions of gaseous pollutants from vehicle exhausts, these were assumed negligible. Assessment was limited to gaseous impacts from the generator sets only;
- Due to the unavailability of local emission factors, the United Stated Environmental Protection Agency (US-EPA) and Australian NPI emission factors were utilised extensively in the emissions inventory;
- Background air quality assessment was limited to monitoring dust deposition rates; and
- This assessment was based on the proposed openpit Palmietkuilen Coal Mine project infrastructure provided by client.

20.8 Noise

The following assumptions and limitations applicable to the Noise Impact Assessment:

- The construction phase is assumed to be carried out during daytime hours (06:00-22:00), therefore only a daytime scenario was modelled for the construction phase and the subsequent impact of the construction phase refers only to the daytime;
- The resulting noise contours represent worst case LAeq at any receiver located 360 degrees in the horizontal plane around the noise sources. The noise modelling software is limited to calculating the predominant wind direction (or downwind conditions of propagation) per single receptor only. Calm wind conditions have therefore been included in the model due to the number of surrounding receptors.

Thus, the noise dispersion plots do not represent a typical seasonal scenario in the predominant wind direction but rather a yearly average of the area's meteorological conditions in all directions; and

- In essence the modelling follows a conservative worst case scenario approach assuming all activities for each phase are being carried out simultaneously; and
- Noise dispersion modelling was not performed for the blasting activities. Blasting is rather assessed according to its linear pressure (dBLin) instead of its A-weighted pressure (dBA) to establish the overpressure strength of the blast (refer to the blasting and vibration assessment report).

20.8.1 Trade-offs

The specialists have included mitigation measures as part of their studies to minimize impacts and reduce the significance of these impacts. However some mitigation measures may have an effect on other sensitive areas of the site and may therefore influence ratings of other impacts.

This is particularly the case for the mitigation measures recommended to reduce the impact of noise on surrounding residents to the north of the project area.

Noise mitigations include:

- Alternative haul route to the siding – alternative routes have been investigated. Alternative routes will still have an impact on a different area of the project and will increase the dust levels. It is preferred if existing roads are utilized;
- Alternative dump location – the infrastructure has been kept in one footprint to minimize disturbance. An alternative location may result in the dust model to expand and impact additional residents as well impacting on more wetland areas; and
- Construction of a 20m berm along northern boundary – the feasibility of this mitigation may be investigated further however this may increase the visual impact of the mine as well as increase the dispersion and generation of dust on site.

20.9 Visual

A VIA is open to subjectivity. This subjectivity is due to the different opinions receptors may have of a proposed project. Oberholzer (2005) defines receptors as "individuals, groups or communities who are subject to the visual influence of a particular project". A receptor may be partial to the fact that a proposed project is occurring in an area, which becomes a source of economic upliftment for a community, whereas another receptor may view a proposed project as a negative factor which could hamper tourism or recreational activities.

Many factors can enhance or reduce the visual impact of a proposed project. Vegetation near a receptor's viewpoint can greatly reduce that receptor's view of a proposed project. Other factors such as weather/climatic conditions and seasonal change can also affect a receptor's view of a proposed project.

It is, therefore, difficult to determine the visual impact of the Project from the viewpoint, as well as perspective, of each individual receptor. Consequently, this report focuses on the size of the viewshed area as an indication of the significance of the visual impacts of the Project. Four key viewpoints were selected for the photomontages to provide an example of the expected views of the Project.

The 5 metre contour relief data from CD:NGI does not include contours for any of the mining activities for the Project area and surrounds. These could potentially provide some screening of the Project. To produce a more representative topographical model, the contour data was edited and contours added for these mining activities. This will increase the accuracy of the viewshed modelling to be conducted during the impact assessment phase. Some infrastructure heights were not available for this study and assumptions were made. These assumptions were based on the heights of infrastructure from similar projects and confirmed by Canyon Coal.

The site visit took place on 18th October 2016. The weather conditions were mainly sunny skies with some small clouds and haze at times. Hazy conditions are not optimal conditions to take photographs for use in a VIA but sufficient visual observations and photographs were obtained for this study.

The local study area for the HIA was defined as the Lesedi Local Municipality and heritage resources were only identified within this local study area (Digby Wells, 2016b). Due to the location of the Project area in the northern corner of the Lesedi Local Municipality, the viewshed area extends into parts of three local municipalities (Ekurhuleni, Lesedi and Victor Khanye Local Municipalities). It was therefore not possible to accurately determine how many heritage sites would be potential visual receptors of the Project.

20.10 Blasting and Vibrations

The following assumptions and limitations applicable to the Blasting and Vibrations Impact Assessment:

- The Project is a greenfields project with no drilling and blasting operations currently active;
- 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 confirmation of the predicted values as it is a greenfields site with no current blasting activities;
- Blast Management & Consulting was not involved in the blast design. The information on blast design applied was provided by Canyon Coal; and

- The work done is based on the author's knowledge and information provided by Canyon Coal.

20.11 Social

The results of StatsSA's 2016 Community Survey were not yet published for Municipal Wards (i.e. regional study area) at the time this report was compiled. It is recommended that the relevant sections of this report be updated once this data is released. The SIA report is based on available information obtained from Canyon Coal, secondary sources, specialists' assessments, as well as a sample of stakeholders consulted during the site visit. The sources consulted are not exhaustive, although deemed sufficient to meet the ToR for this assessment.

Social impacts associated with the eventual closure and decommissioning of the Project are addressed but were not subject to a detailed assessment. This omission is motivated by the fact that predictions concerning the characteristics of the receiving social environment at the time of closure and decommissioning are subject to a large margin of error, thus significantly reducing the accuracy of an impact assessment.

21 Item 3(p): Reasoned opinion as to whether the proposed activity should or should not be authorised

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

Various specialist studies were undertaken during the EIA Phase of the Project with the objective of identifying and weighing anticipated impacts and risks associated with the activities outlined in Table 11-1 above as well as in accordance to all relevant legislative requirements.

The findings of the impact assessment have shown that the Project will have adverse impacts on the receiving environment, including:

- The **change in land use** from intensive cultivation (agriculture) to open pit mining;
- The **loss of wetland habitat** for the creation of the open pit. A total of 255.2 ha of wetland area will be lost; of which 201.9 ha is associated with the open pit and 53.3 ha the supporting infrastructure.;
- There will be **alterations of the two subcatchments of Aston Lake**;
- **Increased sedimentation of surface water resources** which may also impact aquatic biota;
- **Reduction in catchment yields** as dirty water runoff within the mine will be contained in the PCD. Groundwater loss and flow from the pit will also contribute toward baseflow reduction;
- Nuisance noise, dust and visual impacts;

- **Displacement of households** located in the proposed open pit footprint;
- **Direct impact to burial grounds and graves** located within the open pit footprint; and
- An **irreversible impact to the land use and the overall land capability**.

Where possible, mitigation and management measures, no-go areas, as well as further recommendations have been provided by specialist which in reducing the significance of these impacts to minor or negligible significance, including:

- Berms must be maintained as a buffer between the coal handling area and the sensitive receiving environment
- The edge of the wetlands and at least a 32 m buffer must continue to be clearly demarcated as no-go areas and sensitive receptors
- Dirty water from the storm water system and pollution control dam should be treated and released back into the surrounding wetland systems; downstream of the dewatering cone of depression
- Re-vegetate the rehabilitated areas with grasses (Andropogon appendiculatus, Andropogon eucomus, Andropogon huillensis, Aristida congesta subsp. Barbicollis, Arundinella nepalensis, Cynodon dactylon, Eragrostis capensis, Eragrostis curvula, Eragrostis gummiflua, Eragrostis racemose, Fingerhuthia Africana, Hyparrhenia hirta, Hyparrhenia tamba, Imperata cylindrical, Melinis repens, Paspalum dilatatum, Setaria sphacelata, Sporobolus africanus, Sporobolus pyramidalis, Themeda triandra, Trichoneura grandiglumis and Tristachya leucothrix);
- Canyon Coal should finalise the Project layout plan and determine its policy and approach to displacement, as this would inform the extent of resettlement, i.e. whether it will recognise both direct and indirect forms of displacement as well as whether they will strive towards international best practice or local standards; and
- Consideration of redesigns of the proposed open pit. Where redesigns are not feasible, complete a BGGC and GRP as regulated by Section 36 of the NHRA and Chapters XI and IX of the Regulations to the Act must be implemented to identify as far as possible bona fide NoK to consult and reach agreement as to the appropriate management of the burial grounds through a required GRP.

Monitoring plans, which should be implemented throughout the life of the mine, have also been provided to ensure that adverse impacts are realised and continuous improvements are developed.

Positive social and economic impacts will be realised at local, regional and national level. Nationally, the Project will contribute coal requirement to meet the demand for electricity supply as well as knock-on benefits such as tax contributions. At regional and local level, the Project has the potential to improve local socio-economic profiles through job creation, development of SMMEs and skills development. The revenue generated by the mine will translate into R430.6 million (2016 prices) of value added annually and R19.9 billion (2016 prices) of GDP over the lifespan of the Project. Assuming that the direct impact on GDP, i.e. R164.2 million, to be created on an annual basis will be registered within the municipal boundaries, it can be suggested that the Palmietkuilen Coal Mine operations will expand the current LLM GDP economy by 2.3%, while the mining sector's GDP increase by about 70% (Urban-Econ, 2016).

Currently the wetlands on site have been identified as disturbed and the system in the area has been severely impacted by farming activities as well as industries upstream and other anthropogenic activities. Options of improving the water quality or reducing the current damage on the overall system will be investigated as part of the IWULA process, with discussions with the DWS, and will look at improving the system on a larger scale.

Several Mining Right applications are in progress in the surrounding areas of the proposed project and therefore it may be investigated to look at what positive impacts could be cumulated on a regional level between all the mining houses.

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

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;
- Environmental monitoring should take place as recommended;
- A grievance system or communication platform must be established to create a forum for the public to interact with the mining house;
- The PCD must be designed and operated in such a way that it will not spill more than once in 50 years. The dam must be able to contain the water required for operations and a storm event including a 0.8m freeboard at all times;
- A Resettlement Action Plan must be developed and agreed upon with affected parties prior to displacement related activities; and
- The closure cost assessment should be updated and submitted as per the legislative requirements.

21.2.2 Rehabilitation requirements

The post-mining land use should be restored to either grazing and/or cultivation and should represent the pre-mining land use, as far as possible. 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.

The closure and rehabilitation objectives for the Project are listed below, and should be met:

- Achieve a final land use that is sustainable and meets both legislative requirements and stakeholder needs;
- 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. The Rehabilitation, Decommissioning and Mine Closure Plan (Appendix Q) aims to assist AOL in carrying out successful rehabilitation for the proposed mine.

22 Item 3(q): Period for which the environmental authorisation is required

AOL intends to mine 200 000 tons of coal per month and the coal resource has is estimated at 125.98 Mt. Mining operations, excluding construction and decommissioning, are anticipated to be maintained for a period of 51 years. Should the EA, WML and IWUL be granted, the total LOM has therefore been calculated at 53 years including a two year ramp-up period.

23 Item 3(r): Undertaking

Please refer to Part B, Section 12 for the complete undertaking applicable to the EIA and EMP sections of this report

24 Item 3(s): Financial provision

The financial provision was calculated according to Regulation 6 of the Financial Provision Regulations (2015) which prescribe the minimum content requirements.

The financial provision estimate was calculated based on the Financial Provision Regulations (GNR. 1147). The estimated financial provision required for the rehabilitation and closure of the proposed Project is **R 162 441 981.00** (Year 10) and **R 330 475 001.00** (LoM) **excl. VAT**. The financial provision estimate associated with the LoM and Year 10 of operations is included in the Table 24-1 below.

Table 24-1: Canyon Coal Financial Provision Summary

Area and Description	Year 10 of Operation 2026	End of Life 2069
Infrastructure and Rehabilitation		
Area 1: Mine Office	R297 709	R297 709
Area 2: Plant infrastructure	R2 528 445	R2 792 798
Area 3: Mining and Related areas	R131 113 650	R275 428 583
Area 4: Linear infrastructure	R2 418 734	R2 418 734
Sub-total	**R136 358 539**	**R280 937 825**
Monitoring and Maintenance		
Monitoring Costs (Groundwater and Surface water 5 Years)	R1 595 900	R1 427 600
Monitoring Costs (Vegetation 3 Years)	R67 809	R79 563
Maintenance Costs (Vegetation 3 Years)	R2 602 367	R3 079 962
Sub-total	**R4 266 076**	**R4 587 124**
Project Management (6%)	R8 181 512	R16 856 269
Contingency (10%)	R13 635 854	R28 093 782
GRAND TOTAL (Excl. VAT)	**R162 441 981**	**R330 475 001**

24.1 Assumptions

The following assumptions have been made and limitations identified, during the calculation of the financial provision:

- All infrastructure will be removed from the mine at closure;
- All infrastructure will be constructed in year 1, as per the Mine Works Programme (MWP);
- The concrete will only be demolished up to 1000 mm below natural ground level;

- Inert 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 6 m;
- All fences will be removed at end of life;
- The pollution control dam will be lined with HDPE and it was assumed that 150mm silt will require removal over 40% of the dam area;
- The dirty water trench will be lined with 150 mm thick concrete;
- No contamination will be present at the tarpaulin area;
- For Year 10 of operation and LoM, the discard dump will be used as backfill material into the open pit, therefore allowance was made to rip the footprint, import 300 mm topsoil and vegetating the footprint area;
- All temporary structures will be removed from site prior to closure;
- All the material on stockpile areas would have been removed prior to closure, and therefore only footprint rehabilitation is allowed for;
- According to the MWP the coal seams will vary between 12 m and 60 m depth, thus it was assumed the pit will have a total depth of 60 m. The pit was divided up in 6 benches with a height of 10 m each;
- General surface rehabilitation must involve the shaping of the surface topography to match the surrounding landscape and 300mm 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;
- For Year 10 of operation, including one year of construction, it is assumed that the open pit will be backfilled and rehabilitated. According to the life of mine (LoM) plan the pit area at Year 9 of mining (effectively Year 10 due to mining only starting in Year 2) will be 17.9 ha with an average pit depth of 36 m;
- At LoM, it is assumed that the open pit would have been rehabilitated concurrently. A final void at Year 53 will require backfill. A total area of 39.31 ha and an average pit depth of 36 m would require backfill material;
- All soft and hard overburden material will be used to rehabilitate the open pit;
- Water monitoring costs have been included for 4 surface points and 17 groundwater points for at least 5 years after mine closure;
- Vegetation monitoring and maintenance on rehabilitated areas is assumed to take place for three years after closure;

- A contingency of 10% on all infrastructure costs has been allowed for. This contingency takes into account possible omissions and price fluctuations with regard to plant hire and fuel;
- A 6% allowance has been included for project management fees. 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 from the client; and
- The financial provision estimate has been calculated for end of life of mining and at the end of Year 10 of operations.

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

The environmental liability only focused on the proposed mining activities and was calculated by means of the DMR standard method for assessment of mine closure. Activities incorporated into the calculation included the demolition and management of physical infrastructure, rehabilitation of the waste facilities as well as the rehabilitation of these affected areas.

The areas for the mine which needed to be included in the current assessment were provided to Digby Wells by the applicant. These areas were assumed to be all that the applicant was liable for and no investigation was conducted to determine whether the applicant is responsible for, and has any liabilities for additional areas.

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

Provided the Mining Right is approved, AOL 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.

25 Item 3(t): Deviations from the approved scoping report and plan of study

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

There were no deviations from the plan of study as stipulated in the Scoping Report.

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

There were no deviations from the plan of study as stipulated in the Scoping Report.

26 Item 3(u): Other Information required by the competent authority

26.1 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 SIA (Appendix N) and Economic Assessment (Appendix O). The impacts were also quantified based on the pre-determined baseline conditions in 11.1.12 and 11.1.13 respectively.

People in the vicinity of the mine will experience positive and negative impacts of the proposed Project. Physical displacement of households located in the direct footprint area of the proposed pit has been identified as a major adverse socio-economic impact, however, mitigation measures namely the development of a Resettlement Action Plan and grievance mechanism have been proposed.

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

The HIA (Appendix M) 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.

The Project area's CS assessment demonstrated that the identified heritage resources categories range from very high to negligible significance. The proposed Project would result in a direct negative impact on two burial grounds and graves located within the proposed open pit infrastructure. This will have irreversible impacts on these resources unless redesigns are economically feasible.

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.

Part B: Environmental Management Programme Report

1 Item 1(a): Details of the EAP

Digby Wells has been appointed as the independent Environmental Assessment Practitioner (EAP) to undertake the EIA process and associated WULA. The details of the EAP are provided in below.

Table 1-1: Contact Details of the EAP

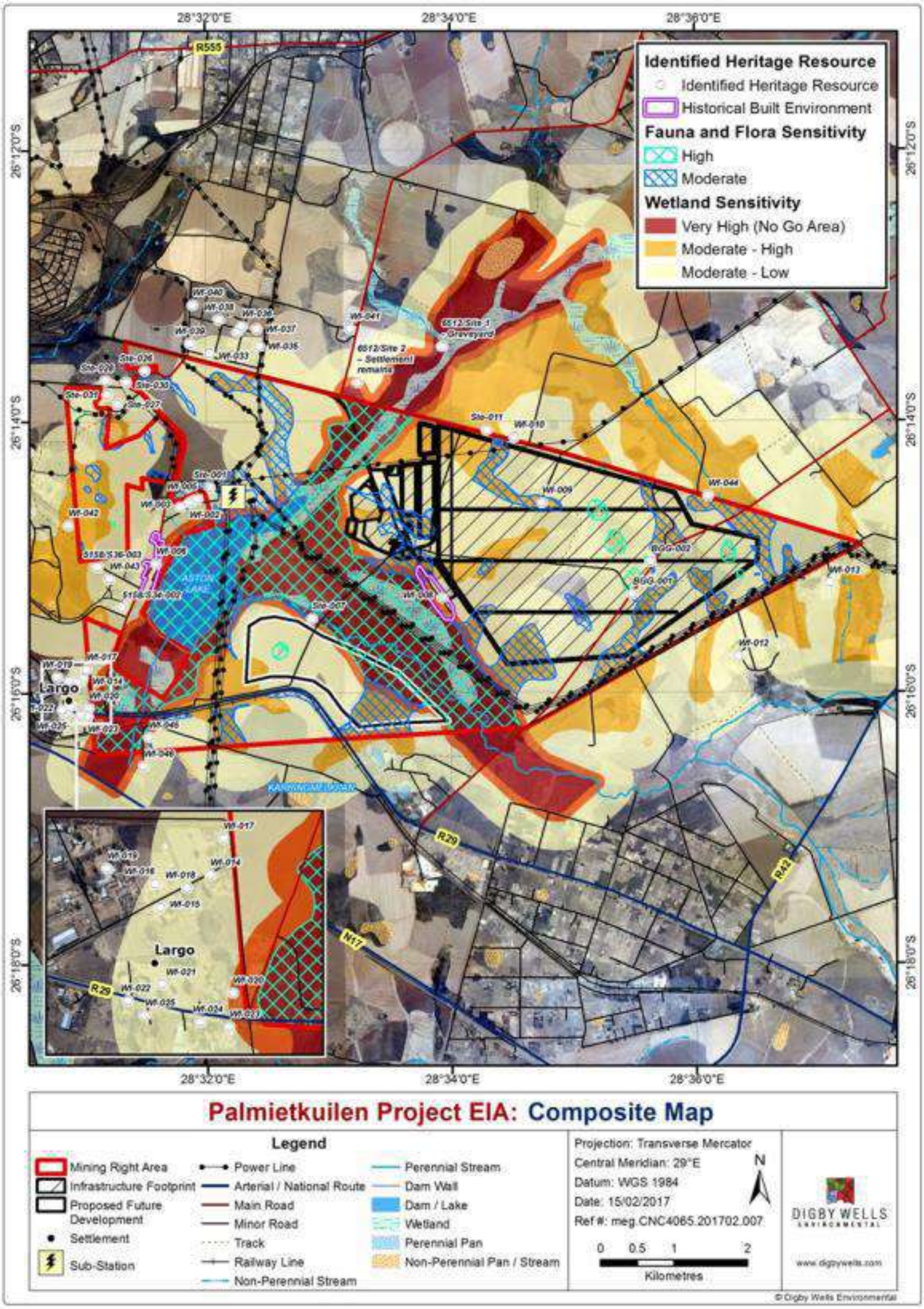
Name of Practitioner:	Stephanie Aken
Telephone:	011 789 9495
Fax:	011 069 6801
Postal Address	Private Bag X10046, Randburg, 2125, South Africa
Email:	stephanie.aken@digbywells.com

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

Refer to Part A: Section 10 for the list of aspects associated with the proposed Project.

3 Item 1(c): Composite Map

The Composite Map is displayed below.



Plan 65: Composite Map

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.

The following points outline the main objectives for rehabilitation and closure:

- Achieve a final land use that is sustainable and meets both legislative requirements and stakeholder needs.
- 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 (refer to Section 6, Part A); 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 AOL in carrying out successful rehabilitation for the proposed Palmietkuilen Coal Mine.

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 Environmental Response Plan is 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.

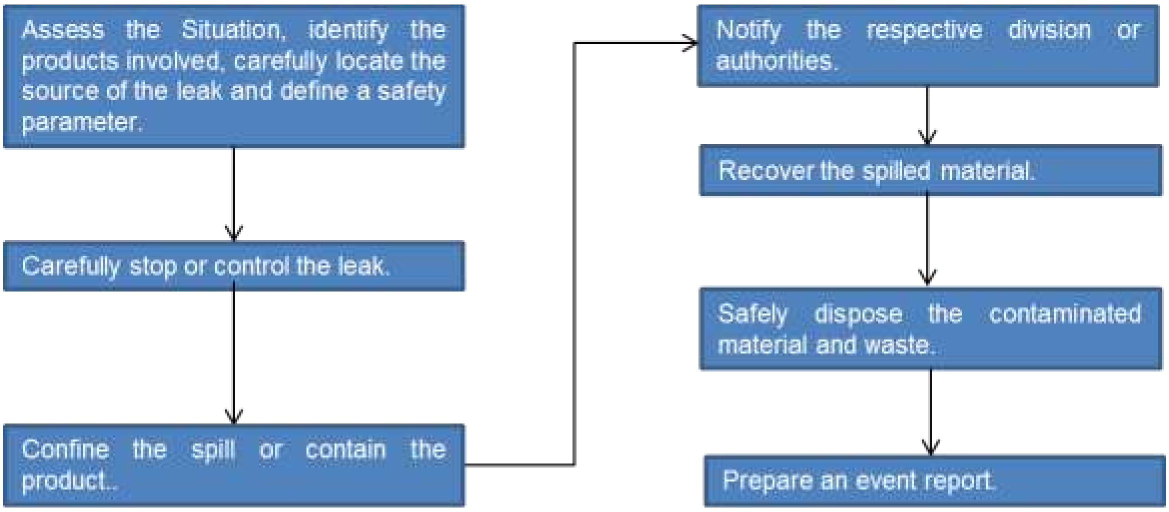


Figure 4-1: Emergency response procedure overview

- 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.

- 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

Post-mining water decant is predicted to occur once the final void has been rehabilitated and groundwater levels are allowed to return back to natural level. It is anticipated that this decant will be acid forming (acid mine draining, AMD). Long-term passive water treatment options will need to be investigated by AOL to prevent untreated AMD decant water from entering the catchment.

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

A detailed Geochemistry study is being undertaken to assess the potential of AMD post-closure (Appendix R).

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

A detailed Geochemistry study is being undertaken to assess the potential of AMD post-closure (Appendix R).

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

A detailed Geochemistry study is being undertaken to assess the potential of AMD post-closure (Appendix R).

The eastern basin of the Witwatersrand is recognised for current AMD related issues. Based on the broader cumulative impacts, further engagement with surrounding mining houses will be undertaken to explore the potential for a regional management strategy for AMD

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

Water is required for use in crushing and within the screening plant, on various stockpiles as well as for potable use. It is therefore planned that water is either abstracted from Aston Lake, owned by the Schoeman Boerdery or new boreholes. These water sources and volumes are still to be confirmed by undertaking the relevant feasibility studies.

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

AOL is in the process of applying for an IWULA from DWS as per the requirements of the NWA, namely the following water uses:

- Section 21 (a);
- Section 21 (b);
- Section 21 (c & i);
- Section 21 (f);
- Section 21 (j).

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

The proposed mitigation measures and its compliance with the relevant standards are presented in Table 4-1.

Table 4-1: Impacts to be mitigated

Activities	Aspect Affected	Phase	Size and scale of disturbance	Mitigation Measures	Compliance with standards	Time period for implementation
Site clearance and topsoil removal	Soil and Land Use Capability	Construction	Open pit & infrastructure footprint	▪ Ensure proper storm water management designs are in place; ▪ If any erosion occurs, corrective actions (erosion berms) must be taken to minimise any further erosion from taking place; ▪ Only the designate access routes are to be used to reduce any unnecessary compaction; ▪ Topsoil should be stripped by means of an excavator bucket and loaded onto dump trucks; ▪ Topsoil stockpiles are to be kept to a maximum height of 10 m; ▪ If possible topsoil should be stripped during dry months, as to reduce compaction; ▪ Compaction of the removed topsoil must be avoided by prohibiting traffic on stockpiles; ▪ The stockpiles must be vegetated in order to reduce the risk of erosion; and ▪ Handling of the stripped must be minimised to ensure the structure does not deteriorate.	Chamber of Mines Guidelines	Design and construction phase
	Flora and Fauna	Construction	Eragrostis Grassland (280ha) Riparian Vegetation/habitat type (51ha)	▪ Relocation of infrastructure; ▪ Rehabilitation with native grass species; ▪ Relocation of Red Data species, should any species be recorded in developing footprint area during vegetation clearing; and ▪ Implement an alien management plan.	National Environmental Management Act (NEMA),1998 (Act 107 of 1998); and National Environmental Biodiversity Act (NEMBA),2004 (Act10 of 2004).	Rehabilitation should take place after decommissioning as outlined in the Rehabilitation Plan Report; and Relocation of Red Data flora species prior to vegetation clearing – screening of areas prior to vegetation clearance
	Surface Water	Construction	Open pit & infrastructure footprint	▪ Clearing of vegetation must be limited to the development footprint area, and the use of existing access roads must be prioritised so as to minimise construction of new access roads in these areas; ▪ If possible, construction activities must be prioritised to the dry months of the year (May-October) to limit mobilisation of sediments or hazardous substances from construction vehicles used during site clearing; ▪ The proposed topsoil and overburden stockpiles must be covered or vegetated as soon as possible to prevent sediment erosion. Location of measures as per SWMP; ▪ Contaminated storm water runoff from this area will be routed through trenches to silt trap sumps at the bottom of the stockpiles; ▪ Contaminated storm water runoff from the sump will be routed through channels to the PCDs for reuse; ▪ Water quality monitoring should be implemented as an management option;	Based on the GN 704 requirements regarding stormwater management for mining activities it is noted that all clean and dirty water must be separated. The clean water diversion will be sized to accommodate the 1:50 year storm event. The containment facility should be sized to accommodate the anticipated dirty water runoff as a result of the 1:50 year storm event.	Design and construction phase

Activities	Aspect Affected	Phase	Size and scale of disturbance	Mitigation Measures	Compliance with standards	Time period for implementation
				Haul roads must be well compacted to avoid erosion of the soil into the streams; ▪ Dust suppression on the haul roads and cleared areas must be regularly undertaken; and ▪ All dirty water channels must be constructed and placed within the dirty water infrastructure areas, such that all dirty water runoff emanating from these areas are captured and contained to a dirty water containment facility. The proposed channels should be lined and sized to cater for the 1:50 year storm event.		
	Groundwater	Construction	<0.5 km^2	▪ Site clearance and construction activities should take place above the water table, if applicable. No impact on the groundwater is expected if the activities take place above the water table; ▪ Site clearance should be kept to a minimum area and short duration, if possible; ▪ If trenches are going to be excavated below the water level, dewatering of the aquifer to lower the water table locally can be considered to ensure that the construction takes place above the groundwater level and the water quality remains acceptable. The abstracted water can be utilised for dust suppression, vegetation irrigation or discharged to pollution control dams for evaporation. Since the groundwater is not expected to be polluted at this stage, the utilisation of the water for activities such as dust suppression or irrigation will not cause negative environmental impacts; ▪ The PCD should not be placed on areas with the potential for increased infiltration to groundwater, such as over fault zones; and ▪ PCD should be lined to pro-actively prevent infiltration of contaminated seepage water.	Compliance to the approved WULA	Groundwater monitoring must commence from the start of the construction phase Protection of the water table and groundwater quality should commence with the start of the construction phase
	Wetlands	Construction	53.3 ha for infrastructure and 201.9 ha associated with the open pit area.	▪ There are no mitigation measures for loss of habitat; and ▪ Avoid and minimise impacts where possible, else rehabilitate and offset wetland sections.	Section 19 of the NWA Section 21 (c), (g) and (i) of the NWA Section 24 of the Constitution NEM:BA NEMA Department of Water and Forestry (DWAF) guidelines for the delineation of wetlands (2005); Mining and Biodiversity Guideline (DEA et al., 2013).	Design and construction phase
	Aquatic Ecology	Construction	10 km^2	▪ Minimise the removal of vegetation in the infrastructure footprint area to prevent erosion and sedimentation of the river systems; ▪ Re-vegetation of the disturbed areas within the construction footprint once	National Water Act, 1998 (Act No. 36 of 1998).	Design and construction phase

