REPORT

# Draft EIA / EMP Report: Application for EA and WUL for the proposed Grootegeluk Turfvlakte Expansion Project at Grootegeluk Coal Mine near Lephalale, Limpopo Province

*Exxaro Resources Limited*

## DMRE Reference Number: LP 30/5/1/2/3/2/1(46) EM

Submitted to:

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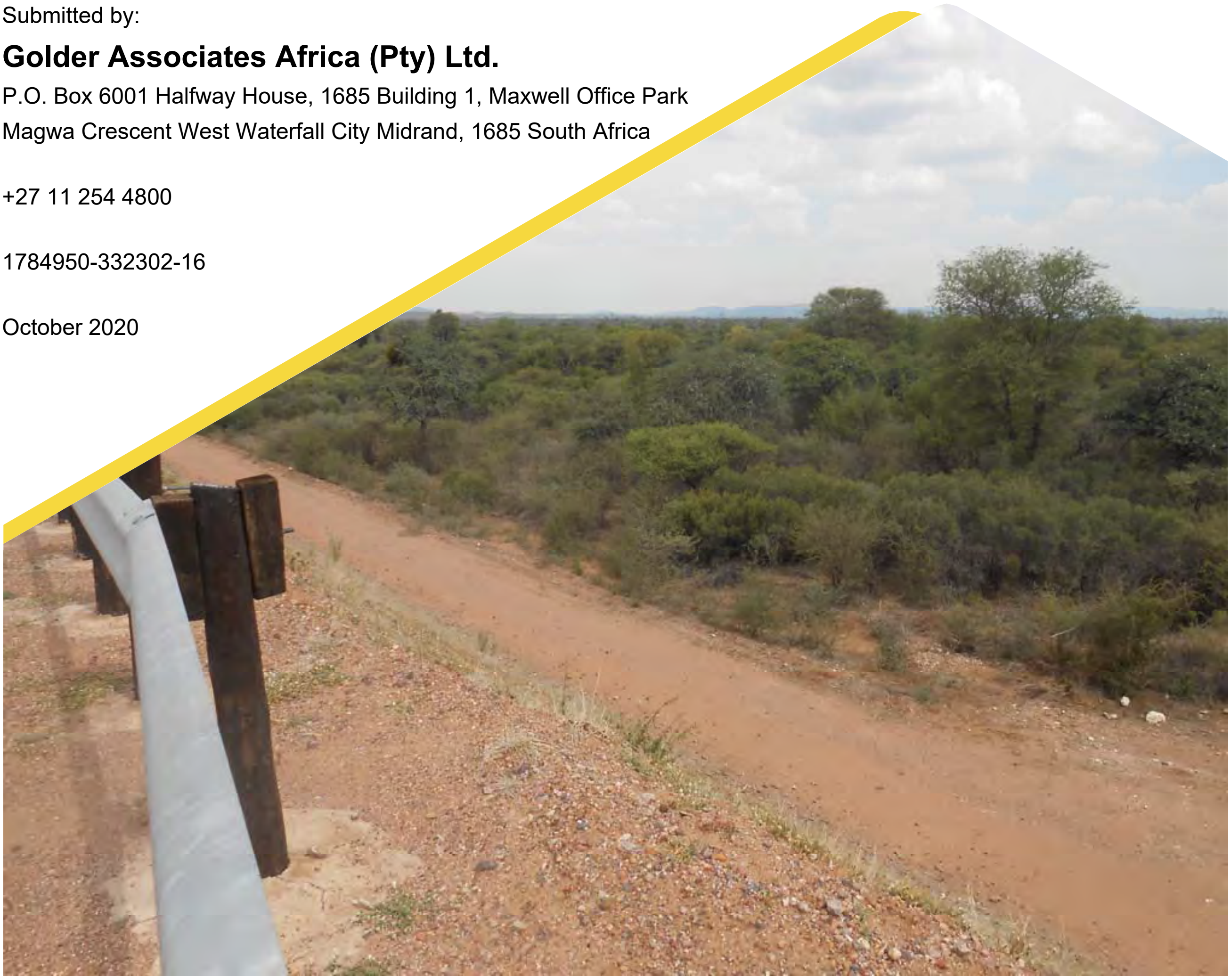

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mineral resources

Department:
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REPUBLIC OF SOUTH AFRICA

# ENVIRONMENTAL IMPACT ASSESSMENT REPORT
# And
# ENVIRONMENTAL MANAGEMENT PROGRAMME REPORT

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

**NAME OF APPLICANT:** Exxaro Resources Limited

**TEL NO:** 014 763 9288

**POSTAL ADDRESS:**

**PHYSICAL ADDRESS:** Farm Enkelbult 462 LQ within the jurisdiction of Lephalale Local Municipality of Waterberg District, Limpopo Province

**FILE REFERENCE NUMBER:** **LP 30/5/1/2/3/2/1(46) EM**

**SAMRAD: N/A**

# PURPOSE OF THIS DOCUMENT

Exxaro Resources (Pty) Ltd (Exxaro) operates the Grootegeluk Coal Mine, located approximately 20 km west of Lephalale in the Limpopo Province. Exxaro is proposing to expand their existing mining operations by extending the opencast mining operation to the eastern portion of the farm Turfvlakte 463 LQ. The farm is located within Grootegeluk Coal Mine's existing Mining Right, LP 46 MRC.

Golder Associates Africa (Pty) Ltd (Golder), an independent environmental and engineering company, was appointed by Exxaro to conduct the required environmental authorisation and licensing processes for the proposed project. The proposed extension opencast operations will consist of two pits, namely Pit 1 and Pit 2. Pit 1 will be 158 ha in size and will be approximately 88 m deep, while Pit 2 will be 64 ha and approximately 109 m deep.

In terms of the Environmental Impact Assessment (EIA) Regulations GN R.324 – GN R.327 of 7 April 2017, Exxaro must submit an application for Environmental Authorisation (EA) to the Department of Mineral Resources and Energy (DMRE), undertake an EIA and submit an Environmental Impact Assessment Report (EIAR) and an Environmental Management Programme (EMPr), which describes how the environmental impacts of the proposed mining operations will be managed and mitigated, to the DMRE. The proposed mining operations will require a Water Use Licence (WUL) and an Integrated Water and Waste Management Plan (IWWMP). An application for a WUL has been submitted to the Department of Water and Sanitation (DWS).

As part of the EIA process, Exxaro is required to submit a Scoping Report, an EIAR and an EMPr, which describe the environmental impacts of the proposed development and how they will be managed and mitigated. During this process, the public is consulted on an on-going basis, with issues and concerns being recorded and incorporated into the process for evaluation. The public is also given the opportunity to comment on the project, the proposed activities and the proposed environmental management measures. Feedback will be provided when a decision on the application for environmental authorisation and WUL have been made by the DMRE and DWS, respectively.

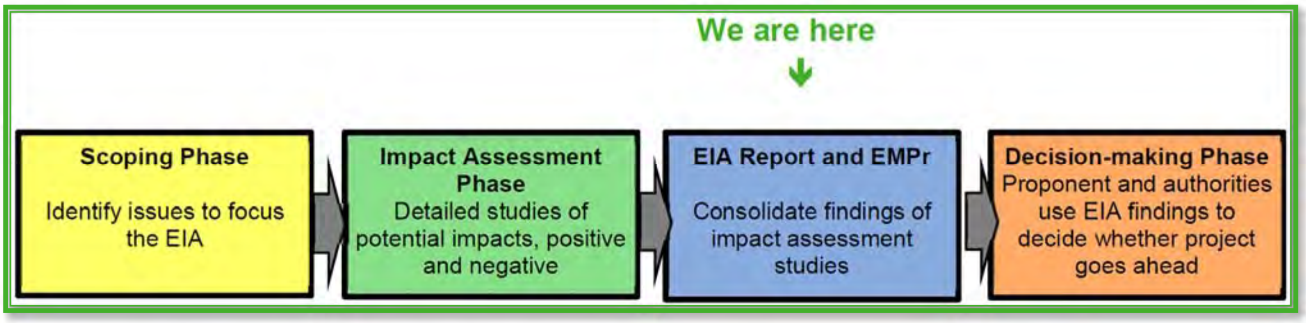
The due date for comment on the draft EIA/EMP report closes on **Wednesday, 25 November 2020**. Comments received during the public review period will be acknowledged and recorded in the final version of the EIA/EMP report, which will be submitted to the DMRE for decision-making.

## Summary of what the Environmental Impact Assessment report contains

This report contains:

- A description of the proposed mining activities.
- An overview of the EIA process, including public participation.
- A description of the existing environment in and around the proposed project area.
- The assessed environmental impacts and recommended mitigation measures.
- The findings of the specialist studies.
- An environmental management programme.

  A list of interested and affected parties involved during the EIA process and their comments (Comments and Response Report).




**The figure above shows the various phases of an Environmental Impact Assessment. This EIA is in the Impact Assessment Phase, during which interested and affected parties comment on the proposed project**

## PUBLIC REVIEW OF THE EIA/EMPR REPORT

The printed copies of the draft EIA/EMPr report is available for comment for a period of 30 days from **Monday, 26 October 2020** until **Wednesday, 25 November 2020** at the public places in the project area, as listed in the table below. The report is also available for download from the Golder website at https://www.golder.com/global-locations/africa/south-africa-public-documents/ and upon request from the Golder Public Participation Office at ppoffice@golder.co.za.

| PUBLIC PLACE | CONTACT PERSON | CONTACT NUMBER |
|---|---|---|
| **Lephalale Public Library**<br>Corner Joe Slovo Lane and Douwater Road, Lephalale | **Ms Hazel Mashaba** | **014 762 1453** |
| **Lephalale Police Station (SAPS)**<br>3 Herman Street, Lephalale | **Colonel Ramakgwakgwa** | **014 762 1000** |
| **Marapong Public Library**<br>916 Phukubye Street, Marapong | **Mr Sophonia Petja** | **014 762 1617** |
| **Golder Associates Africa, Midrand** | **Ms Mabel Qinisile** | **(011) 254 4800** |
| **The Golder Associates Africa website** | **https://www.golder.com/global-locations/vifelo/south-africa-public-documents/** | |

## OPPORTUNITIES FOR PUBLIC REVIEW

Stakeholders who wish to comment on the EIAR/EMPr may do so in any of the following ways:

- Completing the comment sheet enclosed with this report or on-line via the Golder website (www.golder.com/public)
- Additional written submissions
- Comment by e-mail or telephone.

## DUE DATE FOR COMMENT ON THIS EIA/EMPR REPORT IS WEDNESDAY, 25 NOVEMBER 2020

Please submit comments to the Public Participation Office:

Mabel Qinisile

Golder Associates Africa (Pty) Ltd

P O Box 6001

HALFWAY HOUSE, 1685

Tel: (011) 254 4805 / 4937

Fax: 086 582 1561

Email: ppoffice@golder.co.za

# EXECUTIVE SUMMARY

## Introduction

Exxaro Resources Limited (Exxaro) is a South Africa-based diversified resources company with business interests in South Africa, Europe and the United States of America.

Exxaro manages six coal mines in the Limpopo and Mpumalanga provinces of South Africa. The six mines jointly produce 39 Mtpa of power station, steam and coking coal. Most of the power station coal is supplied to Eskom. Semi-coke and related products are produced for the ferroalloys industry. The six managed coal mines are:

- Grootegeluk Coal Mine, Lephalale, Limpopo Province.
- Leeuwpan Coal Mine, Delmas, Mpumalanga Province.
- Matla Coal Mine, Kriel, Mpumalanga Province.
- North Block Coal Operations, Belfast, Mpumalanga Province.
- Tshikondeni Coal Mine, Musina, Limpopo Province (currently under decommissioning and rehabilitation).
- Arnot Coal Mine, eMalahleni, Mpumalanga Province (currently under decommissioning, rehabilitation, care and maintenance).

Exxaro is proposing to expand their existing mining operations at the Grootegeluk Coal Mine by extending the opencast mining operations to the eastern portion of the farm Turfvlakte 463 LQ. The farm is located within Grootegeluk Coal Mine's existing Mining Right, LP 46 MRC.

## Project Description

The proposed Grootegeluk Turfvlakte Expansion Project will consist of two pits, namely Pit 1 and Pit 2. Pit 1 will be 158 ha in size and will be 88 m deep, while Pit 2 will be 64 ha and 109 m deep.

Sufficient coal reserves have been proven to support opencast mining. Due to faulting in the area, Benches 9A and B and Bench 11 will be at quite shallow depths and high-quality coal can be mined at a favourable stripping ratio.

Grootegeluk Coal Mine is considering two options for the mining of Pit 1 and Pit 2. The preferred option is to mine Pit 1 and then Pit 2 to produce 1.5 million tonnes per annum run of mine (ROM) coal over a period of sixteen (16) years. Pit 1 will be mined from year 1 to 11. Mining of Pit 2 will commence in year 12 and ceases in year 16. The alternative option is to mine the two pits concurrently, with Pit 1 being mined from year 1 to 4 and Pit 2 from year 1 to 7, to produce 3 million tonnes per annum ROM coal over a period of 7 years.

The interburden and coal mined from Pit 1 and Pit 2 will be transported to and handled at the existing Grootegeluk Coal Mine plants. The mining operations will be undertaken 24 hrs, six days a week.

The proposed infrastructure to be established at surface in support of the coal mining operation includes haul roads connecting the proposed pits to the existing Grootegeluk Coal Mine operations, laydown area for the mine equipment and offices, a topsoil stockpile, surface water management infrastructure (sumps and pipelines), waste management area (waste skips), and a sub-station.

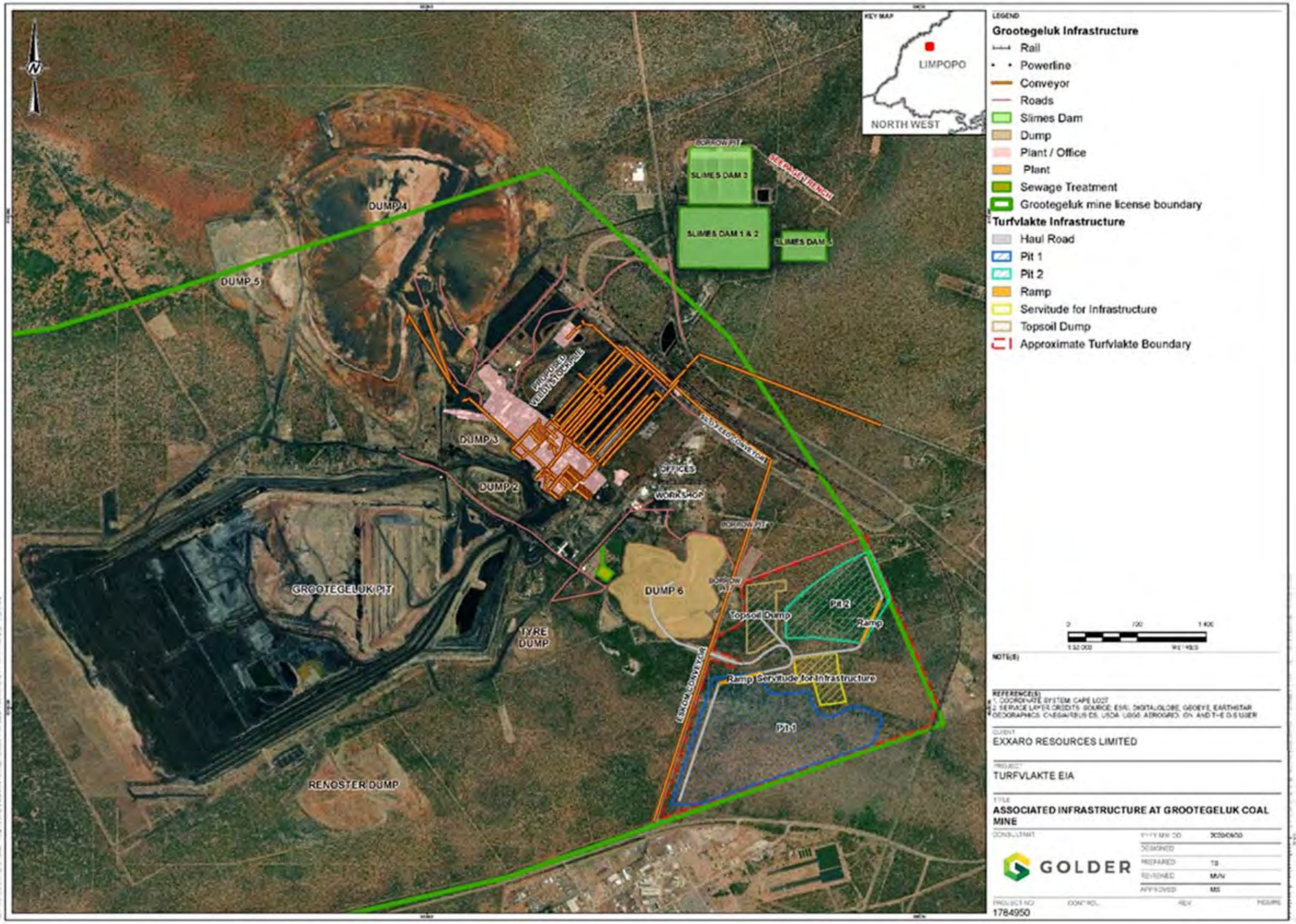



**Figure 1: Location of the proposed Grootegeluk Turfvlakte Expansion Project in relation to the existing Grootegeluk Coal Mine**

## Authorisation Process

The proposed Project requires an application for Environmental Authorisation (EA) to be undertaken through a Scoping and Environmental Impact Assessment (EIA) process in terms of EIA Regulations of 2014, as amended, under the National Environmental Management Act 107 of 1998 (NEMA), as amended.