Activities	Aspect Affected	Phase	Size and scale of disturbance	Mitigation Measures	Compliance with standards	Time period for implementation
				construction is completed; ▪ Soils compacted by heavy machinery in areas that are not utilised post construction can be ripped to allow infiltration; ▪ Ensure that storm water management structures are within good working condition through regular inspection, especially after large storm events; ▪ Where storm water enters river systems, sediment/silt and debris trapping, as well as energy dissipation control measures must be put in place; ▪ Storm water must be diverted from construction activities and managed in such a manner to disperse runoff and prevent the concentration of storm water flow; ▪ The vegetation of unpaved roadsides; and ▪ Inspection of paved and unpaved roads to monitor for erosion.		
	Air Quality	Construction	Open pit & infrastructure footprint	▪ Site clearing must be done in phases; ▪ Use of suppressants and binders on exposed areas to reduce dust generation; ▪ The area of disturbance at all times must be kept to a minimum and no unnecessary clearing, digging or scraping must occur, especially on windy days (with wind speed ≥ 5.4 m/s); ▪ The drop heights when loading onto trucks and at tipping points should be minimised.	National Environmental Management: Air Quality Act, Act.39 of 2004; National Environmental Management: Air Quality Act, 2004 (Act No. 39 of 2004) - National Dust Control Regulations (2013).	Design and construction phase
	Noise (noise levels in excess of 7 dBA at certain Mpumalanga receptors)	Construction	Impacting only on certain receptors in the Mpumalanga Province	▪ Alternative location of the northernmost hard overburden dump; ▪ Alternative location of the haul route towards the siding; ▪ Restricting construction activities to daylight hours (06:00 – 18:00) and not during weekends and public holidays; ▪ Locating of diesel generator away from noise sensitive receptors, as well as placing generators on isolation mounts and installation of secondary silencers; ▪ Mining related machines and vehicles to be serviced to the designed requirements of the machinery/vehicles to ensure noise suppression mechanisms are effective e.g. installed exhaust mufflers; ▪ Reversing alarms on vehicles should be broadband reversing alarms which emit directional, lower, less intrusive sound; ▪ Environmental noise monitoring to establish compliance with the regulations and to verify the predicted noise levels; and ▪ Switching off equipment when not in use.	National Noise Control Regulations Gauteng Noise Control Regulations	Design and construction phase
	Visual	Construction	Local	▪ Where possible use fencing that will screen the project area from nearby receptors; and ▪ Limit the height and footprint area of temporary laydown areas and facilities for the construction workers. ▪ Vegetation should only be removed when and where necessary. ▪ Topsoil should only be removed when and where necessary; ▪ Topsoil stockpiles should be vegetated with grasses (Andropogon appendiculatus, Andropogon eucomus, Andropogon huillensis, Aristida	To minimise the negative visual impacts caused by site clearing.	Design and construction phase

Activities	Aspect Affected	Phase	Size and scale of disturbance	Mitigation Measures	Compliance with standards	Time period for implementation
				congesta subsp. Barbicollis, Arundinella nepalensis, Cynodon dactylon, Eragrostis capensis, Eragrostis curvula, Eragrostis gummiflua, Eragrostis racemose, Fingerhuthia Africana, Hyparrhenia hirta, Hyparrhenia tamba, Imperata cylindrical, Melinis repens, Paspalum dilatatum, Setaria sphacelata, Sporobolus africanus, Sporobolus pyramidalis, Themeda triandra, Trichoneura grandiglumis and Tristachya leucothrix) where possible so as to blend into the surrounding landscape and reduce dust generation; ▪ Limit the footprint area of topsoil stockpiles where possible; ▪ Limit the height of the topsoil stockpile to 20 m; and ▪ Apply dust suppression techniques to limit dust generated from topsoil stockpiles.		
	Cultural Heritage	Construction; and Operational Phase	~3 500 ha	▪ Reduce through the completion of a BGGC process and compilation / implementation of a CMP	NHRA Section 36 Chapters XI and IX of the NHRA Regulations	Pre-construction
	Social (appointment of workforce)	Construction; and Operational Phase	At least 136 jobs will be created for individuals from local communities	▪ Assign preferred employment status to those experiencing the bulk of the negative project impacts (communities located within and surrounding the Project footprint e.g. Palmietkuilen Community, Vischkuil, Endicott, Welgedacht, Slovo Park, etc.); ▪ Promotion of local, female and youth employment to achieve and where feasible exceed the targets set out by the Mining Charter; ▪ Where possible labour-intensive construction methods should be promoted; ▪ Verification of local residential status through consultation with appropriate authorities (e.g. municipal structures, community leaders, and landowners) ▪ Consult neighbouring businesses/mines to determine if they would be willing to make their skills registers available; ▪ Identify required core skills, expand skills audits to community and align and implement training and skills development initiatives to findings of audit; ▪ Expand skills development programmes, especially ABET programmes, to include surrounding communities; ▪ Recruitment via a registry of job seekers and potentially coordinated through the DoL; ▪ Provide local employees with reference letters certificates of completion for in-house (on-the-job) training; ▪ Monitor subcontractors in terms of local employment targets; ▪ Provide focused training to construction phase employees from the host communities to increase their chances for employment during the operations; ▪ The Project's database of the local labour pool should be updated to include people who were employed by the Project during the construction phase.	Mineral and Petroleum Resource Development Act (Act of 2002). National Environmental Management Act (Act of 1998 Employment Equity Act, 1998 (Act No. 55 of 1998); Basic Conditions of Employment Act, 1997 (Act No. 75 of 1997); Labour Relations Act, 1995 (Act No. 66 of 1995); Skills Development Act (Act No. 97 of 1998 as amended); and Company employment policies.	Pre-construction
Increased vehicular activities	Fauna and Flora	Construction, operation and decommissioning	Haul road infrastructure	▪ Erection of signage; ▪ Implementing speed limit on site (30 km/h); and ▪ Restricting driving at night.	National Environmental Management Act (NEMA),1998 (Act 107 of 1998)	Signage should be erected before at the start of the construction phase.

Activities	Aspect Affected	Phase	Size and scale of disturbance	Mitigation Measures	Compliance with standards	Time period for implementation
		phases			National Environmental Biodiversity Act (NEMBA),2004 (Act10 of 2004)	
Construction of mine related infrastructure, including roads, pipes and dams	Groundwater	Construction, operation and decommissioning phases	Local	▪ Overburden and topsoil stockpiles should be managed to minimise infiltration of contaminants to the groundwater. ▪ The vegetation of the stockpile and covering them with soil to minimise rainfall infiltration and mobilisation of dissolved metals. ▪ Groundwater monitoring. ▪ Avoid placement of the PCD on areas with the potential for increased infiltration to groundwater, such as over fault zones. ▪ All contaminant, storm water, waste and hazardous waste storage facilities and other contaminated water storage areas (PCD) should be lined to prevent infiltration of contaminated seepage water proactively. ▪ Monitoring of groundwater quality and water levels is recommended with continuous refining and updating of the monitoring network based on the results obtained. ▪ The PCD should be operated in such a way that it does not overflow more than once in 50 years.	Compliance to the approved WULA	Groundwater monitoring must commence from the start of the construction phase Protection of the water table and groundwater quality should commence with the start of the construction phase
	Wetlands	Construction	Infrastructure footprint	▪ The edge of the non-directly impacted wetlands, and at least a 32 m buffer if possible, must be clearly demarcated in the field as no-go zones that will last for the duration of the construction phase. ▪ Staff need to be educated about the sensitivities of the wetland habitat. ▪ Wetland monitoring must be carried out during the construction phase by a wetland specialist to ensure no unnecessary impact to wetlands is realised; and if so that a remedy is put in place as soon as possible. ▪ Refer to the Surface Water Report for details on a Storm Water Management Plan that is to be carried out. This must be in operation during the construction phase and wetlands must be highlighted as sensitive receptors. ▪ Refer to the Fauna and Flora Report (Digby Wells, 2016c) for mitigation measures relating to floristic impacts as well as faunal species disturbances; for example, ▪ minimal bright lights should be left on at night time and they should not face outwards of the site; and ▪ An alien and invasive plant species management programme must be in place from the construction phase.	Section 19 of the NWA Section 21 (c), (g) and (i) of the NWA Section 24 of the Constitution NEM:BA NEMA Department of Water and Forestry (DWAF) guidelines for the delineation of wetlands (2005); Mining and Biodiversity Guideline (DEA et al., 2013).	Design and construction phase
	Air Quality	Construction	Few meters from project activity. Impacts will be limited to the site and immediate surroundings.	▪ Activity must be carried out judiciously to ameliorate dust emissions. ▪ Use of suppressants on exposed areas to reduce dust generation.	National Environmental Management: Air Quality Act, Act.39 of 2004; National Environmental Management: Air Quality Act, 2004 (Act No. 39 of 2004) - National	Immediately the construction phase commences.

Activities	Aspect Affected	Phase	Size and scale of disturbance	Mitigation Measures	Compliance with standards	Time period for implementation
					Dust Control Regulations (2013).	
	Noise ((noise levels in excess of 7 dBA at certain Mpumalanga receptors)	Construction	Impacting only on certain receptors in the Mpumalanga Province	▪ Alternative location of the northernmost hard overburden dump should be considered; ▪ Alternative location of the haul route towards the siding should be considered; ▪ Restricting construction activities to daylight hours (06:00 – 18:00) and not during weekends and public holidays; ▪ Locating of diesel generator away from noise sensitive receptors, as well as placing generators on isolation mounts and installation of secondary silencers; ▪ Mining related machines and vehicles to be serviced to the designed requirements of the machinery/vehicles to ensure noise suppression mechanisms are effective e.g. installed exhaust mufflers; ▪ Reversing alarms on vehicles should be broadband reversing alarms which emit directional, lower, less intrusive sound; ▪ Environmental noise monitoring to establish compliance with the regulations and to verify the predicted noise levels; and ▪ Switching off equipment when not in use.	National Noise Control Regulations Gauteng Noise Control Regulations	construction phase
	Visual	Construction	Local	▪ Ensure screening vegetation is left intact around the Project area and near receptors; ▪ Ensure the surface infrastructure does not exceed the proposed heights; ▪ Surface infrastructure should be painted natural hues so as to blend into the surrounding landscape where possible; ▪ Pylons and metal structures should be galvanised so as to weather to a matt grey finish rather than be painted silver. If the pylons and metal structures are painted, it is recommended that a neutral matt finish be used; and ▪ Where possible avoid construction activities at night. If construction activities take place at night then down lighting must be implemented to minimise light pollution.	To minimise the negative visual impacts caused by construction of mine related infrastructure.	Construction Phase
	Surface Water	Construction	All surface infrastructure amounts to 1.5 km^2	▪ Ensure all the dirty water emanating from the dirty water areas will be collected via silt traps before entering the PCD. This water should be stored for re-use within the mine so as to prevent unnecessary discharge into the environment. ▪ Should the contained water be more than the water use requirement, the Best Practice Guidelines (BPGs) advise that the water be recycled or as the last resort be treated to acceptable levels and discharged either to the natural environment or be supplied to other industries as a lower grade of water.	DWS Best Practice Guideline G4: Impact prediction Based on GN 704, the mine infrastructure in question should fall outside of the 1:100 year floodline or 100 m, whichever is greater.	During the construction and operation of the entire infrastructure.
	Macro-Economic	Construction	Local	▪ The impact is positive; measures to maximise the stimulation of the economy may include procurement of goods and services from local business where feasible; ▪ Recruit local labour; ▪ Sub-contract to local construction companies;	Mineral and Petroleum Resource Development Act (Act of 2002). National Environmental	Throughout LOM

Activities	Aspect Affected	Phase	Size and scale of disturbance	Mitigation Measures	Compliance with standards	Time period for implementation
				▪ Use local suppliers where viable and arrange with the local Small and Medium and Micro Enterprises to provide transport, catering and other services for the construction crew; ▪ Use labour intensive construction methods, where feasible; ▪ Sub-contract to local construction companies; ▪ Use local suppliers; ▪ Set-up a skills desk at the local municipal office and in the nearby communities to identify skills available in the community and assist in recruiting local labour during both construction and operation; ▪ Ensure that the main contractor shares knowledge with the sub-contracting companies during the construction period; ▪ Encourage the main contractor to offer internships and learnerships, especially to those coming from the local communities; ▪ Employ labour intensive methods in construction; ▪ Sub-contract to local construction companies; ▪ Use local suppliers where viable and arrange with the local Small and Medium Enterprises to provide transport, catering, and other services for the construction crew; ▪ No enhancement; ▪ The establishment of the mine should be done with a minimal impact on the agricultural land and on the footprint of the properties; ▪ Engage with directly affected farmers and landowners on alternative farming locations and investigate ways to minimise loss of agricultural production. ▪ Off-set impact by training local small-scale farmers as stated in SLP in order to have no net loss; ▪ If feasible, continue utilising land not affected by the mine’s footprint for agricultural production; ▪ Where possible, ensure that land preparation and rehabilitation activities implemented during various staged of the mine’s lifecycle allow for restoration of land to above-grazing capacity, i.e. suitable for crop production; ▪ Mitigation measures proposed by visual and noise specialists should be strictly adhered to, to minimise the probability and intensity of the visual exposure in the area; ▪ Independent appraisals of properties and land values in the area adjacent to the site to determine the baseline before the project’s implementation is advisable; ▪ Educate and inform the affected parties on the potential environmental impacts that could ensue and the activities to adequately manage perceptions regarding potential effects of the project on the surrounding land uses; ▪ Engage with respective researchers and specialists to determine with greater certainty the effect that any negative environmental impacts could affect the production of eggs on the nearby egg farms;	Management Act (Act of 1998 Employment Equity Act, 1998 (Act No. 55 of 1998); Basic Conditions of Employment Act, 1997 (Act No. 75 of 1997); Labour Relations Act, 1995 (Act No. 66 of 1995); Skills Development Act (Act No. 97 of 1998 as amended); and Company employment policies.	

Activities	Aspect Affected	Phase	Size and scale of disturbance	Mitigation Measures	Compliance with standards	Time period for implementation
				▪ Engage with adjacent landowners and compile the baseline, as well as monitor the effects of the mining activity on the production at the potentially affected farms; ▪ In the event that the production is affected and proven to be the result of mining activity, engage with adjacent landowners and investigate appropriate alternatives suitable for all the parties to ensure overall production is not affected (relocation, expansion of other facilities, etc.); and ▪ Strictly adhere to environmental specialists recommendations.		
Blasting and development of initial box-cut for mining, including stockpiling from initial box-cuts	Air Quality	Construction	Impact will be localized, extending across the site to nearby settlements.	▪ Activity must be carried out judiciously to ameliorate dust emissions ▪ Wet drilling	National Environmental Management: Air Quality Act, Act.39 of 2004; National Environmental Management: Air Quality Act, 2004 (Act No. 39 of 2004) - National Dust Control Regulations (2013).	Immediately the construction phase commences.
	Noise ((noise levels in excess of 7 dBA at certain Mpumalanga receptors)	Construction	Impacting only on certain receptors in the Mpumalanga Province	▪ Alternative location of the northernmost hard overburden dump should be considered; ▪ Alternative location of the haul route towards the siding should be considered; ▪ Restricting construction activities to daylight hours (06:00 – 18:00) and not during weekends and public holidays; ▪ Locating of diesel generator away from noise sensitive receptors, as well as placing generators on isolation mounts and installation of secondary silencers; ▪ Mining related machines and vehicles to be serviced to the designed requirements of the machinery/vehicles to ensure noise suppression mechanisms are effective e.g. installed exhaust mufflers; ▪ Reversing alarms on vehicles should be broadband reversing alarms which emit directional, lower, less intrusive sound; ▪ Environmental noise monitoring to establish compliance with the regulations and to verify the predicted noise levels; and ▪ Switching off equipment when not in use.	National Noise Control Regulations Gauteng Noise Control Regulations	construction phase
	Visual	Construction	Local	▪ Apply dust suppression techniques to limit the dust from the demolition area; ▪ Use shade cloth/netting to screen the demolition area; ▪ Ensure all infrastructure is demolished and removed from the site; ▪ Limit the quantity and time of rubble stored on site; ▪ Ensure that the open pit is backfilled with material from the overburden stockpiles; ▪ Rehabilitate all disturbed areas; ▪ Ensure that the rehabilitated area is re-contoured and profiled to create a free-draining topography; ▪ Spread topsoil over the rehabilitated area;	To minimise the negative visual impacts caused by the change of land use from agriculture to mining.	Decommissioning Phase

Activities	Aspect Affected	Phase	Size and scale of disturbance	Mitigation Measures	Compliance with standards	Time period for implementation
				▪ Ensure that surface water and drainage lines are rehabilitated; ▪ Re-vegetate the rehabilitated areas with grasses (Andropogon appendiculatus, Andropogon eucomus, Andropogon huillensis, Aristida congesta subsp. Barbicollis, Arundinella nepalensis, Cynodon dactylon, Eragrostis capensis, Eragrostis curvula, Eragrostis gummiflua, Eragrostis racemose, Fingerhuthia Africana, Hyparrhenia hirta, Hyparrhenia tamba, Imperata cylindrical, Melinis repens, Paspalum dilatatum, Setaria sphacelata, Sporobolus africanus, Sporobolus pyramidalis, Themeda triandra, Trichoneura grandiglumis and Tristachya leucothrix); and ▪ Ensure all the mitigation/management actions outlined in the Closure and Rehabilitation reports are conducted.		
	Cultural Heritage	Construction and operation	~3 500 ha	▪ Reduce through the completion of a BGGC process and compilation / implementation of a CMP ▪ Avoid though amendment of the infrastructure design. Where not feasible, a BGGC and GRP must be completed	NHRA Section 36 Chapters XI and IX of the NHRA Regulations	Pre-construction
Temporary storage of hazardous products, including fuel and explosives, as well as waste and sewage.	Air Quality	Construction	Impacts will be limited to the site and immediate surroundings	▪ Strict adherence to products and waste management plan; ▪ Handled, stored and disposed hazardous substances in accordance with the local regulations; ▪ Store hazardous substances in clearly labelled containers; ▪ Emergency situations must be dealt with promptly i.e. spills. ▪ Provision of secondary containment for fuel storage.	National Environmental Management: Air Quality Act, Act.39 of 2004; National Environmental Management: Air Quality Act, 2004 (Act No. 39 of 2004) - National Dust Control Regulations (2013).	Commencement of construction phase.
Operation and maintenance of the topsoil and overburden stockpiles	Soils, Land Use and Land Capability	Operational	Open pit & infrastructure	▪ Ensure proper storm water management designs are in place; ▪ If any erosion occurs, corrective actions (erosion berms) must be taken to minimise any further erosion from taking place; and ▪ Only the designate access routes are to be used to reduce any unnecessary compaction.	Chamber of Mines Guidelines	Operational Phase
	Groundwater	Operational	<1 km^2	▪ Overburden and discard stockpiles should be managed to minimise infiltration of contaminants to the groundwater. ▪ The vegetation of the stockpile and covering them with soil to minimise rainfall infiltration and mobilisation of dissolved metals. ▪ Groundwater monitoring.	DWS Best Practice Guideline G4: Impact prediction	Stockpile design should be completed before the construction starts. Groundwater monitoring must commence from the start of the construction phase.

Activities	Aspect Affected	Phase	Size and scale of disturbance	Mitigation Measures	Compliance with standards	Time period for implementation
Stripping topsoil and overburden	Air Quality	Operational	It was assumed that stripping will occur in phases Impact is limited to the site and immediate surrounding.	▪ Stripping must be done in phases; ▪ Use of suppressants and binders on exposed areas to reduce dust generation; ▪ The area of disturbance at all times must be kept to a minimum and no unnecessary clearing, digging or scraping must occur, especially on windy days (with wind speed ≥ 5.4 m/s); ▪ The drop heights when loading onto trucks and at tipping points should be minimised.	National Environmental Management: Air Quality Act, Act.39 of 2004; National Environmental Management: Air Quality Act, 2004 (Act No. 39 of 2004) - National Dust Control Regulations (2013).	Immediately the construction phase commences.
	Visual	Operational	Local	▪ Apply dust suppression techniques to limit the dust from the demolition area; ▪ Use shade cloth/netting to screen the demolition area; ▪ Ensure all infrastructure is demolished and removed from the site; ▪ Limit the quantity and time of rubble stored on site; and ▪ Rehabilitate all disturbed areas. ▪ To increase the neutral visual impacts caused by demolition and removal of all infrastructure.	To minimise the negative visual impacts caused by stripping of topsoil and soft overburden.	Operational Phase
Site clearing	Flora and Fauna	Construction, operation and decommissioning phases	Disturbed areas	▪ Implement an alien management plan.	National Environmental Management Act (NEMA),1998 (Act 107 of 1998); and National Environmental Biodiversity Act (NEMBA),2004 (Act10 of 2004).	Alien management plan to be implemented after construction quarterly for 2 years and after decommissioning quarterly for two years.
Increased vehicular activities	Flora and Fauna	Construction, operation and decommissioning phases	Access roads	▪ Construction, operation and decommissioning phases	National Environmental Management Act (NEMA),1998 (Act 107 of 1998); and National Environmental Biodiversity Act (NEMBA),2004 (Act10 of 2004)	Signage should be erected at the commencement of the phase.
Pollution control dam	**Grondwater**	Operational	▪ <0.5 km^2	▪ Avoid placement of the pollution control dam on areas with the potential for increased infiltration to groundwater, such as over fault zones. ▪ All contaminant, storm water, waste and hazardous waste storage facilities and other contaminated water storage areas (pollution control dam) should be lined to prevent infiltration of contaminated seepage water proactively. ▪ Monitoring of groundwater quality and water levels is recommended with continuous refining and updating of the monitoring network based on the results obtained. ▪ All pollution control dam should be operated in such a way that it does not	▪ DWS Best Practice Guideline A4: Pollution Control Dam	▪ PCD design should be completed before the construction starts. ▪ Groundwater monitoring must commence from the start of the construction phase.

Activities	Aspect Affected	Phase	Size and scale of disturbance	Mitigation Measures	Compliance with standards	Time period for implementation
				overflow more than once in 50 years.		
Hauling/Conveying of coal; Plant and equipment operations; and Power Generation	Surface Water	Operational	<0.5 km^2	▪ Vehicles must only be serviced within designated service bays; ▪ The management of general and other forms of waste must ensure collection and disposal into clearly marked skip bins that can be collected by approved contractors for disposal to the appropriate disposal sites; ▪ The fuel, lubricant and explosives storage facilities must be located on a hard standing area (paved or concrete surface that is impermeable), roofed and bunded in accordance with SANS1200 specifications. This will prevent mobilization of leaked hazardous substances; and ▪ An emergency spillage response plan and spill kits should be in place and accessible to the responsible monitoring team. The Material Safety Data Sheets (MSDS) should be kept on site for the Life of Mine for reference to anytime in terms of handling, storage and disposal of materials.	SANS1200 specifications. Compliance to the approved WULA	During the entire project life.
	Visual	Operational	Local	▪ Limit the speed of vehicles on the haul roads to reduce dust; and ▪ Haul roads should be watered frequently by means of a water bowser to suppress dust.	To minimise the negative visual impacts caused by loading and hauling overburden (including topsoil, soft overburden and hard overburden).	Operational Phase
	Visual	Operational	Local	▪ Topsoil stockpiles should be vegetated with grasses (Andropogon appendiculatus, Andropogon eucomus, Andropogon huillensis, Aristida congesta subsp. Barbicollis, Arundinella nepalensis, Cynodon dactylon, Eragrostis capensis, Eragrostis curvula, Eragrostis gummiflua, Eragrostis racemose, Fingerhuthia Africana, Hyparrhenia hirta, Hyparrhenia tamba, Imperata cylindrical, Melinis repens, Paspalum dilatatum, Setaria sphacelata, Sporobolus africanus, Sporobolus pyramidalis, Themeda triandra, Trichoneura grandiglumis and Tristachya leucothrix) where possible so as to blend in with the surrounding landscape and reduce dust generation; ▪ Limit the footprint area of topsoil stockpiles where possible; ▪ Limit the height of the topsoil stockpile to 20 m; ▪ Ensure the soft overburden and hard overburden stockpiles do not exceed the proposed height of 20 m; and		

Activities	Aspect Affected	Phase	Size and scale of disturbance	Mitigation Measures	Compliance with standards	Time period for implementation
				▪ Apply dust suppression techniques to limit dust generated from stockpiles.		
Open pit mining to a depth of 60 m, requiring dewatering.	Wetlands	Operational	Local	There are no foreseen mitigation actions that may significantly lessen the impact on the receiving catchment. However, the following should be done: ▪ Dirty water from the storm water system and pollution control dam should be treated and released back into the surrounding wetland systems; downstream of the dewatering cone of depression. ▪ The haul roads and servitude must also have well-designed stream crossings and drainage areas, which should be maintained. The wetlands outside of this must be demarcated as no-go areas. ▪ Dust management programme must be in place; ▪ The haul roads and servitude must be monitored and maintained to best operating standards. This should be done in the dry season (May – August). ▪ The wetland must be monitored on a regular basis to ensure no residual impact to the wetland and river is realised; and if so that remediation measures are followed. ▪ If possible, truck loads should be covered; particularly in dry and windy seasons. ▪ Berms must be maintained as a buffer between the coal handling area and the sensitive receiving environment.	Section 19 of the NWA Section 21 (c), (g) and (i) of the NWA Section 24 of the Constitution NEM:BA NEMA Department of Water and Forestry (DWAF) guidelines for the delineation of wetlands (2005); Mining and Biodiversity Guideline (DEA et al., 2013).	Design and operational phase
	Groundwater	Operational	8.5 km^2	▪ Store the dewatered water in pollution control dam and ensure that the dam will has sufficient storage volume. If that is not possible, re-introduce treated water into the streams after ensuring that they meet the required river quality objectives. ▪ Affected receptors (if proven through monitoring) should be compensated. ▪ Groundwater monitoring should be conducted.	Compliance to the approved WULA	Groundwater monitoring must commence from the start of the construction phase Conceptual and numerical models should be refined every two years in the first four years and thereafter every five years based on groundwater monitoring results.
	Groundwater	Operational	8.5 km^2	▪ Ensure that backfilled areas are rehabilitated and revegetated; ▪ Place all material which could generate leachates at the base of the pits so that groundwater contamination is minimised. ▪ Affected receptors should be compensated; ▪ Groundwater monitoring, to assess the time series water level and quality impacts and trends; and ▪ Update the numerical model as more groundwater information is collected.		

Activities	Aspect Affected	Phase	Size and scale of disturbance	Mitigation Measures	Compliance with standards	Time period for implementation
General operational activities such as the use and maintenance of haul roads, stockpiling of ROM coal, transportation of coal to the washing plant.	Wetlands	Operational	Local	▪ The haul roads and servitude must also have well-designed stream crossings and drainage areas, which should be maintained. The wetlands outside of this must be demarcated as no-go areas. ▪ Dust management programme must be in place; ▪ The haul roads and servitude must be monitored and maintained to best operating standards. This should be done in the dry season. ▪ The wetland must be monitored on a regular basis to ensure no residual impact to the wetland and river is realised; and if so that remediation measures are followed. ▪ If possible, truck loads should be covered; particularly in dry and windy seasons. ▪ Berms must be maintained as a buffer between the coal handling area and the sensitive receiving environment.	Section 19 of the NWA Section 21 (c), (g) and (i) of the NWA Section 24 of the Constitution NEM:BA NEMA Department of Water and Forestry (DWAF) guidelines for the delineation of wetlands (2005); Mining and Biodiversity Guideline (DEA et al., 2013).	Design and operational phase
	Aquatic Ecology	Operational	10 km^2	▪ Diversion trench and berm systems which diverts clean storm water around pollution sources and convey and contain dirty water to central pollution control impoundments; ▪ Barrier systems, including synthetic, clay and geological or other approved mitigation methods to minimise contaminated seepage and runoff from stockpiles and pollution control facilities from entering the local aquatic systems; ▪ Where storm water enters river systems from disturbed sites, sediment and debris trapping, as well as energy dissipation control measures must be put in place; ▪ The planting of indigenous vegetation around pollution control impoundments and structures should be completed as this has been shown to be effective in erosion and nutrient control; ▪ Ensure that all the dirty water emanating from the dirty water areas be collected in the PCD for re-use within the mine, to prevent unnecessary discharge into the environment; ▪ The dirty water collection trenches should be cleaned regularly to reduce the build-up of washed off coal fines and ensure they are able to accommodate and convey the 1:50 year peak flows. This material should be disposed to an appropriate licenced facility ▪ Stockpiling should be monitored so that the side slopes do not encourage erosion of the slopes resulting in silt transported into the trenches from the stockpiles, allowing some silt to settle on the dirty water site rather than in the channels; and ▪ In addition to the control of storm water, water quality supplemented by aquatic ecology monitoring should form part of the system where water in the PCD's and surrounding streams are monitored for quality. This ensures that pollution sources are monitored during the mining process.	National Water Act, 1998 (Act No. 36 of 1998).	Operation Phase.