Golder Associates Africa (Pty) Ltd. (Golder), an independent Environmental Assessment Practitioner, is conducting the Scoping and EIA process.

The purpose of this draft EIA Report is to assess the key environmental impacts/risk related to the proposed open pit operations and associated infrastructure and identifying management and monitoring actions to mitigate the anticipated environmental impacts/risks.

Concurrently with the application for EA and supported by this Scoping and EIA process, the proposed project must acquire a Water Use Licence (WUL) from the Department of Water and Sanitation.

## Baseline Environmental Conditions and Potential Environmental Impacts/Risks

Section 7 of this report describes the biophysical and socio-economic environment that may be affected by the proposed opencast mining development. The findings of the environmental impact assessment studies, per phase of the project, is detailed in section 10 of this report.

The environmental aspects considered in this draft EIA Report are:

### Geology

The regional geology in the area is characterised by the igneous and sedimentary rocks of the Karoo Supergroup. The Grootegeluk Turfvlakte Expansion Project is situated on the southern portion of the Limpopo Depression, a relatively small corridor between the Limpopo River in the west and the Palala-Pietersburg Plateau in the east.

The project area is located in the Waterberg Coal Field and includes all the major units of the Karoo Supergroup, comprising from surface of the Stormberg Group, Beaufort Group, Ecca Group and the Dwyka group forming the basement.

The proposed open pit mining operations will result in a permanent impact on the geology of the project area during the operational phase. The rollover method of opencast mining will place the waste rock and overburden back in more or less their position and reduce the impact somewhat.

### Climate

The proposed project area is located in the Waterberg region of South Africa, which falls within the subtropical high-pressure belt. The highest temperatures are typically experienced during the summer months of December, January and February, and the lowest during the winter months of June, July and August.

### Air Quality

The Grootegeluk Turfvlakte Expanison project area is located within the Waterberg-Bojanala Priority Area (WBPA). The region is characterised by natural bushveld, interspersed with plots of cultivated land, small scale farming and protected natural reserves.

The Grootegeluk Coal Mine, and the neighbouring Eskom power stations, Medupi and Matimba, are prominent features in the local landscape. Key sources of air pollution in the area are coal mining, power generation, domestic fuel burning, vehicle emissions and the generation of dust on unpaved roads.

Potential sensitive receptors in the vicinity of the current Grootegeluk Coal Mine and the proposed Thabametsi and Turfvlakte mining operations, include dispersed farmsteads, lodges, towns and natural reserves.

Dust and fine particulates are the key pollutants of concern during all phases of the project due to the disturbance and movement of topsoil, interburden and coal as well as vehicles on unpaved roads.

## Topography

The general topography of the area is described as “Plains”, with slopes that vary between 0 and 3%. Elevation around the project area varies from 900 to 922 m above sea level. The area is generally featureless except for elevation differences caused by Nelsonskop (922 m) in the north and the Waterberg range (3,600 m) in the south. Drainage appears to be in an east-north-easterly direction towards the Mogol River and consists mainly of dry sandy gullies such as the “Sandloopspruit”.

The construction of the required on-site and water management infrastructure as well as the opencast pits, including the permanent voids at closure, will have an impact on topography in the immediate area.

## Soil, Land Use and Land Capacity

The Grootegeluk Turfvlakte Expansion project area comprise of land types Ae252 and Ah85, as derived from the land type memoirs and associated maps of 2326 Ellisras.

The current land use within the proposed mining areas are used for game farming and farm roads with the remainder of the area used for transportation (crossing bridge to Grootegeluk Coal Mine) and commercial land-use (Manketti Lodge). The land use within the Grootegeluk Coal Mine comprises of mining.

In comparison to the National Land Capability, which indicates that at least 64% of the project area has moderate land capability, the local level assessment classified the area is not suitable for the production of annual crops.

Vegetation and topsoil will be stripped from 265 ha of land over the life of mine for the construction of the haul roads, infrastructure laydown area and for the open pit operations.  However, the application of rollover mining, with continuous concurrent rehabilitation, will provide significant mitigation towards partially restoring the site. With the expected soil degradation occurring, a decline in the overall soil quality and health, may hinder the soil suitability for the end land use.

## Ecology

The project area is located in the Limpopo Sweet Bushveld (ref. SVcb19) vegetation type of the savanna biome.

The savanna biome is the largest biome in South Africa, covering approximately 35% of the country’s land surface. Savannas are characterised by a dominant grass layer, over-topped by a discontinuous, yet distinct woody plant component. Primary determinants of savanna composition, structure and functioning are fire, a distinct seasonal climate, substrate type, and browsing and grazing by large herbivores.

Limpopo Sweet Bushveld extends northwards from the lower reaches of the Crocodile and Marico Rivers to the Limpopo Valley and into Botswana. It is characterised by undulating or irregular plains dominated by open woodland.

A number of statutorily declared nature reserves, as well as informal conservation areas are present in the broader region surrounding the study area. These include Marakele National Park, D’Nyala Nature Reserve, Welgevonden Private Nature Reserve, Hans Strijdom Nature Reserve and the neighbouring Tierkop Private Nature Reserve.

The Waterberg Biosphere Reserve occupies approximately 650 000 ha of the Waterberg district to the south of the Grootegeluk Turfvlakte Expansion project area.

The proposed opencast mining activities and associated infrastructure will require stripping of vegetation in the project area and will result in the disturbance of fauna and flora as a result of habitat loss and degradation, habitat fragmentation, mortality and disturbance of fauna and potential establishment and spread of alien invasive species.

## Surface Water

The Grootegeluk Coal Mine and Grootegeluk Turfvlakte Expansion project area is situated in the A42J quaternary catchment of the Limpopo Water Management Area (WMA). The main water resources in the quaternary catchment are the Sandloopspruit which flows east north-east to join the Mokolo River approximately 40 km south of the Limpopo River.

In the absence of mitigation, the mining of coal and associated activities could result in runoff with high silt load and contaminants such as fuel, hydraulic fluids, and chemicals. The topsoil stockpile and uncontrolled surface runoff could contribute to the silt load.

## Groundwater

The aquifer at the Grootegeluk Turfvlakte Expansion project area is classified as a minor aquifer system, as defined by the Hydrogeological Map Series published by DWAF (1996). The small western part of the Grootegeluk Turfvlakte Expansion project area aquifer is classified as a fractured aquifer zone, whereas the greater part (proposed locality of Pit 1 and PIT 2) is classified as intergranular and fractured. Both aquifer zones have an average borehole yield of about 0.5 l/s, which is typical of the Karoo Super Group.

The proposed open pit mining operations will result in the lowering of the local groundwater table due to necessary mine dewatering and groundwater contamination with nitrates due to blasting. The effects of dewatering will be in addition to that caused by the existing Grootegeluk Coal Mine pit, located approximately 3 km to the west of Pit 1.

This allows sufficient time for chemical reactions to take place in the mined-out areas and other potential pollution sources to produce. Acid Rock Drainage conditions in the mined-out areas and activities associated with the proposed mining could result in groundwater contamination due to spillages of fuels, lubricants, hydraulic fluids and chemicals, in the absence of appropriate mitigation measures.

## Noise

Ambient noise sources recorded at the study area include adjacent mining activities, power station noise, traffic and domestic noise.

The proposed mining operations will contribute to the existing noise levels in the area. The noise from the mining machinery will be audible but will not exceed the daytime level for urban districts beyond the recommended 500 m blast zone boundary and at some sensitive areas along the way as the mining front moves along the length of the coal deposit.

## Visual

The wider study area is characterised by a mixture of completely transformed and developed land associated with the adjacent Grootegeluk Coal Mine, Eskom Power Stations, the Marapong residential area as well as large tracts of undeveloped natural bushveld, under either game or livestock management.

The Grootegeluk Turfvlakte Expansion project area comprises natural bushveld with negligible levels of transformation and disturbance that are limited to a network of game viewing vehicle tracks.

The project will add to the existing visual impact due to human activities in the area. The mine's surface infrastructure, moving vehicles and occasional dust plumes will be visible during the daytime and both fixed and moving lights will be visible during the night-time.

## Cultural and Heritage

The proposed Grootegeluk Turfvlakte Expansion project is located in an area covered by consistent level sandy plains with open savannah bush. A solitary kopje, Nelsonskop, occurs near the project area and is associated with human occupation in the past.

Pistorius (2020) states that the Grootegeluk Turfvlakte Expansion project area was sparsely populated by humans in the past. However, occupation started at an early period, resulting in the presence of humans in the area over a long time span, but on a limited scale.

There are no known heritage resources within the mine-affected area, but the possibility of unearthing buried resources during construction and mining operations cannot be ruled out.

## Palaeontology

The Karoo Supergroup is renowned for its fossil wealth. It is marked as Undifferentiated Strata of the Karoo Supergroup, but correlates with the Vryheid Formation (Pe, Pv), Ecca Group and the Grootegeluk Formation which is rich in plant fossils such as the *Glossopteris* flora represented by stumps, leaves, pollen and fructifications.

There are no known palaeontological resources within the mine-affected area, but the possibility of unearthing buried resources during construction and mining operations cannot be ruled out.

## Traffic

The Grootegeluk Turfvlakte Expansion project site is accessed *via* the existing Grootegeluk Mine entrance, which is accessible from Road D2001 at the intersection with the road to Marapong. The intersection of D2001, that provides access to both Grootegeluk Coal Mine and Marapong, is signalised.

Due to the low possibility that the project will create new jobs, the cumulative impact on the current traffic in the area is expected to be negligible.

## Socio-economic

The Grootegeluk Turfvlakte Expansion project area falls within the Waterberg District Municipality (DM) and the Lephalale Local Municipality (LM) in the Limpopo Province. The Lephalale LM forms the main growth and development point in the municipal area.

The population within the LM was 115 767 in 2001 and increased significantly to 140 240 in 2016.

Mining, Agriculture and Tourism comprise the main sectors which characterise the economic profile of the Waterberg District. The mining industry in the municipal area contributes to the economic development of the Waterberg District and Limpopo Province. The Lephalale LM has a 44% employment rate, with 42% being economically inactive and 12% unemployed.

Local residence will experience negative impacts such as noise, dust, visual and population influx, but also modest positive impacts resulting from job sustainability and expenditure on local goods and services.

## Greenhouse Gas Emissions and Climate Change

The proposed Grootegeluk Turfvlakte Expansion Project's Scope 1 and Scope 2 emissions will contribute to South Africa's GHG emissions, and ultimately to climate change during the construction, operational and closure phases. The contribution of the project’s emissions is however deemed to be low compared to the other emitters in the immediate area.

# OPSOMMING

## Inleiding

Exxaro Resources Limited (Exxaro) is ‘n Suid-Afrika-gebaseerde gediversifiseerde hulpbronmaatskappy met sakebelange in Suid-Afrika, Europa en die Verenigde State van Amerika.

Exxaro bestuur die Groogegeluk Steenkoolmyn naby Lephalale in Limpopo as deel van ‘n portefeulje van sewe steenkoolmyne in Suid-Afrika. Die ses myne produseer gesamentlik 39 miljoen ton per jaar kragstasiesteenkool, stoomsteenkool en metallurgiese steenkool. Die meerderhied van die kragstasiesteenkool word aan Eskom verskaf. Semi-metallurgiese steenkool en verwante produkte word vervaardig vir die ferro-allooie bedryf. Die ses steenkoolmyne wat deur Exxaro bestuur word is:

- Grootegeluk Steenkoolmyn, Lephalale, Limpopo Provinsie;
- Leeuwpan Steenkoolmyn, Delmas, Mpumalanga Provinsie;
- Matla Steenkoolmyn, Kriel, Mpumalanga Provinsie;
- North Block Steenkoolbedrywighede, Belfast, Mpumalanga Provinsie;
- Tshikondeni Steenkoolmyn, Musina, Limpopo Provinsie (tans in die slutingsfase); en
- Arnot Steenkoolmyn, Emalahleni, Mpumalanga Provinsie (tans in die sluitingsfase).

Exxaro se projekvoorstel sluit die uitbreiding van hul oopgroef mynboubedrywighede, by die Grootegeluk Steenkoolmyn, na die oostelike gedeelte van die plaas Turfvlakte 463 LQ in. Die plaas is geleë binne die huidige Mynboureg (LP 46 MRC) van die Grootegeluk Steenkoolmyn.

## Projekbeskrywing

Die oopgroef mynboubedrywighede sal bestaan uit twee oopgroewe, naamlik Groef 1 en Groef 2. Die voorkeuropsie is om eers Groef 1 en dan Groef 2 te myn, wat potensieel 1.5 miljoen ton steenkool per jaar oor ‘n tydperk van twaalf (16) jaar sal lewer. Groef 1 sal gemyn word van jaar 1 tot jaar 11. Mynboubedrywighede sal begin in jaar 12 en eindig in jaar 16. Die alternatief is om eers Groef 2 en dan Groef 1 te myn, wat potensieel 3 miljoen ton steenkool per jaar oor 'n tydperk van sewe (7) jaar sal lewer.

Die tussenlae en steenkool vanuit Groef 1 en Groef 2 sal vervoer word na en hanteer word by die bestaande Grootegeluk Steenkoolmyn aanlegte. Die mynboubedrywighede sal 24 uur per dag, ses dae ‘n week plaasvind.

Die voorgestelde infrastruktuur wat ter ondersteuning van die Grootegeluk Turfvlakte steenkoolmynoperasie opgerig sal word, sluit in paaie, ‘n bogrondbergingshoop, waterbestuursinfrastruktuur, afvalbestuursgebiede, ‘n substasie en voertuig parkeerplekke.

## Goedkeuringsproses

Ten einde die voorgestelde Omgewingsmagtiging vir die voorgestelde projek te verkry, word daar van Exxaro verwag om ‘n Omgewingsimpakstudie (OIS) in terme van die OIS Regulasies van 2014, soos gewyis, onder die Wet op Nasionale Omgewingsbestuur, 1998 (Wet 107 van 1998) (soos gewysig) te onderneem.

Golder Associates Africa (Pty) Ltd (hierna Golder), ‘n onafhanklike omgewingskonsultant, is aangestel om die OIS en die samestelling van die Omgewingsbestuursprogram (OBP) te onderneem.

Hierdie Omgewingsimpakstudie fokus op die identifisering van die belangrikste impakte en risiko’s wat verband hou met die voorgestelde ontwikkeling asook die beskrywing van bestuurs- en moniteringsmaatreels vir die versagting van die verwagte impakte en risiko’s.