Activities	Aspect Affected	Phase	Size and scale of disturbance	Mitigation Measures	Compliance with standards	Time period for implementation
	Social (appointment of workforce)	Construction; and Operational Phase	Another 320 jobs will be created (50% local)	▪ - Assign preferred employment status to those experiencing the bulk of the negative project impacts (communities located within and surrounding the Project footprint e.g. Palmietkuilen Community, Vischkuil, Endicott, Welgedacht, Slovo Park, etc.); ▪ - Promotion of local, female and youth employment to achieve and where feasible exceed the targets set out by the Mining Charter; ▪ - Where possible labour-intensive construction methods should be promoted; ▪ - Verification of local residential status through consultation with appropriate authorities (e.g. municipal structures, community leaders, and landowners) ▪ - Consult neighbouring businesses/mines to determine if they would be willing to make their skills registers available; ▪ - Identify required core skills, expand skills audits to community and align and implement training and skills development initiatives to findings of audit; ▪ - Expand skills development programmes, especially ABET programmes, to include surrounding communities; ▪ - Recruitment via a registry of job seekers and potentially coordinated through the DoL; ▪ - Provide local employees with reference letters certificates of completion for in-house (on-the-job) training; ▪ - Monitor subcontractors in terms of local employment targets; ▪ - Provide focused training to construction phase employees from the host communities to increase their chances for employment during the operations; ▪ The Project's database of the local labour pool should be updated to include people who were employed by the Project during the construction phase.	Mineral and Petroleum Resource Development Act (Act of 2002). National Environmental Management Act (Act of 1998 Employment Equity Act, 1998 (Act No. 55 of 1998); Basic Conditions of Employment Act, 1997 (Act No. 75 of 1997); Labour Relations Act, 1995 (Act No. 66 of 1995); Skills Development Act (Act No. 97 of 1998 as amended); and Company employment policies and SLP.	Prior to start of construction and on-going during operational phase
	Macro-economic	Construction	Local	▪ Procurement of goods and services from local business where feasible, will increase benefits to the local economy, but will not change the rating; ▪ Explore local procurement prospects; ▪ Employ local labour to increase benefit to the local community; ▪ The mine is required by law to adhere to the provisions detailed in the Social and Labour Plan – no augmentation measures required; ▪ Investigate opportunities to increase local procurement and localise mine's expenditure; and ▪ Explore opportunities to employ as many people from the local communities as possible.	Mineral and Petroleum Resource Development Act (Act of 2002). National Environmental Management Act (Act of 1998 Employment Equity Act, 1998 (Act No. 55 of 1998); Basic Conditions of Employment Act, 1997 (Act No. 75 of 1997); Labour Relations Act, 1995 (Act No. 66 of 1995); Skills Development Act (Act No. 97 of 1998 as amended); and Company employment policies.	Throughout LOM

Activities	Aspect Affected	Phase	Size and scale of disturbance	Mitigation Measures	Compliance with standards	Time period for implementation
Development and operation of surface infrastructure	Surface Water	Operational	<0.5 km^2	▪ Vehicles must only be serviced within designated service bays; ▪ The management of general and other forms of waste must ensure collection and disposal into clearly marked skip bins that can be collected by approved contractors for disposal to the appropriate disposal sites; ▪ The fuel, lubricant and explosives storage facilities must be located on a hard standing area (paved or concrete surface that is impermeable), roofed and bunded in accordance with SANS1200 specifications. This will prevent mobilization of leaked hazardous substances; and ▪ An emergency spillage response plan and spill kits should be in place and accessible to the responsible monitoring team. The Material Safety Data Sheets (MSDS) should be kept on site for the Life of Mine for reference to anytime in terms of handling, storage and disposal of materials.	SANS1200 specifications.	During the entire project life.
Drilling and blasting of ROM ore and overburden	Noise Impact	Operational	Impacting on certain receptors in the Mpumalanga Province during the day and night time as well as measuring above the night time rural guideline (35dBA) towards the east and south east within 650m from opencast pit footprint	▪ Stripping topsoil and soft overburden (only open cast pit footprint and northernmost hard overburden dump); ▪ Removal of overburden, including drilling and blasting of hard overburden; ▪ Loading, hauling and stockpiling of overburden (only northernmost overburden dump); ▪ Load, haul and stockpiling of ROM coal; and ▪ Hauling coal to siding	National Noise Control Regulations Gauteng Noise Control Regulations	Upon commencement of the operational phase
	Air Quality	Operational	Impact will be localized, extending across the site to nearby settlements.	▪ Activity must be carried out judiciously to ameliorate dust emissions; and ▪ Wet drilling	National Environmental Management: Air Quality Act, Act.39 of 2004; Ambient air quality - Limits for common pollutants, SANS1929:2005. National Environmental Management: Air Quality Act (Act.39 of 2004) – Listed Activities and Associated Minimum Emission Standard, 2013.	Measurement must commence prior to the start of operation and for the project life.
	Blasting and	Operational	Open pit	▪ Increase stemming length; ▪ Use quality stemming material;	National Environmental Management Act, 1998 (Act No.	Operational Phase

Activities	Aspect Affected	Phase	Size and scale of disturbance	Mitigation Measures	Compliance with standards	Time period for implementation
	Vibrations			▪ Controls put in place for management of stemming lengths; ▪ Relocate POI's of concern at least 650m; and ▪ Implementation of proper blast designs. ▪ Use correct product; ▪ Control product quality; ▪ Prevent sleep time for charged blast holes; ▪ Ensure same day charge and blast; ▪ Implementation of proper blast designs. ▪ Reduce Charge Mass/Delay; ▪ Increase stemming length; ▪ Controls need to be put in place for management of stemming lengths and quality stemming material; ▪ Relocate POI's of concern at least 650m; and ▪ Implementation of proper blast design.	107 of 1998) (NEMA) Mine Health and Safety Act, 1996 (Act No. 29 of 1996) Mineral and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002) (MPRDA) Explosives Act, 2003 (Act No. 15 of 2003)	
	Visual	Operational	Local	▪ Apply dust suppression techniques to limit the dust generated from the blasting; ▪ Ensure that the open pit is backfilled with material from the overburden stockpiles; ▪ Rehabilitate all disturbed areas; ▪ Ensure that the rehabilitated area is re-contoured and profiled to create a free-draining topography; ▪ Spread topsoil over the rehabilitated area; ▪ Ensure that surface water and drainage lines are rehabilitated; ▪ Re-vegetate the rehabilitated areas with grasses (Andropogon appendiculatus, Andropogon eucomus, Andropogon huillensis, Aristida congesta subsp. Barbicollis, Arundinella nepalensis, Cynodon dactylon, Eragrostis capensis, Eragrostis curvula, Eragrostis gummiflua, Eragrostis racemose, Fingerhuthia Africana, Hyparrhenia hirta, Hyparrhenia tamba, Imperata cylindrical, Melinis repens, Paspalum dilatatum, Setaria sphacelata, Sporobolus africanus, Sporobolus pyramidalis, Themeda triandra, Trichoneura grandiglumis and Tristachya leucothrix); and ▪ Ensure all the mitigation/management actions outlined in the Closure and Rehabilitation reports are conducted.	To minimise the negative visual impacts caused by loading and hauling overburden (including topsoil, soft overburden and hard overburden).	Operational Phase
	Cultural Heritage	Operational	~3 500 ha	▪ Reduce through the completion of a BGGC process and compilation / implementation of a CMP	NHRA Section 36 Chapters XI and IX of the NHRA Regulations	Pre-construction
Loading, handling and stockpiling of ROM ore and overburden	Air Quality	Operational	Emissions will extend as far as the project site	▪ The drop heights when loading onto trucks and at tipping points should be minimised; ▪ The use of dust suppressants and binders on haul roads to reduce dust generation; ▪ There is need to set maximum speed limits on haul roads and to have these limits enforced.	National Environmental Management: Air Quality Act, Act.39 of 2004; Ambient air quality - Limits for common pollutants,	Measurement must commence prior to the start of operation and for the project life.

Activities	Aspect Affected	Phase	Size and scale of disturbance	Mitigation Measures	Compliance with standards	Time period for implementation
					SANS1929:2005. National Environmental Management: Air Quality Act (Act.39 of 2004) – Listed Activities and Associated Minimum Emission Standard, 2013.	
Generation of power using diesel generators	Air Quality	Operational	Impact can be felt locally, extending outside the mine boundary as gaseous pollutants are easily dispersed	▪ Selective catalytic reduction technology; and ▪ Use of electrostatic precipitators; ▪ Gas scrubbers.	National Environmental Management: Air Quality Act, Act.39 of 2004; Ambient air quality - Limits for common pollutants, SANS1929:2005. National Environmental Management: Air Quality Act (Act.39 of 2004) – Listed Activities and Associated Minimum Emission Standard, 2013.	Measurement must commence prior to the start of operation and for the project life.
Storage, handling and treatment of hazardous material	Air Quality	Operational	Impact will extend as far as the project site	▪ Handled, stored and disposed hazardous substances in accordance with the local regulations; ▪ Store hazardous substances in clearly labelled containers; ▪ Deal with emergency situations promptly i.e. spills; ▪ Provision of secondary containment for fuel storage.	National Environmental Management: Air Quality Act, Act.39 of 2004; Ambient air quality - Limits for common pollutants, SANS1929:2005. National Environmental Management: Air Quality Act (Act.39 of 2004) – Listed Activities and Associated Minimum Emission Standard, 2013.	Measurement must commence prior to the start of operation and for the project life.
Demolition of infrastructure	Soil, Land Use and Land Capability	Decommissioning & Rehabilitation	Open pit & infrastructure footprint	▪ Compacted areas must be ripped to loosen the soil structure; ▪ Implement rehabilitation measures as defined in rehabilitation report; ▪ Topsoil should be replaced for rehabilitation purposes only; and ▪ Stockpiles should be used for their designated final purposes.	Chamber of Mines Guidelines	Decommissioning and Rehabilitation
	Wetlands	Decommissioning and Closure	Local	▪ The edge of the wetlands and at least a 32 m buffer must continue to be clearly demarcated as no-go areas and sensitive receptors. ▪ The rehabilitation footprint kept as small as possible and non-impacted wetlands must be avoided. ▪ Careful attention must be given to handling wetland soils, if any. ▪ Wetland monitoring must be carried out during the rehabilitation phase to ensure no unnecessary impact to wetlands is realised; and if so that a	Section 19 of the NWA Section 21 (c), (g) and (i) of the NWA Section 24 of the Constitution NEM:BA	Design and Rehabilitation phase

Activities	Aspect Affected	Phase	Size and scale of disturbance	Mitigation Measures	Compliance with standards	Time period for implementation
				remedy is put in place as soon as possible. ▪ Please refer to the full Rehabilitation Plan Report (Digby Wells, 2016) as part of this EIA for full mitigation and management actions. ▪ An alien invasive plant management plant must be implemented.	NEMA Department of Water and Forestry (DWAF) guidelines for the delineation of wetlands (2005); Mining and Biodiversity Guideline (DEA et al., 2013).	
	Surface Water	Decommissioning and Closure	Impact will be limited to the site and immediate surroundings.	▪ Use of accredited contractors for removal or demolition of infrastructures must be ensured; ▪ Seeding of the backfilled area must be implemented, where seeding is not effective, this must be repeated until it becomes sustainable; and ▪ The constructed dirty water trenches will have to remain until post closure. This will ensure dirty water is captured and contained during removal of infrastructures.	GN 704 Condition 9 describes the temporary or permanent cessation of mine or activity. At cessation of operations, the persons operating a mining activity should ensure that all pollution control measures have been designed, modified, constructed and maintained so as to comply with these regulations.	During cessation of operations
	Air Quality	Decommissioning	Impact is limited to the site and immediate surroundings	▪ The dismantling area disturbed must be kept to a minimum; ▪ Drop heights when offloading must be minimised; ▪ Limit demolition activities to non-windy days; Rehabilitated landscape should be vegetated; and ▪ Use of dust suppressant on dirt roads and exposed areas.	National Environmental Management: Air Quality Act, Act.39 of 2004, 2004; National Environmental Management: Air Quality Act, 2004 (Act No. 39 of 2004), National Dust Control Regulations (2013).	Measurement must commence prior to the decommissioning operation and few month after it ends.
	Noise	Decommissioning	Local, not extending beyond project area	▪ Restricting decommissioning activities to daylight hours (06:00 – 18:00) and not during weekends and public holidays; ▪ Mining related machines and vehicles to be serviced to the designed requirements of the machinery/vehicles to ensure noise suppression mechanisms are effective e.g. installed exhaust mufflers; and ▪ Switching off equipment when not in use.	National Noise Control Regulations Gauteng Noise Control Regulations	Upon commencement of the closure phase
	Visual	Decommissioning	Local	▪ Apply dust suppression techniques to limit the dust from the demolition area; ▪ Use shade cloth/netting to screen the demolition area; ▪ Ensure all infrastructure is demolished and removed from the site; ▪ Limit the quantity and time of rubble stored on site; and ▪ Rehabilitate all disturbed areas.	To increase the neutral visual impacts caused by demolition and removal of all infrastructure.	Decommissioning and Closure Phase
Increased vehicular activities	Flora and Fauna	Construction, operation and decommissioning phases	Local	▪ Erection of signage; ▪ Implementing speed limit on site; and ▪ Restricting driving at night	National Environmental Management Act (NEMA),1998 (Act 107 of 1998); and National Environmental Biodiversity Act (NEMBA),2004 (Act10 of 2004)	Signage should be erected upon commencement of construction phase.

Activities	Aspect Affected	Phase	Size and scale of disturbance	Mitigation Measures	Compliance with standards	Time period for implementation
Rehabilitation of Project area	Flora and Fauna	Construction, operation and decommissioning phases	Local	▪ Alien management plan.	National Environmental Management Act (NEMA),1998 (Act 107 of 1998); and National Environmental Biodiversity Act (NEMBA),2004 (Act10 of 2004).	Alien management plan to be implemented after construction quarterly for 2 years and after decommissioning quarterly for two years.
	Aquatic Ecology	Closure and decommissioning phase	10 km^2	▪ Water treatment options should be considered with respect to AMD.	National Water Act,1998 (Act No. 36 of 1998).	Closure and decommissioning phase.
	Air Quality	Decommissioning	Impact is limited to the site and immediate surroundings.	▪ The dismantling area disturbed must be kept to a minimum; ▪ Drop heights when offloading must be minimised; ▪ Limit demolition activities to non-windy days; Rehabilitated landscape should be vegetated; and ▪ Use of dust suppressant on dirt roads and exposed areas.	National Environmental Management: Air Quality Act, Act.39 of 2004, 2004; National Environmental Management: Air Quality Act, 2004 (Act No. 39 of 2004), National Dust Control Regulations (2013).	Measurement must commence prior to the decommissioning operation and few month after it ends.
	Visual	Decommissioning	Local	▪ Ensure that the open pit is backfilled with material from the overburden stockpiles; ▪ Rehabilitate all disturbed areas; ▪ Ensure that the rehabilitated area is re-contoured and profiled to create a free-draining topography; ▪ Spread topsoil over the rehabilitated area; ▪ Ensure that surface water and drainage lines are rehabilitated; ▪ Re-vegetate the rehabilitated areas with grasses (Andropogon appendiculatus, Andropogon eucomus, Andropogon huillensis, Aristida congesta subsp. Barbicollis, Arundinella nepalensis, Cynodon dactylon, Eragrostis capensis, Eragrostis curvula, Eragrostis gummiflua, Eragrostis racemose, Fingerhuthia Africana, Hyparrhenia hirta, Hyparrhenia tamba, Imperata cylindrical, Melinis repens, Paspalum dilatatum, Setaria sphacelata, Sporobolus africanus, Sporobolus pyramidalis, Themeda triandra, Trichoneura grandiglumis and Tristachya leucothrix); and ▪ Ensure all the mitigation/management actions outlined in the Closure and Rehabilitation reports are conducted.	To increase the neutral visual impacts caused by rehabilitation (including spreading of soil, re-vegetation and profiling or contouring).	Decommissioning and Closure Phase
Post-closure monitoring	Soil, Land Use and Land Capability	Post-closure	Open pit & infrastructure footprint	▪ The rehabilitated areas must be assessed once a year for compaction, erosion and fertility; ▪ Compacted areas must be ripped to loosen the soil structure; ▪ Only designated access routes should be used to reduce any unnecessary compaction; and ▪ Corrective actions must be taken to minimise any further erosion from taking place	Chamber of Mines Guidelines	Post-Closure

Activities	Aspect Affected	Phase	Size and scale of disturbance	Mitigation Measures	Compliance with standards	Time period for implementation
	Groundwater	Post-closure	Local	▪ Capture the decant before joining the streams, treat it and re-introduce it into the streams. ▪ Management solutions should be upon agreement with the impacted stake holders. ▪ Monitoring of groundwater water levels and mine inflow rates. ▪ Update numerical model and decant rates as aquifer information becomes available.	SANS. River quality objectives. South African water quality guidelines for drinking, irrigation and livestock watering.	Post-Closure
	Surface Water	Decommissioning, Closure and Post-closure	Local project area to surrounding areas (municipality)	▪ Decant capture and treatment prior to discharge into the stream	Section 19 of the National Water Act (NWA), 1998 (Act No. 36 of 1998);	Rehabilitation and closure phase
	Wetlands	Decommissioning, Closure and Post-closure	Local	▪ Long-term passive water treatment options will need to be investigated by AOL to prevent untreated AMD decant water from entering the catchment. ▪ Groundwater and wetlands must be monitored post-mining for potential decant. ▪ Rehabilitation and remediation actions must be in place to respond to any decant or AMD discharge that is unforeseen.	Section 19 of the NWA Section 21 (c), (g) and (i) of the NWA Section 24 of the Constitution NEM:BA NEMA Department of Water and Forestry (DWAF) guidelines for the delineation of wetlands (2005); Mining and Biodiversity Guideline (DEA et al., 2013).	Rehabilitation and closure phase

5 Item 1(e): Impact management outcomes

A description of the objectives and outcomes of the EMP is outlined Table 5-1.

Table 5-1: Objectives and outcomes of the EMP

Activities	Potential impacts	Aspects affected	Phase	Mitigation type	Standard to be achieved
Site clearance and topsoil removal	Loss of topsoil – erosion, compaction, land capability and land use	Soil, Land Use and Land Capability	Construction	▪ Site clearing procedures; ▪ Storm-water management plan	Soil Management in terms of the Chamber of Mines Guidelines for Rehabilitation
	Habitat loss for flora and fauna;	Flora And Fauna	Construction	▪ Conservation Management Plan; ▪ Alien management plan; and ▪ Rehabilitation Plan.	Alien species management in accordance with NEMBA Regulations
	Loss of species diversity	Flora And Fauna	Construction	▪ Conservation Management Plan; ▪ Alien management plan. ▪ Rehabilitation Plan	To minimise the loss of habitat
	Potential loss of Red Data plant species.	Flora And Fauna	Construction	▪ Relocation of Red Data flora species; ▪ Conservation Management Plan; ▪ Alien management plan; and ▪ Rehabilitation Plan.	To minimise the loss of Red Data plant species
	Habitat fragmentation and increased establishment of alien plant species.	Flora And Fauna	Construction	▪ Conservation Management Plan; ▪ Alien management plan; and ▪ Rehabilitation Plan.	To prevent the invasion of alien plant species and limit fragmentation
	Siltation of surface water resources leading to deteriorated water quality	Surface Water	Construction	▪ Storm Water Management Plan ▪ Dust Management Plan	To prevent siltation of surface water resources
	Removal of topsoil and site clearing may have an impact on the groundwater provided that the area affected by this activity extends beyond the local water table	Groundwater	Construction	▪ Groundwater monitoring.	To prevent impacts to the groundwater table
	Removal of wetland soils and vegetation; loss of wetland habitat.	Wetlands	Construction	▪ Mitigation Hierarchy ▪ Storm Water Management Plan	To compensate for the loss of wetland habitat and prevent unnecessary impacts on wetlands
	Increased runoff resulting in erosion and sedimentation of downstream habitats. Increased runoff from manmade structures resulting in the erosion and sedimentation of downstream river reaches.	Aquatic Ecology	Construction	▪ Storm Water Management Plan ▪ Biomonitoring	To prevent loss of aquatic habitats
	Poor air quality due to site clearing and wind erosion	Air Quality	Construction	▪ Dust Management Plan ▪ Dust Monitoring Programme	To minimise the generation of fugitive dust, PM_{10} and $PM_{2.5}$
	Noise disturbance (noise levels in excess of 7 dBA at certain Mpumalanga receptors)	Noise	Construction	▪ Vehicle Maintenance Plan	To minimise noise levels
	Site establishment will have a negative visual impact on the receiving environment. The Project area will become noticeable to nearby receptors due to the increased levels of activity on the site.	Visual	Construction	▪ Dust Management Plan ▪ Dust Monitoring Programme ▪ Mine Plan	To minimise the negative visual impacts caused by site clearance
	Topsoil removal and stockpiling will have a negative visual impact on the receiving environment. Dust from the stockpiles will also have a negative visual impact.	Visual	Construction	▪ Dust Management Plan ▪ Dust Monitoring Programme ▪ Mine Plan	To minimise the negative visual impacts caused by site clearance

Activities	Potential impacts	Aspects affected	Phase	Mitigation type	Standard to be achieved
Construction of infrastructure	Loss of topsoil – erosion, compaction, land capability and land use	Soil, Land Use and Land Capability	Construction	▪ Site clearing procedures; ▪ Storm-water management plan	Soil Management in terms of the Chamber of Mines Guidelines for Rehabilitation
	Industrial activity within a natural ecosystem is a negative impact to habitat integrity.	Wetlands	Construction	▪ Mitigation Hierarchy ▪ Storm Water Management Plan	To compensate for the loss of wetland habitat and prevent unnecessary impacts on wetlands
	Construction over sensitive riparian habitats resulting in the loss of degradation of aquatic habitat.	Aquatic Ecology	Construction	▪ Storm Water Management Plan ▪ Biomonitoring	To minimise the loss of aquatic habitat
	The construction of surface infrastructure will have a negative visual impact on the receiving environment. The surface infrastructure will change the sense of place of the Project area from an agricultural sense of place to an industrial/mining sense of place. Construction area lighting at night will have a negative visual impact on the receiving environment. The construction area lighting will be visible from a distance of up to 10 km and will draw attention to the Project area. This will also have a negative impact on the sense of place.	Visual	Construction	▪ Mine Plan	To minimise the negative visual impacts caused by the construction of infrastructure
Relocation of infrastructure	Relocation of infrastructure will have a negative visual impact on the receiving environment. Change of land use from agriculture to mining will have a negative visual impact on the receiving environment. This change of land use will change the sense of place of the Project area and surrounds from an agricultural sense of place to an industrial/mining sense of place resulting in a loss of scenic character and increased visual disturbance. The change of land use will contribute to the cumulative impacts of mining on the regional environment.	Visual	Construction	▪ Mine Plan	To minimise the negative visual impacts caused by the relocation of infrastructure
Construction of stockpiles	Loss of topsoil – erosion and compaction	Soil, Land Use and Land Capability	Construction	▪ Site clearing procedures; ▪ Storm-water management plan	Soil Management in terms of the Chamber of Mines Guidelines for Rehabilitation
	Noise disturbance (noise levels in excess of 7 dBA at certain Mpumalanga receptors)	Noise	Construction	▪ Vehicle Maintenance Plan	To minimise noise levels
Increased vehicular activities	Road-kills and disturbance of fauna and potential loss of fauna diversity	Flora and Fauna	Construction	▪ Conservation Management Plan	To minimise the loss of fauna diversity
	Increase in ambient noise levels at surrounding communities due to vehicular activities	Noise	Construction	▪ Vehicle Maintenance Plan ▪ Mine Design	To minimise noise levels
Blasting and Development of Initial Box-Cut for Mining	Change of land use from agriculture to mining will have a negative visual impact on the receiving environment. This change of land use will change the sense of place of the Project area and surrounds from an agricultural sense of place to an industrial/mining sense of place resulting in a loss of scenic character and increased visual disturbance. The change of land use will contribute to the cumulative impacts of mining on the regional environment.	Visual	Construction	▪ Mine Design ▪ Blast plan ▪ Dust Management Plan	To minimise the negative visual impacts caused by blasting

Activities	Potential impacts	Aspects affected	Phase	Mitigation type	Standard to be achieved
	Blasting and development of the initial box-cut for mining will have a negative visual impact on the receiving environment. Drilling and blasting will result in noise and dust thereby attracting attention to the Project area. Dust from blasting will have a negative visual impact. The box-cut will dramatically contrast the surrounding agricultural area as it will result in a scar on the landscape.	Visual	Construction	▪ Mine Design ▪ Blast plan ▪ Dust Management Plan	To minimise the negative visual impacts caused by blasting
	Stockpiling from the initial box-cut will have a negative visual impact on the receiving environment. Dust from the stockpiles will also have a negative visual impact. The impact of the stockpiles will occur for the life of the Project. This impact will be reversed when the material from the stockpiles is used to backfill the open pit during the decommissioning and closure phase.	Visual	Construction	▪ Mine Design ▪ Blast plan ▪ Dust Management Plan	To minimise the negative visual impacts caused by blasting
	Increase in ambient noise levels at surrounding communities	Noise	Construction	▪ Mine Design ▪ Blast Plan	To minimise noise levels
	Destruction of burial grounds and graves	Heritage	Construction	▪ Conservation Management Plan	To prevent the loss of knowledge
	Employment creation	Social	Construction	▪ SLP ▪ Procurement Policy ▪ Employment Strategy ▪ Recruitment Policy	To ensure local labour is appointed and goods and services are procured locally
	Multiplier effects on the local economy	Social	Construction	Manage and minimise through: ▪ SLP ▪ LED ▪ Procurement Policy ▪ Employment Strategy ▪ Recruitment Policy	To ensure goods and services are procured locally and local suppliers are developed
	Community development and social upliftment	Social	Construction	▪ SLP	To ensure surrounding communities benefit from the development
	Displacement of persons on or making use of the land	Social	Construction	▪ Abbreviated Resettlement Action Plan ▪ Grievance Mechanism	To ensure land users are compensated fairly
	Disruption of daily movement patterns due to project related traffic on local roads	Social	Construction	▪ Traffic Management Plan	To minimise the disruption due to increased traffic
	Influx of people resulting in pressure on local services, resources and facilities; establishment and growth of informal settlements; increase in social pathologies and conflict/ competition between newcomers and incumbent population	Social	Construction	▪ Grievance Mechanism ▪ Influx Management Plan	To manage and minimise the impact on service delivery and resources, spread of social pathologies and potential conflict within communities
	Health and safety impacts resulting from construction activities	Social	Construction	▪ Health and Safety Policy	To minimise injuries during construction
	Direct and indirect impacts on surrounding land users due to the presence of the mine (impact on tourism, sense of place etc.)	Social	Construction	▪ Environmental Monitoring Programmes ▪ Environmental Management Plan ▪ Emergency Response Plan ▪ Integrated Water and Waste Management Plan ▪ Storm Water Management Plan ▪ Rehabilitation Plan ▪ Grievance Mechanism	To minimise and mitigate negative impacts on the properties surrounding the operation
	Opposition from stakeholders because of perceived negative impacts	Social	Construction	▪ Grievance Mechanism	To manage stakeholder perceptions
	Increase in Production	Macro-Economic	Construction	▪ SLP	To ensure surrounding communities

Activities	Potential impacts	Aspects affected	Phase	Mitigation type	Standard to be achieved
				▪ LED ▪ Procurement Policy ▪ Employment Strategy ▪ Recruitment Policy	benefit from the development
	Impact on GDP	Macro-Economic	Construction	▪ SLP ▪ LED ▪ Procurement Policy ▪ Employment Strategy ▪ Recruitment Policy	To ensure surrounding communities benefit from the development
	Impact on Employment	Macro-Economic	Construction	▪ SLP ▪ LED ▪ Procurement Policy ▪ Employment Strategy ▪ Recruitment Policy	To ensure surrounding communities benefit from the development
	Impact on Skills Development	Macro-Economic	Construction	▪ SLP ▪ LED ▪ Procurement Policy ▪ Employment Strategy ▪ Recruitment Policy	To ensure surrounding communities benefit from the development
	Impact on Household Income	Macro-Economic	Construction	▪ SLP ▪ LED ▪ Procurement Policy ▪ Employment Strategy ▪ Recruitment Policy	To ensure surrounding communities benefit from the development
	Impact on Government Revenue	Macro-Economic	Construction	▪ SLP ▪ LED ▪ Procurement Policy ▪ Employment Strategy ▪ Recruitment Policy	To ensure surrounding communities benefit from the development
	Impact on Agricultural Production due to Sterilisation of Productive Agricultural Land	Macro-Economic	Construction	▪ SLP ▪ LED ▪ Procurement Policy ▪ Employment Strategy ▪ Recruitment Policy	To ensure surrounding communities benefit from the development
	Potential Negative Impact on Property Value	Macro-Economic	Construction	▪ SLP ▪ LED ▪ Procurement Policy ▪ Employment Strategy ▪ Recruitment Policy	To ensure surrounding communities benefit from the development
	Potential Negative Impact on Egg Industry	Macro-Economic	Construction	▪ SLP ▪ LED ▪ Procurement Policy ▪ Employment Strategy ▪ Recruitment Policy	To ensure surrounding communities benefit from the development
Clearing of vegetation	Habitat loss for flora and fauna;	Flora And Fauna	Operational	▪ Conservation Management Plan; ▪ Alien management plan; and ▪ Rehabilitation Plan.	To minimise the loss of habitat
	Loss of species diversity	Flora And Fauna	Operational	▪ Conservation Management Plan; ▪ Alien management plan. ▪ Rehabilitation Plan	To minimise the loss of habitat
	Potential loss of Red Data plant species.	Flora And Fauna	Operational	▪ Relocation of Red Data flora species; ▪ Conservation Management Plan; ▪ Alien management plan; and ▪ Rehabilitation Plan.	To minimise the loss of Red Data plant species