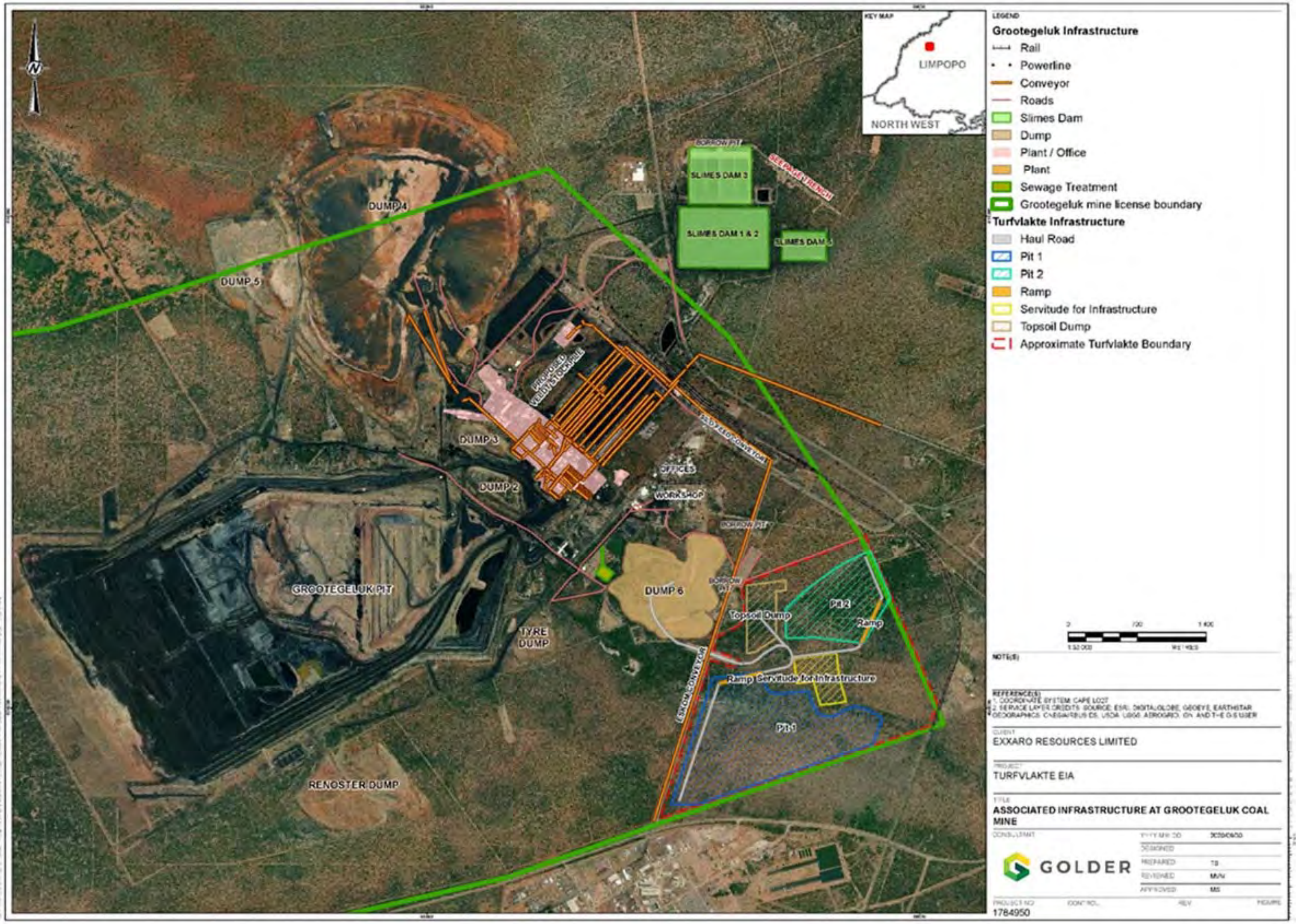



**Figure 2: Ligging van die voorgestelde Grootegeluk Turfvlakte oopgroef mynboubedrywighede ten opsigte van die bestaande Grootegeluk Steenkoolmyn**

Gelyktydig met die aansoek vir omgewingsmagtiging, en ondersteun deur die huidige Omgewingsimpakstudie, word dit ook vereis dat ‘n aansoek vir ‘n Watergebruikslisensie ingedien word word by die Departement van Water en Sanitasie.

## Beskrywing van die Potensieel Geaffekteerde Omgewing

Gedeelte 7 van hierdie verslag beskryf die biofisiese en sosio-ekonomiese omgewing wat potensieel deur die voorgestelde ontwikkeling geraak sal word.  Die bevindings van die impakbepalingstudies, per fase van die projek, is uiteengesit in gedeelte 10 van hierdie verslag.

Die omgewingsaspekte wat aangespreek word in hierdie konsep Omgewingsimpakstudie is hier onder aangedui.

### Geologie

Die streeksgeologie word gekenmerk deur die stollings- en sedimentêre gesteentes van die Karoo Supergroep. Die Grootegeluk Turfvlakteuitbreidingsprojek is geleë in die suidelike gedeelte van die Limpopo-depressie, 'n relatief klein korridor tussen die Limpoporivier in die weste en die Palala-Pietersburg-plato in die ooste.

Die projekgebied is geleë in die Waterberg-steenkoolveld en sluit al die hoofeenhede van die Karoo-supergroep in. Dit bestaan uit die Stormberg-groep, Beaufort-groep, Ecca-groep en die Dwyka-groep wat die kelder vorm.

Die voorgestelde oopgroefmynbedrywighede sal 'n permanente impak op die geologie van die voorgestelde gebied gedurende die operasionele fase hê. Die oorrolmetode van oopgroefmynbou sal die rots en oorbelasting min of meer in hul posisie plaas en die impak ietwat verminder.

### Klimaat

Die voorgestelde projekgebied is in die Waterberg-streek van Suid-Afrika, wat binne die subtropiese hoëdrukgordel val. Die hoogste temperature word tipies gedurende die somermaande van Desember, Januarie en Februarie ervaar, en die laagste gedurende die wintermaande van Junie, Julie en Augustus.

### Luggehalte

Die Grootegeluk Turfvlakte projekgebied is geleë in die Waterberg-Bojanala Prioriteitsgebied. Die streek word gekenmerk deur natuurlike bosveld, afgewissel met verboude landbougrond, kleinskaalboerdery en beskermde natuurlike gebiede.

Die Grootegeluk Steenkoolmyn, en die naburige Eskom kragstasies, Medupi en Matimba, is prominent in die plaaslike landskap. Sleutelbesoedelingsbronne in die omgewing is steenkoolmynbou, kragopwekking, huishoudelike brandstofverbranding, voertuiguitlaatgasse en die vrylating van stof op ongeteerde paaie.

Potensiële sensitiewe reseptore in die omgewing van die huidige Grootegeluk Steenkoolmyn en die voorgestelde Thabametsi- en Turfvlakte mynboubedrywighede sluit in plaasopstalle, oornagverblyf, dorpe en natuurreservate.

Stof en fyn deeltjies is die belangrikste bron lugbesoedeling gedurende alle fases van die projek as gevolg van die versteuring en verskuiwing van bogrond, tussenlae en steenkool, sowel as voertuie wat op ongeteerde paaie ry.

### Topografie

Die algemene topografie van die gebied word beskryf as “vlaktes" met hellings wat wissel tussen 0 en 3%. Hoogtes rondom die projekgebied wissel van 900 tot 922 m bo seespieël. Die gebied is oor die algemeen gelyk, behalwe vir die hoogtes verbonde aan Nelsonskop (922 m) in die noorde en die Waterberg-reeks

(3.600 m) in die suide. Dreinering vind in ‘n oostelike tot noordoostelike rigting na die Mogolrivier plaas en bestaan hoofsaaklik uit droë sandlope soos die Sandloopspruit.

Die konstruksie van mynbou en waterbestuursinfrastruktuur, mynbougroewe en permanente holtes na sluiting sal ‘n invloed hê op die topografie in die onmiddelike omgewing.

## Grond, Grondgebruik en Grondvermoë

Die Grootegeluk Turfvlakte projekgebied bestaan uit landtipes Ae252 en Ah85, soos gelys in die landtipe memoires en geassosieerde kaarte van 2326 Ellisras.

Die huidige grondgebruik binne die voorgestelde myngebied word gebruik vir wildboerdery en plaaspaaie, terwyl die res van die area vir vervoer gebruik word (kruisbrug na Grootegeluk-steenkoolmyn) en kommersiële grondgebruik (Manketi Lodge). Die grondgebruik in die Grootegeluk-steenkoolmyn bestaan uit mynbou.

In vergelyking met die nasionale grondvermoë, wat aandui dat ten minste 64% van die projekgebied matige grondvermoë het, is die op plaaslike vlak beoordeel dat die gebied nie geskik is vir die produksie van eenjarige gewasse nie.

Plantegroei en bogrond sal gedurende die mynboubedrywighede van ‘n gebied van sowat 265 ha gestroop word vir die uitleg van die paaie, die oprigting van infrastruktuur en vir die oopgroefbedrywighede. Die toepassing van mynbou met aaneenlopende rehabilitasie sal egter aansienlike versagting bied vir die gedeeltelike herstel van die terrein. As die verwagte grondagteruitgang plaasvind, kan 'n afname in die algehele grondkwaliteit en gesondheid die grondgeskiktheid vir die eindgrondgebruik belemmer.

## Biodiversiteit

Die projekgebied is in die Limpopo Soetbosveld (ref. SVcb19) plantegroeitipe van die savanna-bioom geleë.

Die savanna-bioom is die grootste bioom in Suid-Afrika, wat ongeveer 35% van die land se grondoppervlak beslaan. Savannas word gekenmerk deur 'n dominante graslaag, tesame met 'n onderbroke, maar tog kenmerkende houtagtige plantkomponent. Primêre kenmerke van savanna samestelling, struktuur en funksionering is vuur, 'n afsonderlike seisoenale klimaat, substraat tipe, en verkenning en weiding deur groot plantvreters.

Die Limpopo Soetbosveld strek noordwaarts vanaf die onderste lope van die Krokodil- en Maricoriviere na die Limpopovallei en tot in Botswana. Dit word gekenmerk deur golwende of onreëlmatige vlaktes wat deur oop bosveld oorheers word.

'n Aantal statutêr verklaarde natuurreservate, sowel as informele bewaringsgebiede, is teenwoordig in die breër omgewing rondom die studiegebied. Dit sluit in die Marakele Nasionale Park, die D'Nyala natuurreservaat, die Welgevonden private natuurreservaat, die Hans Strijdom natuurreservaat en die naburige Tierkop private natuurreservaat.

Die Waterbergbiosfeerreservaat beslaan ongeveer 650 000 ha van die Waterbergdistrik suid van die Grootegeluk Turfvlakteuitbreiding projekgebied.

Die voorgestelde oopgroefbedrywinghede en gepaardgaande infrastruktuur benodig die verwydering van plantegroei in die projekgebied en sal die versteuring van fauna en flora tot gevolg hê as gevolg van verlies en agteruitgang van habitat, fragmentering van habitat, mortaliteit en versteuring van fauna en potensiële vestiging en verspreiding van uitheemse indringerspesies.

## Oppervlakwater

Die Grootegeluk Steenkoolmyn en Grootegeluk Turfvlakteuitbreiding projekgebied is geleë in die A42J-kwaternêre opvanggebied van die Limpopo Waterbestuursgebied (WBG). Die belangrikste waterbronne in die kwaternêre opvanggebied is die Sandloopspruit wat oos-noordoos vloei om by die Mokolo-rivier, ongeveer 40 km suid van die Limpoporivier, aan te sluit.

In die afwesigheid van versagtende maatreëls kan die ontginning van steenkool en gepaardgaande aktiwiteite lei tot oppervlakwaterafloop met hoë slikbelading en besoedeling soos brandstof, hidrouliese vloeistowwe en chemikalieë. Die bogrondberginshoop en onbeheerde afloop van die oppervlakwater kan bydra tot die slikbelading.

## Grondwater

Die waterdraende geologiese struktuur in die Grootegeluk Turfvlakteuitbreiding projekgebied word geklassifiseer as 'n klein waterdraende sisteem, soos gedefinieer deur die Hidrogeologiese Kaartreeks gepubliseer deur die DWAF (1996). Die klein westelike deel van die Grootegeluk Turfvlakteuitbreiding projekgebied is as 'n gebreekte waterdraende sone geklassifiseer, terwyl die grootste gedeelte (voorgestelde ligging van Groef 1 en Groef 2) geklassifiseer word as intergranulêr en gebroke. Albei waterdraende sones het 'n gemiddelde boorgatopbrengs van tussen 0.5 l/s, wat tipies van die Karoo Supergroep is.

Die voorgestelde oopgroefbedrywighede sal daartoe lei dat die plaaslike grondwatertafel verlaag word as gevolg van die nodige ontwatering van die myn asook die besoedeling van grondwater met nitrate as gevolg van die gebruk van plofstof. Die gevolge van ontwatering sal aanvullend wees tot die wat reeds veroorsaak word deur die bestaande Grootegeluk-steenkoolmyngroef, ongeveer 3 km ten weste van Groef 1.

Ontwatering laat voldoende tyd toe vir chemiese reaksies in die ontginde gebiede en om ander potensiële besoedelingsbronne te produseer. Suurrotsdreineringstoestande in die ontginde gebiede en aktiwiteite wat verband hou met die voorgestelde mynbou, kan besoedeling in grondwater tot gevolg hê as gevolg van mors van brandstof, smeermiddels, hidroliese vloeistowwe en chemikalieë, indien daar nie gepaste versagtingsmaatreëls toegepas word nie.

## Geraas

Omliggende geraasbronne wat by die studiegebied waargeneem kan word, sluit in mynbou-aktiwiteite, geraas vanaf die twee kragstasies, verkeer en huishoudelike geraas.

Die voorgestelde oopgroefbedrywighede sal bydra tot die bestaande geraasvlakke in die gebied. Die geraas van die mynmasjinerie sal hoorbaar wees, maar dit sal nie die daaglikse vlakkte normaalweg in stedelike distrikte oorskry verder as die aanbevole grens van die ontploffingszone van 500 m en op sensitiewe gebiede langs die pad nie.

## Visueel

Die wyer studiegebied word gekenmerk deur 'n mengsel van heeltemal getransformeerde en ontwikkelde grond wat verband hou met die aangrensende Grootegeluksteenkoolmyn, Eskom-kragstasies, die Marapong-woongebied asook groot dele van onontwikkelde natuurlike bosveld, onder wild- of veebestuur.

Die Grootegeluk Turfvlakteuitbreiding projekgebied bestaan uit natuurlike bosveld met onbeduidende vlakke van transformasie en versteuring wat beperk is tot 'n netwerk van wildkyk-voertuigroetes.

Die projek sal bydra tot die bestaande visuele impak as gevolg van menslike aktiwiteite in die omgewing. Die infrastruktuur van die myn, bewegende voertuie en af en toe se stofwolke sal gedurende die dag sigbaar wees. Permanente en bewegende ligte sal gedurende die nag sigbaar wees.

## Kultuur en erfenis

Die Turfvlakte projekgebied is geleë in 'n gebied van aaneenlopende en gelyke sanderige vlaktes wat met oop savannabosse bedek is. 'n Alleenstaande koppie, Nelsonskop, kom naby die projekgebied voor en word geassosieer met menslike besetting in die verlede. Volgens Pistorius (2020) was die Grootegeluk

Turfvlakteuitbreiding projekgebied in die verlede yl bevolk deur mense. Besetting het in ‘n vroë stadium plaasgevind, wat gelei het tot die teenwoordigheid van mense in die omgewing oor 'n lang tydperk, maar op 'n beperkte skaal.

Geen kultuur en erfenishulpbronne is geidentifiseer in die gebied wat deur die oopgroefbedrywighede geraak sal word nie, maar die moontlikheid om begrawe hulpbronne op te grawe tydens konstruksie en mynboubedrywighede, kan nie uitgesluit word nie.

## Palaeontologie

Die Karoo Supergroep is bekend vir sy rykdom aan fossiele. Dit word aangedui as Ongedifferensieerde Strata van die Karoo Supergroep, maar dit korreleer met die Vryheid Struktuur (Pe, Pv), Ecca Groep en die Grootegeluk Struktuur wat ryk is aan plantfossiele soos die *Glossopteris* flora wat verteenwoordig word deur stompe, blare, stuifmeel en vrug-vormende strukture.

Geen paleontologiese bronne is geidentifiseer in die gebied wat deur die oopgroefbedrywighede geraak sal word nie, maar die moontlikheid om begrawe hulpbronne op te grawe tydens konstruksie en mynboubedrywighede, kan nie uitgesluit word nie.

## Verkeer

Toegang tot die Grootegeluk Turfvlakteuitbreiding projekgebied is *via* die bestaande Grootegeluk myningang wat vanaf D2001 by die kruising met die pad na Marapong toeganklik is. Die D2001 kruising , wat toegang verleen tot beide Grootegeluk Steenkoolmyn en Marapong, word met ‘n verkeerslig beheer.

Vanweë die lae moontlikheid dat die projek nuwe werkgeleenthede sal skep, sal die kumulatiewe impak op die huidige verkeer in die gebied na verwagting minimaal wees.

## Sosio-ekonomie

Die Grootegeluk Turfvlakteuitbreiding projekgebied val binne die Waterberg Distriksmunisipaliteit (DM) en die Lephalale Plaaslike Munisipaliteit (PM) in die Limpopo Provinsie. Die Lephalale PM is die belangrikste groei- en ontwikkelingspunt in die munisipale gebied.

Die bevolking van die PM was 115 767 in 2001 en het teen 2016 aansienlik toegeneem tot 140 240.

Mynbou, landbou en toerisme is die hoofsektore wat die ekonomiese profiel van die Waterbergdistrik uitmaak. Die mynbou wat in die munisipale gebied bedryf word, dra grootliks by tot die ekonomiese ontwikkeling van die Waterberg Distrik en Limpopo Provinsie. Die Lephalale PM het 'n indiensnemingsyfer van 44%, met 42% ekonomies onaktief en 12% werkloos.

Plaaslike huishoudings en besighede mag negatiewe impakte ervaar soos geraas, stof, visuele impakte en bevolkingsinvloei, maar ook beskeie positiewe impakte as gevolg van werkvolhoubaarheid en uitgawes aan plaaslike goedere en dienste voortgebrind deur die voorgestelde projek.

## Kweekhuisgasvrystellings en klimaatsverandering

Die voorgestelde oopgroefbedrywinghede se Bestek 1 en Bestek 2 gasvrystellings, tydens al die fases van die projek, sal bydra tot Suid Afrika se kweekhuisgasverystellings en uiteindelik ook klimaatsverandering. Die projek se bydrae sal egter minimaal wees invergeleke met die omringende gasvrystellers.

# KAKARETŠO YA PHETHIŠO

## Matseno

Khamphani ya Exxaro Resources Limited (Exxaro) ke khamphani yeo e lego Afrika-Borwa ya go ba le methopo ye farologanego, ya dikgahlego tša kgwebo ka Afrika-Borwa, Yuropa le Amerika.

Exxaro e swere taolo ya meepo ye tshela ya malahla diprofenseng tša Limpopo le Mpumalanga mono Afrika Borwa. Meepo ye tshela ye e tšweletša di tone tse 39 000 000 ka ngwaga ya seteišene sa mohlagase, mušimeetse le *coking coal* (mohuta wa malahla ao a šomišetšwago go tšweletša coke, elego sebešwa le selo seo se fetogago ge se tsentšhitšwe ka sebešong sa moubo). Malahla a mantši a seteišene sa mohlagase a sa fiwa Eskom. Seka-pešwa le ditšweletšwa tšeo di amegago di tšweleletšwa intasetering ya ferroalloys. Meepo ye tshela yeo go swerwego taolo ya yona ke:

- Moepo wa Malahla wa Grootegeluk, Lephalale, Profenseng ya Limpopo.
- Moepo wa Malahla wa Leeuwpan, Delmas, Profenseng ya Mpumalanga.
- Moepo wa Malahla wa Matla, Kriel, Profenseng ya Mpumalanga.
- Diopareišene tša Malahla tša North Block, Belfast, Profenseng ya Mpumalanga.
- Moepo wa Malahla wa Tshikondeni, Musina. Profenseng ya Limpopo (yeo ga bjale e lego ka tlase ga tlogedišo le tsošološo).
- Moepo wa Malahla wa Arnot, eMalahleni, Profenseng ya Mpumalanga (yeo ga bjale e lego ka tlase ga tlogedišo, tsošološo, tlhokomelo le tshwaro).

Exxaro e šišinya go katološa diopareišene tša moepo wa bona tšeo di lego gona go Moepo wa Malahla wa Grootegeluk ka go katološetša diopareišene tšeo di lego gona tša moepo tša opencast (bokagodimo bja lefase bjo bo phailwego go fihlehlela moo malahla a hwetšwago gona) go polasa ya Turfvlakte 463 LQ. Polasa ye e hwetšagala ka gare ga Ditokelo tšeo di lego gona tša Moepo wa Malahla wa Grootegeluk, tša LP 46 MRC.

## Tlhalošo ya Protšeke

Diopareišene tšeo di šišintšwego tša opencast di tla ba le melete ye mebedi, yeo e bitšwago Molete 1 le Molete 2. Molete 1 o tla ba dihektara tše 158 ka bogolo gomme o tla ba dimetara tše 64 go iša tlase, mola Molete 2 o tla ba bogolo ba dihektara tše 64 le dimetara tše 109 go iša tlase.

Diresefe tšeo di enetšego tša malahla di bontšhitše go ba le thekgo go moepo wa Molete wa go Bulega (opencast). Ka mabaka a go diphošo ka moo lefelong, Dibentšhe tša 9A le B ga mmogo le Bentšhe ya 11 di tla ba botebo bjo bo sa išego tlase kudu, gomme khwalithi ya godimo ya malahla e ka epša ka mokgwa wa kabo ya tlošo yeo e ratwago kudu.

Moepo wa Malahla wa Grootegeluk o akanywa ka ga dikgetho tše pedi tša moepong wa Molete 1 le Molete 2. Kgetho ye e ratwago ke ya go epša ga Molete 1 go latele Molete 2 go tšweletša dipoelo tše dimilione tše 1.5 ka *run of mine* (ROM) ya malahla ya ngwaga, lebakeng la mengwaga ye lesometshela (16). Molete 1 o tla epša go tloga ngwageng wa mathomo (1) go iša go mengwaga ye lesometee (11). Go epša ga Molete 2 go tla thoma ngwageng wa bo lesomepedi (12) gwa fetšwa ngwageng wa bo lesometshela (16). Kgetho ya tlhatlolano ke go epa melete ye mebedi sammaletee, ka Molete 1 wo o epšago go tloga ngwageng wa 1 go iša go wa 4 go latela Molete 2 go tloga go ngwaga 1 go iša go wa 7, go tšweletša dipoelo tše dimilione tše 3 ka ngwaga tša mohuta wa malahla wa ROM mengwageng ye šupago (7).

Interburden (e lego diepša tša magareng ga mafelo a mabedi a a kgahlegelwago ke tša ikonomi bjalo ka tšeo di arogantšhago diponagalo tša lelahla) le malahla ao a epilwego go tšwa go Molete 1 le Molete 2 a tla išwa le go swarwa diplanteng tšeo di lego gona tša Moepo wa Malahla wa Grootegeluk. Diopareišene tša moepo di tla diragatšwa ka diiri tše 24, matšatši a tshela a beke.

Infrastraktšha yeo e šišintšwego e tla thewa bokagodimong go thekga opareišene ya moepo wa malahla e akaretša ditsela tšeo di diretšwego tshepedišo ya merwalo ye boima (go swana le ya ditheraka), tšeo di kopanago le melete yeo e šišintšwego e lego gona le diopareišene tša Moepo wa Malahla wa Grooegeluk, lefelo la go šomišetšwa ditlabakelo tša moepo le dikantoro, phaele ya mobu, taolo ya meago ya meetse eo e lego bokagodimong (disampo le megala ya diphaephe), lefelo la taolo ya matšhila (setšhelo sa matšhila), le seteišene se sennyane sa mohlagase.

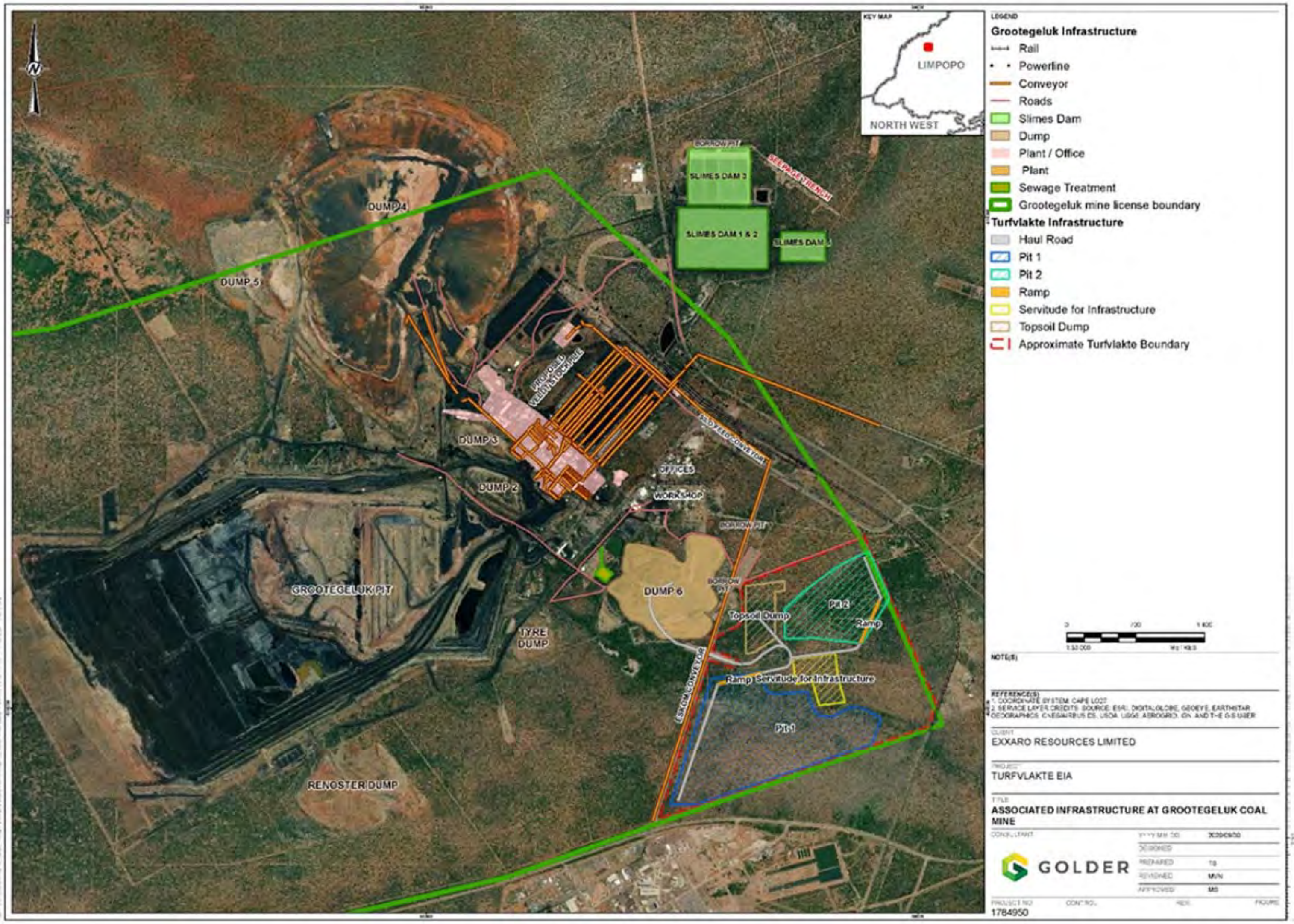



**Figure 3: Lefelo la Protšeke ye e šišintšwego la Molete wa go Bulega wa Turfvlakte kamanong le Moepo wo o šomago wa Malahla wa Grooegeluk**

## Tshepetšo ya Tumelelo

Protšeke ye e šišintšwego e nyaka kgopelo ya Environmental Authorisation (EA) gore e dirwe ka mokgwa wa go labella mmogo le tshepetšo ya Environmental Impact Assessment (EIA) go ya ka Melao ya EIA ya 2014, go ya ka moo e fetošitšwego, ka tlase ga molao wo o bitšwago National Environmental Management Act 107 wa 1998 (NEMA), go ya ka moo o fetošitšwego ka gona.

Golder Associates Africa (Pty) Ltd. (Golder), Mošomedi wa Bolekodi bja tša Tikologo yo a ikemetšego ka noši, o swaragane le mošomo wa go lebelela tshepedišo ya EIA.

Morero wa sekgwarinywa se sa pego ya EIA ke go lekola dikhuetšokgolo tša tikologo/ye e amanago le kotsi ya diopareišene le dikago yeo e amegago, le go šupa taolo le ditiragalo tša bolebeledišiši go fokotša dikotsi tša tikologo tšeo di lebeletšwego.

Sammaletee le go dira dikgopelo tša EA le go thekgwa ka tebello le tshepetšo ya EIA, protšeke ye e šišintšwego e swanetše go hwetša leasense ya meetse yeo e tsebjago ka la Water Use Licence (WUL) go tšwa go Kgoro ya Merero ya Meetse le Kagodikgwa.

## Dipeelano tša Motheo tša Tikologo le Dikotsi/Dikhuetšo tšeo di tlago tša Tikologo

Karolo 7 ya pego ye e hlaloša tikologo ya biofisikhale le tikologo ya tša ekonomi ya tša leago tšeo di ka angwago ke kgodišo ye e šišintšwego ya go epša ga tšwetšopele ya opencast. Dikhwetšagalo tša dithuto tša tekolo ya khuetšo ya tikologo, go ya ka kgato la protšeke, di filwe ka botlalo ka go karolo ya 10 ya pego ye.

Makala a tikologo ao a akanywago ka go sekgwarinywa se sa Pego sa EIA:

### Thutaswika-

Thutaswika ya selete lefelong e na le mohuta wa matlapa a *igneous (*ao a bopegago ka mokgwa wa phodišo le go tiišwa) le a *sedimentary* (ao a bopegago ka mokgwa wa kgoboketšo), a Karoo Supergroup. Protšeke ya Molete wa go Bulega wo wa Turfvlakte e hwetšagala karolwaneng ya borwa bja Limpopo, phasetše ye nnyane magareng ga Noka ya Limpopo ka bosobelatšatši le Palala - Sehlaba sa Polokwane ka bohlabatšatši.

Lefelo la protšeke le hwetšagala Waterberg Coal Field gomme le akaretša diyuniti tše kgolo ka moka tša Karoo Supergroup, di nago le go tšwa bokagodimong bja Sehlopha sa Stormberg, Sehlopha sa Beaufort, Sehlopha sa Ecca le sehlopha sa Dwyka seo se agagilego lebato la lebato la ka tlase.

Diopareišene tša protšeke ye e šišintšwego ya Molete wa go Bulega wa moepo di tla feleletša ka khuetšo ya saruri go thutaswika ya lefelo la protšeke, nakong ya kgato la opareišene. Mokgwa wa go epa ka go iša pele wa go epša ga opencast o tla bea waste rock (e lego letlapa la mašaledi a mešomo ya meepo ka go fapana) le *overburden* (mobu wa bokagodimo) morago ka godimo goba tlase ga maemo a bona le go fokotša khuetšo ka tsela ye itšego.

### Klaemete

Lefelo la protšeke ye e šišintšwego le hwetšagala seleteng sa Waterberg go la Afrika-Borwa, seo se welago ka gare ga *subtropical high-pressure belt*. Ditempereitšha tša godimo di itemogelwa dikgweding tša selemo tša Disemere, Jeneware le Febereware, le tša tlase nakong ya dikgwedi tša marega tša June, Julae le Agostose.

### Khwaliti ya Moya

Lefelo la protšeke ya Turfvlakte le ka gare ga Waterberg-Bojanala Priority Area (WBPA). Selete se na le sekgwa sa tlhago, diploto tšeo di phatlaletšego ka gare ga mašemo a a hlagotšwego, temo ya go sebe ya kgoparara gomme e šireleditšwe ke diresefe tša tlhago.

Moepo wa Malahla wa Grootegeluk, le diteišene tša mohlagases tša kgauswi tša Eskom, Medupi le Matimba, ke dibopego tša segae tšeo di bonagalago kudu. Methopokgolo ya tšhilafatšo ya moya mo lefelong le ke go epša ga malahla, tlhagišo ya mohlagase, go fiša sebešwa sa segaeng, dikedišo tša dinamelwa le tlhagišo ya lerole mebileng ya go se kgorwe.

Bao ga bjale e tla bago baamogedi ba amegago maikutlong, tikologong yeo ya Moepo wa Malahla wa Grootegeluk le Thabametsi le diopareišene tša moepo waTurfvlakte tšeo di šišintšwego, ba akaretša meago ya go phatlalala ya dipolaseng, dilotše, ditoropo le mafelo a tlhago ao a beetšwego tša pabalelo.

Lerole le ditsekana tše nnyane ke tšona ditšhilafatšikgolo tšeo go tshwenyegwago ka tšona nakong ya magato ka moka a tshepetšo ya protšeke ka lebaka la meferehlo le tshepedišo ya mobugodimo, *interburden* le malahla ga mmogo le dinamelwa tšeo di šomišwago ditseleng tšeo di sego tša kgorwa.

## Topokrafi

Topokrafi ya lefelo ka kakaretšo e hlalošwa bjalo ka “Melala”, ka ditshekamo tšeo di farologanego magareng ga dipersente tša 0 le 3. Tlhatlošo go rarela lefelo la protšeke e farologanego go tloga go 900 go iša go 922 m ka godimo ga tekanetšo ya lewatle/ka godimo ga tekanetšo ya lewatle. Lefelo leo ka kakaretšo ga le na dibopego ntle le difarologanyo tšeo di hlotšwego ke Nelsonskop (922 m) ka go la leboa le mohlwaela wa Waterberg (3,600 m) ka go la borwa. Tšhollo e bonagala go ba ka thoko tša bohlaba-leboa go yela Nokeng ya Mogolo gomme e na le maope ao a omilego santeng ka “Sandloopspruit”.

Kago ya lefelong leo le meago yeo e nyakegago ya taolo ya meetse moo go šomelwago gona, ga mmogo le melete ya opencast, go akaretša le sebaka sa ruri ge go tswalelwa, di tla ba le khuetšo go topography lefelong la kgauswi kudu.

## Mobu, Tšhomišo ya Naga le Boteng bja Naga

Lefelo la protšeke ya Turfvlakte le na le mehuta ya naga ya Ae252 le Ah85, bjalo ka ge di tšerwe go dikgopotšo tša histori tša mohuta wa naga le dimmepe tšeo di amanago le yona tša 2326 Ellisras.

Tšhomišo ya bjale ya naga ka gare ga mafelo ao a šišintšwego a moepo a šomišetšwa bolemi bja diphoofolo le ditsela tša polasa le lešaledi la lefelo leo le šomišeditšwego tša dinamelwa (leporogo la go tshelela ka go mmoepo wa Grootegeluk) le tšhomišetšo ya kgwebo (Lotše ya Manketti). Tšhomišo ya naga ka gare ga Moepo wa Malahla wa Grootegeluk e na le meepo.

Ge go bapetšwa le Bokgoni bja tša Naga bja Setšhaba, bjo bo šupago gore bonnyane bja dipersente tše masometshelanne (64%) tša lefelo la protšeke le na le bokgoni bja naga bja magareng, tekolo ya tekanyo ya gae yeo e hlophilwego gore lefelo leo ga le a swanelwa ke go tšweletša dibjalo tša ngwaga.