Activities	Potential impacts	Aspects affected	Phase	Mitigation type	Standard to be achieved
	Noise disturbance (noise levels in excess of 7 dBA at certain Mpumalanga receptors and noise levels in excess of night time guideline at Gauteng rural receptor)	Noise	Operational	▪ Vehicle Maintenance Plan ▪ Mine Design	To minimise noise levels
	Stripping of topsoil and soft overburden will have a negative visual impact on the receiving environment. As the Project area is stripped it will become noticeable to nearby receptors as it will contrast the surrounding area.	Visual	Operational	▪ Mine Design ▪ Dust Management Plan ▪ Rehabilitation Plan	To minimise the negative visual impacts caused by soil stripping
Overburden removal and open pit mining	Reduction in catchment yield	Surface water	Operational	▪ No mitigation possible	-
	Reduction of groundwater quantity as a result of mine dewatering	Groundwater	Operational	▪ Groundwater Monitoring Plan ▪ Implement a plan to supply affected receptors with water	To minimise groundwater quantity related impacts to affected receptors
	Groundwater contamination as a result of open pit mining, seepage from the PCD and waste stockpiling	Groundwater	Operational	▪ Groundwater Monitoring Plan ▪ Implement a plan to supply affected receptors with water	To minimise groundwater quantity related impacts to affected receptors
	Perforation of rock and groundwater reserves leading to severe hydrological and geomorphological impacts to wetlands and catchment due to draw down cone	Wetlands	Operational	▪ Mitigation Hiearchy ▪ Storm Water Management Plan	To compensate for the loss of wetland habitat and prevent unnecessary impacts on wetlands
	Noise disturbance (noise levels in excess of 7 dBA at certain Mpumalanga receptors and noise levels in excess of night time guideline at Gauteng rural receptor)	Noise	Operational	▪ Vehicle Maintenance Plan ▪ Blast Plan	To minimise noise levels
	Ground vibration could damage houses and roads nn	Blasting	Operational	▪ Ground Vibration Monitoring Plan ▪ Implementation of blasting buffer zones	To prevent ground vibrations from impacting on sensitive receptors and from damaging the integrity of structures
	Air blast could damage houses	Blasting	Operational	▪ Air Blast Monitoring Plan	To prevent air blast from impacting on the structural integrity of houses and other buildings
	Fly rock could damage houses and impact on roads	Blasting	Operational	▪ Implementation of blasting buffer zone	To prevent fly rock from damaging buildings
	Impact of noxious fumes on houses and roads	Blasting	Operational	▪ Quality Control Procedure	To prevent noxious fumes from impacting on farm steads and sensitive receptors
	Removal of overburden (including drilling and blasting of hard overburden) will have a negative visual impact on the receiving environment. Drilling and blasting will result in noise and dust thereby attracting attention to the Project area. Dust from blasting will have a negative visual impact. The open pit will dramatically contrast the surrounding agricultural area as it will result in a scar on the landscape.	Visual	Operational	▪ Mine Design ▪ Dust Management Plan ▪ Rehabilitation Plan	To minimise the negative visual impacts caused by overburden removal
	Destruction of burial grounds and graves	Heritage	Construction	▪ Conservation Management Plan	To prevent the loss of heritage resources
	Drilling and blasting of coal will have a negative visual impact on the receiving environment. Drilling and blasting will result in noise and dust thereby attracting attention to the Project area. Dust from blasting will have a negative visual impact. The open pit will dramatically contrast the surrounding agricultural area as it will result in a scar on the landscape. Once coal is removed from the open pit there will be insufficient material to backfill	Visual	Operational	▪ Mine Design ▪ Dust Management Plan ▪ Rehabilitation Plan	To minimise the negative visual impacts caused by open pit mining

Activities	Potential impacts	Aspects affected	Phase	Mitigation type	Standard to be achieved
	the open pit completely and a void will remain. This will result in a permanent and irreversible negative visual impact on the receiving environment.				
Operation of surface infrastructure	Development and operation of surface infrastructure resulting in runoff that could result in contamination of rivers	Surface water	Operational	▪ Storm Water Management Plan ▪ Dust Management Plan	To prevent contamination of surface water resources
	The operational mining activities occurring within an ecologically sensitive catchment, which pose significant potential negative impacts to functioning wetlands and catchment.	Wetlands	Operational	▪ Mitigation Hiearchy ▪ Storm Water Management Plan	To compensate for the loss of wetland habitat and prevent unnecessary impacts on wetlands
	Loss of topsoil – erosion and compaction	Soils, Land Use and Land Capability	Operational	▪ Site clearing procedures ▪ Storm-water management plan	Soil Management in terms of the Chamber of Mines Guidelines for Rehabilitation
Increased vehicular activities	Road-kills and disturbance of fauna and potential loss of fauna diversity	Flora and Fauna	Operational	▪ Conservation Management Plan	To minimise the loss of fauna diversity
	Increase in ambient noise levels at surrounding communities due to vehicular activities	Noise	Operational	▪ Vehicle Maintenance Plan ▪ Mine Design	To minimise noise levels
	Noise disturbance (noise levels in excess of 7 dBA at certain Mpumalanga receptors and noise levels in excess of night time guideline at Gauteng rural receptor)	Noise	Operational	▪ Vehicle Maintenance Plan ▪ Mine Design	To minimise noise levels
	Vehicular activity on haul roads will have a negative visual impact on the receiving environment. Dust from the vehicular activity will also have a negative visual impact.	Visual	Operational	▪ Dust Management Plan	To minimise the negative visual impacts caused by hauling material
	Maintenance of the haul roads may require the acquisition of additional material such as from borrow pits which will have a negative visual impact on the receiving environment.	Visual	Operational	▪ Mine Design ▪ Dust Management Plan	To minimise the negative visual impacts caused by hauling material
Storage, hauling, processing, and stockpiling of coal and overburden.	Runoff of water which has come into contact with the carboniferous material will contain various pollutants that may contaminate downstream river reaches.	Aquatic Ecology	Operational	▪ Storm Water Management Plan ▪ Biomonitoring	To prevent and minimise erosion and the loss of aquatic habitat
	Runoff could results in contamination of rivers	Surface water	Operational	▪ Storm Water Management Plan ▪ Dust Management Plan	To prevent contaminated runoff from entering surface water resources
	Noise disturbance (noise levels in excess of 7 dBA at certain Mpumalanga receptors and noise levels in excess of night time guideline at Gauteng rural receptor)	Noise	Operational	▪ Vehicle Maintenance Plan ▪ Mine Design	To minimise noise levels
	Stockpiling of overburden (including topsoil, soft overburden and hard overburden) will have a negative visual impact on the receiving environment. Dust from the stockpiles will also have a negative visual impact. The impact of the stockpiles will occur for the life of the Project. This impact will be reversed when the material from the stockpiles is used to backfill the open pit (soft overburden and hard overburden) and rehabilitate the Project area (topsoil) during the decommissioning and closure phase.	Visual	Operational	▪ Mine Design ▪ Dust Management Plan ▪ Rehabilitation Plan	To minimise the negative visual impacts caused by stockpiling of overburden
Drilling, blasting, stockpiles, crushing,	Reduction in catchment yield	Surface water	Operational	▪ No mitigation possible	
	Runoff could results in contamination of rivers	Surface water	Operational	▪ Storm Water Management Plan ▪ Dust Management Plan	To prevent contaminated runoff from

Activities	Potential impacts	Aspects affected	Phase	Mitigation type	Standard to be achieved
loading, hauling					entering surface water resources
	Reduced air quality due to dust generation	Air Quality	Operational	▪ Dust Management Plan ▪ Dust Monitoring Programme	To minimise the generation of fugitive dust, PM_{10} and $PM_{2.5}$
	Noise disturbance (noise levels in excess of 7 dBA at certain Mpumalanga receptors and noise levels in excess of night time guideline at Gauteng rural receptor)	Noise	Operational	▪ Vehicle Maintenance Plan ▪ Mine Design	To minimise noise levels
	Stockpiling of ROM coal will have a negative visual impact on the receiving environment. Dust from the stockpiles will also have a negative visual impact.	Visual	Operational	▪ Mine Design ▪ Dust Management Plan ▪ Rehabilitation Plan	To minimise the negative visual impacts caused by stockpiling
	Plant area lighting at night will have a negative visual impact on the receiving environment. The plant area lighting will be visible at night and will draw attention to the Project area. This will also have a negative impact on the sense of place.	Visual	Operational	▪ Mine Design ▪ Dust Management Plan ▪ Rehabilitation Plan	To minimise the negative visual impacts caused by operation of wash plant
	Disposal of discard from the washing plant on the discard dump will have a negative visual impact on the receiving environment. The impact of the discard dump will occur for the life of the Project. This impact will be reversed if the material from the discard dump is re-washed or used to backfill the open pit during the decommissioning and closure phase.	Visual	Operational	▪ Mine Design ▪ Dust Management Plan ▪ Rehabilitation Plan	To minimise the negative visual impacts caused by operation of discard dump
	Loss of access to burial grounds and degradation on intrinsic value	Heritage	Operation	▪ Conservation Management Plan	To prevent the loss of heritage resources
General Operational Activities	Job creation	Social	Operational	▪ SLP ▪ Procurement Policy ▪ Employment Policy ▪ Recruitment Policy	To ensure local labour is appointed and good and services are procured locally
	Stimulation and growth of the local and district economies	Social	Operational	▪ SLP ▪ LED ▪ Procurement Policy ▪ Employment Strategy ▪ Recruitment Policy	To ensure goods and services are procured locally and local suppliers are developed
	Dependency on the mine for sustaining the local economy	Social	Operational	▪ SLP	To minimise the effects of mine closure
	Impact on Production	Macro-Economic	Operational	▪ SLP ▪ LED ▪ Procurement Policy ▪ Employment Strategy ▪ Recruitment Policy	To ensure goods and services are procured locally and local suppliers are developed
	Impact on GDP	Macro-Economic	Operational	▪ SLP ▪ LED ▪ Procurement Policy ▪ Employment Strategy ▪ Recruitment Policy	To ensure goods and services are procured locally and local suppliers are developed
	Impact on Employment	Macro-Economic	Operational	▪ SLP ▪ LED ▪ Procurement Policy ▪ Employment Strategy ▪ Recruitment Policy	To ensure goods and services are procured locally and local suppliers are developed
	Impact on Skills Development	Macro-Economic	Operational	▪ SLP ▪ LED	To ensure goods and services are procured locally and local suppliers

Activities	Potential impacts	Aspects affected	Phase	Mitigation type	Standard to be achieved
				▪ Procurement Policy ▪ Employment Strategy ▪ Recruitment Policy	are developed
	Impact on Household Income	Macro-Economic	Operational	▪ SLP ▪ LED ▪ Procurement Policy ▪ Employment Strategy ▪ Recruitment Policy	To ensure goods and services are procured locally and local suppliers are developed
	Impact on Government Revenue	Macro-Economic	Operational	▪ SLP ▪ LED ▪ Procurement Policy ▪ Employment Strategy ▪ Recruitment Policy	To ensure goods and services are procured locally and local suppliers are developed
Demolition of the infrastructure	Loss of topsoil – erosion, compaction, land capability and land use	Soils, Land Use and Land Capability	Decommissioning	▪ Closure plan	Soil Management in terms of the Chamber of Mines Guidelines for Rehabilitation
	Contamination of water by dirty runoff	Surface water	Decommissioning	▪ Storm Water Management Plan	To prevent contaminated runoff from entering surface water resources
	Siltation of surface water resources due to increased erosion from exposed surfaces	Surface water	Decommissioning	▪ Storm Water Management Plan ▪ Rehabilitation Plan	To minimise erosion from exposed surfaces
	Similarly to the construction and operational phase, the decommissioning and rehabilitation activities occurring within an ecologically sensitive catchment pose significant potential negative impacts to functioning wetlands and catchment. Furthermore, the rehabilitated area could cause major negative impacts due to spread of alien invasive vegetation, increased soil compaction erosion and subsequent sedimentation into the wetland ecosystems.	Wetlands	Decommissioning	▪ Mitigation Hierarchy ▪ Storm Water Management Plan	To compensate for the loss of wetland habitat and prevent unnecessary impacts on wetlands
	Road-kills and disturbance of fauna	Flora and Fauna	Decommissioning	▪ Conservation Management Plan	To minimise the loss of fauna diversity
	Reduced air quality due to dust generation from rehabilitation and wind erosion	Air Quality	Decommissioning	▪ Dust Management Plan ▪ Dust Monitoring Programme	To minimise the generation of fugitive dust, PM_{10} and $PM_{2.5}$
	Noise disturbance (noise levels in excess of 7 dBA at certain Mpumalanga receptors and noise levels in excess of night time guideline at Gauteng rural receptor)	Noise	Decommissioning	▪ Vehicle Maintenance Plan ▪ Mine Design	To minimise noise levels
	Demolition and removal of all infrastructure will have a negative visual impact on the receiving environment. Dust from the demolition process will also have a negative visual impact. Once the infrastructure is removed and rehabilitation of the disturbed areas is complete, there will be an overall neutral visual impact on the receiving environment.	Visual	Decommissioning	▪ Dust Management Plan ▪ Rehabilitation Plan	To minimise the negative visual impacts caused by operation of wash plant
Rehabilitation of the project area	Loss of topsoil – erosion, compaction and land capability	Soils, Land Use and Land Capability	Decommissioning	▪ Rehabilitation plan	Soil Management in terms of the Chamber of Mines Guidelines for Rehabilitation
	Habitat fragmentation and increased establishment of alien plant species.	Flora and Fauna	Decommissioning	▪ Rehabilitation plan	To minimise the loss of habitat
	Rehabilitation (including spreading of soil, re-vegetation and profiling or	Visual	Decommissioning	▪ Dust Management Plan ▪ Rehabilitation Plan	To minimise the negative visual

Activities	Potential impacts	Aspects affected	Phase	Mitigation type	Standard to be achieved
	contouring) will have a negative visual impact on the receiving environment. Once coal is removed from the open pit there will be insufficient material to backfill the open pit completely and a void will remain. This will result in a permanent and irreversible negative visual impact on the receiving environment. This impact will be reduced if the Project area is re-contoured and profiled to create a free-draining topography. Once rehabilitation is complete and the Project area has re-contoured and profiled to create a free-draining topography there will be an overall neutral visual impact on the receiving environment.				impacts caused by operation of wash plant
Post-closure monitoring	Loss of topsoil – erosion, fertility and compaction	Soils, Land Use and Land Capability	Post-closure	▪ Rehabilitation and Closure plan	Soil Management in terms of the Chamber of Mines Guidelines for Rehabilitation
	Groundwater Contamination after closure	Groundwater	Post-closure	▪ Groundwater Monitoring ▪ Closure Plan	To minimise groundwater contamination
	Mine decanting and contamination of surface water bodies	Groundwater	Post-closure	▪ Groundwater Monitoring ▪ Active water treatment ▪ Closure Plan	To minimise groundwater contamination
	Post-mining water decant is predicted to occur once the final void has been rehabilitated and groundwater levels are allowed to return back to natural level. It is anticipated that this decant will be acid forming.	Wetlands	Post-closure	▪ Manage and minimise through: ▪ Mitigation Hierarchy ▪ Storm Water Management Plan	To compensate for the loss of wetland habitat and prevent unnecessary impacts on wetlands
	Post-mining decant of groundwater will have negative impacts on the downstream water quality.	Aquatic Ecology	Post-closure	▪ Storm Water Management Plan ▪ Biomonitoring	To prevent and minimise erosion and the loss of aquatic habitat

6 Item 1(f): Impact Management Actions

A description of impact management actions, identifying the manner in which the impact management objectives and outcomes contemplated in paragraphs 4 and 5 will be achieved in Table 6-1.

Table 6-1: Impact management actions

Activities	Potential impacts	Aspects affected	Phase	Mitigation Measures	Time period for implementation	Compliance with standards
Site clearance and topsoil removal	Loss of topsoil – erosion, compaction, land capability and land use	Soil, Land Use and Land Capability	Construction	▪ Ensure proper storm water management designs are in place; ▪ If any erosion occurs, corrective actions (erosion berms) must be taken to minimise any further erosion from taking place; ▪ Only the designate access routes are to be used to reduce any unnecessary compaction; ▪ Topsoil should be stripped by means of an excavator bucket and loaded onto dump trucks; ▪ Topsoil stockpiles are to be kept to a maximum height of 10 m; ▪ If possible topsoil should be stripped during dry months, as to reduce compaction; ▪ Compaction of the removed topsoil must be avoided by prohibiting traffic on stockpiles; ▪ The stockpiles must be vegetated in order to reduce the risk of erosion; and ▪ Handling of the stripped must be minimised to ensure the structure does not deteriorate.	Design and construction phase	Chamber of Mines Guidelines
	Habitat loss for flora and fauna;	Flora And Fauna	Construction	▪ Relocation of infrastructure, where possible; ▪ Rehabilitation with native grass species; and ▪ Relocation of Red Data species, should any species be recorded in developing footprint area during vegetation clearing. ▪ Implement an alien management plan.	Rehabilitation should take place after decommissioning as outlined in the Rehabilitation Plan Report; and Relocation of Red Data flora species prior to vegetation clearing – screening of areas prior to vegetation clearance	National Environmental Management Act (NEMA),1998 (Act 107 of 1998); and National Environmental Biodiversity Act (NEMBA),2004 (Act10 of 2004).
	Loss of species diversity	Flora And Fauna	Construction	▪ Relocation of infrastructure, where possible; ▪ Rehabilitation with native grass species; and ▪ Relocation of Red Data species, should any species be recorded in developing footprint area during vegetation clearing. ▪ Implement an alien management plan.	Rehabilitation should take place after decommissioning as outlined in the Rehabilitation Plan Report; and Relocation of Red Data flora species prior to vegetation clearing – screening of areas prior to vegetation clearance	National Environmental Management Act (NEMA),1998 (Act 107 of 1998); and National Environmental Biodiversity Act (NEMBA),2004 (Act10 of 2004).
	Potential loss of Red Data plant species.	Flora And Fauna	Construction	▪ Relocation of infrastructure, where possible; ▪ Rehabilitation with native grass species; and ▪ Relocation of Red Data species, should any species be recorded in developing footprint area during vegetation clearing. ▪ Implement an alien management plan.	Rehabilitation should take place after decommissioning as outlined in the Rehabilitation Plan Report; and	National Environmental Management Act (NEMA),1998 (Act 107 of 1998); and National Environmental Biodiversity Act (NEMBA),2004 (Act10 of 2004).

Activities	Potential impacts	Aspects affected	Phase	Mitigation Measures	Time period for implementation	Compliance with standards
					Relocation of Red Data flora species prior to vegetation clearing – screening of areas prior to vegetation clearance	
	Habitat fragmentation and increased establishment of alien plant species.	Flora And Fauna	Construction	▪ Implement an alien management plan.	Alien management plan to be implemented after construction quarterly for 2 years and after decommissioning quarterly for two years.	National Environmental Management Act (NEMA),1998 (Act 107 of 1998); and National Environmental Biodiversity Act (NEMBA),2004 (Act10 of 2004).
	Siltation of surface water resources leading to deteriorated water quality	Surface Water	Construction	▪ Clearing of vegetation must be limited to the development footprint area, and the use of existing access roads must be prioritised so as to minimise construction of new access roads in these areas; ▪ If possible, construction activities must be prioritised to the dry months of the year (May-October) to limit mobilisation of sediments or hazardous substances from construction vehicles used during site clearing; ▪ The proposed topsoil and overburden stockpiles must be covered or vegetated as soon as possible to prevent sediment erosion. Location of measures as per SWMP ; ▪ Contaminated storm water runoff from this area will be routed through trenches to silt trap sumps at the bottom of the stockpiles; ▪ Contaminated storm water runoff from the sump will be routed through channels to the PCDs for reuse; ▪ Water quality monitoring should be implemented as an management option; Haul roads must be well compacted to avoid erosion of the soil into the streams; ▪ Dust suppression on the haul roads and cleared areas must be regularly undertaken; and ▪ All dirty water channels must be constructed and placed within the dirty water infrastructure areas, such that all dirty water runoff emanating from these areas are captured and contained to a dirty water containment facility. The proposed channels should be lined and sized to cater for the 1:50 year storm event.	Design and construction phase	Based on the GN 704 requirements regarding stormwater management for mining activities it is noted that all clean and dirty water must be separated. The clean water diversion will be sized to accommodate the 1:50 year storm event. The containment facility should be sized to accommodate the anticipated dirty water runoff as a result of the 1:50 year storm event.
	Removal of topsoil and site clearing may have an impact on the groundwater provided that the area affected by this activity extends beyond the local water table	Groundwater	Construction	▪ Site clearance and construction activities should take place above the water table, if applicable. No impact on the groundwater is expected if the activities take place above the water table; ▪ Site clearance should be kept to a minimum area and short duration, if possible; ▪ If trenches are going to be excavated below the water level, dewatering of the aquifer to lower the water table locally can be considered to ensure that the construction takes place above the groundwater	Groundwater monitoring must commence from the start of the construction phase Protection of the water table and groundwater quality should commence with the start of the construction phase	Compliance to the WULA once approved

Activities	Potential impacts	Aspects affected	Phase	Mitigation Measures	Time period for implementation	Compliance with standards
				level and the water quality remains acceptable. The abstracted water can be utilised for dust suppression, vegetation irrigation or discharged to pollution control dams for evaporation. Since the groundwater is not expected to be polluted at this stage, the utilisation of the water for activities such as dust suppression or irrigation will not cause negative environmental impacts; ▪ The PCD should not be placed on areas with the potential for increased infiltration to groundwater, such as over fault zones; and ▪ PCD should be lined to pro-actively prevent infiltration of contaminated seepage water.		
	Removal of wetland soils and vegetation; loss of wetland habitat.	Wetlands	Construction	▪ There are no mitigation measures for loss of habitat. ▪ Avoid and minimise impacts where possible, else rehabilitate and offset wetland sections.	Design and construction phase	Section 19 of the NWA Section 21 (c), (g) and (i) of the NWA Section 24 of the Constitution NEM:BA NEMA Department of Water and Forestry (DWAF) guidelines for the delineation of wetlands (2005); Mining and Biodiversity Guideline (DEA et al., 2013).
	Increased runoff resulting in erosion and sedimentation of downstream habitats. Increased runoff from manmade structures resulting in the erosion and sedimentation of downstream river reaches.	Aquatic Ecology	Construction	▪ Minimise the removal of vegetation in the infrastructure footprint area to prevent erosion and sedimentation of the river systems; ▪ Re-vegetation of the disturbed areas within the construction footprint once construction is completed; ▪ Soils compacted by heavy machinery in areas that are not utilised post construction can be ripped to allow infiltration; ▪ Ensure that storm water management structures are within good working condition through regular inspection, especially after large storm events; ▪ Where storm water enters river systems, sediment/silt and debris trapping, as well as energy dissipation control measures must be put in place; ▪ Storm water must be diverted from construction activities and managed in such a manner to disperse runoff and prevent the concentration of storm water flow; ▪ The vegetation of unpaved roadsides; and ▪ Inspection of paved and unpaved roads to monitor for erosion.	Design and construction phase	National Water Act, 1998 (Act No. 36 of 1998).
	Poor air quality due to site clearing and wind erosion	Air Quality	Construction	▪ Site clearing must be done in phases; ▪ Use of suppressants and binders on exposed areas to reduce dust generation; ▪ The area of disturbance at all times must be kept to a minimum and no unnecessary clearing, digging or scraping must occur, especially on windy days (with	Design and construction phase	National Environmental Management: Air Quality Act, Act.39 of 2004; National Environmental Management: Air Quality Act, 2004 (Act No. 39 of 2004) - National Dust Control Regulations (2013).

Activities	Potential impacts	Aspects affected	Phase	Mitigation Measures	Time period for implementation	Compliance with standards
				wind speed ≥ 5.4 m/s); ▪ The drop heights when loading onto trucks and at tipping points should be minimised.		
	Noise disturbance (noise levels in excess of 7 dBA at certain Mpumalanga receptors)	Noise	Construction	▪ Alternative location of the northernmost hard overburden dump should be considered; ▪ Alternative location of the haul route towards the siding should be considered; ▪ Restricting construction activities to daylight hours (06:00 – 18:00) and not during weekends and public holidays; ▪ Locating of diesel generator away from noise sensitive receptors, as well as placing generators on isolation mounts and installation of secondary silencers; ▪ Mining related machines and vehicles to be serviced to the designed requirements of the machinery/vehicles to ensure noise suppression mechanisms are effective e.g. installed exhaust mufflers; ▪ Reversing alarms on vehicles should be broadband reversing alarms which emit directional, lower, less intrusive sound; ▪ Environmental noise monitoring to establish compliance with the regulations and to verify the predicted noise levels; and ▪ Switching off equipment when not in use.	Design and construction phase	National Noise Control Regulations Gauteng Noise Control Regulations
	Site establishment will have a negative visual impact on the receiving environment. The Project area will become noticeable to nearby receptors due to the increased levels of activity on the site.	Visual	Construction	▪ Where possible use fencing that will screen the project area from nearby receptors; and ▪ Limit the height and footprint area of temporary laydown areas and facilities for the construction workers. ▪ Vegetation should only be removed when and where necessary. ▪ Topsoil should only be removed when and where necessary; ▪ Topsoil stockpiles should be vegetated with grasses (Andropogon appendiculatus, Andropogon eucomus, Andropogon huillensis, Aristida congesta subsp. Barbicollis, Arundinella nepalensis, Cynodon dactylon, Eragrostis capensis, Eragrostis curvula, Eragrostis gummiflua, Eragrostis racemose, Fingerhuthia Africana, Hyparrhenia hirta, Hyparrhenia tamba, Imperata cylindrical, Melinis repens, Paspalum dilatatum, Setaria sphacelata, Sporobolus africanus, Sporobolus pyramidalis, Themeda triandra, Trichoneura grandiglumis and Tristachya leucothrix) where possible so as to blend into the surrounding landscape and reduce dust generation; ▪ Limit the footprint area of topsoil stockpiles where possible; ▪ Limit the height of the topsoil stockpile to 20 m; and ▪ Apply dust suppression techniques to limit dust	Construction Phase	To minimise the negative visual impacts caused by site clearing.

Activities	Potential impacts	Aspects affected	Phase	Mitigation Measures	Time period for implementation	Compliance with standards
				generated from topsoil stockpiles.		
	Topsoil removal and stockpiling will have a negative visual impact on the receiving environment. Dust from the stockpiles will also have a negative visual impact.	Visual	Construction	▪ Where possible use fencing that will screen the project area from nearby receptors; and ▪ Limit the height and footprint area of temporary laydown areas and facilities for the construction workers. ▪ Vegetation should only be removed when and where necessary. ▪ Topsoil should only be removed when and where necessary; ▪ Topsoil stockpiles should be vegetated with grasses (Andropogon appendiculatus, Andropogon eucomus, Andropogon huillensis, Aristida congesta subsp. Barbicollis, Arundinella nepalensis, Cynodon dactylon, Eragrostis capensis, Eragrostis curvula, Eragrostis gummiflua, Eragrostis racemose, Fingerhuthia Africana, Hyparrhenia hirta, Hyparrhenia tamba, Imperata cylindrical, Melinis repens, Paspalum dilatatum, Setaria sphacelata, Sporobolus africanus, Sporobolus pyramidalis, Themeda triandra, Trichoneura grandiglumis and Tristachya leucothrix) where possible so as to blend into the surrounding landscape and reduce dust generation; ▪ Limit the footprint area of topsoil stockpiles where possible; ▪ Limit the height of the topsoil stockpile to 20 m; and ▪ Apply dust suppression techniques to limit dust generated from topsoil stockpiles.	Construction Phase	To minimise the negative visual impacts caused by site clearing.
	Destruction of burial grounds and graves	Heritage	Construction and operational	▪ Avoid the loss of burial grounds and graves though amendment of the infrastructure design. Where not feasible, a BGGC and GRP must be completed	Pre-construction	NHRA Section 36 Chapters XI and IX of the NHRA Regulations
Construction of infrastructure	Loss of topsoil – erosion, compaction, land capability and land use	Soil, Land Use and Land Capability	Construction	▪ Ensure proper storm water management designs are in place; ▪ If any erosion occurs, corrective actions (erosion berms) must be taken to minimise any further erosion from taking place; ▪ Only the designate access routes are to be used to reduce any unnecessary compaction; ▪ Topsoil should be stripped by means of an excavator bucket and loaded onto dump trucks; ▪ Topsoil stockpiles are to be kept to a maximum height of 10 m; ▪ If possible topsoil should be stripped during dry months, as to reduce compaction; ▪ Compaction of the removed topsoil must be avoided by prohibiting traffic on stockpiles; ▪ The stockpiles must be vegetated in order to reduce the risk of erosion; and	Design and construction phase	Chamber of Mines Guidelines

Activities	Potential impacts	Aspects affected	Phase	Mitigation Measures	Time period for implementation	Compliance with standards
				▪ Handling of the stripped must be minimised to ensure the structure does not deteriorate.		
	Industrial activity within a natural ecosystem is a negative impact to habitat integrity.	Wetlands	Construction	▪ The edge of the non-directly impacted wetlands, and at least a 32 m buffer if possible, must be clearly demarcated in the field as no-go zones that will last for the duration of the construction phase. ▪ Staff need to be educated about the sensitivities of the wetland habitat. ▪ Wetland monitoring must be carried out during the construction phase by a wetland specialist to ensure no unnecessary impact to wetlands is realised; and if so that a remedy is put in place as soon as possible. ▪ Refer to the Surface Water Report (Digby Wells, 2016f) for details on a Storm Water Management Plan that is to be carried out. This must be in operation during the construction phase and wetlands must be highlighted as sensitive receptors. ▪ Refer to the Fauna and Flora Report (Digby Wells, 2016c) for mitigation measures relating to floristic impacts as well as faunal species disturbances; for example, ▪ minimal bright lights should be left on at night time and they should not face outwards of the site; and ▪ an alien and invasive plant species management programme must be in place from the construction phase.	Design and construction phase	Section 19 of the NWA Section 21 (c), (g) and (i) of the NWA Section 24 of the Constitution NEM:BA NEMA Department of Water and Forestry (DWAF) guidelines for the delineation of wetlands (2005); Mining and Biodiversity Guideline (DEA et al., 2013).
	Construction over sensitive riparian habitats resulting in the loss of degradation of aquatic habitat.	Aquatic Ecology	Construction	▪ Minimise the removal of vegetation in the infrastructure footprint area to prevent erosion and sedimentation of the river systems; ▪ Re-vegetation of the disturbed areas within the construction footprint once construction is completed; ▪ Soils compacted by heavy machinery in areas that are not utilised post construction can be ripped to allow infiltration; ▪ Ensure that storm water management structures are within good working condition through regular inspection, especially after large storm events; ▪ Where storm water enters river systems, sediment/silt and debris trapping, as well as energy dissipation control measures must be put in place; ▪ Storm water must be diverted from construction activities and managed in such a manner to disperse runoff and prevent the concentration of storm water flow; ▪ The vegetation of unpaved roadsides; and ▪ Inspection of paved and unpaved roads to monitor for erosion.	Design and construction phase	National Water Act, 1998 (Act No. 36 of 1998).
	The construction of surface infrastructure will have a negative visual impact on the receiving environment. The surface infrastructure will change the sense of place of the Project area from an	Visual	Construction	▪ Ensure screening vegetation is left intact around the Project area and near receptors; ▪ Ensure the surface infrastructure does not exceed the proposed heights; ▪ Surface infrastructure should be painted natural hues so as to blend into the surrounding landscape where	Construction Phase	To minimise the negative visual impacts caused by construction of mine related infrastructure.