Mobugodimo wa dimela o tla tlošwa go tloga go dihektara tše 265 tša naga bophelong bja moepo bakeng sa kago ya ditsela tšeo di diretšwego dinamela tša go rwala merwalo ye boima, lefelo la infrastraktšha yeo e adilwego le diopareišene tša molete wa go bulega. Le ge go le bjalo, modiro wa go epa ka mokgwa wa mpidikane, wa tsošološo ya go epa o tšwelela pele sammeletee, e tla fana ka phokotšego ye e bonagalago, go išeng go pušološo ya seripa sa lefelo leo la kago/ka go lelengwe go tsošološwa lefelo leo la kago. Ka tšwelelo ya theošo yeo e hutšwago mobung, go theoga ga khwalithi ya mobu ka kakaretšo le tša maphelo, di ka thibela tshwanelego ya mobu go šomišetšwa naga mafelelong.

## Ekholotši

Lefelo la protšeke le sekgwa seo se bitšwago Limpopo Sweet Bushveld (ref. SVcb19) ke mohuta wa semela sa savanna biome.

Savanna biome ke semela se segolo sa biome kudu go la Afrika-Borwa, se akaretšago go ka ba dipersente tše masometharohlano (35%) tša bogodimo bja bokagodimo bja naga. Di-savanna di tletše ka tlhatlagano ya bjang, tša namelwa godimo ke karolo? ya semela sa legong, seo se sa tšwelego pele eupša se fapaneng ka tlhago. Tlhamo ya dikhuetšo tša motheo tša savanna, sebopego le go šoma ga yona ke mollo, klaemete ya sehla yeo e bonagalago, mohuta wa substreite (llaga yeo diphedi di dulago ka tlase ga yona le go hwetša phepo), le go lebelelwa gammogo le go fulwa ke dijamerogo tše kgolo.

Sethokgwa sa go tsebja ka la Limpopo Sweet Bushveld se katologela go yela leboa go tšwa kgauswi le phihlelelo ya dinoka tša Crocodile le Marico go iša go Molapo wa Limpopo le ka go Botswana. E farologantšhwa ke namelelo ya mokgwa wa lephotho goba melala ye e tlago e sepela e bušwago ke naga ye e bulegilego ya sethokgwa.

Mafelo a mmalwa a tlhago ao a tsebišitšwe semolao, ga mmogo le mafelo ao a pabalelo a go se be a semmušo a hwetšagala seleteng se se ahlamego, go rarela lefelo la thuto. Mafelo a a ama Marakele National Park, D'Nyala Nature Reserve, Welgevonden Private Nature Reserve, Hans Strijdom Nature Reserve le mafelo a boagišane a Tierkop Private Nature Reserve.

Lefelo la diphoofolo la Waterberg Biosphere le dutše dihektara tšeo di ka bago 650 000 tša setereke sa Waterberg go iša go borwa bja lefelo la protšeke ya Turfvlakte.

Mešomo ye e šišintšwego ya moepo ya opencast le meago yeo e amegago di tla nyaka go tlošwa dimela ka lefelong la protšeke gomme le tla feleletša ka pherehlo ya fauna le flora bjalo ka poelo ya tahlegelo ya bodulo le kokobetšo, thubagantšho ya bodulo, lehu le pherehlo ya fauna le kgonagalo ya theo le phatlalatšo ya mohuta yeo e tsebišwago ka ntle ga mola wa tšona wa thutafase tlhago.

## Meetse a bokagodimo

Moepo wa Malahla wa Grootegeluk le lefelo la protšeke la Turfvalakte o hwetšagala ka go A42J quaternary catchment ya Limpopo Water Management Area (WMA). Mothopokgolo wa meetse ka go quaternary catchment ke Sandloopspruit yeo e falalelago go bohlabela-leboa go kopana le Noka ya Mokolo go ka ba dikilometara tše 40 borwa bja Noka ya Limpopo.

Ge go se na le phokotšo, moepo wa malahla le mešomo yeo e amegago e ka feleletša ka morwalo wa go ntšhwa ga meetse ka go mobutšhaledi wa godimo le ditšhilafatši tše bjalo ka sebešwa, diela tša hydrauliki, le dikhemikhale. Phaele ya stoko sa mobugodimo le go ntšhwa ga meetse a bokagodimo bja go se laolege di ka ba le seabe go morwalo wa mobutšhaledi.

## Meetse a ka tlase

*Aquifer* yeo e lego lefelong la protšeke ya Turfvlakte e hlopša ka mokgwa wa *aquifer* ye nnyane, go ya ka mo e bitšwago ka gona ke Hydrogeological Map Series published by DWAF (1996). Karolwana ya bodikelatšatši bja lefelo la protšeke ya Turfvlakte, *aquifer* e hlopša bjalo ka mogaro wa aquifer yeo e robegilego, mola karolo ye kgolo (lefelo leo le šišintšwego la Molete 1 le MOLETE 2) e hlopša bjalo ka *intergranular* le ye robegilego. Magaro a *aquifer* ka bobedi a na le tswala ya petse ya palogare ya go ka ba 0.5 l/s, e lego yona thwii ya Karoo Super Group.

Diopareišene tša protšeke ye e šišintšwego ya Molete wa go Bulega wa moepo di tla feleletša ka theogo ya tafola ya meetse a ka tlase a segaeng, ka lebaka la go ntšhwa ga meetse go go nyakegago le tšhilafatšo ya meetse a ka tlase a go ba le di-nitrate ka lebaka la moubo. Kamego ya go ntšhwa ga meetse e tla ba kokeletšo yeo e hlotšwego ke molete wo o lego gona go Moepo wa Malahla wa Grootegeluk, e lego dikilometara tšeo di ka bago tše tharo 3 go ya bosobelatšatši bja Molete 1.

Se se dumelela nako ye e lekanego ya phetogelo ya khemikhale go diragala mafelong ao a epilwego le methopo ya ditšhilafatšo tšeo di tlago go ba gona go tšweletša dipeelano tša Kgamolo ya *Acid Rock* ka go mafelo a epilwego le mešomo yeo e amanago le moepo wo o šišintšwego o ka feleletšago ka tšhilafatšo ya meetse a ka tlase ka lebaka la metšhologo ya dibešwa, dikirisi, diela tša hydrauliki le dikhemikhale, ge go se na le maano a phokotšo ya maleba.

## Lešata

Methopo ya lešata la *Ambient* yeo e rekotilwego lefelong la thuto e akaretša mešomo ya meepo ya mabapi, lešata la seteišene sa mohlagase, sephethephete le lešata la legae.

Diopareišene tše di šišintšwego tša moepo di tla ba le seabe go tekanyo ya lešata leo le šetšego le le gona lefelong. Lešata la go tšwa metšheneng ya moepo le tla kwagala eupša le ka se fete tekanyo ya mosegare ya dileteng tša sekgoweng, go fetiša dimetara tše makgolo a mahlano (500 m) ka go mollwane wa legaro la kubulo wo o eleditšwego le go mafelo a a kgwathago maikwelo tseleng ge bokapele bja go epa bo šuthela pele, go bapela le botelele bja megogolwa ya lelahla.

## Ya pono

Thutu ye petlekilego kutšwana e na le motswako wo fetošitšwego ka botlalo le naga yeo e tšweleditšwego pele yeo e amanago le Moepo wa Malahla wa Grootegeluk wa mabapi, Seteišene sa mohlagase sa Eskom, lefelo la bodulo la Marapong ga mmogo le mehlala ye megolo go sethokgwa sa tlhago seo se sa tšwetšwago pele, ka tlase ga taolo ya diphoofolo goba diruiwa.

Lefelo la protšeke ya Turfvlakte le na le sethokgwa sa tlhago seo se nago magato a phetošo a a hlokomologilwego le pherehlo yeo e kgaoletšwego go neteweke ya mehlala ya senamelwa sa go bonwa ga diphoofolo.

Protšeke e tla oketša khuetšong ya pono yeo e šetšego e le gona ka lebaka la mešomo ya batho ba o ba lego lefelong. Infrastraktšha ya bokagodimo bja moepo, go sepediša dikoloi le go tupa ga lerwele ga go tla ka sewelo go tla bonagala nakong ya mosegare le mabone a emego le a go sepetšwa ka bobedi a tla bonagala nakong ya bošego.

## Tša Setšo le Bohwa

Protšeke ye e šišintšwego ya Molete wa go Bulega wa Turfvlakte e lefelong leo le khupeditšwego ke tekanyetšo ye sa fetogego ya melala ya sehlaba le sethokgwa se se bulegilego sa savanna. Hlogo ya bodulanoši, Nelsonskop, e tšwelela kgauswi le lefelo la protšeke ebile e amana le bodulo bja batho nakong ye e fetilego.

Pistorius (2018) o bolela gore lefelo la protšeke ya Turfvlakte le be le na le palonyana ye nnyane ya batho peleng. Le ge go le bjalo, bodulo bja lona go thomile e sale ka pela, la feleletša le na le batho lefelong leo ge nako e dutše e telefalela go ya pele, eupša ka kokeletsego se se kgaoleditšwego.

Ga go na le methopo ye e tsebjago ya bohwa lefelong leo le angwago ke moepo, eupša kgonagalo ya go epolla methopo ye e bolokilwego nakong ya kago le diopareišene tša moepo di ka se phaelwe ka thoko.

## Palaeontolotši (lekala la saense leo le amanago le mašaledi a kgale, diphoofolo le dimela.)

Sehlopha sa go bitšwa Karoo Supergroup se tsebalega kudu ka ga bohumi bja fosili (mašaledi a kgale). E swailwe ka la gore ke *Undifferentiated Strata of the Karoo Supergroup*,eupša e bapišwa le Vryheid Formation (Pe, Pv), Ecca Group le Grootegeluk Formation yeo e humilego ka dimela tša difosili bjalo ka *Glossopteris flora* yeo e emelwago ke dikotana, mahlare, modula le tshepetšo ya go mediša dienywa.

Ga go na le methopo ye e tsebjago ya palaeontolotši ka gare ga lefelo la go angwa ke moepo, eupša kgonagalo ya go epolla methopo yeo e bitletšwego nakong ya kago le diopareišene tša moepo di ka se hlokomologwe.

## Sephethephethe

Lefelo la go šomela la protšeke ya Turfvlakte le fihlelelwa *ka go tsena* botsenong bjo bo lego gona bja Moepo wa Grootegeluk, bjo bo fihlelelwago go tšwa go Tsela ya D2001 magahlanong a mmila wa go ya Marapong. Magahlano a D2001, ao a fanago ka phihlelelo ya Moepo wa Malahla wa Grootegeluk le Marapong ka bobedi, e bontšhitšwe.

Ka mabaka a kgonagalo ya tlase ya gore protšeke e ka hlola mešomo ye meswa, khuetšo ya bjale ya sephethephethe lefelong le e holofelwa go hlokomologwa.

## Tša Ekonomi ya Leago

Lefelo la protšeke ya Turfvlakte le wela ka gare ga mmasepala wa setereke se se bitšwago Waterberg District (DM) le sa Lephalale seo se tsebjago ka Lephalale Local Municipality (LM) ka go Profense ya Limpopo. Lephalale LM e bopa kgaolo ye kgolo le ntlha ya kgatelopele ka lefelong la mmasepala.

Setšhaba sa ka gare ga LM se be se le 115 767 ka 2001 gomme sa ba le ponagalo ye kgolo ya go golela go 140 240 ka nngwaga wa 2016.

Tša Meepo, Temo le Boeti ke karolo ya disektarakgolo tšeo di nago le semelo sa profaele ya ekonomi ya Setereke sa Waterberg. Intaseteri ya moepo ka go lefelo le la mmasepala le fa seabe go kgatelopele ya tša ekonomi go Waterberg District le Profentshe ya Limpopo. Mmasepala wa Lephalale (LM) o na le tekanyo ya mešomo ka dipersente tše 44%, ka go yeo dipersente tše 42% e lego tšeo di sa šomego ka go tša ikonomi le dipersente tše lesomepedi (12%) tša bao ba se nago mešomo.

Badudi ba mono gae ba tla itemogela dikhuetšo tšeo di sa rategego bjalo ka lešata, lerole, dibonwa le phalalelo ya baagi, eupša le dikhuetšo tšeo di rategago tša bobotlana, tšeo e lego ditlamorago tša go tšwa tshwarelelong ya mošomo le tshenyagalelo go dithoto tša selegae le ditirelo.

## Dikedišo tša Gase ya Greenhouse le Phetogo ya Klaemete

Protšeke ye e šišintšwego ya dikedišo tša Skoupo sa 1 le Skoupo sa 2 tša Molete wa go Bulega wa Turfvlakte di tla fa seabe go dikedišo tša GHG ya Afrika-Borwa gomme mafelelong go phetogo ya klaemete nakong ya magato a kago, opareišene le tswalelo. Seabe sa dikedišo tša protšeke se bonwa se le tlase ge go bapetšwa le ditšweletši tše dingwe ka lefelong la kgauswiuswi le lona.

# LIST OF ACRONYMS AND ABBREVIATIONS

| Abbreviation | Description |
|---|---|
| BIL | Background Information Letter |
| DEA | Department of Environmental Affairs |
| DMRE | Department of Minerals and Energy |
| DSR | Draft Scoping Report |
| DWS | Department of Water and Sanitation |
| EA | Environmental Authorisation |
| EAP | Environmental Assessment Practitioner |
| EIA | Environmental Impact Assessment |
| EMPr | Environmental Management Programme |
| FSR | Final Scoping Report |
| GN | General Notice |
| ha | Hectares |
| I&APs | Interested and affected parties |
| IWWMP | Integrated Water and Waste Management Plan |
| km | Kilometre |
| m | Metres |
| MR | Mining Right |
| Mtpa | Million Tonnes per Annum |
| NEMA | National Environmental Management Act, 1998 (Act 107 of 1998) |
| SG | Surveyor General |
| WML | Waste Management Licence |
| WUL | Water Use Licence |

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# PART A
# SCOPE OF ASSESSMENT AND ENVIRONMENTAL IMPACT ASSESSMENT REPORT

## 1.0 INTRODUCTION AND BACKGROUND

Exxaro Resources Limited (Exxaro) is a South Africa-based diversified resources company with business interests in South Africa, Europe and the United States of America.

Exxaro was formed as a result of an empowerment transaction that involved the unbundling of Kumba Resources' iron ore assets and the relisting of Kumba as Exxaro in November 2006. The two companies that were formed through the transaction are:

- Exxaro, which focusses on coal, mineral sands and base metals and industrial minerals; and
- Kumba Iron Ore, which focusses on iron ore.

Exxaro manages seven coal mines in the Limpopo and Mpumalanga provinces of South Africa. The seven mines produce high-quality thermal, metallurgical, and coking coal for both domestic markets, such as Eskom and the ferroalloys industry, and export markets. The seven coal mines are:

- Grootegeluk Coal Mine, Lephalale, Limpopo Province;
- Leeuwpan Coal Mine, Delmas, Mpumalanga Province;
- Matla Coal Mine, Kriel, Mpumalanga Province;
- Dorstfontein Complex, Kriel, Mpumalanga;
- Forzando Complex, Bethal, Mpumalanga;
- Belfast Coal Mine, Belfast, Mpumalanga; and
- Mafube Coal Mine, Middelburg, Mpumalanga Province (50% ownership).

Exxaro is proposing to expand their existing mining operations at the Grootegeluk Coal Mine by extending the opencast mining operations to the eastern portion of the farm Turfvlakte 463 LQ. The farm is located within Grootegeluk Coal Mine's existing Mining Right, LP 46 MRC.

### 1.1 Content of this report

The main purpose of this EIA/EMPr report is to provide a description of the current baseline environmental conditions within the proposed project area, and to describe the identified environmental impacts and mitigation measures for the proposed activities.

This document has been structured as follows to meet the requirements of Appendix 3 of the 2014 EIA Regulations, as amended in April 2017:

- **Introduction and overview** – Introduce the project and the project proponent, provides an overview of the project, provides the details of the environmental assessment practitioner, and explains the EIA process.
- **Project Motivation** – Motivates the need for and desirability of the project.
- **EIA Process** – Summarises the process being undertaken with respect to the EIA for the project, inclusive of the methodology utilised for scoping.

- **Description of the Proposed Project** - Provides a summary of the key project components, the project location, scale, nature and design, production process, main inputs and outputs, schedule and activities during different phases of the project, inclusive of a description of the project location and the properties on which the project will take place.
- **Project Alternatives** – Summarises alternatives considered by the project proponent.
- **Policy, Legal and Administrative Framework** – Discusses the environmental policy, legal, and administrative framework applicable to the proposed project. This framework includes a summary of relevant South African regulations, the applicable administrative framework, and the environmental permitting process.
- **Description of the Environment that may be affected** – Describes the current pre-project biophysical, socio-economic, and cultural status of the area, key characteristics (sensitive or vulnerable areas), important heritage resources, current land use and livelihoods.
- **Environmental Issues and Potential Impacts of the Project -** Describes the identified impacts and recommended mitigation measures.
- **Public Consultation** – This section provides a summary of the public consultation activities undertaken as part of the EIA/EMPr process.
- **Next Steps in the Process** – Indicates what the next steps in the process are.
- **References** – References to literature consulted.
- **Appendices** – Technical material supporting the EIA report, including the Curricula Vitae (CV) of the EAP, stakeholder comments and supporting information, preliminary design reports, specialist impact assessment reports, and document limitations.