Activities	Potential impacts	Aspects affected	Phase	Mitigation Measures	Time period for implementation	Compliance with standards
	agricultural sense of place to an industrial/mining sense of place. Construction area lighting at night will have a negative visual impact on the receiving environment. The construction area lighting will be visible from a distance of up to 10 km and will draw attention to the Project area. This will also have a negative impact on the sense of place.			possible; ▪ Pylons and metal structures should be galvanised so as to weather to a matt grey finish rather than be painted silver. If the pylons and metal structures are painted, it is recommended that a neutral matt finish be used; and ▪ Where possible avoid construction activities at night. If construction activities take place at night then down lighting must be implemented to minimise light pollution.		
	Increase in Production	Macro-economic	Construction	▪ The impact is positive; measures to maximise the stimulation of the economy may include procurement of goods and services from local business where feasible.	Throughout LOM	Mineral and Petroleum Resource Development Act (Act of 2002). National Environmental Management Act (Act of 1998 Employment Equity Act, 1998 (Act No. 55 of 1998); Basic Conditions of Employment Act, 1997 (Act No. 75 of 1997); Labour Relations Act, 1995 (Act No. 66 of 1995); Skills Development Act (Act No. 97 of 1998 as amended); and Company employment policies.
	Impact on GDP	Macro-economic	Construction	▪ Recruit local labour; ▪ Sub-contract to local construction companies; and ▪ Use local suppliers where viable and arrange with the local Small and Medium and Micro Enterprises to provide transport, catering and other services for the construction crew.	Throughout LOM	Mineral and Petroleum Resource Development Act (Act of 2002). National Environmental Management Act (Act of 1998 Employment Equity Act, 1998 (Act No. 55 of 1998); Basic Conditions of Employment Act, 1997 (Act No. 75 of 1997); Labour Relations Act, 1995 (Act No. 66 of 1995); Skills Development Act (Act No. 97 of 1998 as amended); and Company employment policies.
	Impact on Employment	Macro-economic	Construction	▪ Use labour intensive construction methods, where feasible; ▪ Sub-contract to local construction companies; ▪ Use local suppliers; and ▪ Set-up a skills desk at the local municipal office and in the nearby communities to identify skills available in the community and assist in recruiting local labour during both construction and operation.	Throughout LOM	Mineral and Petroleum Resource Development Act (Act of 2002). National Environmental Management Act (Act of 1998 Employment Equity Act, 1998 (Act No. 55 of 1998); Basic Conditions of Employment Act, 1997 (Act No. 75 of 1997); Labour Relations Act, 1995 (Act No. 66 of 1995); Skills Development Act (Act No. 97 of 1998 as amended); and Company employment policies.
	Impact on Skills Development	Macro-economic	Construction	▪ Ensure that the main contractor shares knowledge with the sub-contracting companies during the	Throughout LOM	Mineral and Petroleum Resource Development Act (Act of 2002). National Environmental Management Act

Activities	Potential impacts	Aspects affected	Phase	Mitigation Measures	Time period for implementation	Compliance with standards
				construction period; and ▪ Encourage the main contractor to offer internships and learnerships, especially to those coming from the local communities.		(Act of 1998 Employment Equity Act, 1998 (Act No. 55 of 1998); Basic Conditions of Employment Act, 1997 (Act No. 75 of 1997); Labour Relations Act, 1995 (Act No. 66 of 1995); Skills Development Act (Act No. 97 of 1998 as amended); and Company employment policies.
	Impact on Household Income	Macro-economic	Construction	▪ Employ labour intensive methods in construction; ▪ Sub-contract to local construction companies; and ▪ Use local suppliers where viable and arrange with the local Small and Medium Enterprises to provide transport, catering, and other services for the construction crew.	Throughout LOM	Mineral and Petroleum Resource Development Act (Act of 2002). National Environmental Management Act (Act of 1998 Employment Equity Act, 1998 (Act No. 55 of 1998); Basic Conditions of Employment Act, 1997 (Act No. 75 of 1997); Labour Relations Act, 1995 (Act No. 66 of 1995); Skills Development Act (Act No. 97 of 1998 as amended); and Company employment policies.
	Impact on Government Revenue	Macro-economic	Construction	▪ No enhancement.	Throughout LOM	Mineral and Petroleum Resource Development Act (Act of 2002). National Environmental Management Act (Act of 1998 Employment Equity Act, 1998 (Act No. 55 of 1998); Basic Conditions of Employment Act, 1997 (Act No. 75 of 1997); Labour Relations Act, 1995 (Act No. 66 of 1995); Skills Development Act (Act No. 97 of 1998 as amended); and Company employment policies.
	Impact on Agricultural Production due to Sterilisation of Productive Agricultural Land	Macro-economic	Construction	▪ The establishment of the mine should be done with a minimal impact on the agricultural land and on the footprint of the properties ▪ Engage with directly affected farmers and landowners on alternative farming locations and investigate ways to minimise loss of agricultural production. ▪ Off-set impact by training local small-scale farmers as stated in SLP in order to have no net loss. ▪ If feasible, continue utilising land not affected by the mine's footprint for agricultural production. ▪ Where possible, ensure that land preparation and rehabilitation activities implemented during various staged of the mine's lifecycle allow for restoration of land to above-grazing capacity, i.e. suitable for crop	Throughout LOM	Mineral and Petroleum Resource Development Act (Act of 2002). National Environmental Management Act (Act of 1998 Employment Equity Act, 1998 (Act No. 55 of 1998); Basic Conditions of Employment Act, 1997 (Act No. 75 of 1997); Labour Relations Act, 1995 (Act No. 66 of 1995); Skills Development Act (Act No. 97 of 1998 as amended); and Company employment policies.

Activities	Potential impacts	Aspects affected	Phase	Mitigation Measures	Time period for implementation	Compliance with standards
				production.		
	Potential Negative Impact on Property Value	Macro-economic	Construction	▪ Mitigation measures proposed by visual and noise specialists should be strictly adhered to, to minimise the probability and intensity of the visual exposure in the area; ▪ Independent appraisals of properties and land values in the area adjacent to the site to determine the baseline before the project's implementation is advisable; and ▪ Educate and inform the affected parties on the potential environmental impacts that could ensue and the activities to adequately manage perceptions regarding potential effects of the project on the surrounding land uses.	Throughout LOM	Mineral and Petroleum Resource Development Act (Act of 2002). National Environmental Management Act (Act of 1998 Employment Equity Act, 1998 (Act No. 55 of 1998); Basic Conditions of Employment Act, 1997 (Act No. 75 of 1997); Labour Relations Act, 1995 (Act No. 66 of 1995); Skills Development Act (Act No. 97 of 1998 as amended); and Company employment policies.
	Potential Negative Impact on Egg Industry	Macro-economic	Construction	▪ Engage with respective researchers and specialists to determine with greater certainty the effect that any negative environmental impacts could affect the production of eggs on the nearby egg farms; ▪ Engage with adjacent landowners and compile the baseline, as well as monitor the effects of the mining activity on the production at the potentially affected farms; ▪ In the event that the production is affected and proven to be the result of mining activity, engage with adjacent landowners and investigate appropriate alternatives suitable for all the parties to ensure overall production is not affected (relocation, expansion of other facilities, etc.); and ▪ Strictly adhere to environmental specialists recommendations.	Throughout LOM	Mineral and Petroleum Resource Development Act (Act of 2002). National Environmental Management Act (Act of 1998 Employment Equity Act, 1998 (Act No. 55 of 1998); Basic Conditions of Employment Act, 1997 (Act No. 75 of 1997); Labour Relations Act, 1995 (Act No. 66 of 1995); Skills Development Act (Act No. 97 of 1998 as amended); and Company employment policies.
Relocation of infrastructure	Relocation of infrastructure will have a negative visual impact on the receiving environment. Change of land use from agriculture to mining will have a negative visual impact on the receiving environment. This change of land use will change the sense of place of the Project area and surrounds from an agricultural sense of place to an industrial/mining sense of place resulting in a loss of scenic character and increased visual disturbance. The change of land use will contribute to the cumulative impacts of mining on the	Visual	Construction	▪ Limit the footprint area of the road where possible by utilising existing roads for the relocation; ▪ The road should be wetted frequently by means of a water bowser to suppress dust; and ▪ Ensure screening vegetation is left intact along the sides of the road.	Construction Phase	To minimise the negative visual impacts caused by relocation of infrastructure.

Activities	Potential impacts	Aspects affected	Phase	Mitigation Measures	Time period for implementation	Compliance with standards
	regional environment.					
Construction of stockpiles	Loss of topsoil – erosion and compaction	Soil, Land Use and Land Capability	Construction	▪ Ensure proper storm water management designs are in place; ▪ If any erosion occurs, corrective actions (erosion berms) must be taken to minimise any further erosion from taking place; ▪ Only the designate access routes are to be used to reduce any unnecessary compaction; ▪ Topsoil should be stripped by means of an excavator bucket and loaded onto dump trucks; ▪ Topsoil stockpiles are to be kept to a maximum height of 10 m; ▪ If possible topsoil should be stripped during dry months, as to reduce compaction; ▪ Compaction of the removed topsoil must be avoided by prohibiting traffic on stockpiles; ▪ The stockpiles must be vegetated in order to reduce the risk of erosion; and ▪ Handling of the stripped must be minimised to ensure the structure does not deteriorate.	Design and construction phase	Chamber of Mines Guidelines
	Noise disturbance (noise levels in excess of 7 dBA at certain Mpumalanga receptors)	Noise	Construction	▪ Restricting construction activities to daylight hours (06:00 – 18:00) and not during weekends and public holidays; ▪ Locating of diesel generator away from noise sensitive receptors, as well as placing generators on isolation mounts and installation of secondary silencers; ▪ Mining related machines and vehicles to be serviced to the designed requirements of the machinery/vehicles to ensure noise suppression mechanisms are effective e.g. installed exhaust mufflers; ▪ Reversing alarms on vehicles should be broadband reversing alarms which emit directional, lower, less intrusive sound; ▪ Environmental noise monitoring to establish compliance with the regulations and to verify the predicted noise levels; and ▪ Switching off equipment when not in use.	Design and construction phase	National Noise Control Regulations Gauteng Noise Control Regulations
Increased vehicular activities	Road-kills and disturbance of fauna and potential loss of fauna diversity	Flora and Fauna	Construction	▪ Erection of signage; ▪ Implementing speed limit on site; and ▪ Restricting driving at night	Signage should be erected before the operational phase.	National Environmental Management Act (NEMA),1998 (Act 107 of 1998); and National Environmental Biodiversity Act (NEMBA),2004 (Act10 of 2004)
	Increase in ambient noise levels at surrounding communities due to vehicular activities	Noise	Construction	▪ Restricting construction activities to daylight hours (06:00 – 18:00) and not during weekends and public holidays; ▪ Locating of diesel generator away from noise sensitive receptors, as well as placing generators on isolation mounts and installation of secondary silencers; ▪ Mining related machines and vehicles to be serviced to the designed requirements of the machinery/vehicles to ensure noise suppression	Design and construction phase	National Noise Control Regulations Gauteng Noise Control Regulations

Activities	Potential impacts	Aspects affected	Phase	Mitigation Measures	Time period for implementation	Compliance with standards
				mechanisms are effective e.g. installed exhaust mufflers; ▪ Reversing alarms on vehicles should be broadband reversing alarms which emit directional, lower, less intrusive sound; ▪ Environmental noise monitoring to establish compliance with the regulations and to verify the predicted noise levels; and ▪ Switching off equipment when not in use.		
Blasting and Development of Initial Box-Cut for Mining	Change of land use from agriculture to mining will have a negative visual impact on the receiving environment. This change of land use will change the sense of place of the Project area and surrounds from an agricultural sense of place to an industrial/mining sense of place resulting in a loss of scenic character and increased visual disturbance. The change of land use will contribute to the cumulative impacts of mining on the regional environment.	Visual	Construction	▪ Apply dust suppression techniques to limit the dust from the demolition area; ▪ Use shade cloth/netting to screen the demolition area; ▪ Ensure all infrastructure is demolished and removed from the site; ▪ Limit the quantity and time of rubble stored on site; ▪ Ensure that the open pit is backfilled with material from the overburden stockpiles; ▪ Rehabilitate all disturbed areas; ▪ Ensure that the rehabilitated area is re-contoured and profiled to create a free-draining topography; ▪ Spread topsoil over the rehabilitated area; ▪ Ensure that surface water and drainage lines are rehabilitated; ▪ Re-vegetate the rehabilitated areas with grasses (Andropogon appendiculatus, Andropogon eucomus, Andropogon huillensis, Aristida congesta subsp. Barbicollis, Arundinella nepalensis, Cynodon dactylon, Eragrostis capensis, Eragrostis curvula, Eragrostis gummiflua, Eragrostis racemose, Fingerhuthia Africana, Hyparrhenia hirta, Hyparrhenia tamba, Imperata cylindrical, Melinis repens, Paspalum dilatatum, Setaria sphacelata, Sporobolus africanus, Sporobolus pyramidalis, Themeda triandra, Trichoneura grandiglumis and Tristachya leucothrix); and ▪ Ensure all the mitigation/management actions outlined in the Closure and Rehabilitation reports are conducted.	Decommissioning and Closure Phase	To minimise the negative visual impacts caused by the change of land use from agriculture to mining.
	Blasting and development of the initial box-cut for mining will have a negative visual impact on the receiving environment. Drilling and blasting will result in noise and dust thereby attracting attention to the Project area. Dust from blasting will have a negative visual impact. The box-cut will dramatically contrast the surrounding agricultural area as it will result in a scar on the landscape.	Visual	Construction	▪ Apply dust suppression techniques to limit the dust from the demolition area; ▪ Use shade cloth/netting to screen the demolition area; ▪ Ensure all infrastructure is demolished and removed from the site; ▪ Limit the quantity and time of rubble stored on site; ▪ Ensure that the open pit is backfilled with material from the overburden stockpiles; ▪ Rehabilitate all disturbed areas; ▪ Ensure that the rehabilitated area is re-contoured and profiled to create a free-draining topography; ▪ Spread topsoil over the rehabilitated area; ▪ Ensure that surface water and drainage lines are	Construction Phase	To minimise the negative visual impacts caused by blasting and development of the initial box-cut for mining.

Activities	Potential impacts	Aspects affected	Phase	Mitigation Measures	Time period for implementation	Compliance with standards
				rehabilitated; ▪ Re-vegetate the rehabilitated areas with grasses (Andropogon appendiculatus, Andropogon eucomus, Andropogon huillensis, Aristida congesta subsp. Barbicollis, Arundinella nepalensis, Cynodon dactylon, Eragrostis capensis, Eragrostis curvula, Eragrostis gummiflua, Eragrostis racemose, Fingerhuthia Africana, Hyparrhenia hirta, Hyparrhenia tamba, Imperata cylindrical, Melinis repens, Paspalum dilatatum, Setaria sphacelata, Sporobolus africanus, Sporobolus pyramidalis, Themeda triandra, Trichoneura grandiglumis and Tristachya leucothrix); and ▪ Ensure all the mitigation/management actions outlined in the Closure and Rehabilitation reports are conducted.		
	Stockpiling from the initial box-cut will have a negative visual impact on the receiving environment. Dust from the stockpiles will also have a negative visual impact. The impact of the stockpiles will occur for the life of the Project. This impact will be reversed when the material from the stockpiles is used to backfill the open pit during the decommissioning and closure phase.	Visual	Construction	▪ Apply dust suppression techniques to limit the dust from the demolition area; ▪ Use shade cloth/netting to screen the demolition area; ▪ Ensure all infrastructure is demolished and removed from the site; ▪ Limit the quantity and time of rubble stored on site; ▪ Ensure that the open pit is backfilled with material from the overburden stockpiles; ▪ Rehabilitate all disturbed areas; ▪ Ensure that the rehabilitated area is re-contoured and profiled to create a free-draining topography; ▪ Spread topsoil over the rehabilitated area; ▪ Ensure that surface water and drainage lines are rehabilitated; ▪ Re-vegetate the rehabilitated areas with grasses (Andropogon appendiculatus, Andropogon eucomus, Andropogon huillensis, Aristida congesta subsp. Barbicollis, Arundinella nepalensis, Cynodon dactylon, Eragrostis capensis, Eragrostis curvula, Eragrostis gummiflua, Eragrostis racemose, Fingerhuthia Africana, Hyparrhenia hirta, Hyparrhenia tamba, Imperata cylindrical, Melinis repens, Paspalum dilatatum, Setaria sphacelata, Sporobolus africanus, Sporobolus pyramidalis, Themeda triandra, Trichoneura grandiglumis and Tristachya leucothrix); and ▪ Ensure all the mitigation/management actions outlined in the Closure and Rehabilitation reports are conducted.	Construction Phase	To minimise the negative visual impacts caused stockpiling from the initial box-cut.
	Increase in ambient noise levels at surrounding communities	Noise	Construction	▪ Alternative location of the northernmost hard overburden dump should be considered; ▪ Alternative location of the haul route towards the siding should be considered; ▪ Restricting construction activities to daylight hours (06:00 – 18:00) and not during weekends and public holidays;	Design and construction phase	National Noise Control Regulations Gauteng Noise Control Regulations

Activities	Potential impacts	Aspects affected	Phase	Mitigation Measures	Time period for implementation	Compliance with standards
				▪ Locating of diesel generator away from noise sensitive receptors, as well as placing generators on isolation mounts and installation of secondary silencers; ▪ Mining related machines and vehicles to be serviced to the designed requirements of the machinery/vehicles to ensure noise suppression mechanisms are effective e.g. installed exhaust mufflers; ▪ Reversing alarms on vehicles should be broadband reversing alarms which emit directional, lower, less intrusive sound; ▪ Environmental noise monitoring to establish compliance with the regulations and to verify the predicted noise levels; and ▪ Switching off equipment when not in use.		
	Destruction of burial grounds and graves	Heritage	Construction	▪ Avoid though amendment of the infrastructure design. Where not feasible, a BGGC and GRP must be completed	Pre-construction	NHRA Section 36 Chapters XI and IX of the NHRA Regulations
Construction activities	Spilled organic compounds could reach the groundwater environment depending on the amount of spill and the depth of the water table	Groundwater	Construction	▪ Machinery should be maintained properly; ▪ Diesel or other chemicals must be handled appropriately and the necessary measures implemented to prevent spillages of happening. Re-fuelling protocols must also be followed; ▪ Hydrocarbon storage areas must be in a bounded area and should comply with the relevant SANS standards; ▪ A protocol to manage any spillages should be developed to ensure that all spillages are contained to the smallest possible area and cleaned up immediately. The contaminated material must be removed and disposed of to an appropriate licenced land fill site; and ▪ Groundwater should be monitored.	Groundwater monitoring must commence from the start of the construction phase Protection of the water table and groundwater quality should commence with the start of the construction phase	Compliance to the WULA once approved
	Employment creation	Social	Construction	▪ Assign preferred employment status to those experiencing the bulk of the negative project impacts (communities located within and surrounding the Project footprint e.g. Palmietkuilen Community, Vischkuil, Endicott, Welgedacht, Slovo Park, etc.); ▪ Promotion of local, female and youth employment to achieve and where feasible exceed the targets set out by the Mining Charter; ▪ Where possible labour-intensive construction methods should be promoted; ▪ Verification of local residential status through consultation with appropriate authorities (e.g. municipal structures, community leaders, and landowners) ▪ Consult neighbouring businesses/mines to determine if they would be willing to make their skills registers available; ▪ Identify required core skills, expand skills audits to community and align and implement training and	Pre-construction	Mineral and Petroleum Resource Development Act (Act of 2002). National Environmental Management Act (Act of 1998 Employment Equity Act, 1998 (Act No. 55 of 1998); Basic Conditions of Employment Act, 1997 (Act No. 75 of 1997); Labour Relations Act, 1995 (Act No. 66 of 1995); Skills Development Act (Act No. 97 of 1998 as amended); and Company employment policies.

Activities	Potential impacts	Aspects affected	Phase	Mitigation Measures	Time period for implementation	Compliance with standards
				skills development initiatives to findings of audit; ▪ Expand skills development programmes, especially ABET programmes, to include surrounding communities; ▪ Recruitment via a registry of job seekers and potentially coordinated through the DoL; ▪ Provide local employees with reference letters certificates of completion for in-house (on-the-job) training; ▪ Monitor subcontractors in terms of local employment targets; ▪ Provide focused training to construction phase employees from the host communities to increase their chances for employment during the operations; ▪ The Project's database of the local labour pool should be updated to include people who were employed by the Project during the construction phase.		
	Multiplier effects on the local economy	Social	Construction	▪ Assign preferred employment status to those experiencing the bulk of the negative project impacts (communities located within and surrounding the Project footprint e.g. Palmietkuilen Community, Vischkuil, Endicott, Welgedacht, Slovo Park, etc.); ▪ Promotion of local, female and youth employment to achieve and where feasible exceed the targets set out by the Mining Charter; ▪ Where possible labour-intensive construction methods should be promoted; ▪ Verification of local residential status through consultation with appropriate authorities (e.g. municipal structures, community leaders, and landowners) ▪ Consult neighbouring businesses/mines to determine if they would be willing to make their skills registers available; ▪ Identify required core skills, expand skills audits to community and align and implement training and skills development initiatives to findings of audit; ▪ Expand skills development programmes, especially ABET programmes, to include surrounding communities; ▪ Recruitment via a registry of job seekers and potentially coordinated through the DoL; ▪ Provide local employees with reference letters certificates of completion for in-house (on-the-job) training; ▪ Monitor subcontractors in terms of local employment targets; ▪ Provide focused training to construction phase employees from the host communities to increase their chances for employment during the operations; ▪ The Project's database of the local labour pool should be updated to include people who were	Pre-construction	Mineral and Petroleum Resource Development Act (Act of 2002). National Environmental Management Act (Act of 1998 Employment Equity Act, 1998 (Act No. 55 of 1998); Basic Conditions of Employment Act, 1997 (Act No. 75 of 1997); Labour Relations Act, 1995 (Act No. 66 of 1995); Skills Development Act (Act No. 97 of 1998 as amended); and Company employment policies.

Activities	Potential impacts	Aspects affected	Phase	Mitigation Measures	Time period for implementation	Compliance with standards
				employed by the Project during the construction phase.		
	Community development and social upliftment	Social	Construction	▪ Assign preferred employment status to those experiencing the bulk of the negative project impacts (communities located within and surrounding the Project footprint e.g. Palmietkuilen Community, Vischkuil, Endicott, Welgedacht, Slovo Park, etc.); ▪ Promotion of local, female and youth employment to achieve and where feasible exceed the targets set out by the Mining Charter; ▪ Where possible labour-intensive construction methods should be promoted; ▪ Verification of local residential status through consultation with appropriate authorities (e.g. municipal structures, community leaders, and landowners) ▪ Consult neighbouring businesses/mines to determine if they would be willing to make their skills registers available; ▪ Identify required core skills, expand skills audits to community and align and implement training and skills development initiatives to findings of audit; ▪ Expand skills development programmes, especially ABET programmes, to include surrounding communities; ▪ Recruitment via a registry of job seekers and potentially coordinated through the DoL; ▪ Provide local employees with reference letters certificates of completion for in-house (on-the-job) training; ▪ Monitor subcontractors in terms of local employment targets; ▪ Provide focused training to construction phase employees from the host communities to increase their chances for employment during the operations; ▪ The Project's database of the local labour pool should be updated to include people who were employed by the Project during the construction phase.	Pre-construction	Mineral and Petroleum Resource Development Act (Act of 2002). National Environmental Management Act (Act of 1998 Employment Equity Act, 1998 (Act No. 55 of 1998); Basic Conditions of Employment Act, 1997 (Act No. 75 of 1997); Labour Relations Act, 1995 (Act No. 66 of 1995); Skills Development Act (Act No. 97 of 1998 as amended); and Company employment policies.
	Displacement of persons on or making use of the land	Social	Construction	▪ Assign preferred employment status to those experiencing the bulk of the negative project impacts (communities located within and surrounding the Project footprint e.g. Palmietkuilen Community, Vischkuil, Endicott, Welgedacht, Slovo Park, etc.); ▪ Promotion of local, female and youth employment to achieve and where feasible exceed the targets set out by the Mining Charter; ▪ Where possible labour-intensive construction methods should be promoted; ▪ Verification of local residential status through consultation with appropriate authorities (e.g. municipal structures, community leaders, and landowners)	Pre-construction	Mineral and Petroleum Resource Development Act (Act of 2002). National Environmental Management Act (Act of 1998 Employment Equity Act, 1998 (Act No. 55 of 1998); Basic Conditions of Employment Act, 1997 (Act No. 75 of 1997); Labour Relations Act, 1995 (Act No. 66 of 1995); Skills Development Act (Act No. 97 of 1998 as amended); and Company employment policies.

Activities	Potential impacts	Aspects affected	Phase	Mitigation Measures	Time period for implementation	Compliance with standards
				▪ Consult neighbouring businesses/mines to determine if they would be willing to make their skills registers available; ▪ Identify required core skills, expand skills audits to community and align and implement training and skills development initiatives to findings of audit; ▪ Expand skills development programmes, especially ABET programmes, to include surrounding communities; ▪ Recruitment via a registry of job seekers and potentially coordinated through the DoL; ▪ Provide local employees with reference letters certificates of completion for in-house (on-the-job) training; ▪ Monitor subcontractors in terms of local employment targets; ▪ Provide focused training to construction phase employees from the host communities to increase their chances for employment during the operations; ▪ The Project's database of the local labour pool should be updated to include people who were employed by the Project during the construction phase.		
	Disruption of daily movement patterns due to project related traffic on local roads	Social	Construction	▪ Assign preferred employment status to those experiencing the bulk of the negative project impacts (communities located within and surrounding the Project footprint e.g. Palmietkuilen Community, Vischkuil, Endicott, Welgedacht, Slovo Park, etc.); ▪ Promotion of local, female and youth employment to achieve and where feasible exceed the targets set out by the Mining Charter; ▪ Where possible labour-intensive construction methods should be promoted; ▪ Verification of local residential status through consultation with appropriate authorities (e.g. municipal structures, community leaders, and landowners) ▪ Consult neighbouring businesses/mines to determine if they would be willing to make their skills registers available; ▪ Identify required core skills, expand skills audits to community and align and implement training and skills development initiatives to findings of audit; ▪ Expand skills development programmes, especially ABET programmes, to include surrounding communities; ▪ Recruitment via a registry of job seekers and potentially coordinated through the DoL; ▪ Provide local employees with reference letters certificates of completion for in-house (on-the-job) training; ▪ Monitor subcontractors in terms of local employment targets;	Pre-construction	Mineral and Petroleum Resource Development Act (Act of 2002). National Environmental Management Act (Act of 1998 Employment Equity Act, 1998 (Act No. 55 of 1998); Basic Conditions of Employment Act, 1997 (Act No. 75 of 1997); Labour Relations Act, 1995 (Act No. 66 of 1995); Skills Development Act (Act No. 97 of 1998 as amended); and Company employment policies.

Activities	Potential impacts	Aspects affected	Phase	Mitigation Measures	Time period for implementation	Compliance with standards
				▪ Provide focused training to construction phase employees from the host communities to increase their chances for employment during the operations; ▪ The Project's database of the local labour pool should be updated to include people who were employed by the Project during the construction phase.		
	Influx of people resulting in pressure on local services, resources and facilities; establishment and growth of informal settlements; increase in social pathologies and conflict/ competition between newcomers and incumbent population	Social	Construction	▪ Assign preferred employment status to those experiencing the bulk of the negative project impacts (communities located within and surrounding the Project footprint e.g. Palmietkuilen Community, Vischkuil, Endicott, Welgedacht, Slovo Park, etc.); ▪ Promotion of local, female and youth employment to achieve and where feasible exceed the targets set out by the Mining Charter; ▪ Where possible labour-intensive construction methods should be promoted; ▪ Verification of local residential status through consultation with appropriate authorities (e.g. municipal structures, community leaders, and landowners) ▪ Consult neighbouring businesses/mines to determine if they would be willing to make their skills registers available; ▪ Identify required core skills, expand skills audits to community and align and implement training and skills development initiatives to findings of audit; ▪ Expand skills development programmes, especially ABET programmes, to include surrounding communities; ▪ Recruitment via a registry of job seekers and potentially coordinated through the DoL; ▪ Provide local employees with reference letters certificates of completion for in-house (on-the-job) training; ▪ Monitor subcontractors in terms of local employment targets; ▪ Provide focused training to construction phase employees from the host communities to increase their chances for employment during the operations; ▪ The Project's database of the local labour pool should be updated to include people who were employed by the Project during the construction phase.	Pre-construction	Mineral and Petroleum Resource Development Act (Act of 2002). National Environmental Management Act (Act of 1998 Employment Equity Act, 1998 (Act No. 55 of 1998); Basic Conditions of Employment Act, 1997 (Act No. 75 of 1997); Labour Relations Act, 1995 (Act No. 66 of 1995); Skills Development Act (Act No. 97 of 1998 as amended); and Company employment policies.
	Health and safety impacts resulting from construction activities	Social	Construction	▪ Assign preferred employment status to those experiencing the bulk of the negative project impacts (communities located within and surrounding the Project footprint e.g. Palmietkuilen Community, Vischkuil, Endicott, Welgedacht, Slovo Park, etc.); ▪ Promotion of local, female and youth employment to achieve and where feasible exceed the targets set out by the Mining Charter; ▪ Where possible labour-intensive construction	Pre-construction	Mineral and Petroleum Resource Development Act (Act of 2002). National Environmental Management Act (Act of 1998 Employment Equity Act, 1998 (Act No. 55 of 1998); Basic Conditions of Employment Act, 1997 (Act No. 75 of 1997); Labour Relations Act, 1995 (Act No. 66 of

Activities	Potential impacts	Aspects affected	Phase	Mitigation Measures	Time period for implementation	Compliance with standards
				methods should be promoted; ▪ Verification of local residential status through consultation with appropriate authorities (e.g. municipal structures, community leaders, and landowners) ▪ Consult neighbouring businesses/mines to determine if they would be willing to make their skills registers available; ▪ Identify required core skills, expand skills audits to community and align and implement training and skills development initiatives to findings of audit; ▪ Expand skills development programmes, especially ABET programmes, to include surrounding communities; ▪ Recruitment via a registry of job seekers and potentially coordinated through the DoL; ▪ Provide local employees with reference letters certificates of completion for in-house (on-the-job) training; ▪ Monitor subcontractors in terms of local employment targets; ▪ Provide focused training to construction phase employees from the host communities to increase their chances for employment during the operations; ▪ The Project's database of the local labour pool should be updated to include people who were employed by the Project during the construction phase.		1995); Skills Development Act (Act No. 97 of 1998 as amended); and Company employment policies.
	Direct and indirect impacts on surrounding land users due to the presence of the mine (impact on tourism, sense of place etc.)	Social	Construction	▪ Assign preferred employment status to those experiencing the bulk of the negative project impacts (communities located within and surrounding the Project footprint e.g. Palmietkuilen Community, Vischkuil, Endicott, Welgedacht, Slovo Park, etc.); ▪ Promotion of local, female and youth employment to achieve and where feasible exceed the targets set out by the Mining Charter; ▪ Where possible labour-intensive construction methods should be promoted; ▪ Verification of local residential status through consultation with appropriate authorities (e.g. municipal structures, community leaders, and landowners) ▪ Consult neighbouring businesses/mines to determine if they would be willing to make their skills registers available; ▪ Identify required core skills, expand skills audits to community and align and implement training and skills development initiatives to findings of audit; ▪ Expand skills development programmes, especially ABET programmes, to include surrounding communities; ▪ Recruitment via a registry of job seekers and potentially coordinated through the DoL;	Pre-construction	Mineral and Petroleum Resource Development Act (Act of 2002). National Environmental Management Act (Act of 1998 Employment Equity Act, 1998 (Act No. 55 of 1998); Basic Conditions of Employment Act, 1997 (Act No. 75 of 1997); Labour Relations Act, 1995 (Act No. 66 of 1995); Skills Development Act (Act No. 97 of 1998 as amended); and Company employment policies.

Activities	Potential impacts	Aspects affected	Phase	Mitigation Measures	Time period for implementation	Compliance with standards
				▪ Provide local employees with reference letters certificates of completion for in-house (on-the-job) training; ▪ Monitor subcontractors in terms of local employment targets; ▪ Provide focused training to construction phase employees from the host communities to increase their chances for employment during the operations; ▪ The Project's database of the local labour pool should be updated to include people who were employed by the Project during the construction phase.		
	Opposition from stakeholders because of perceived negative impacts	Social	Construction	▪ Assign preferred employment status to those experiencing the bulk of the negative project impacts (communities located within and surrounding the Project footprint e.g. Palmietkuilen Community, Vischkuil, Endicott, Welgedacht, Slovo Park, etc.); ▪ Promotion of local, female and youth employment to achieve and where feasible exceed the targets set out by the Mining Charter; ▪ Where possible labour-intensive construction methods should be promoted; ▪ Verification of local residential status through consultation with appropriate authorities (e.g. municipal structures, community leaders, and landowners) ▪ Consult neighbouring businesses/mines to determine if they would be willing to make their skills registers available; ▪ Identify required core skills, expand skills audits to community and align and implement training and skills development initiatives to findings of audit; ▪ Expand skills development programmes, especially ABET programmes, to include surrounding communities; ▪ Recruitment via a registry of job seekers and potentially coordinated through the DoL; ▪ Provide local employees with reference letters certificates of completion for in-house (on-the-job) training; ▪ Monitor subcontractors in terms of local employment targets; ▪ Provide focused training to construction phase employees from the host communities to increase their chances for employment during the operations; ▪ The Project's database of the local labour pool should be updated to include people who were employed by the Project during the construction phase.	Pre-construction	Mineral and Petroleum Resource Development Act (Act of 2002). National Environmental Management Act (Act of 1998 Employment Equity Act, 1998 (Act No. 55 of 1998); Basic Conditions of Employment Act, 1997 (Act No. 75 of 1997); Labour Relations Act, 1995 (Act No. 66 of 1995); Skills Development Act (Act No. 97 of 1998 as amended); and Company employment policies.
Clearing of vegetation	Habitat loss for flora and fauna;	Flora And Fauna	Operational	▪ Rehabilitation with native grass species; and ▪ Relocation of Red Data species, should any species be recorded in developing footprint area during vegetation clearing.	Rehabilitation should take place after decommissioning as outlined in the	National Environmental Management Act (NEMA),1998 (Act 107 of 1998); and National Environmental Biodiversity Act (NEMBA),2004 (Act10 of 2004).

Activities	Potential impacts	Aspects affected	Phase	Mitigation Measures	Time period for implementation	Compliance with standards
					Rehabilitation Plan Report; and Relocation of Red Data flora species prior to vegetation clearing – screening of areas prior to vegetation clearance	
	Loss of species diversity	Flora And Fauna	Operational	▪ Rehabilitation with native grass species; and ▪ Relocation of Red Data species, should any species be recorded in developing footprint area during vegetation clearing.	Rehabilitation should take place after decommissioning as outlined in the Rehabilitation Plan Report; and Relocation of Red Data flora species prior to vegetation clearing – screening of areas prior to vegetation clearance	National Environmental Management Act (NEMA),1998 (Act 107 of 1998); and National Environmental Biodiversity Act (NEMBA),2004 (Act10 of 2004).
	Potential loss of Red Data plant species.	Flora And Fauna	Operational	▪ Rehabilitation with native grass species; and ▪ Relocation of Red Data species, should any species be recorded in developing footprint area during vegetation clearing.	Rehabilitation should take place after decommissioning as outlined in the Rehabilitation Plan Report; and Relocation of Red Data flora species prior to vegetation clearing – screening of areas prior to vegetation clearance	National Environmental Management Act (NEMA),1998 (Act 107 of 1998); and National Environmental Biodiversity Act (NEMBA),2004 (Act10 of 2004).
	Noise disturbance (noise levels in excess of 7 dBA at certain Mpumalanga receptors and noise levels in excess of night time guideline at Gauteng rural receptor)	Noise	Operational	▪ Stripping topsoil and soft overburden (only open cast pit footprint and northernmost hard overburden dump); ▪ Removal of overburden, including drilling and blasting of hard overburden; ▪ Loading, hauling and stockpiling of overburden (only northernmost overburden dump); ▪ Load, haul and stockpiling of ROM coal; and ▪ Hauling coal to siding	Upon commencement of the operational phase	National Noise Control Regulations Gauteng Noise Control Regulations
	Stripping of topsoil and soft overburden will have a negative visual impact on the receiving environment. As the Project area is stripped it will become noticeable to nearby receptors as it will contrast the surrounding area.	Visual	Operational	▪ Topsoil should only be removed when and where necessary; and ▪ Only remove soft overburden when and where necessary.	Operational Phase	To minimise the negative visual impacts caused by stripping of topsoil and soft overburden.
Overburden removal and open pit mining	Reduction in catchment yield	Surface water	Operational	▪ Effective surface water management whereby all clean water is diverted into the nearby streams	Design and operational phase	Based on the GN 704 requirements regarding stormwater management for mining activities it is noted that all clean and dirty water must be separated. The clean water diversion will be sized to accommodate the 1:50 year storm event. The containment facility should be sized to

Activities	Potential impacts	Aspects affected	Phase	Mitigation Measures	Time period for implementation	Compliance with standards
						accommodate the anticipated dirty water runoff as a result of the 1:50 year storm event.
	Reduction of groundwater quantity as a result of mine dewatering	Groundwater	Operational	▪ Store the dewatered water in pollution control dam and ensure that the dam will has sufficient storage volume. If that is not possible, re-introduce treated water into the streams after ensuring that they meet the required river quality objectives. ▪ Affected receptors (if proven through monitoring) should be compensated. ▪ Groundwater monitoring should be conducted.	Groundwater monitoring must commence from the start of the construction phase Protection of the water table and groundwater quality should commence with the start of the construction phase	Compliance to the WULA once approved
	Groundwater contamination	Groundwater	Operational	▪ Dewatering should be conducted efficiently ▪ Dewatering level should be kept close to the coal seam floor, not deeper. ▪ Affected receptors should be compensated ▪ Ensure that the waste rock material that shows a significant potential to generate acid is deposited at the base of the pit in such a way that it will be completely flooded with groundwater. ▪ Groundwater monitoring should be conducted monthly.	Groundwater monitoring must commence from the start of the construction phase Protection of the water table and groundwater quality should commence with the start of the construction phase	Compliance to the WULA once approved
	Groundwater contamination as a result of open pit mining, seepage from the PCD and waste stockpiling	Groundwater	Operational	▪ Overburden and topsoil stockpiles should be managed to minimise infiltration of contaminants to the groundwater; ▪ The vegetation of the stockpile and covering them with soil to minimise rainfall infiltration and mobilisation of dissolved metals; ▪ Groundwater monitoring; ▪ Avoid placement of the pollution control dams on areas with the potential for increased infiltration to groundwater, such as over fault zones; ▪ All contaminant, storm water, waste and hazardous waste storage facilities and other contaminated water storage areas (pollution control dams) should be lined to prevent infiltration of contaminated seepage water proactively; ▪ Monitoring of groundwater quality and water levels is recommended with continuous refining and updating of the monitoring network based on the results obtained; and ▪ All pollution control dams should be operated in such a way that it does not overflow more than once in 50 years.	Groundwater monitoring must commence from the start of the construction phase Protection of the water table and groundwater quality should commence with the start of the construction phase	Compliance to the WULA once approved
	Perforation of rock and groundwater reserves leading to severe hydrological and geomorphological impacts to wetlands and catchment due to draw down cone	Wetlands	Operational	▪ There are no foreseen mitigation actions that may significantly lessen the impact on the receiving catchment. However, the following should be done: ▪ Dirty water from the storm water system and pollution control dam should be treated and released back into the surrounding wetland systems; downstream of the dewatering cone of depression. ▪ The haul roads and servitude must also have well-designed stream crossings and drainage areas,	Design and operational phase	Section 19 of the NWA Section 21 (c), (g) and (i) of the NWA Section 24 of the Constitution NEM:BA NEMA Department of Water and Forestry (DWAF) guidelines for the delineation of wetlands (2005); Mining and Biodiversity Guideline (DEA et

Activities	Potential impacts	Aspects affected	Phase	Mitigation Measures	Time period for implementation	Compliance with standards
				which should be maintained. The wetlands outside of this must be demarcated as no-go areas. ▪ Dust management programme must be in place; ▪ The haul roads and servitude must be monitored and maintained to best operating standards. This should be done in the dry season. ▪ The wetland must be monitored on a regular basis to ensure no residual impact to the wetland and river is realised; and if so that remediation measures are followed. ▪ If possible, truck loads should be covered; particularly in dry and windy seasons. ▪ Berms must be maintained as a buffer between the coal handling area and the sensitive receiving environment.		al., 2013).
	Noise disturbance (noise levels in excess of 7 dBA at certain Mpumalanga receptors and noise levels in excess of night time guideline at Gauteng rural receptor)	Noise	Operational	▪ Stripping topsoil and soft overburden (only open cast pit footprint and northernmost hard overburden dump); ▪ Removal of overburden, including drilling and blasting of hard overburden; ▪ Loading, hauling and stockpiling of overburden (only northernmost overburden dump); ▪ Load, haul and stockpiling of ROM coal; and ▪ Hauling coal to siding	Upon commencement of the operational phase	National Noise Control Regulations Gauteng Noise Control Regulations
	Ground vibration could damage houses and roads	Blasting	Operational	▪ Reduce Charge Mass/Delay; ▪ Reconsider blast initiation system – electronics; ▪ Relocate POI's of concern at least 650m; and ▪ Implementation of proper blast design.	Operational Phase	National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA) Mine Health and Safety Act, 1996 (Act No. 29 of 1996) Mineral and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002) (MPRDA) Explosives Act, 2003 (Act No. 15 of 2003)
	Air blast could damage houses	Blasting	Operational	▪ Reduce Charge Mass/Delay; ▪ Increase stemming length; ▪ Controls need to be put in place for management of stemming lengths and quality stemming material; ▪ Relocate POI's of concern at least 650m; and ▪ Implementation of proper blast design.	Operational Phase	National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA) Mine Health and Safety Act, 1996 (Act No. 29 of 1996) Mineral and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002) (MPRDA) Explosives Act, 2003 (Act No. 15 of 2003)
	Fly rock could damage houses and impact on roads	Blasting	Operational	▪ Increase stemming length; ▪ Use quality stemming material; ▪ Controls put in place for management of stemming lengths; ▪ Relocate POI's of concern at least 650m; and ▪ Implementation of proper blast designs.	Operational Phase	National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA) Mine Health and Safety Act, 1996 (Act No. 29 of 1996) Mineral and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002) (MPRDA) Explosives Act, 2003 (Act No. 15 of 2003)
	Impact of noxious fumes on houses and roads	Blasting	Operational	▪ Use correct product; ▪ Control product quality;	Operational Phase	National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA)

Activities	Potential impacts	Aspects affected	Phase	Mitigation Measures	Time period for implementation	Compliance with standards
				▪ Prevent sleep time for charged blast holes; ▪ Ensure same day charge and blast; and ▪ Implementation of proper blast designs.		Mine Health and Safety Act, 1996 (Act No. 29 of 1996) Mineral and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002) (MPRDA) Explosives Act, 2003 (Act No. 15 of 2003)
	Removal of overburden (including drilling and blasting of hard overburden) will have a negative visual impact on the receiving environment. Drilling and blasting will result in noise and dust thereby attracting attention to the Project area. Dust from blasting will have a negative visual impact. The open pit will dramatically contrast the surrounding agricultural area as it will result in a scar on the landscape.	Visual	Operational	▪ Only remove overburden when and where necessary; and ▪ Apply dust suppression techniques to limit the dust generated from the blasting.	Operational Phase	To minimise the negative visual impacts caused by the removal of overburden (including drilling and blasting of hard overburden).
	Drilling and blasting of coal will have a negative visual impact on the receiving environment. Drilling and blasting will result in noise and dust thereby attracting attention to the Project area. Dust from blasting will have a negative visual impact. The open pit will dramatically contrast the surrounding agricultural area as it will result in a scar on the landscape. Once coal is removed from the open pit there will be insufficient material to backfill the open pit completely and a void will remain. This will result in a permanent and irreversible negative visual impact on the receiving environment.	Visual	Operational	▪ Apply dust suppression techniques to limit the dust generated from the blasting; ▪ Ensure that the open pit is backfilled with material from the overburden stockpiles; ▪ Rehabilitate all disturbed areas; ▪ Ensure that the rehabilitated area is re-contoured and profiled to create a free-draining topography; ▪ Spread topsoil over the rehabilitated area; ▪ Ensure that surface water and drainage lines are rehabilitated; ▪ Re-vegetate the rehabilitated areas with grasses (Andropogon appendiculatus, Andropogon eucomus, Andropogon huillensis, Aristida congesta subsp. Barbicollis, Arundinella nepalensis, Cynodon dactylon, Eragrostis capensis, Eragrostis curvula, Eragrostis gummiflua, Eragrostis racemose, Fingerhuthia Africana, Hyparrhenia hirta, Hyparrhenia tamba, Imperata cylindrical, Melinis repens, Paspalum dilatatum, Setaria sphacelata, Sporobolus africanus, Sporobolus pyramidalis, Themeda triandra, Trichoneura grandiglumis and Tristachya leucothrix); and ▪ Ensure all the mitigation/management actions outlined in the Closure and Rehabilitation reports are conducted.	Operational Phase Decommissioning and Closure Phase	To minimise the negative visual impacts caused by drilling and blasting of coal.
Operation of surface infrastructure	Development and operation of surface infrastructure resulting in runoff that could result in contamination of rivers	Surface water	Operational	▪ Vehicles must only be serviced within designated service bays; ▪ The management of general and other forms of waste must ensure collection and disposal into clearly marked skip bins that can be collected by approved contractors for disposal to the appropriate disposal sites; ▪ The fuel, lubricant and explosives storage facilities must be located on a hard standing area (paved or concrete surface that is impermeable), roofed and bunded in accordance with SANS1200	During the entire project life.	SANS1200 specifications.

Activities	Potential impacts	Aspects affected	Phase	Mitigation Measures	Time period for implementation	Compliance with standards
				specifications. This will prevent mobilization of leaked hazardous substances; and ▪ An emergency spillage response plan and spill kits should be in place and accessible to the responsible monitoring team. The Material Safety Data Sheets (MSDS) should be kept on site for the Life of Mine for reference to anytime in terms of handling, storage and disposal of materials.		
	Groundwater contamination from PCD	Groundwater	Operational	▪ Avoid placement of the pollution control dam on areas with the potential for increased infiltration to groundwater, such as over fault zones. ▪ All contaminant, storm water, waste and hazardous waste storage facilities and other contaminated water storage areas (pollution control dam) should be lined to pro-actively prevent infiltration of contaminated seepage water. ▪ Monitoring of groundwater quality and water levels is recommended with continuous refining and updating of the monitoring network based on the results obtained.	PCD design should be completed before the construction starts. Groundwater monitoring must commence from the start of the construction phase.	DWS Best Practice Guideline A4: Pollution Control Dam.
	The operational mining activities occurring within an ecologically sensitive catchment, which pose significant potential negative impacts to functioning wetlands and catchment.	Wetlands	Operational	▪ The edge of the non-directly impacted wetlands, and at least a 32 m buffer if possible, must be clearly demarcated in the field as no-go zones that will last for the duration of the construction phase. ▪ Staff need to be educated about the sensitivities of the wetland habitat. ▪ Wetland monitoring must be carried out during the construction phase by a wetland specialist to ensure no unnecessary impact to wetlands is realised; and if so that a remedy is put in place as soon as possible. ▪ Refer to the Surface Water Report for details on a Storm Water Management Plan that is to be carried out. This must be in operation during the construction phase and wetlands must be highlighted as sensitive receptors. ▪ Refer to the Fauna and Flora Report (Digby Wells, 2016c) for mitigation measures relating to floristic impacts as well as faunal species disturbances; for example, ▪ minimal bright lights should be left on at night time and they should not face outwards of the site; and ▪ an alien and invasive plant species management programme must be in place from the construction phase.	Design and operational phase	Section 19 of the NWA Section 21 (c), (g) and (i) of the NWA Section 24 of the Constitution NEM:BA NEMA Department of Water and Forestry (DWAF) guidelines for the delineation of wetlands (2005); Mining and Biodiversity Guideline (DEA et al., 2013).
	Loss of topsoil – erosion and compaction	Soils, Land Use and Land Capability	Operational	▪ Ensure proper storm water management designs are in place; ▪ If any erosion occurs, corrective actions (erosion berms) must be taken to minimise any further erosion from taking place; and ▪ Only the designate access routes are to be used to reduce any unnecessary compaction.	Operational Phase	Chamber of Mines Guidelines
Increased	Road-kills and disturbance of fauna and	Flora and Fauna	Operational	▪ Construction, operation and decommissioning phases	Signage should be erected before the	National Environmental Management Act (NEMA),1998 (Act 107 of 1998); and

Activities	Potential impacts	Aspects affected	Phase	Mitigation Measures	Time period for implementation	Compliance with standards
vehicular activities	potential loss of fauna diversity				operational phase.	National Environmental Biodiversity Act (NEMBA),2004 (Act10 of 2004)
	Increase in ambient noise levels at surrounding communities due to vehicular activities	Noise	Operational	▪ Stripping topsoil and soft overburden (only open cast pit footprint and northernmost hard overburden dump); ▪ Removal of overburden, including drilling and blasting of hard overburden; ▪ Loading, hauling and stockpiling of overburden (only northernmost overburden dump); ▪ Load, haul and stockpiling of ROM coal; and ▪ Hauling coal to siding	Upon commencement of the operational phase	National Noise Control Regulations Gauteng Noise Control Regulations
	Vehicular activity on haul roads will have a negative visual impact on the receiving environment. Dust from the vehicular activity will also have a negative visual impact.	Visual	Operational	▪ Limit the speed of vehicles on the haul roads to reduce dust; and ▪ Haul roads should be wetted frequently by means of a water bowser to suppress dust.	Operational Phase	To minimise the negative visual impacts caused by loading and hauling of ROM coal.
	Maintenance of the haul roads may require the acquisition of additional material such as from borrow pits which will have a negative visual impact on the receiving environment.	Visual	Operational	▪ Limit the speed of vehicles on the haul roads to reduce dust; and ▪ Haul roads should be wetted frequently by means of a water bowser to suppress dust.	Operational Phase	To minimise the negative visual impacts caused by use of the haul roads.
Storage, hauling, processing, and stockpiling of coal and overburden.	Runoff of water which has come into contact with the carboniferous material will contain various pollutants that may contaminate downstream river reaches.	Aquatic Ecology	Operational	▪ Diversion trench and berm systems which diverts clean storm water around pollution sources and convey and contain dirty water to central pollution control impoundments; ▪ Barrier systems, including synthetic, clay and geological or other approved mitigation methods to minimise contaminated seepage and runoff from stockpiles and pollution control facilities from entering the local aquatic systems; ▪ Where storm water enters river systems from disturbed sites, sediment and debris trapping, as well as energy dissipation control measures must be put in place; ▪ The planting of indigenous vegetation around pollution control impoundments and structures should be completed as this has been shown to be effective in erosion and nutrient control; ▪ Ensure that all the dirty water emanating from the dirty water areas be collected in the PCD for re-use within the mine, to prevent unnecessary discharge into the environment; ▪ The dirty water collection trenches should be cleaned regularly to reduce the build up of washed off coal fines and ensure they are able to accommodate and convey the 1:50 year peak flows. This material should be disposed to an appropriate licenced facility ▪ Stockpiling should be monitored so that the side slopes do not encourage erosion of the slopes resulting in silt transported into the trenches from the	Operation Phase.	National Water Act, 1998 (Act No. 36 of 1998).

Activities	Potential impacts	Aspects affected	Phase	Mitigation Measures	Time period for implementation	Compliance with standards
				stockpiles, allowing some silt to settle on the dirty water site rather than in the channels; and ▪ In addition to the control of storm water, water quality supplemented by aquatic ecology monitoring should form part of the system where water in the PCD's and surrounding streams are monitored for quality. This ensures that pollution sources are monitored during the mining process.		
	Runoff could results in contamination of rivers	Surface water	Operational	▪ Vehicles must only be serviced within designated service bays; ▪ The management of general and other forms of waste must ensure collection and disposal into clearly marked skip bins that can be collected by approved contractors for disposal to the appropriate disposal sites; ▪ The fuel, lubricant and explosives storage facilities must be located on a hard standing area (paved or concrete surface that is impermeable), roofed and bunded in accordance with SANS1200 specifications. This will prevent mobilization of leaked hazardous substances; and ▪ An emergency spillage response plan and spill kits should be in place and accessible to the responsible monitoring team. The Material Safety Data Sheets (MSDS) should be kept on site for the Life of Mine for reference to anytime in terms of handling, storage and disposal of materials.	During the entire project life.	SANS1200 specifications.
	Noise disturbance (noise levels in excess of 7 dBA at certain Mpumalanga receptors and noise levels in excess of night time guideline at Gauteng rural receptor)	Noise	Operational	▪ Stripping topsoil and soft overburden (only open cast pit footprint and northernmost hard overburden dump); ▪ Removal of overburden, including drilling and blasting of hard overburden; ▪ Loading, hauling and stockpiling of overburden (only northernmost overburden dump); ▪ Load, haul and stockpiling of ROM coal; and ▪ Hauling coal to siding	Upon commencement of the operational phase	National Noise Control Regulations Gauteng Noise Control Regulations
	Stockpiling of overburden (including topsoil, soft overburden and hard overburden) will have a negative visual impact on the receiving environment. Dust from the stockpiles will also have a negative visual impact. The impact of the stockpiles will occur for the life of the Project. This impact will be reversed when the material from the stockpiles is used to backfill the open pit (soft overburden and hard overburden) and rehabilitate the Project area (topsoil) during the decommissioning and closure phase.	Visual	Operational	▪ Limit the speed of vehicles on the haul roads to reduce dust; and ▪ Haul roads should be wetted frequently by means of a water bowser to suppress dust.	Operational Phase	To minimise the negative visual impacts caused by loading and hauling overburden (including topsoil, soft overburden and hard overburden).

Activities	Potential impacts	Aspects affected	Phase	Mitigation Measures	Time period for implementation	Compliance with standards
Drilling, blasting, stockpiles, crushing, loading, hauling	Reduction in catchment yield	Surface water	Operational	▪ Effective surface water management whereby all clean water is diverted into the nearby streams	Design and operational phase	Based on the GN 704 requirements regarding stormwater management for mining activities it is noted that all clean and dirty water must be separated. The clean water diversion will be sized to accommodate the 1:50 year storm event. The containment facility should be sized to accommodate the anticipated dirty water runoff as a result of the 1:50 year storm event.
	Runoff could results in contamination of rivers	Surface water	Operational	▪ Vehicles must only be serviced within designated service bays; ▪ The management of general and other forms of waste must ensure collection and disposal into clearly marked skip bins that can be collected by approved contractors for disposal to the appropriate disposal sites; ▪ The fuel, lubricant and explosives storage facilities must be located on a hard standing area (paved or concrete surface that is impermeable), roofed and bunded in accordance with SANS1200 specifications. This will prevent mobilization of leaked hazardous substances; and ▪ An emergency spillage response plan and spill kits should be in place and accessible to the responsible monitoring team. The Material Safety Data Sheets (MSDS) should be kept on site for the Life of Mine for reference to anytime in terms of handling, storage and disposal of materials.	During the entire project life.	SANS1200 specifications.
	Groundwater contamination	Groundwater	operational	▪ Overburden and discard stockpiles should be managed to minimise infiltration of contaminants to the groundwater. ▪ The vegetation of the stockpile and covering them with soil to minimise rainfall infiltration and mobilisation of dissolved metals. ▪ Groundwater monitoring.		
	Reduced air quality due to dust generation	Air Quality	Operational	▪ The drop heights when loading onto trucks and at tipping points should be minimised; ▪ The use of dust suppressants and binders on haul roads to reduce dust generation; ▪ There is need to set maximum speed limits on haul roads and to have these limits enforced.	Measurement must commence prior to the start of operation and for the project life.	National Environmental Management: Air Quality Act, Act.39 of 2004; Ambient air quality - Limits for common pollutants, SANS1929:2005. National Environmental Management: Air Quality Act (Act.39 of 2004) – Listed Activities and Associated Minimum Emission Standard, 2013.
	Noise disturbance (noise levels in excess of 7 dBA at certain Mpumalanga receptors and noise levels in excess of night time guideline at Gauteng rural receptor)	Noise	Operational	▪ Stripping topsoil and soft overburden (only open cast pit footprint and northernmost hard overburden dump); ▪ Removal of overburden, including drilling and blasting of hard overburden; ▪ Loading, hauling and stockpiling of overburden (only northernmost overburden dump); ▪ Load, haul and stockpiling of ROM coal; and ▪ Hauling coal to siding	Upon commencement of the operational phase	National Noise Control Regulations Gauteng Noise Control Regulations

Activities	Potential impacts	Aspects affected	Phase	Mitigation Measures	Time period for implementation	Compliance with standards
	Stockpiling of ROM coal will have a negative visual impact on the receiving environment. Dust from the stockpiles will also have a negative visual impact.	Visual	Operational	▪ Limit the footprint area of the ROM coal stockpile where possible; ▪ Ensure the ROM coal stockpile does not exceed the proposed height of 10 m; ▪ Limit the quantity and time of ROM coal stored on site; and ▪ Apply dust suppression techniques to limit dust generated from the ROM coal stockpile.	Operational Phase	To minimise the negative visual impacts caused by stockpiling of ROM coal.
	Plant area lighting at night will have a negative visual impact on the receiving environment. The plant area lighting will be visible at night and will draw attention to the Project area. This will also have a negative impact on the sense of place.	Visual	Operational	▪ Down lighting must be implemented for operational activities taking place at night to minimise light pollution; and ▪ Ensure the product stockpile does not exceed the proposed height of 10 m.	Operational Phase	To minimise the negative visual impacts caused by operation of the washing plant.
	Disposal of discard from the washing plant on the discard dump will have a negative visual impact on the receiving environment. The impact of the discard dump will occur for the life of the Project. This impact will be reversed if the material from the discard dump is re-washed or used to backfill the open pit during the decommissioning and closure phase.	Visual	Operational	▪ Ensure the discard dump does not exceed the proposed height of 20 m.	Operational Phase	To minimise the negative visual impacts caused by operation of the discard dump.
	Loss of access to burial grounds and degradation on intrinsic value	Heritage	Operation	▪ Reduce through the completion of a BGGC process and compilation / implementation of a CMP	Pre-construction	NHRA Section 36 Chapters XI and IX of the NHRA Regulations
General Operational Activities	Job creation	Social	Operational	▪ Assign preferred employment status to those experiencing the bulk of the negative project impacts (communities located within and surrounding the Project footprint e.g. Palmietkuilen Community, Vischkuil, Endicott, Welgedacht, Slovo Park, etc.); ▪ Promotion of local, female and youth employment to achieve and where feasible exceed the targets set out by the Mining Charter; ▪ Where possible labour-intensive construction methods should be promoted; ▪ Verification of local residential status through consultation with appropriate authorities (e.g. municipal structures, community leaders, and landowners) ▪ Consult neighbouring businesses/mines to determine if they would be willing to make their skills registers available; ▪ Identify required core skills, expand skills audits to community and align and implement training and skills development initiatives to findings of audit; ▪ Expand skills development programmes, especially ABET programmes, to include surrounding communities;	Pre-construction	Mineral and Petroleum Resource Development Act (Act of 2002). National Environmental Management Act (Act of 1998 Employment Equity Act, 1998 (Act No. 55 of 1998); Basic Conditions of Employment Act, 1997 (Act No. 75 of 1997); Labour Relations Act, 1995 (Act No. 66 of 1995); Skills Development Act (Act No. 97 of 1998 as amended); and Company employment policies.