# 2.0 PROPONENT AND PRACTITIONER DETAILS

## 2.1 Details of the proponent

For purposes of this EIA, the following person may be contacted at Exxaro Grootegeluk Coal Mine:

**Table 1: Proponent's contact details**

| | |
|---|---|
| **Contact Person** | Filomaine Swanepoel |
| **Address** | Farm Enkelbult 462 LQ within the jurisdiction of Lephalale Local Municipality of Waterberg District, Limpopo Province |
| **Telephone** | 014 763 9288 |
| **Fax** | 014 763 9453 |
| **E-mail** | Filomaine.Swanepoel@exxaro.com |

## 2.2 Details of Environmental Assessment Practitioner

Exxaro has appointed Golder Associates Africa (Pty) Ltd (Golder) as an independent Environmental Assessment Practitioner (EAP) to undertake EIA that is required to support the application for environmental authorisation (EA) and water use licence application (WULA) for the proposed Grootegeluk Turfvlakte Expansion Project at Grootegeluk Coal Mine.

Golder Associates Africa is a member of the world-wide Golder Associates group of companies, offering a variety of specialised engineering and environmental services. Employee owned since its formation in 1960, the Golder Associates group employs more than 7 500 people who operate from more than 155 offices located throughout Africa, Asia, Australasia, Europe, North America and South America. In Africa Golder has offices in South Africa, Ghana, Mozambique, and the DRC.

Golder has no vested interest in the proposed project and hereby declares its independence as required by the EIA Regulations.

For purposes of this EIA, the following persons may be contacted at Golder:

**Table 2: Details of Golder Associates**

| | |
|---|---|
| **Name** | Golder Associates Africa (Pty) Ltd |
| **Address** | Building 1, Magwa Crescent West, Maxwell Office Park, Waterfall City, Midrand<br>P.O.Box 6001, Halfway House, 1685, South Africa<br>Telephone: (011) 254 4800<br>Fax: (086)582 1561 |
| **Environmental Assessment Practitioner (EAP)** | **Marié Schlechter** (Senior Environmental Specialist)<br>Ms Schlechter has worked in the mining industry and environmental consultancy for over nineteen (19) years, gaining experience in the environmental management discipline. Marié has experience in conducting and managing environmental impact assessment projects, implementation, maintenance and internal auditing of environmental management systems as well as compliance audits.<br>Marié is a Registered Environmental Assessment Practitioner (EAP No: 2020/1430).<br>Email: mschlechter@golder.co.za<br>*Full CV is provided APPENDIX B.* |
| **Public Participation Specialist** | **Brian Magongoa** (Public Participation Specialist)<br>Email: bmagongoa@golder.co.za |

## 2.3 Description of the property

**Table 3: Details of area applied for**

| Aspect | Description |
|---|---|
| Farm Names | Enkelbult 462 LQ (Portion 0 and 1)<br>Turfvlakte 463 LQ |
| Application area | 439 ha |
| Magisterial District | Waterberg District Municipality |
| Distance and direction from nearest town | Grootegeluk Coal Mine is located approximately 15 km (by road) to the north-northwest of Lephalale |
| 21-digit Surveyor General Codes | Enkelbult 462 LQ (Portion 0) - T0LQ00000000046200000<br>Enkelbult 462 LQ (Portion 1) - T0LQ00000000046200001<br>Turfvlakte 463 LQ - T0LQ00000000046300000 |

## 2.4 Locality Map

### 2.4.1 Magisterial District and relevant Local Authority

The Grootegegeluk Turfvlakte Expansion project area, as part of the Exxaro Grootegeluk Coal Mine, falls within the jurisdiction of the Lephalale Magisterial District (Figure 4). The project area is located in the Lephalale Local Municipality, which falls within the boundaries of the Waterberg District Municipality, in the Limpopo Province.

The Turfvlakte project area falls within the A42J Quaternary Catchment (Figure 4)

### 2.4.2 Surface Right Owners and use of immediately adjacent land

The proposed project area is bordered by the remainder of the Grootegeluk Coal Mine to the immediate north, northeast, northwest and western sides, the Eskom Medupi Power Station to the south and privately-owned land to the east and southeast (Figure 5). The Matimba Power Station is located approximately 3 km to the east and the Marapong community is located approximately 5 km to the northeast.

The farm Tufvlakte 463 LQ is already included in the Grootegleuk Mining Right area (Figure 6).

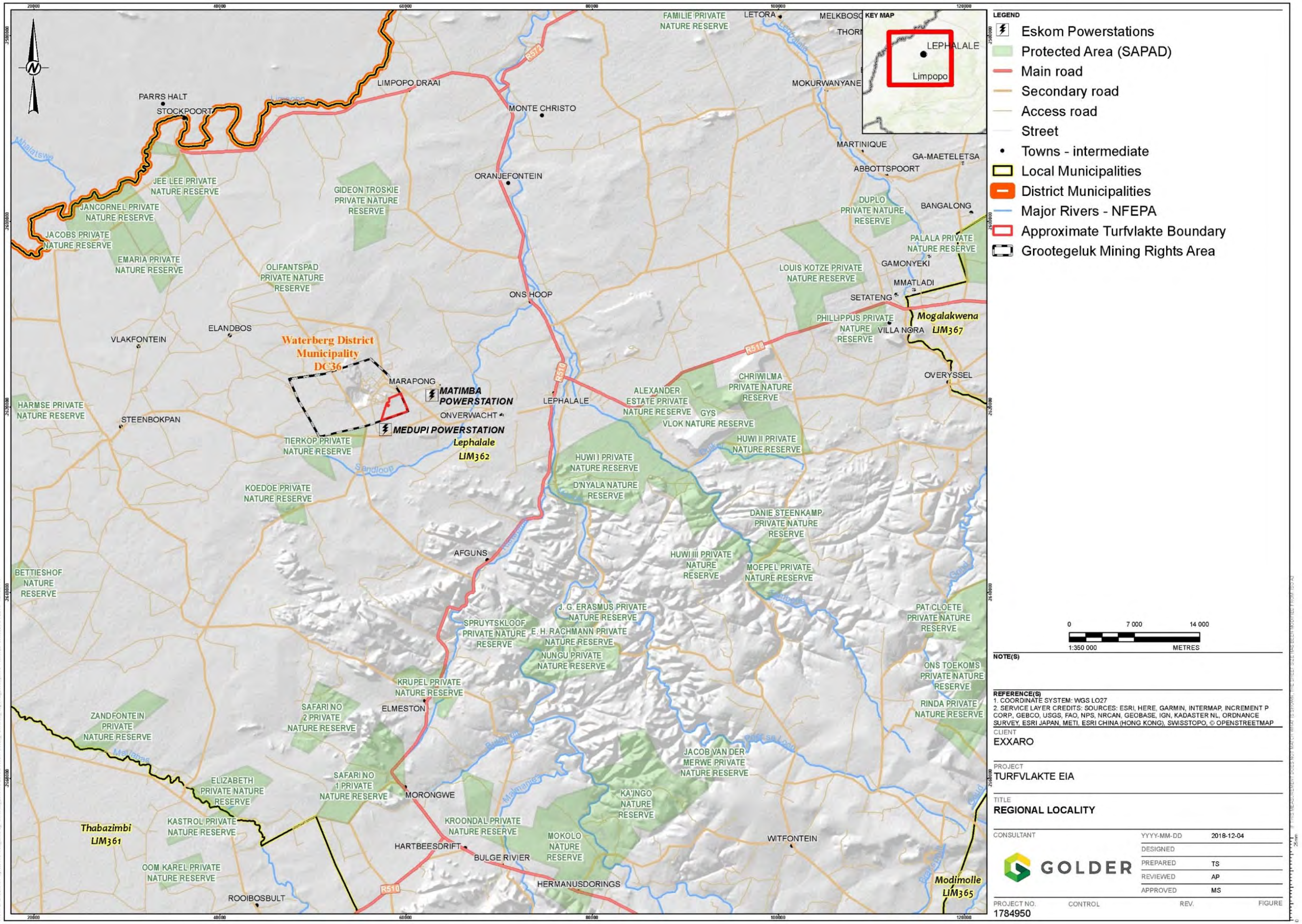



**Figure 4: Regional Locality of the Grootegeluk Coal Mine.**

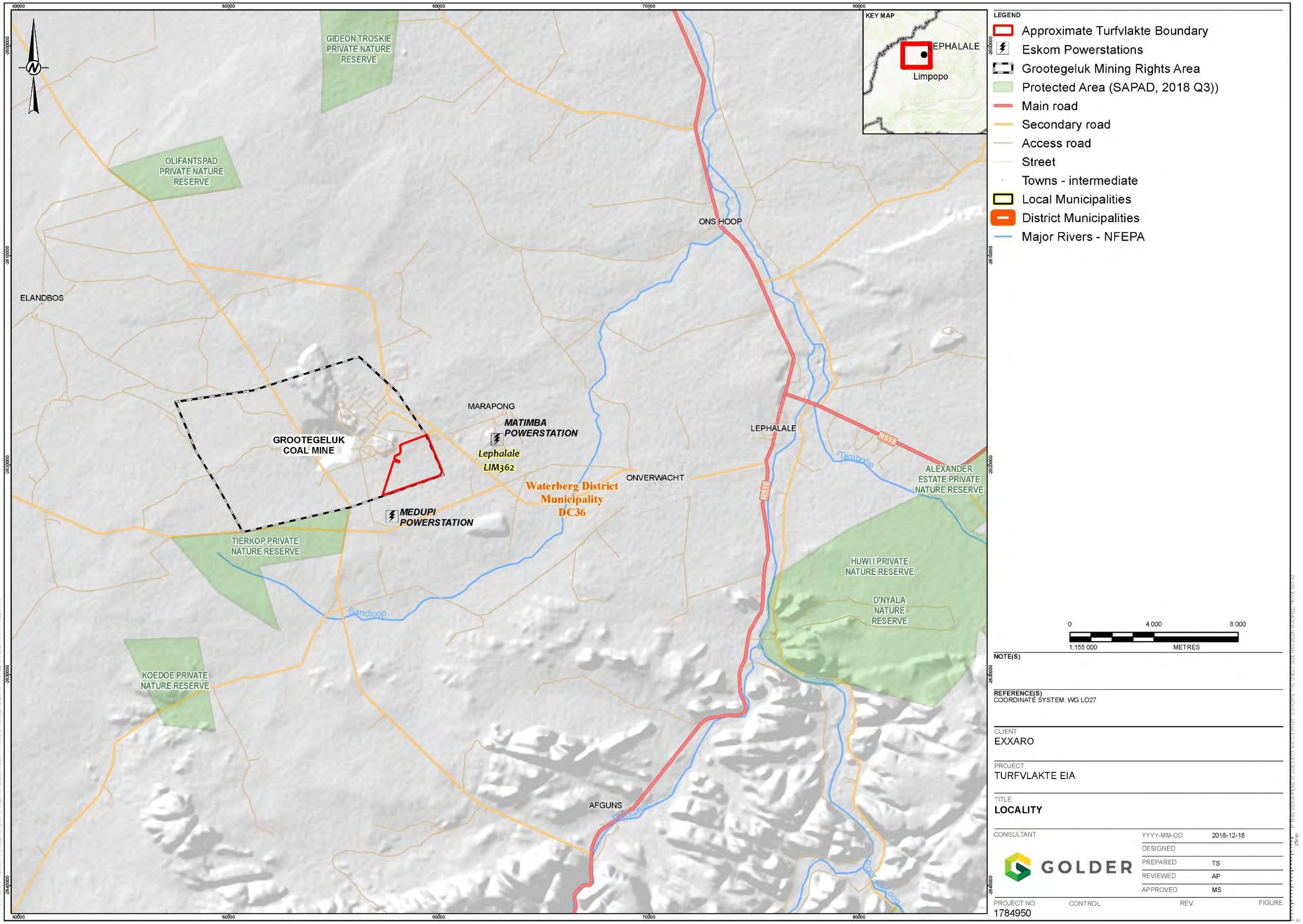



**Figure 5: Locality of the Grootegeluk Turfvlakte Expansion Project Area.**

The surface right owners of the various farm portions in the vicinity of the project area are listed in Table 4 and illustrated in Figure 6.

**Table 4: List of surface right owners in the vicinity of the project area**

| Farm Name and Portion | Surface Right Owner |
|---|---|
| Grootegeluk 459 LQ | Exxaro Resources Limited |
| Enkelbult 462 LQ | Exxaro Resources Limited |
| Nelsonskop 464 LQ (Portion 1 and Remainder) | Exxaro Resources Limited |
| Hieromtrent 460 LQ | Exxaro Resources Limited |
| Turfvlakte 463 LQ | Exxaro Resources Limited |
| Grootestryd 465 LQ (Portion 3) | Exxaro Resources Limited |
| Grootestryd 465 LQ (Portion 5) | Lephalale Local Municipality |
| Grootestryd 465 LQ (Portion Remainder) | Eskom Holdings Limited |
| Eenzaamheid 687 LQ | Eskom Holdings Limited |
| Naauw Ontkomen 509 LQ | Eskom Holdings Limited |
| Hanglip 508 LQ (Portion 9) | Eskom Holdings Limited |
| Hanglip 508 LQ (Portions 1 and 2) | Batis Prop 10 (Pty) Ltd |
| Hanglip 508 LQ (Portions 1, 2 and 3) | Waterkloof Familie Trust |

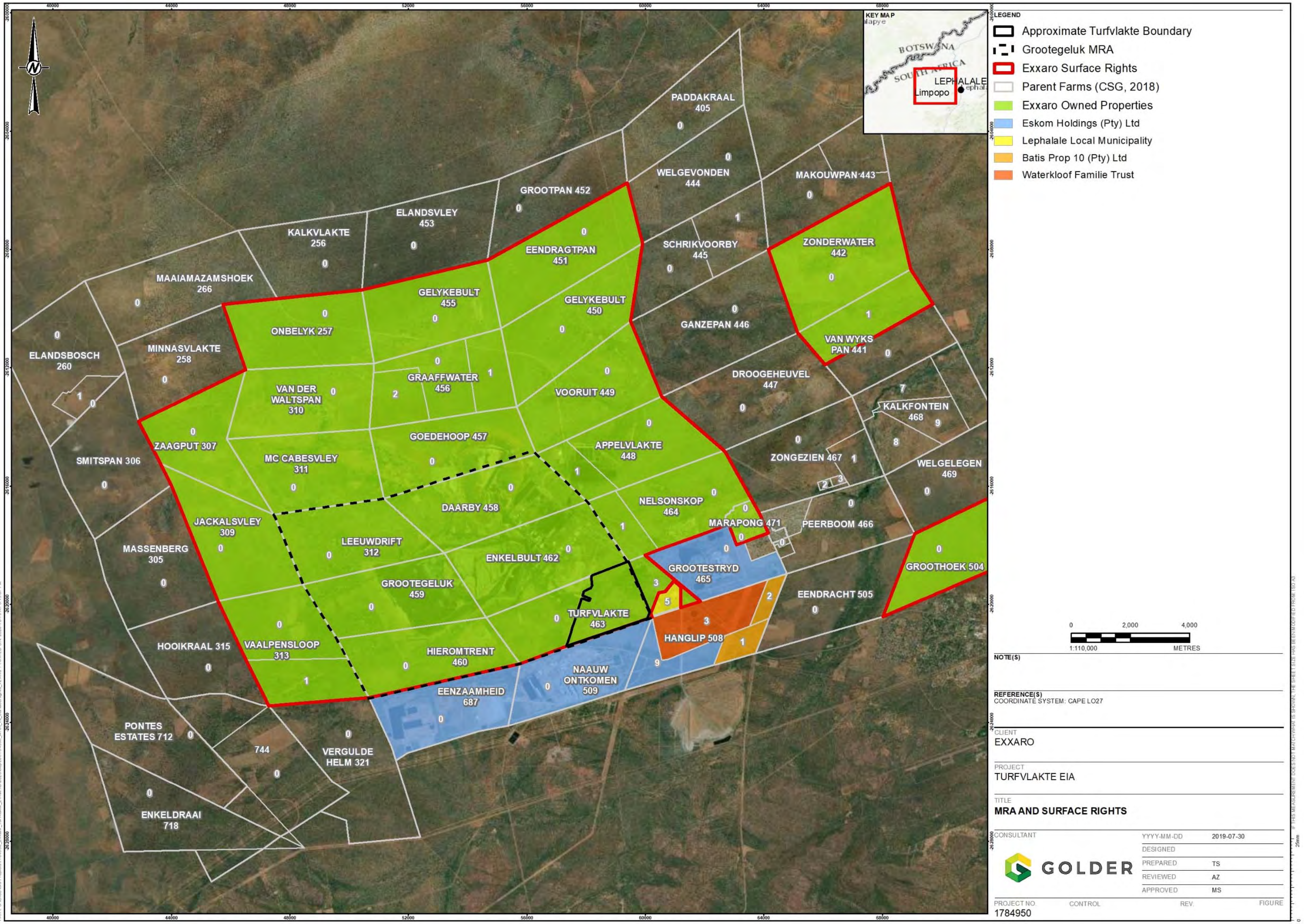



**Figure 6: Surface Right Owners**

## 2.5 Description and Scope of the Proposed Overall Activity

### 2.5.1 Location

The Grootegeluk Turfvlakte Expansion Project is situated approximately 30 km west of Lephalale, located in the Waterberg region (which forms part of the Bushveld region) of the Limpopo Province of South Africa.