Activities	Potential impacts	Aspects affected	Phase	Mitigation Measures	Time period for implementation	Compliance with standards
				▪ Recruitment via a registry of job seekers and potentially coordinated through the DoL; ▪ Provide local employees with reference letters certificates of completion for in-house (on-the-job) training; ▪ Monitor subcontractors in terms of local employment targets; ▪ Provide focused training to construction phase employees from the host communities to increase their chances for employment during the operations; ▪ The Project's database of the local labour pool should be updated to include people who were employed by the Project during the construction phase.		
	Stimulation and growth of the local and district economies	Social	Operational	▪ Assign preferred employment status to those experiencing the bulk of the negative project impacts (communities located within and surrounding the Project footprint e.g. Palmietkuilen Community, Vischkuil, Endicott, Welgedacht, Slovo Park, etc.); ▪ Promotion of local, female and youth employment to achieve and where feasible exceed the targets set out by the Mining Charter; ▪ Where possible labour-intensive construction methods should be promoted; ▪ Verification of local residential status through consultation with appropriate authorities (e.g. municipal structures, community leaders, and landowners) ▪ Consult neighbouring businesses/mines to determine if they would be willing to make their skills registers available; ▪ Identify required core skills, expand skills audits to community and align and implement training and skills development initiatives to findings of audit; ▪ Expand skills development programmes, especially ABET programmes, to include surrounding communities; ▪ Recruitment via a registry of job seekers and potentially coordinated through the DoL; ▪ Provide local employees with reference letters certificates of completion for in-house (on-the-job) training; ▪ Monitor subcontractors in terms of local employment targets; ▪ Provide focused training to construction phase employees from the host communities to increase their chances for employment during the operations; ▪ The Project's database of the local labour pool should be updated to include people who were employed by the Project during the construction phase.	Pre-construction	Mineral and Petroleum Resource Development Act (Act of 2002). National Environmental Management Act (Act of 1998 Employment Equity Act, 1998 (Act No. 55 of 1998); Basic Conditions of Employment Act, 1997 (Act No. 75 of 1997); Labour Relations Act, 1995 (Act No. 66 of 1995); Skills Development Act (Act No. 97 of 1998 as amended); and Company employment policies.
	Dependency on the mine for sustaining the local economy	Social	Operational	▪ Assign preferred employment status to those experiencing the bulk of the negative project impacts	Pre-construction	Mineral and Petroleum Resource Development Act (Act of 2002).

Activities	Potential impacts	Aspects affected	Phase	Mitigation Measures	Time period for implementation	Compliance with standards
				(communities located within and surrounding the Project footprint e.g. Palmietkuilen Community, Vischkuil, Endicott, Welgedacht, Slovo Park, etc.); ▪ Promotion of local, female and youth employment to achieve and where feasible exceed the targets set out by the Mining Charter; ▪ Where possible labour-intensive construction methods should be promoted; ▪ Verification of local residential status through consultation with appropriate authorities (e.g. municipal structures, community leaders, and landowners) ▪ Consult neighbouring businesses/mines to determine if they would be willing to make their skills registers available; ▪ Identify required core skills, expand skills audits to community and align and implement training and skills development initiatives to findings of audit; ▪ Expand skills development programmes, especially ABET programmes, to include surrounding communities; ▪ Recruitment via a registry of job seekers and potentially coordinated through the DoL; ▪ Provide local employees with reference letters certificates of completion for in-house (on-the-job) training; ▪ Monitor subcontractors in terms of local employment targets; ▪ Provide focused training to construction phase employees from the host communities to increase their chances for employment during the operations; ▪ The Project's database of the local labour pool should be updated to include people who were employed by the Project during the construction phase.		National Environmental Management Act (Act of 1998 Employment Equity Act, 1998 (Act No. 55 of 1998); Basic Conditions of Employment Act, 1997 (Act No. 75 of 1997); Labour Relations Act, 1995 (Act No. 66 of 1995); Skills Development Act (Act No. 97 of 1998 as amended); and Company employment policies.
	Impact on Production	Macro-economic	Operational	▪ Procurement of goods and services from local business where feasible, will increase benefits to the local economy, but will not change the rating.	Throughout LOM	Mineral and Petroleum Resource Development Act (Act of 2002). National Environmental Management Act (Act of 1998 Employment Equity Act, 1998 (Act No. 55 of 1998); Basic Conditions of Employment Act, 1997 (Act No. 75 of 1997); Labour Relations Act, 1995 (Act No. 66 of 1995); Skills Development Act (Act No. 97 of 1998 as amended); and Company employment policies.
	Impact on GDP	Macro-economic	Operational	▪ Explore local procurement prospects.	Throughout LOM	Mineral and Petroleum Resource Development Act (Act of 2002). National Environmental Management Act (Act of 1998 Employment Equity Act, 1998 (Act No. 55 of

Activities	Potential impacts	Aspects affected	Phase	Mitigation Measures	Time period for implementation	Compliance with standards
						1998); Basic Conditions of Employment Act, 1997 (Act No. 75 of 1997); Labour Relations Act, 1995 (Act No. 66 of 1995); Skills Development Act (Act No. 97 of 1998 as amended); and Company employment policies.
	Impact on Employment	Macro-economic	Operational	▪ Employ local labour to increase benefit to the local community	Throughout LOM	Mineral and Petroleum Resource Development Act (Act of 2002). National Environmental Management Act (Act of 1998 Employment Equity Act, 1998 (Act No. 55 of 1998); Basic Conditions of Employment Act, 1997 (Act No. 75 of 1997); Labour Relations Act, 1995 (Act No. 66 of 1995); Skills Development Act (Act No. 97 of 1998 as amended); and Company employment policies.
	Impact on Skills Development	Macro-economic	Operational	▪ The mine is required by law to adhere to the provisions detailed in the Social and Labour Plan – no augmentation measures required	Throughout LOM	Mineral and Petroleum Resource Development Act (Act of 2002). National Environmental Management Act (Act of 1998 Employment Equity Act, 1998 (Act No. 55 of 1998); Basic Conditions of Employment Act, 1997 (Act No. 75 of 1997); Labour Relations Act, 1995 (Act No. 66 of 1995); Skills Development Act (Act No. 97 of 1998 as amended); and Company employment policies.
	Impact on Household Income	Macro-economic	Operational	▪ Investigate opportunities to increase local procurement and localise mine's expenditure; and ▪ Explore opportunities to employ as many people from the local communities as possible	Throughout LOM	Mineral and Petroleum Resource Development Act (Act of 2002). National Environmental Management Act (Act of 1998 Employment Equity Act, 1998 (Act No. 55 of 1998); Basic Conditions of Employment Act, 1997 (Act No. 75 of 1997); Labour Relations Act, 1995 (Act No. 66 of 1995); Skills Development Act (Act No. 97 of 1998 as amended); and Company employment policies.
	Impact on Government Revenue	Marco-economic	Operational	▪ No enhancement	Throughout LOM	Mineral and Petroleum Resource Development Act (Act of 2002). National Environmental Management Act (Act of 1998 Employment Equity Act, 1998 (Act No. 55 of 1998);

Activities	Potential impacts	Aspects affected	Phase	Mitigation Measures	Time period for implementation	Compliance with standards
						Basic Conditions of Employment Act, 1997 (Act No. 75 of 1997); Labour Relations Act, 1995 (Act No. 66 of 1995); Skills Development Act (Act No. 97 of 1998 as amended); and Company employment policies.
Demolition of the infrastructure	Loss of topsoil – erosion, compaction, land capability and land use	Soils, Land Use and Land Capability	Decommissioning	▪ Compacted areas must be ripped to loosen the soil structure; ▪ Implement rehabilitation measures as defined in rehabilitation report; ▪ Topsoil should be replaced for rehabilitation purposes only; and ▪ Stockpiles should be used for their designated final purposes.	Decommissioning and Rehabilitation	Chamber of Mines Guidelines
	Contamination of water by dirty runoff	Surface water	Decommissioning	▪ Effective surface water management whereby all clean water is diverted into the nearby streams	Design and decommissioning phase	Based on the GN 704 requirements regarding stormwater management for mining activities it is noted that all clean and dirty water must be separated. The clean water diversion will be sized to accommodate the 1:50 year storm event. The containment facility should be sized to accommodate the anticipated dirty water runoff as a result of the 1:50 year storm event.
	Siltation of surface water resources due to increased erosion from exposed surfaces	Surface water	Decommissioning	▪ Vehicles must only be serviced within designated service bays; ▪ The management of general and other forms of waste must ensure collection and disposal into clearly marked skip bins that can be collected by approved contractors for disposal to the appropriate disposal sites; ▪ The fuel, lubricant and explosives storage facilities must be located on a hard standing area (paved or concrete surface that is impermeable), roofed and bunded in accordance with SANS1200 specifications. This will prevent mobilization of leaked hazardous substances; and ▪ An emergency spillage response plan and spill kits should be in place and accessible to the responsible monitoring team. The Material Safety Data Sheets (MSDS) should be kept on site for the Life of Mine for reference to anytime in terms of handling, storage and disposal of materials.	During the entire project life.	SANS1200 specifications.
	Similarly to the construction and operational phase, the decommissioning and rehabilitation activities occurring within an ecologically sensitive catchment pose significant potential negative impacts to functioning wetlands and catchment. Furthermore, the rehabilitated area could cause major negative impacts due to spread of alien invasive vegetation,	Wetlands	Decommissioning	▪ The haul roads and servitude must also have well-designed stream crossings and drainage areas, which should be maintained. The wetlands outside of this must be demarcated as no-go areas. ▪ Dust management programme must be in place (Air Quality Report, Digby Wells, 2016a) ▪ The haul roads and servitude must be monitored and maintained to best operating standards. This should be done in the dry season.	Design and Rehabilitation phase	Section 19 of the NWA Section 21 (c), (g) and (i) of the NWA Section 24 of the Constitution NEM:BA NEMA Department of Water and Forestry (DWAF) guidelines for the delineation of wetlands (2005); Mining and Biodiversity Guideline (DEA et

Activities	Potential impacts	Aspects affected	Phase	Mitigation Measures	Time period for implementation	Compliance with standards
	increased soil compaction erosion and subsequent sedimentation into the wetland ecosystems.			▪ The wetland must be monitored on a regular basis to ensure no residual impact to the wetland and river is realised; and if so that remediation measures are followed. ▪ If possible, truck loads should be covered; particularly in dry and windy seasons. ▪ Berms must be maintained as a buffer between the coal handling area and the sensitive receiving environment.		al., 2013).
	Road-kills and disturbance of fauna	Flora and Fauna	Decommissioning	▪ Erection of signage; ▪ Implementing speed limit on site; and ▪ Restricting driving at night	Signage should be erected before the operational phase.	National Environmental Management Act (NEMA),1998 (Act 107 of 1998); and National Environmental Biodiversity Act (NEMBA),2004 (Act10 of 2004)
	Reduced air quality due to dust generation from rehabilitation and wind erosion	Air Quality	Decommissioning	▪ The dismantling area disturbed must be kept to a minimum; ▪ Drop heights when offloading must be minimised; ▪ Limit demolition activities to non-windy days; Rehabilitated landscape should be vegetated; and ▪ Use of dust suppressant on dirt roads and exposed areas.	Measurement must commence prior to the decommissioning operation and few month after it ends.	National Environmental Management: Air Quality Act, Act.39 of 2004, 2004; National Environmental Management: Air Quality Act, 2004 (Act No. 39 of 2004), National Dust Control Regulations (2013).
	Noise disturbance (noise levels in excess of 7 dBA at certain Mpumalanga receptors and noise levels in excess of night time guideline at Gauteng rural receptor)	Noise	Decommissioning	▪ Restricting decommissioning activities to daylight hours (06:00 – 18:00) and not during weekends and public holidays; ▪ Mining related machines and vehicles to be serviced to the designed requirements of the machinery/vehicles to ensure noise suppression mechanisms are effective e.g. installed exhaust mufflers; and ▪ Switching off equipment when not in use.	Upon commencement of the closure phase	National Noise Control Regulations Gauteng Noise Control Regulations
	Demolition and removal of all infrastructure will have a negative visual impact on the receiving environment. Dust from the demolition process will also have a negative visual impact. Once the infrastructure is removed and rehabilitation of the disturbed areas is complete, there will be an overall neutral visual impact on the receiving environment.	Visual	Decommissioning	▪ Apply dust suppression techniques to limit the dust from the demolition area; ▪ Use shade cloth/netting to screen the demolition area; ▪ Ensure all infrastructure is demolished and removed from the site; ▪ Limit the quantity and time of rubble stored on site; and ▪ Rehabilitate all disturbed areas.	Decommissioning and Closure Phase	To increase the neutral visual impacts caused by demolition and removal of all infrastructure.
Rehabilitation of the project area	Loss of topsoil – erosion, compaction and land capability	Soils, Land Use and Land Capability	Decommissioning	▪ Compacted areas must be ripped to loosen the soil structure; ▪ Implement rehabilitation measures as defined in rehabilitation report; ▪ Topsoil should be replaced for rehabilitation purposes only; and ▪ Stockpiles should be used for their designated final purposes.	Decommissioning and Rehabilitation	Chamber of Mines Guidelines
	Habitat fragmentation and increased establishment of alien plant species.	Flora and Fauna	Decommissioning	▪ Alien management plan.	Alien management plan to be implemented after construction quarterly for 2 years and after decommissioning	National Environmental Management Act (NEMA),1998 (Act 107 of 1998); and National Environmental Biodiversity Act (NEMBA),2004 (Act10 of 2004).

Activities	Potential impacts	Aspects affected	Phase	Mitigation Measures	Time period for implementation	Compliance with standards
					quarterly for two years.	
	Rehabilitation (including spreading of soil, re-vegetation and profiling or contouring) will have a negative visual impact on the receiving environment. Once coal is removed from the open pit there will be insufficient material to backfill the open pit completely and a void will remain. This will result in a permanent and irreversible negative visual impact on the receiving environment. This impact will be reduced if the Project area is re-contoured and profiled to create a free-draining topography. Once rehabilitation is complete and the Project area has re-contoured and profiled to create a free-draining topography there will be an overall neutral visual impact on the receiving environment.	Visual	Decommissioning	▪ Ensure that the open pit is backfilled with material from the overburden stockpiles; ▪ Rehabilitate all disturbed areas; ▪ Ensure that the rehabilitated area is re-contoured and profiled to create a free-draining topography; ▪ Spread topsoil over the rehabilitated area; ▪ Ensure that surface water and drainage lines are rehabilitated; ▪ Re-vegetate the rehabilitated areas with grasses (Andropogon appendiculatus, Andropogon eucomus, Andropogon huillensis, Aristida congesta subsp. Barbicollis, Arundinella nepalensis, Cynodon dactylon, Eragrostis capensis, Eragrostis curvula, Eragrostis gummiflua, Eragrostis racemose, Fingerhuthia Africana, Hyparrhenia hirta, Hyparrhenia tamba, Imperata cylindrical, Melinis repens, Paspalum dilatatum, Setaria sphacelata, Sporobolus africanus, Sporobolus pyramidalis, Themeda triandra, Trichoneura grandiglumis and Tristachya leucothrix); and ▪ Ensure all the mitigation/management actions outlined in the Closure and Rehabilitation reports are conducted.	Decommissioning and Closure Phase	To increase the neutral visual impacts caused by rehabilitation (including spreading of soil, re-vegetation and profiling or contouring).
Post-closure monitoring	Loss of topsoil – erosion, fertility and compaction	Soils, Land Use and Land Capability	Post-closure	▪ The rehabilitated areas must be assessed once a year for compaction, erosion and fertility; ▪ Compacted areas must be ripped to loosen the soil structure; ▪ Only designated access routes should be used to reduce any unnecessary compaction; and ▪ Corrective actions must be taken to minimise any further erosion from taking place	Post-Closure	Chamber of Mines Guidelines
	Groundwater Contamination after closure	Groundwater	Post Closure	▪ Capture decant before joining the streams; treat it and re-introduce it into the tributaries; ▪ Management solutions should be provided by AOL following an agreement with the farmers or communities with impacted rivers; and ▪ Groundwater monitoring.	Post-Closure	Compliance to the WULA once approved
	Mine decanting and contamination of surface water bodies	Groundwater	Post Closure	▪ Ensure that backfilled areas are rehabilitated and revegetated; ▪ Affected receptors should be compensated; ▪ Groundwater monitoring, to assess the time series water level and quality impacts and trends; and ▪ Update the numerical model as more groundwater information is collected.	Post-Closure	SANS. River quality objectives. South African water quality guidelines for drinking, irrigation and livestock watering.
	Post-mining water decant is predicted to occur once the final void has been rehabilitated and groundwater levels are allowed to return back to natural level. It is anticipated that this decant will be acid forming (acid mine draining, AMD).	Wetlands	Post-closure	▪ Long-term passive / active water treatment options will need to be investigated by AOL to prevent untreated AMD decant water from entering the catchment. ▪ Groundwater and wetlands must be monitored post-mining for potential decant. ▪ Rehabilitation and remediation actions must be in place to respond to any decant or AMD discharge	Rehabilitation and closure phase	Section 19 of the NWA Section 21 (c), (g) and (i) of the NWA Section 24 of the Constitution NEM:BA NEMA Department of Water and Forestry (DWAF) guidelines for the delineation of wetlands (2005);

Activities	Potential impacts	Aspects affected	Phase	Mitigation Measures	Time period for implementation	Compliance with standards
				that is unforeseen.		Mining and Biodiversity Guideline (DEA et al., 2013).
	Post-mining decant of groundwater will have negative impacts on the downstream water quality.	Aquatic Ecology	Post-closure	▪ Water treatment options.	Closure and decommissioning phase.	National Water Act ,1998 (Act No. 36 of 1998).

7 Financial provision

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

Regulation 6 of the Financial Provision Regulations (GN R1147 in GG 39425 of 20 November 2015) requires that an applicant for a mining right must determine the financial provision calculation based on the actual costs required for:

- Annual rehabilitation;
- Final rehabilitation, decommissioning and closure; and
- The remediation of latent or residual environmental impacts including but not limited to the pumping and treatment of polluted or extraneous water.

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 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.

The following points outline the main objectives for rehabilitation and closure:

- Achieve a final land use that is sustainable and meets both legislative requirements and stakeholder needs.
- 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 AOL in carrying out successful rehabilitation for the proposed Palmietkuilen Coal Mine.

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

The Closure report will be made available for public review and comment with this draft EIA Report. All comments received will be captured in the final EIA.

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

Refer to Appendix Q for the complete Rehabilitation Plan associated with the Project.

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 was calculated according to Regulation 6 of the Financial Provision Regulations (2015) which prescribe the minimum content requirements.

The financial provision estimate was calculated based on the Financial Provision Regulations (GNR. 1147). The estimated financial provision required for the rehabilitation and closure of the Palmietkuilen Mine is **R 162 441 981.00** (Year 10) and **R 330 475 001.00** (LoM) **excl. VAT**. The financial provision estimate associated with the LoM and Year 10 of operations is included in the Table 7-1 below.

Table 7-1: Canyon Coal Financial Provision Summary

Area and Description	Year 10 of Operation 2026	End of Life 2069
Infrastructure and Rehabilitation		
Area 1: Mine Office	R297 709	R297 709
Area 2: Plant infrastructure	R2 528 445	R2 792 798
Area 3: Mining and Related areas	R131 113 650	R275 428 583
Area 4: Linear infrastructure	R2 418 734	R2 418 734
Sub-total	**R136 358 539**	**R280 937 825**
Monitoring and Maintenance		
Monitoring Costs (Groundwater and Surface water 5 Years)	R1 595 900	R1 427 600
Monitoring Costs (Vegetation 3 Years)	R67 809	R79 563
Maintenance Costs (Vegetation 3 Years)	R2 602 367	R3 079 962
Sub-total	**R4 266 076**	**R4 587 124**
Project Management (6%)	R8 181 512	R16 856 269
Contingency (10%)	R13 635 854	R28 093 782
GRAND TOTAL (Excl. VAT)	**R162 441 981**	**R330 475 001**

7.1.6 1.1.1 Item (i)(1)(f): Confirm that the financial provision will be provided as determined

Provided the mining right is granted, AOL will be responsible to 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

AOL 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 8-7.

8.1 Item 1(g): Monitoring of impact management actions

8.1.1 Soils, Land Use and Land Capability

Soil monitoring plan guidelines should be put in place to ensure that rehabilitation is a success from a soils perspective. The monitoring plan for soils must contain the following:

- The location of soil types that can be stripped and stockpiled together;
- Stripping depths of different soil types; and
- The location, dimensions and volumes of planned stockpiles for different soil types.

Monitoring should always be carried out at the same time of the year. Soils should be sampled and analysed for the following parameters:

- pH (KCl);
- Phosphorus (Bray 1);
- Cations: Calcium, Magnesium, Potassium, Sodium, Zin (mg/kg);
- Cation exchange capacity (CEC);
- Soil organic carbon (%); and
- Soil texture (Clay, Silt and Sand).

The following maintenance is required:

- Repair any damage caused by erosion;
- Traffic should be limited were possible while the vegetation is establishing;
- Replace dead plant material;
- The area must be fenced and animals should be kept off the area until the vegetation is self-sustaining;
- Fertilize grassed area with nitrogen containing fertiliser after germination of seeds;
- If soil is polluted, treat the pollution by means of in-situ bio-remediation; 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 at an appropriate, permitted or licensed disposal facility.

8.1.2 Flora and Fauna

The following aspects were identified in the Flora and Fauna report that require monitoring:

- The impacts on vegetation structure and health
- Impacts on faunal populations and numbers;
- Red Data Listed fauna and flora species (should it be recorded going forward);
- The establishment of alien plant species; and
- The success of rehabilitation activities.

This should be completed by a qualified Terrestrial Ecologist. The monitoring should be undertaken annually.

8.1.3 Surface Water

A surface water monitoring programme is essential as a tool to assist any management plan and to detect negative impacts as they arise and to ensure that the necessary mitigation measures are operating effectively. It also ensures that storm water management structures are in working order. Monitoring should be implemented throughout the life of the mine.

The impacts on water quality will be determined by comparing the monitoring data against the mine WUL, when issued.

Water quality monitoring is recommended at the locations provided in Table 8-1

Table 8-1: Proposed water quality monitoring sites

Point Name	Latitude*	Longitude*
AECSW06	-26.269461	28.523228
SW1	-26.274339	28.572975
SW2	-26.231863	28.55844
Aston Lake	-26.253233	28.527422

The following elements should be monitored:

- **Water quality** - Water quality parameters that need to be analysed are shown in Table 8-2 below;
- **Water quantity** - Monitoring water levels in dams and channels. Records of Pit dewatering should also be kept.
- **Physical structures and SWMP performance** - Personnel should walk around facilities to determine the facilities conditions and pick out any anomalies such as

leaks or overflows and system malfunctions. Dams should be inspected for silting and blockages of inflows, pipelines for hydraulic integrity; monitor the overall SWMP performance.

- **Meteorological data** – Rainfall should be measured.

Table 8-2: Constituents Recommended for Water Quality Analysis

pH Value @ 20°C	Bicarbonate, HCO_3
Sodium, Na	Sodium Absorption Ratio (SAR)
Conductivity mS/m @ 25°C	Chloride, Cl
Potassium, K	Aluminium, Al
Total Dissolved Solids	Sulphate, SO_4
Free and Saline Ammonia as NH_4	Manganese, Mn
Calcium, Ca	Nitrate, NO_3
Magnesium Hardness as $CaCO_3$	Iron, Fe
Calcium Hardness as $CaCO_3$	Fluoride, F
Total Hardness as $CaCO_3$	Chromium, Cr
Langelier Saturation Index (pH-pHs)	Total Suspended Solids
Total Alkalinity as $CaCO_3$	Phosphorus, P
Dissolved Metals using Inductive Coupled Plasma Scan	

8.1.3.1 Proposed Storm Water Management Measures

A SWMP was compiled for the Project area, which covered the clean and dirty water control requirements based on the placement of the proposed infrastructure (refer to Plan 2 above), these areas are indicated in Table 8-3 below.

Table 8-3: Clean and Dirty Area Classification

Area Classification	Mine Areas
Clean runoff areas	Plant offices and mine offices
	Areas within the mine but upstream and downstream of the dirty areas
	Mining contractors yard (paved areas)
Dirty Areas	Overburden stockpiles and product stockpiles
	Pollution Control Dam (PCD)
	Open pit (a source of dirty water through dewatering)
	Haul road and weigh bridge

Area Classification	Mine Areas
	Diesel storage
	Mining Contractor's yard vehicle workshop
	Plant infrastructure, conveyors and slurry dam
	Discard dump

In order to meet the design principles detailed in the GN704 and the BPG G1, the following storm water management measures will be implemented:

- Clean water diversion berms to divert clean water to the downstream environment or nearby watercourse away from the infrastructure area;
- Dirty water channels and berms around all stockpile areas, discard dump areas, contractors camp areas and plant areas, such that all dirty water is captured and contained in the PCD;
- A PCD which will capture and contain dirty water runoff from the afore mentioned dirty areas; and
- Two proposed silt traps/sumps to collect water before it is conveyed to the PCD. This controls siltation of the PCD.

8.1.3.1.1 Peak Flows Catchment Characteristics

A summary of the catchment characteristics together with the estimated peak flows required to size the proposed clean water diversion channels, the dirty water channels and the river diversions are presented in Table 8-4.

Table 8-4 Summary of Catchment Characteristics and Peak Flows

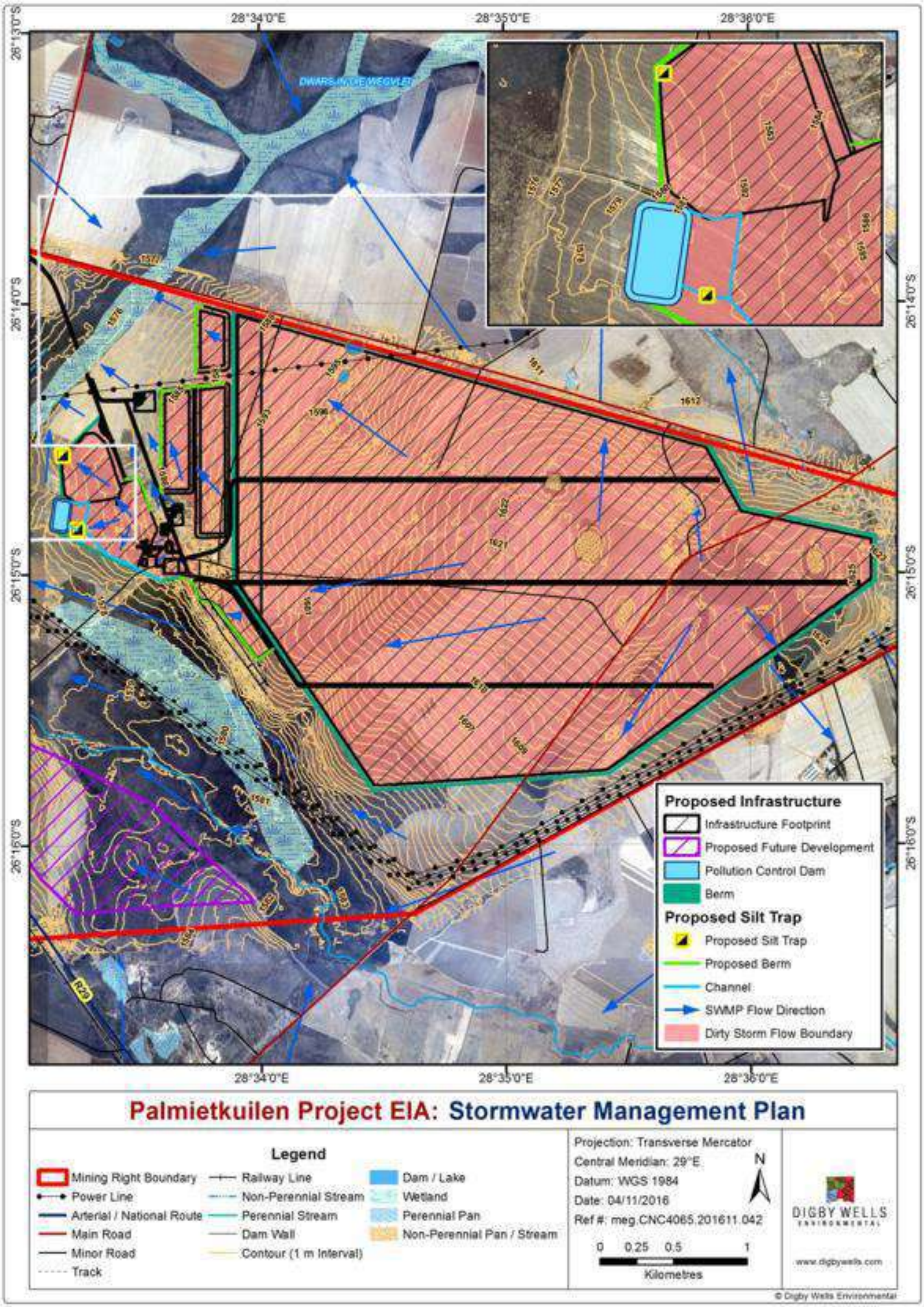
Dirty catchments areas	Area km^2	Longest watercourse (km)	Height difference dz (m)	1:50 year peak flow (m^3/s)	1:100 year peak flow (m^3/s)	Time of Concentration Tc (hr)
Soft and hard stockpiles	0.598	1	8	5.085	6.586	1.06
Plant area	0.672	1.25	13	5.523	7.153	1.1
Workshop	0.002	0.125	1	0.041	0.053	0.24
Open pit	9.103	3.75	33	71.55	92.26	1.15

Figure 8-1 below indicates some examples of trenches for dirty water with berms to ensure clean and dirty water separation occurs.