More specifically, the Grootegeluk Turfvlakte Expansion Project is located on the farm Turfvlakte 463 LQ directly south of the existing Grootegeluk Coal Mine operations and within the existing Mining Right Area of Grootegeluk Coal Mine. The location of the proposed development in relation to the mining rights area is shown in Figure 5 and in relation to adjacent properties in Figure 6.

The site layout of the project is presented in Figure 7 below. It indicates the position of the pits, haul roads, topsoil stockpile and infrastructure laydown area.

Directly south of the project area is the Grootegeluk Coal Mine property border that separates Exxaro-owned land from Eskom-owned land. A provincial road close to this boundary traverses the Eskom property in an east-west direction.

### 2.5.2 Mining operations

Exxaro is proposing to expand their existing mining operations by extending the opencast mining operation to the eastern side of the farm Turfvlakte 463 LQ (Figure 7) which is not part of the curerent Life of Mine plan for the mine. The farm is located within the existing Grootegeluk Coal Mine's Mining Right, LP 46 MRC. The opencast operations will consist of two pits, namely Pit 1 and Pit 2. Pit 1 will be 158 ha in size and will be 88 m deep, while Pit 2 will be 64 ha and 109 m deep.

Sufficient coal reserves have been proven to support opencast mining. Due to faulting in the area, Benches 9A and B and Bench 11 will be at quite shallow depths and high-quality coal can be mined at a favourable stripping ratio (Aurecon , 2018).

Grootegeluk Coal Mine is considering two options for the mining of Pit 1 and Pit 2. The preferred option is to mine Pit 1 and then Pit 2 to produce 1.5 million tonnes per annum run of mine (ROM) coal over a period of sixteen (16) years. Pit 1 will be mined from year 1 to 11. Mining of Pit 2 will commence in year 12 and ceases in year 16 (Figure 8).

The alternative option is to mine the two pits concurrently, with Pit 1 being mined from year 1 to 4 and Pit 2 from year 1 to 7, to produce 3 million tonnes per annum ROM coal over a period of 7 years (Figure 9).

The interburden and coal mined from Pit 1 and Pit 2 will be transported to and handled at the existing Grootegeluk Coal Mine plants.

The mining operations will be undertaken 24 hrs, six days a week.

### 2.5.3 Other operations

The proposed infrastructure to be established at surface in support of the coal mining operation includes haul roads connecting the proposed pits to the existing Grootegeluk Coal Mine operations, laydown area for the mine equipment and offices, water management infrastructure (sumps and pipelines), waste management area (waste skips), and a sub-station.

#### *2.5.3.1 Materials and Waste Management*

The following types of mining related materials and wastes will be handled because of the proposed mining activities:

##### 2.5.3.1.1 Topsoil

The topsoil from the open pit areas will be stripped prior to mining and will be stored on a dedicated topsoil stockpile located in the north-western section of the project area. The topsoil stockpile will be 21 ha in size.

##### 2.5.3.1.2 Overburden

The overburden (material that lies above the coal, such as the hards and softs) generated during the creation of the box cuts (first cut into the overburden to access the coal and interburden) will be stockpiled on the existing Grootegeluk Coal Mine Dump 6.

##### 2.5.3.1.3 Interburden

The interburden (material that separates the coal seams within strata) will be transported with the coal to the existing Grootegeluk Coal Mine plants for further beneficiation.

##### 2.5.3.1.4 Plant Discard

Discharge from the beneficiation process will report to a common discard conveyor, which will also include the fines discard, from where it will be conveyed to backfill the existing Grootegeluk Coal Mine pit.

##### 2.5.3.1.5 Hydrocarbon and hazardous waste

Small amounts of hydrocarbon waste, that includes solid and liquid waste of a petrochemical nature (fuel, grease, oil, etc.) as well as other hazardous waste, will be stored in designated skips or drums for recycling or disposal at a licenced hazardous waste facility in accordance with existing hazardous waste management procedures implemented at Grootegeluk Coal Mine.

##### 2.5.3.1.6 General waste

General waste that includes paper, plastic, glass, etc. will be stored in designated containers for disposal in accordance with the Grootegeluk Coal Mine waste management procedures.

#### *2.5.3.2 Haul Roads*

The proposed haul roads will be constructed to tie into the existing Grootegeluk Coal Mine haul roads. The haul roads will connect the Turfvlakte Pit 1, Pit 2, the infrastructure laydown area, topsoil stockpile with the Grootegeluk Coal Mine Dump 6 and the rest of the Grootegeluk Coal Mine operational areas.

The haul roads have been designed to accommodate large off-highway trucks and will be:

- Dual carriageway;
- Gravel surfaces; and
- 38.2 m wide, allowing for 11 m lane widths and 5.4 m wide earth berms on the side and in the centre of the road.

#### *2.5.3.3 Access Roads*

Access to the Grootegeluk Turfvlakte Expansion Project mining area will be via the existing Grootegeluk Coal Mine access gate. The proposed new access roads will be constructed to tie into the existing Grootegeluk Coal Mine access roads. The access roads will provide access to all the infrastructure areas.

The access roads have been designed to accommodate light vehicles and will be:

- Dual directional roads;
- Gravel surfaces; and
- 10 m wide.

#### 2.5.3.4 Infrastructure Laydown Area

The infrastructure laydown area will be 18 ha and will serve as an area for safe parking, offices and equipment storage.

#### 2.5.3.5 Storm Water Management

The storm water management infrastructure will be designed as per the requirements of Regulation 704 under the National Water Act to ensure separation of clean and dirty water catchments.

Cut-off berms and earth canals will be located upstream of the infrastructure areas to divert the clean water run-off around the dirty infrastructure areas. These canals will integrate into the existing Grootegeluk Coal Mine storm water management system.

The contaminated run-off will be collected in concrete-lined channels that will connect with the existing Grootegeluk Coal Mine storm water management system.

#### 2.5.3.6 Utilities

##### 2.5.3.6.1 Potable Water

A potable water tank, with a capacity of 25 $m^3$, will be constructed to supply potable water for the mining operations. The potable water will be pumped from the existing Grootegeluk Coal Mine potable water system.

##### 2.5.3.6.2 Fire Water

A fire water tank, with a capacity of 25 $m^3$, will be constructed to supply fire water for the mining operations. The fire water will be pumped from the existing Grootegeluk Coal Mine fire water system.

##### 2.5.3.6.3 Sanitation

Sewage from the Grootegeluk Turfvlakte Expansion Project operations will be transferred to the existing Grootegeluk Coal Mine for treatment at the existing sewage treatment facilities.

##### 2.5.3.6.4 Electricity Supply

A substation will be constructed inside the infrastructure laydown area to supply electricity to the mining operations. The substation will be fed from the future Grootegeluk Coal Mine GG1/GG2 33 kV switching station as well as directly from the main Eskom 132/33 kV substation.

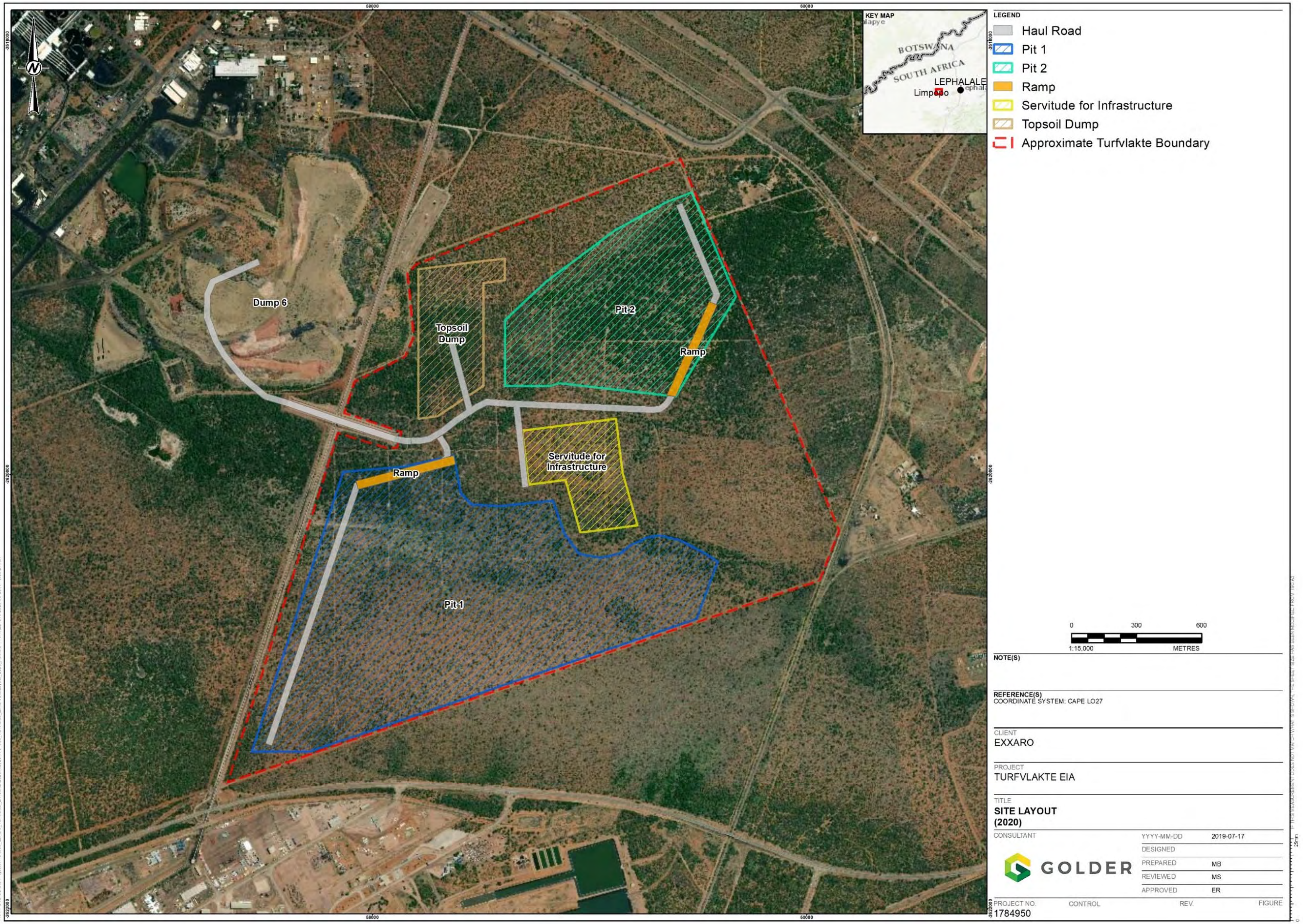



**Figure 7: Infrastructure layout of the proposed Grootegeluk Turfvlakte Expansion Project**

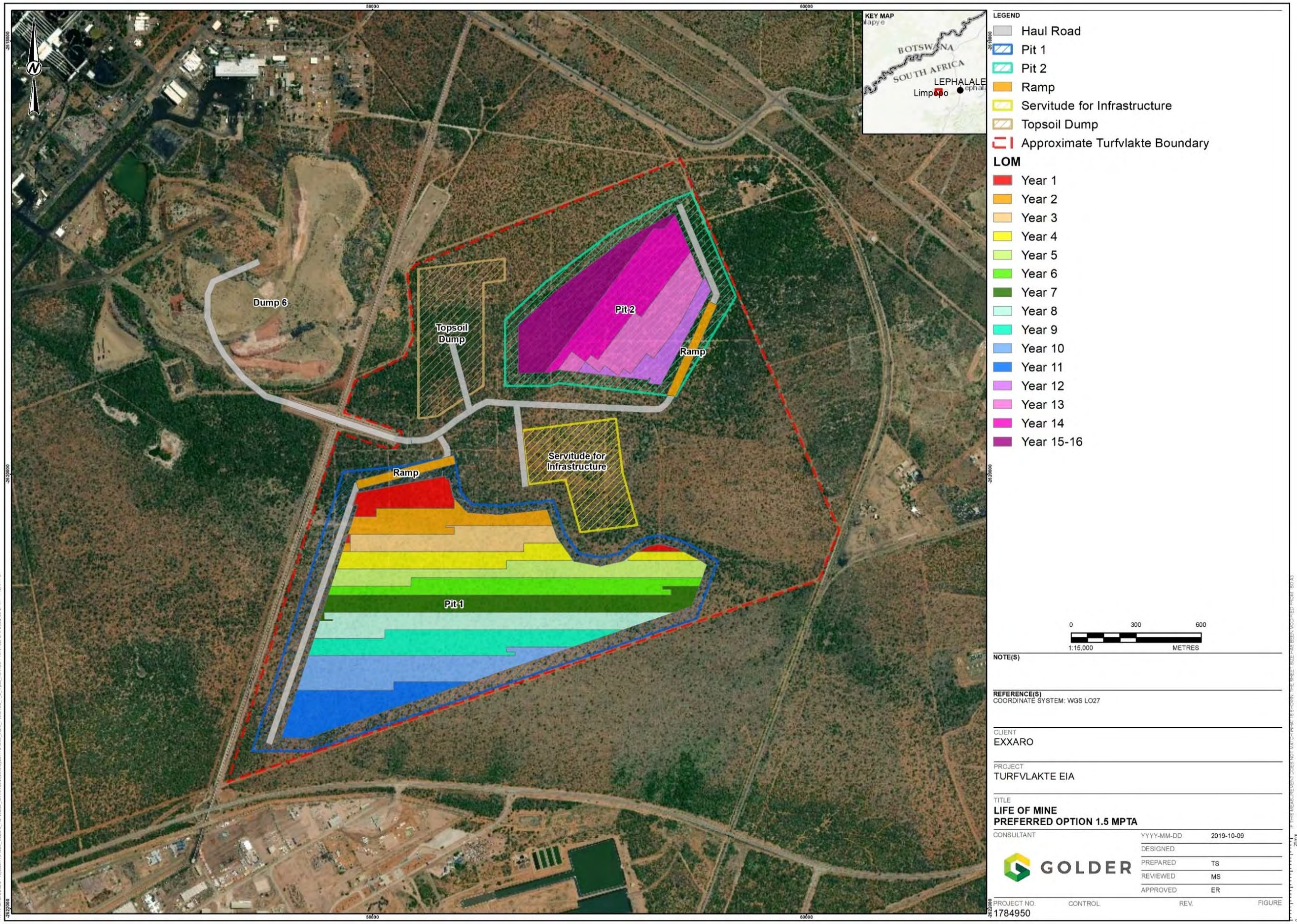



**Figure 8: Life of Mine Preferred Option 1.5 Mtpa**

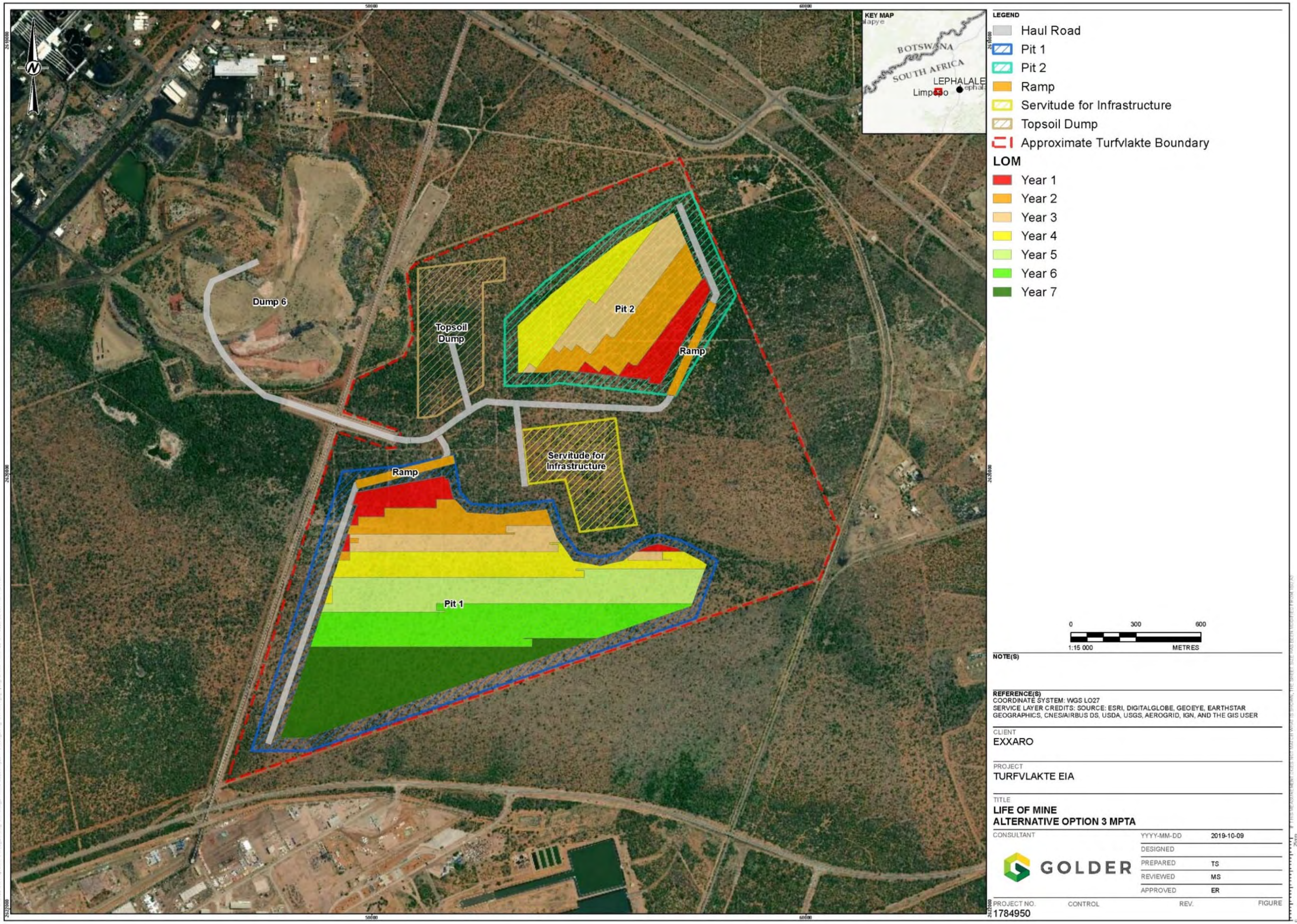



**Figure 9: Life of Mine Alternative Option 3 Mtpa**

### 2.5.4 Listed and Specific Activities

Exxaro has applied for environmental authorisation for the proposed Grootegeluk Turfvlakte Expansion Project. The listed activities that require environmental authorisation in terms of the EIA Regulations GN R. 324, 325, 326 and 327 that commenced on 7 April 2017 are identified in Table 5.