Figure 8-1: Examples of a Dirty Water Trenches and Clean Water Berms

8.1.3.1.2 SWMP

A layout showing the proposed storm water controls mentioned above is presented in Plan 66. The proposed SWMP measures and operational management measures per infrastructure type are presented in the Surface Water Assessment attached as Appendix D.



Plan 66: Proposed Storm Water Management Plan

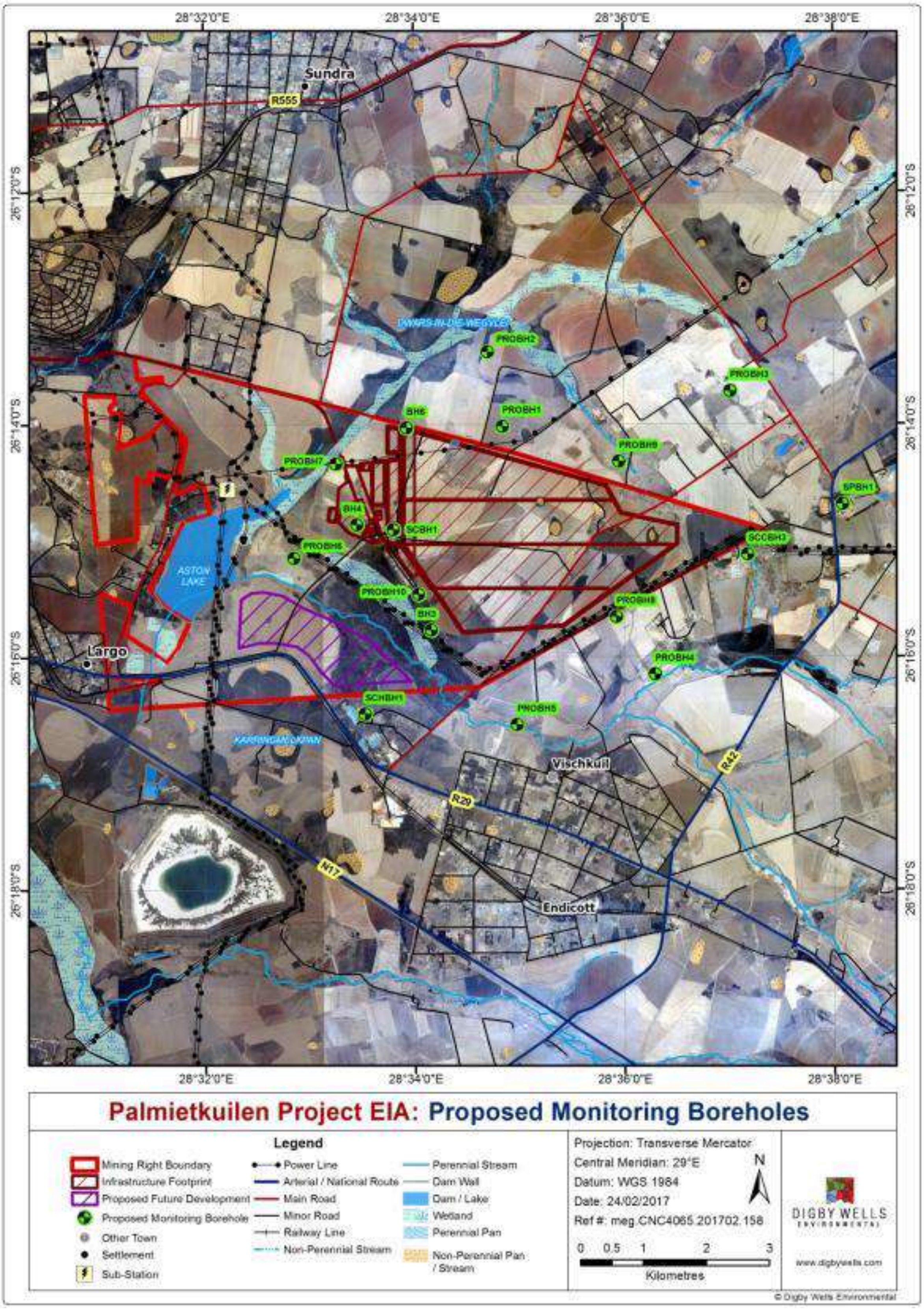
8.1.4 Groundwater

A groundwater monitoring programme is essential to establish the impact of mine dewatering on the local aquifers as well as assess the groundwater quality trends. This is achieved through monitoring of groundwater levels and through sampling and laboratory analysis of groundwater quality.

It is proposed that groundwater monitoring be undertaken according to the schedule provided in Plan 67 below. The proposed monitoring boreholes are strategically located up gradient and down gradient of the predicted contamination plume and cone of depression.

Table 8-5: Proposed Groundwater Monitoring Boreholes

No.	Borehole	Existing / Proposed	Latitude	Longitude
1	BH6	Existing	-43419.9	-2902810
2	BH3	Existing	-43019.6	-2906022
3	BH4	Existing	-44204	-2904353
4	SCBH1	Existing	-43624.3	-2904428
5	SCCBH3	Existing	-37992.3	-2904809
6	SCHBH1	Existing	-44071.9	-2907355
7	SPBH1	Existing	-36488	-2904007
8	PROBH1	Proposed	-41895.9	-2902784
9	PROBH10	Proposed	-43219.2	-2905456
10	PROBH2	Proposed	-42133	-2901599
11	PROBH3	Proposed	-38277.2	-2902215
12	PROBH4	Proposed	-39462.4	-2906719
13	PROBH5	Proposed	-41658.9	-2907525
14	PROBH6	Proposed	-45198.6	-2904886
15	PROBH7	Proposed	-44534.9	-2903385
16	PROBH8	Proposed	-40078.7	-2905802
17	PROBH9	Proposed	-40047.1	-2903337



Plan 67: Proposed Groundwater Monitoring Boreholes

8.1.4.1 Water Level

Groundwater levels must be recorded on a quarterly basis using a dip meter to detect any changes or trends in groundwater elevation and flow direction.

8.1.4.2 Water Sampling and Preservation

When sampling the following procedures are proposed:

- One litre plastic bottles with a cap are required for the sampling exercises; and
- Sample bottles should be marked clearly with the borehole name, date of sampling and the sampler's name and submitted to a SANAS accredited laboratory.

8.1.4.3 Sampling Frequency

Groundwater is a slow-moving medium and drastic changes in the groundwater composition are rarely encountered. Considering the proximity of private boreholes and streams to the proposed mine, monitoring should be conducted monthly to reflect influences of wet and dry seasons. The sampling frequency could be adjusted following the trend analysis.

Samples should be collected by using best practice guidelines and should be analysed by a SANAS accredited laboratory.

Post closure monitoring should continue on monthly basis until a sustainable situation is reached and after it has been signed off by the authorities.

8.1.4.4 Parameters to be Monitored

The following constituents are recommended:

- analysis i.e. Ca, Mg, Na, K, SO_4, NO_3, F, Cl;
- Initial full suite metals and then Al, As, Ba, Cu, Se, Pb, Fe, and other metals identified according to results of the initial analyses;
- pH and Alkalinity; and
- TDS and EC.

8.1.5 Wetlands

Monitoring of the wetlands and mining activities is important to detect any predicted or unforeseen impacts to these sensitive systems and to understand the impact so that a remedial action can be carried out. Mining is an important activity for the economic growth of South Africa but has the potential to have impacts far beyond the boundaries of the project area and longer than the life of mine. It is important to manage impacts to the environment and protect the ecosystem services that it provides; and this is particularly important with regards to wetlands and water resources.

The following aspects require monitoring in relation to wetlands:

- General - All impacts and threats to wetlands predicted or not;
- Removal of wetland soils and vegetation; loss of wetland habitat;
- Industrial activity within a natural ecosystem is a negative impact to habitat integrity;
- Perforation of rock and groundwater reserves leading to severe hydrological and geomorphological impacts to wetlands and catchment due to draw down cone;
- Similarly to the construction phase, the operational mining activities occurring within an ecologically sensitive catchment, which pose significant potential negative impacts to functioning wetlands and catchment;
- Similarly to the construction and operational phase, the decommissioning and rehabilitation activities occurring within an ecologically sensitive catchment pose significant potential negative impacts to functioning wetlands and catchment. Furthermore, the rehabilitated area could cause major negative impacts due to spread of alien invasive vegetation, increased soil compaction erosion and subsequent sedimentation into the wetland ecosystems; and
- Post-mining water decant is predicted to occur once the final void has been rehabilitated and groundwater levels are allowed to return back to natural level. It is anticipated that this decant will be acid forming AMD.

8.1.6 Aquatic Ecology

The aquatic ecology monitoring programme should be designed to enable the detection of potential negative impacts brought about by the proposed Project. The monitoring programme objectives are set out in Table 8-6 below.

Table 8-6: Aquatic Ecology Monitoring Objectives

Location	Monitoring objectives	Frequency of monitoring	Parameters to be monitored
Current sites used in this study.	Overall PES.	Bi-annual (dry and wet season)	Standard River Ecosystem Monitoring Programme (Ecostatus) methods.
Current sites used in this study.	Determine if water quality deterioration is occurring.	Bi-annual	SASS5 scores should not decrease as and be related to mining activities.
Site used in this study and the surface water assessment.	Determine if water quality deterioration is occurring.	Monthly	Standard water quality monitoring, as per the surface water specialist report.
Current sites used in	Determine if water/habitat quality	Bi-annual	Monitor for presence of

this study.	deterioration is occurring.		fish.

8.1.7 Air Quality

8.1.7.1 Dust Monitoring Programme

The monitoring of dust deposition rates has been ongoing since September 2015 to date in the vicinity of the proposed Palmietkuilen Mine. It is advised that such monitoring be continued during the project life. This will ensure historical data needed to fully understand and address particulate emissions from the proposed operation. If sources of fugitive dust are managed effectively at the proposed Palmietkuilen Coal Mine, there will be overall reduction in ambient concentration at surrounding receptors.

8.1.7.2 PM_{10} Monitoring Programme

In accordance with the National Dust Control Regulation promulgated in terms of the NEM: AQA 39 of 2004, dust monitoring is vital if a facilities envisage its activities will impact the ambient air quality. However, if the results from the dust monitoring indicate non-compliance with the dust fallout standard, the air quality officer will request continuous monitoring of PM_{10} (refer to Plan 29). Some facilities though adopt a proactive approach and start monitoring once they realise that they are non-compliant. If the latter is the case, data collected can be useful should the mine come under scrutiny from regulatory agencies (proactive approach).

8.1.8 Noise

It is recommended that a noise monitoring programme be implemented upon commencement of the project in order to assess the project’s noise levels on certain surrounding receptors as well as to validate the modelling results. Monitoring should be undertaken in accordance with the National Noise Control Regulations in conjunction with the SANS 10103:2008 guidelines. The locations to be monitoring are N1 and N2 as per the baseline assessment as well as additional noise monitoring location at the small holdings district (Prosperity AH), refer to Plan 30 above.

8.1.9 Visual

The following monitoring activities should be undertaken during the life of mine which will assist with the adverse visual impacts associated with the Project:

- Dust monitoring and management as per the Air Quality Monitoring Plan (reducing the dust on site will reduce the visual impact of dust);
- The existing rows of trees planted near some farm residences as windbreaks/ vegetation screens need to be maintained and protected against fire and utilisation of the vegetation for fire wood, etc.; and

- Grievances from visual receptors must be monitored and addressed through a Grievance Mechanism.

8.1.10 Blasting and Vibrations

A monitoring programme for recording blasting operations is recommended. This process will be mainly for the development of the different decline shafts. 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.

8.1.11 Cultural Heritage

Project specific CFPs must be developed for the Project. The purpose of the CFPs is to establish procedures that aim to minimise damage and destruction to any heritage resources that may be accidentally exposed during the course of development activities.

The CFPs must clearly describe the type of heritage resources that may occur within the site specific project area, the protocol to follow in the event of accidental exposure of previously unidentified heritage resources, and the appropriate management measures and reporting structures to be adhered to. The CFP at a minimum should include the following:

- Definitions as defined by Section 2 and 38(1) of the NHRA;
- Procedures that detail the following:
  - How to spot a chance find;
  - Steps to be undertaken when a chance find is made;
  - Internal reporting structures;
  - Recording of chance finds; and
  - Legal processes and requirements.

The CFPs must be defined and established as a condition of authorisation prior to the pre-construction phase of the proposed Project.

A Heritage Site Management Plan (HSMP) must be developed to monitor and gauge any potential negative impact to identified Palmietkuil South War Cemetery Memorial during the construction and operational phases of the Project.

The HSMP must at a minimum include:

- A detailed baseline record of the condition of identified heritage resources;

- Established a roles and responsibilities matrix;
- Established a monitoring process and schedule; and
- Define the project specific management and monitoring protocol.

8.1.12 Social

It is proposed that a monitoring programme be developed and implemented to monitor the implementation of social management actions. Furthermore, it is recommended that this is conducted by a competent Monitoring and Evaluation (M&E) officer as the implementation of monitoring tools (surveys, databases, etc.) will require specialised skills.

The M&E approach recommended in this section is based on the “inputs-outputs-outcomes-impacts” model, which assesses performance of each level of the "results chain” (Technopolis, 2014). As such, the following four categories of M&E indicators have been defined:

- Input indicators: These indicators measure the quantity, quality, and timeliness of resources – human, financial and material, technological and information – provided for an activity/ project/ programme;
- Output indicators: These indicators measure the quantity, quality, and timeliness of the products – goods or services – that are the short-term results of an activity/ project/ programme;
- Outcome indicators: These indicators measure the intermediate results generated by programme outputs. They often correspond to any change in people’s behaviour as a result of programme; and
- Impact indicators: These indicators measure the quality and quantity of long-term results generated by programme outputs (e.g. measurable change in quality of life, reduced incidence of diseases, increased income, reduced mortality, etc.).

SIA (Appendix M) provides a detailed framework for monitoring the implementation and performance of social management actions. Each indicator is classified in terms of the four categories as defined above. Objective means of verification, optimal frequency of reporting and responsibility for verification are also defined.

8.2 Item 1(h): Monitoring and reporting frequency

Table 9 4 discusses the monitoring and reporting frequency.

8.3 Item 1(i): Responsible persons

The roles and responsibilities associated with the monitoring programme are set out in Table 8-7.

8.4 Item 1(j): Time period for implementing impact management actions

Table 8-7 captures the time period for implementing impact management actions.

8.5 Item 1(k): Mechanism for monitoring compliance

Table 8-7 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 8-7: Monitoring and Management of Environmental Impacts

Activities	Impacts requiring monitoring programmes	Functional requirements for monitoring	Roles and responsibilities (For the execution of the monitoring programmes)	Monitoring and reporting frequency and time periods for implementing impact management actions
Fauna and Flora Monitoring	Impacts on vegetation structure and health; and Impacts on faunal populations and numbers; Red Data Listed fauna and flora species (should it be recorded going forward)	Ensuring sustainable populations of both fauna and flora persist till closure	Terrestrial Ecologist	Annually
Rehabilitation	Success of rehabilitation	Rehabilitation success	Rehabilitation Specialist and/or botanist	Quarterly for 2 years after closure
Soil disturbance	Establishment of alien plant species	Alien plant monitoring	Qualified botanist	Quarterly monitoring for two years
Surface water	Water quality	Ensure that monitoring is implemented to cover all mining activity areas. Recommended monitoring sites are shown in Table 8-1. Water quality parameters that need to be analyzed are shown in Table 8-2.	Specialist Environmental Water Quality	-Monthly during construction. - Reduce to quarterly on rehabilitated areas. - This can further be reduced to biannually (wet and dry season). -Monitoring needs to carry on after the project has ceased and the results depict a steady state, as is standard practice to detect residual impacts
	Water quantity	Flow monitoring should be carried out in channels and pipelines and at facilities on site. Monitoring water levels in dams and channels. Records of Pit dewatering	Specialist Environmental Quality	-Instantaneous where automatic flow meters are in place for real time measurements. -Where there are no automatic flowmeters weekly monitoring needs to be done. -In operational areas, daily records need to be kept
	Physical structures and 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.	Specialist Environmental Water Quality	Continuous process and yearly formal report
		Dams are inspected for silting and blockages of inflows, pipelines for hydraulic integrity; monitor the overall SWMP performance.	Specialist Environmental Water Quality	Continuous process and yearly formal report
	Meteorological data	Measure rainfall	Environmental Officer	Real time measurement system if in place. Alternatively install a rain gauge and measure storm depths after rainfall events
All activities	Noise disturbance	Noise Monitoring should be conducted by an independent specialist;	The client’s Environmental Coordinator to implement and manage the recommended monitoring programme; and	Monitoring to be conducted on a quarterly basis.

		Monitoring should be undertaken in accordance with the National Noise Control Regulations in conjunction with the SANS 10103:2008 guidelines; The locations to be monitoring are N1 and N2 as per the baseline assessment (refer to Plan 1) as well as additional noise monitoring location at the small holdings district (Prosperity AH)	Independent specialist to carry out the monitoring programme.	Noise levels propagating from the project should not have an exceedance of 7 dBA or more at Mpumalanga receptors as well as not exceed the daytime rural guideline of 45 dBA and night time rural guideline of 35 dBA at the poultry farms to the east and south east. A report must be compiled after the monitoring has been carried out then submitted to management to ascertain compliance with the required regulations and standards.
	General - All impacts and threats to wetlands predicted or not.	▪ Monitoring of the activities through all phases is important to ensure all impacts are remediated as soon as possible; thus preventing and long term residual impacts to the system that compromises the ability of the wetland to function. ▪ The wetlands immediately adjacent to the project area should be demarcated in the field as they are at particular risk of impacts. ▪ The valley bottom wetlands of high sensitivity should be monitored on a regular basis to detect if the mining activities are having any residual or unforeseen impact on the functioning of these important systems. The functional aspects of the wetland should be assessed such as floral diversity, water quality, use of wetland by faunal species, erosion and more. ▪ Monitoring for all risks at highlighted in Section **Error! Reference source not ound.** including uncontrolled erosion, hydrocarbon spills etc. must be done and remediated where needed.	The environmental officer of the mine should monitor the wetlands at all times as part of managing the site and the surrounding area. Independent wetland specialist should carry out monitoring on a regular basis during all phases of the mining project and provide recommended remedial actions where required.	Internal monitoring should be monthly during the construction phase and quarterly during the operational phase. External independent wetland specialist monitoring should be done bi-annually and when needed, i.e. after an incident.
Site Clearance within wetlands and their buffer areas	Removal of wetland soils and vegetation; loss of wetland habitat.	▪ Ensure that the wetlands are demarcated in the field and that no impact is extended beyond the infrastructure area; ▪ Monitor for all risks at highlighted in Section **Error! Reference source not found.** ncluding uncontrolled erosion, hydrocarbon spills etc. and remediate; ensure proper handling and storage of wetland soils; ▪ Must ensure that all activities are done according to the detailed design and are		Construction activities should be monitored monthly by a wetland specialist.

		implemented with the least possible impacts to the wetlands.		
Construction of general infrastructure within wetlands and their buffer areas	Industrial activity within a natural ecosystem is a negative impact to habitat integrity.	▪ As mining progresses, wetlands should be monitored for evidence of loss of functionality due to groundwater changes (the draw down cone). ▪ Monitoring for all risks including uncontrolled erosion, hydrocarbon spills etc. must be done and remediated where needed.		
Open pit mining to a depth of 60 m, requiring dewatering.	Perforation of rock and groundwater reserves leading to severe hydrological and geomorphological impacts to wetlands and catchment due to draw down cone.			Internal monitoring should be monthly during the construction phase and quarterly during the operational phase. External independent wetland specialist monitoring should be done bi-annually and when needed, i.e. after an incident.
General operational activities within and around wetland habitats such as the use and maintenance of haul roads, stockpiling of ROM coal, transportation of coal to the washing plant.	Similarly to the construction phase, the operational mining activities occurring within an ecologically sensitive catchment, which pose significant potential negative impacts to functioning wetlands and catchment.	▪ Ensure that the wetlands are demarcated in the field and that no impact is extended beyond the infrastructure area; ▪ Monitor for all risks at highlighted in Section **Error! Reference source not found.** ncluding uncontrolled erosion, hydrocarbon spills etc. and remediate; ensure proper handling and storage of wetland soils; ▪ Must ensure that all activities are done according to the detailed design and are implemented with the least possible impacts to the wetlands.		
Decommissioning activities within and around remaining wetland habitats, such demolition and removal of all infrastructure, and subsequent final rehabilitation of the final void and area	Similarly to the construction and operational phase, the decommissioning and rehabilitation activities occurring within an ecologically sensitive catchment pose significant potential negative impacts to functioning wetlands and catchment. Furthermore, the rehabilitated area could cause major negative impacts due to spread of alien invasive vegetation, increased soil compaction erosion and subsequent sedimentation into the wetland ecosystems.			Rehabilitation activities should be monitored monthly by a wetland specialist.
Mine closure and post-mining environmental status	Post-mining water decant is predicted to occur once the final void has been rehabilitated and groundwater levels are allowed to return back to natural level. It is anticipated that this decant will be acid forming (acid mine draining, AMD).	▪ Wetland monitoring should: Ensure that the wetlands are demarcated in the field and that no impact is extended beyond the infrastructure area; monitor for all risks at highlighted in Section **Error! Reference ource not found.** including uncontrolled erosion, hydrocarbon spills etc. and remediate; ensure proper handling and storage of wetland soils.		External independent wetland specialist monitoring should be done annually and when needed, i.e. after an incident.
Employment creation	Employment during construction and operation	▪ Local Employment Policy is developed that assigns preferential status to local, female and youth employment, as well as associated targets.	HR Department	Once-off

		▪ Applicable requirements of the existing Recruitment and Selection Policy are applied when employing locally by Canyon Coal and its contractors.	HR Department	Every six months
		▪ Local employment requirements are included in contractor management plans.	Procurement and Supply Chain Management Department	Monthly
		▪ Engagement with relevant groups to ensure that all understand the Project's employment requirements in terms of skills, type of employment.	CLO, HR Department, and Social Manager	Prior to construction, thereafter every six months
		▪ Compilation and implementation of Structured Stakeholder Engagement Plan and Grievance mechanism.	Consultant, Social Manager and CLO	Prior to construction,
		▪ Labour pool database is developed and kept up-to-date.	Procurement and Supply Chain Management Department	Every six months
		▪ Targets in terms of local recruitment are met by Project and contractors.	HR Department	Monthly
		▪ All locally recruited employees are recruited by means of the database.	HR Department	Annually
		▪ Percentage of locally-recruited employees increases on an annual basis.	HR Department	Annually
		▪ Turnover among locally-recruited employees is below 5 %.	HR Department	Annually
Economic development	Multiplier effects on the local economy and diversification and growth of the economy	▪ Project design parameter has avoided/minimised displacement.	Senior management	Pre-construction
		▪ A realistic exclusion zone has been identified and approved.	Land Acquisition/access Manager	Pre-construction
		▪ A transparent negotiation process has been implemented.	Land Acquisition/access Manager Public relations manager	Pre-construction
		▪ Compensation and resettlement is implemented.	Land Acquisition/access Manager Social Manager CLO	Every 3 months at completion
		▪ Develop Company policy to manage various displacement impacts.	RAP Consultant, Social Manager, CLO	Once off
		▪ Implement policy when cases of displacement occur, to ensure that affected people are not worse-off after displacement.	Social Manager, CLO	Directly after displacement
		▪ An ARAP or similar plan has been developed (if applicable).	Social Manager RAP consultant	Once-off (ARAP report)

		▪ Improved quality of life of those affected by displacement impacts.	Consultant , social manager	Three years after displacement
Disruption of movement patterns	Movement Patterns of people may have an impact on the socio-economic environment	▪ Complete Traffic Management Plan.	Consultant	Once off
		▪ Implement mitigation measures of specialist reports (especially traffic impact assessment).	SHEQ Manager Social Manager	Monthly
		▪ Measures implemented (e.g. Grievance procedure).	SHEQ Manager Social Manager	Once off
		▪ Grievance Procedures implemented.	SHEQ Manager Social Manager	Every 3 months
		▪ Number of grievances related to disruption in movement.	SHEQ Manager	Monthly
Influx related impacts	Influx of people may have an impact on the socio-economic environment	▪ Develop Influx management Plan.	SHEQ Manager Social Manager Senior Management	Pre-construction
		▪ Implement recommendations and mitigation outlined in the Influx Management Plan.	Social Manager Public Relations Manager Legal Department	Once-off during construction, thereafter annually
		▪ Investigate partnerships with local authorities.	Social Manager Public Relations Manager Legal Department	Once-off during construction, thereafter annually
		▪ Develop partnership agreements.	Social Manager; Senior Management; and Public Relations Manager	Once-off
		▪ Sign agreements with local authorities on assistance with IDPs and SDFs.	Senior Management	Once-off
Impacts on community health and safety (Socio-economic)	Community health and safety may be impacted by the construction and operation of the mine	▪ Technical Consultant is appointed to develop a Community Health Safety and Security Plan (CHSSP), which should include an awareness campaign.	Procurement and Supply Chain Management Department; Social Manager	Once-off at start of construction, and with a detailed revision when operation commences
		▪ CHSSP is adopted.	Senior management	Once-off at start of construction, and with a detailed revision when operation commences
		▪ CHSSP is implemented.	SHEQ Manager Social Manager	Every 4 months and annually
		▪ Relevant mitigation measures in the EMP are implemented.	SHEQ Manager Social Manager	On-going

		▪ Policing Forum is established.	Social Manager	Once-off at start of operation
		▪ Policing Forum actively participates in addressing community safety and security issues.	Policing Forum; Social Manager	Every 3 months
		▪ HIV/AIDS policy is expanded to include HIV awareness campaigns in communities and provision of Voluntary Counselling and Testing (VCT) for communities.	SHEQ Department; senior management	Once-off
		▪ Service providers appointed to implement HIV awareness campaigns in communities and provide VCT for communities.	Procurement and Supply Chain Management Department; Social Manager	Once-off
		▪ HIV awareness campaigns in communities and provision of VCT for communities are implemented.	Service provider; Social Manager	Annually
		▪ HIV awareness in communities is improved, and VCT services are accessed.	Service provider; Social Manager	Annually
Community development and social upliftment (Socio-economic)	Community development and social upliftment may be impacted by the construction and operation of the mine	▪ Detailed skills inventory is prepared for the Project.	SLP Manager HR Department, with input from the Power plant's technical departments	Once-off, reviewed every 3 years
		▪ Appoint qualified Technical Consultant for Skills Survey.	Procurement and Supply Chain Management Department; Social Manager	Once-off prior to construction
		▪ Skills survey is undertaken in the local communities and local skills database is developed.	Consultant; Social Manager	Once-off prior to construction, updated every five years
		▪ Qualified Training Consultant is appointed to develop training programmes.	HR Department; Procurement and Supply Chain Management Department.	Once-off prior to construction
		▪ Training programme is developed based on the skills gaps identified for the Project.	Consultant; HR Department; Social Manager	Once-off at start of construction, updated every five years
		▪ Training programme is implemented.	HR Department	Annually
		▪ Staff skills levels and job performance improve.	HR Department, with input from line managers	Annually
		▪ Locally recruited construction workforce who received skill training is employed during the operation of the Power plant.	HR Department	Once-off at start of construction
		▪ Skills levels in local communities improve.	HR Department, with input from line managers	Every two years
		▪ AET programmes are implemented for both workers and people from local communities.	SLP Manager Training Service Provider; Social Manager; CLO	Annually
		▪ Locals who received training (and qualified) are employed on the Project or receive	HR Department; Supply chain management	Annually

		procurement contracts with the Project.		
Mine Rehabilitation and Closure	Dependency on the Project for sustaining local economy (Social Closure)	▪ Plan on file.	Consultant, Social Manager	5 years before closure
		▪ Closure Plan implementation report.	Consultant, Social Manager	At closure

9 Item 1(l): Indicate the frequency of the submission of the performance assessment report

A performance assessment will be undertaken on an annual basis after which a Performance Assessment Report will be submitted to the DMR and other relevant governmental departments.

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 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

Management shall establish and maintain procedures for the internal communication between the various levels and functions of the organisation, and receiving, documenting and responding to relevant communication from external I&APs. The organisation shall consider processes for external communication on its significant environmental aspects and record its decision.

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 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:-

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

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

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

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

13 Reference List

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Appendix A: Details of EAP

Appendix B: Public Participation Process

Appendix C: Soil, Land Use and Land Capability Assessment

Appendix D: Surface Water Assessment

Appendix E: Groundwater Assessment

Appendix F: Flora and Fauna Assessment

Appendix G: Wetland Assessment

Appendix H: Aquatic Ecology Assessment

Appendix I: Air Quality Assessment

Appendix J: Noise Assessment

Appendix K: Visual Assessment

Appendix L: Blast and Vibrations Assessment

Appendix M: Cultural Heritage Assessment

Appendix N: Social Assessment

Appendix O: Macro-Economic Assessment

Appendix P: Traffic and Transport Assessment

Appendix Q: Rehabilitation and Closure Plan

Appendix R: Preliminary Geochemistry Assessment