**Table 5: Listed activities requiring environmental authorisation**

| Regulation | Activity Number | Description |
|---|---|---|
| **GN R.327, 7 April 2017** | 9 | *"The development and related operation of infrastructure exceeding 1000 metres in length for the bulk transportation of water or storm water -*<br>*(i) with an internal diameter of 0.36 metres or more; or*<br>*(ii) with a peak throughput of 120 litres per second or more;*<br><br>*Excluding where-*<br>*(a) Such infrastructure is for bulk transportation of storm water or storm water drainage inside a road reserve or railway line reserve; or*<br>*(b) Where such development will occur within an urban area."*<br><br>Storm water from the Grootegeluk Turfvlakte Expansion Project operational areas will be transferred via pipelines to the existing Grootegeluk Coal Mine storm water management system.<br>Potable, raw and fire water will be pumped from the existing Grootegeluk Coal Mine to the Grootegeluk Turfvlakte Expansion Project operations via pipelines.<br>A pipeline will be required to transport water from the open pits to the existing Grootegeluk Coal Mine Operations. |
| **GN R.325, 7 April 2017** | 6 | "*The development of facilities or infrastructure for any purpose or activity which requires a permit or licence or an amended permit or licence in terms of national or provincial legislation governing the generation or release of emissions, pollution or effluent, excluding -*<br>*(i) activities which are identified and included in Listing Notice 1 of 2014;*<br>*(ii) activities which are included in the list of waste management activities published in terms of section 19 of the National Environmental Management: Waste Act, 2008 applies;*<br>*(iii) the development of facilities or infrastructure for the treatment of effluent, polluted water, wastewater or sewage where such facilities have a daily throughput capacity of 2 000 cubic metres or less; or*<br>*(iv) where the development is directly related to aquaculture or infrastructure where the wastewater discharge capacity will not exceed 50 cubic metres per day."* |

| Regulation | Activity Number | Description |
| --- | --- | --- |
| | | The mining operations will require a water use licence as per NWA sections:<br>■ Section 21(c) and Section 21(i):<br>  ▪ Removal of pans within mining area; and<br>  ▪ Proximity of mine infrastructure to wetlands/pans within the area.<br>■ Section 21(g):<br>  ▪ Dust suppression.<br>■ Section 21(j):<br>  ▪ Dewatering of pit areas to continue mining.<br>The above-mentioned water use licence application (WULA) will be applied for in terms of Section 40 of the NWA. The compilation of the WULA will be undertaken in accordance with the published in Regulations GN R.267 as published in Government Gazette No 40713 dated 24 March 2017. |
| | 15 | *"The clearance of an area of 20 hectares or more of indigenous vegetation, excluding where such clearance of indigenous vegetation is required for –*<br>*(i) the undertaking of a linear activity; or*<br>*(ii) maintenance purposes undertaken in accordance with a maintenance management plan."*<br>An area of 269 hectares of indigenous vegetation will be cleared during the construction phase of the project. |
| | 17 | *"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 –*<br>*(a) associated infrastructure, structures and earthworks, directly related to the extraction of a mineral resource; or*<br>*(b) the primary processing of a mineral resource including winning, extraction, classifying, concentrating, crushing, screening or washing;*<br>*but excluding the secondary processing of a mineral resource, including the smelting, beneficiation, reduction, refining, calcining or gasification of the mineral resource in which case activity 6 in this Notice applies."*<br>The proposed Grootegeluk Turfvlakte Expansion Project mining operations is located within the existing Grootegeluk Coal Mine's Mining Right, LP 46 MRC. |
| | 27 | *"The development of a road-*<br>*(i) with a reserve wider than 30 metres; or*<br>*(ii) catering for more than one land of traffic in both directions;*<br>*but excluding a road-* |

| Regulation | Activity Number | Description |
|---|---|---|
| | | *(a) for which an environmental authorisation was obtained for the route determination in terms of activity 5 in Government Notice 387 of 2006 or activity 18 in Government Notice 545 or 2010, in which case activity 24 in Listing Notice 1 of 2014 applies;*<br>*(b) which is 1 kilometre or shorter; or*<br>*(c) where the entire road falls within an urban area."*<br>Haulage roads will be constructed to connect the Turfvlakte Pit 1, Pit 2, the infrastructure laydown area and the topsoil stockpile. The haul roads will be up to 38.2 m wide. All the roads will be inside the existing Grootegeluk Mining Right area and some will tie into the existing Grootegeluk Coal Mine access gate and roads. |

### 2.5.5 Specific activities to be undertaken

The specific activities associated with the proposed project will be:

- Stripping and stockpiling of topsoil in front of the advancing opencast mining front, with bulldozers and front-end loaders.
- Drilling and charging of blast holes, followed by blasting, where necessary. Vibration levels and fly rock occurrence will be recorded during each blast and used to plan subsequent blasts.
- Excavation, loading, hauling and transport of overburden, interburden and coal. The interburden and coal will be transported to the existing Grootegeluk Coal Mine plants while the overburden from the initial box-cuts will be placed on the Grootegeluk Coal Mine Dump 6.
- Roll-over mining will be practiced after the construction of the initial box-cuts.
- Constructing and operating a storm water management infrastructure, that connects to the existing Grootegeluk Coal Mine storm water management system, comprising diversion berms, collection channels, pipelines and sumps.
- Constructing and operating utilities such as a fire water tank, potable water tank, sanitation facilities and electricity supply infrastructure.
- Constructing and operating the supporting infrastructure such as offices, waste management facilities, laydown / safe park area, access and haul roads, pipelines and fencing. See Figure 7 for a layout plan for the supporting infrastructure on Turfvlakte 463 LQ.

# 3.0 POLICY AND LEGISLATIVE CONTEXT

This section provides a brief overview of the legal requirements that must be met by this project.

## 3.1 Mineral and Petroleum Resources Development Act

Exxaro's mining operations at Grootegeluk Coal Mine are covered by an existing Environmental Management Programme report (EMPr) and associated Addenda lodged with the Department of Mineral Resources and Energy (DMRE).

In terms of the Section 41 of the MPRDA and Regulations 53 and 54, the holder of a mining right must make financial provision, in a manner acceptable to the DMRE, for the rehabilitation of negative environmental impacts, both for a planned closure at the end of the life of the mine, and for an unplanned closure during the life of the mine.

## 3.2 National Environmental Management Act

In terms of the National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA), as amended and the EIA Regulations, an application for environmental authorisation for certain listed activities must be submitted to the provincial environmental authority, the national authority (Department of Environmental Affairs, DEA), depending on the types of activities being applied for or, when mining and mineral processing activities are involved, the Department of Mineral Resources and Energy (DMRE).

The current EIA regulations, GN R.324, GN R.325, GN R.326 and GN R.327, promulgated in terms of Sections 24(5), 24M and 44 of the NEMA and subsequent amendments, commenced on 7 April 2017. GN R.327 lists those activities for which a Basic Assessment is required, GN R.325 lists the activities requiring a full EIA (Scoping and Impact Assessment phases) and GN R.324 lists certain activities and competent authorities in specific identified geographical areas. GN R.326 defines the EIA processes that must be undertaken to apply for Environmental Authorisation.

The activities requiring environmental authorisation in terms of the NEMA are included in Table 5.

Copies of this Scoping Report have been sent to the Limpopo Department of Economic Development, Environment, and Tourism (LEDET) for comment. The provincial department is a key I&AP and will be kept informed throughout the EIA process. The EIA will meet the requirements stipulated in GN R.326 and the DEA's guidelines on public participation, published as GN 657 in May 2006.

## 3.3 National Water Act

The National Water Act, 1998 (Act No. 36 of 1998) (NWA) is the primary legislation regulating both the use of water and the pollution of water resources. It is applied and enforced by the Department of Water and Sanitation (DWS).

Section 19 of the National Water Act regulates pollution, which is defined as *"the direct or indirect alteration of the physical, chemical or biological properties of a water resource so as to make it:*

*Less fit for any beneficial purpose for which it may reasonably be expected to be used; or*

*Harmful or potentially harmful to -*

- *The welfare, health or safety of human beings;*
- *Any aquatic or non-aquatic organisms;*
- *The resource quality; or*
- *Property."*

The persons held responsible for taking measures to prevent pollution from occurring, recurring or continuing include persons who own, control, occupy or use the land. This obligation or duty of care is initiated where there is any activity or process performed on the land (either presently or in the past) or any other situation which could lead or has led to the pollution of water.

The following measures are prescribed in the Section 19(2) of the NWA to prevent pollution:

- Cease, modify or control any act or process causing the pollution;
- Comply with any prescribed standard or management practice;
- Contain or prevent the movement of pollutants;
- Eliminate any source of the pollution;
- Remedy the effects of pollution; and
- Remedy the effects of any disturbance to the bed or banks of a watercourse.

The NWA states in Section 22 (1) that a person may only use water:

- Without a licence –
  - if that water use is permissible under Schedule 1;
  - if that water use is permissible as a continuation of an existing lawful use; or
  - if that water use is permissible in terms of a general authorisation issued under Section 39;
- If the water use is authorised by a licence under this Act; or
- If the responsible authority has dispensed with a licence requirement under subsection (3).

Water use is defined in Section 21 of the NWA. Exxaro's proposed mining operations on the eastern portion of the farm Turfvlakte may involve the following water uses:

a) Taking water from a water resource;

b) Storing water;

c) Impeding or diverting the flow of water in a watercourse;

d) Disposing of waste in a manner which may detrimentally impact on a water resource;

e) Disposing in any manner of water which contains waste from, or which has been heated in, any industrial or power generation process;

f) Altering the bed, banks, course or characteristics of a watercourse; and

g) 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.

The proposed mining operations will require a Water Use Licence (WUL) and an Integrated Water and Waste Management Plan (IWWMP). An application for a WUL has been submitted to the Department of Water and Sanitation (DWS).

Regulation 704 of 4 June 1999 defines the manner in which rainwater falling or flowing onto a mining area or an industrial site must be managed and requires inter alia the following:

a) Separation of clean (unpolluted) water from dirty water;

b) Collection and confinement of the water arising within any dirty area into a dirty water system;

c) Design, construction, maintenance and operation of the clean water and dirty water management systems so that it is not likely for either system to spill into the other more than once in 50 years;

d) Design, construction, maintenance and operation of any dam that forms part of a dirty water system to have a minimum freeboard of 0.8 metres above full supply level, unless otherwise specified in terms of Chapter 12 of the Act; and

e) Design, construction, and maintenance of all water systems in such a manner as to guarantee the serviceability of such conveyances for flows up to and including those arising as a result of the maximum flood with an average period of recurrence of once in 50 years.

The site requires a storm water management plant aligned with the requirements of Regulation 704. The proposal storm water management plan is illustrated in Figure 61.

## 3.4 National Environmental Management: Waste Act

The National Environmental Management: Waste Act, 2008 (Act 59 of 2008)(NEMWA) commenced on 1 July 2009. In terms of this Act, all listed waste management activities must be licensed and in terms of Section 44 of the Act, the licensing procedure must be integrated with the environmental impact assessment process.

Government Notice 921, which commenced on 29 November 2013, lists the waste management activities that require licensing in terms of the NEMWA. Licence applications for activities involving hazardous waste must be submitted to the national authority, the Department of Environmental Affairs (DEA) and those for general waste to the provincial authority, in this case the LDEDET.

One of the major amendments effected by the National Environmental Management Amendment Act 2014 is the insertion of Section 24S, as a result of which the NEMWA is now also applicable to mining residue deposits and residue stockpiles, as follows:

***''Management of residue stockpiles and residue deposits***

***24S.*** *Residue stockpiles and residue deposits must be deposited and managed in accordance with the provisions of the National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008), on any site demarcated for that purpose in the environmental management plan or environmental management programme in question.''*

Mining residues were classified as hazardous wastes by default in terms Section 18, Schedule 3 of the National Environmental Management: Waste Amendment Act, 2014 (Act No. 26 of 2014) (NEMWAA), which commenced on 2 June 2014. In terms of Regulations GN R.632 and R.633, which commenced on 24 July 2015, mining residues must be characterised and classified, and the design and management of residue stockpiles and deposits must be based on an assessment of the potential impacts and risks.

No new residue stockpiles will be created as part of the Grootegeluk Turfvlakte Expansion Project. Only topsoil will be stockpiled on site and all overburden, interburden and plant discard will be handled and stored at existing Grootegeluk Coal Mine facilities.

## 3.5 National Environmental Management: Air Quality Act

The main objectives of the National Environmental Management: Air Quality Act 2004 (Act no. 39 of 2004) (NEM: AQA) are to protect the environment by providing reasonable legislative and other measures to:

- Prevent air pollution and ecological degradation;
- Promote conservation; and
- Secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development in alignment with Sections 24a and 24b of the Constitution of the Republic of South Africa.

The Act has devolved the responsibility for air quality management from the national sphere of government to local spheres of government (district and local municipal authorities), who are tasked with baseline characterisation, management and operation of ambient monitoring networks, licensing of listed activities, and development of emissions reduction strategies.

The South African National Ambient Air Quality Standards (NAAQS) for common pollutants prescribe the allowable ambient concentrations of pollutants which are not to be exceeded during a specified time period in a defined area (Table 6). In the event that the standards are exceeded, the ambient air quality is defined as poor and potential adverse health impact are likely to occur.

**Table 6: South African Ambient Air Quality Standards for Criteria Pollutants**

| Pollutant | Averaging Period | Limit Value ($\mu g/m^3$) | Limit Value (ppb) | Frequency of Exceedance | Compliance Date |
|---|---|---|---|---|---|
| Sulphur dioxide ($SO_2$)[(a)] | 10 minute | 500 | 191 | 526 | Immediate |
| | 1 hour | 350 | 134 | 88 | Immediate |
| | 24 hours | 125 | 48 | 4 | Immediate |
| | 1 year | 50 | 19 | 0 | Immediate |
| Nitrogen dioxide ($NO_2$)[(b)] | 1 hour | 200 | 106 | 88 | Immediate |
| | 1 year | 40 | 21 | 0 | Immediate |
| Particulate matter <10 micrograms in diameter ($PM_{10}$)[(c)] | 24 hour | 75 | - | 4 | Immediate |
| | 1 year | 40 | - | 0 | Immediate |
| Particulate matter <2.5 micrograms in diameter ($PM_{2.5}$)[(d)] | 24 hours | 65 | - | 4 | Immediate |
| | 24 hours | 40 | - | 4 | 01/01/2016 – 31/12/2029 |
| | 24 hours | 25 | - | 4 | 01/01/2030 |
| | 1 year | 25 | - | 0 | Immediate |
| | 1 year | 20 | - | 0 | 01/01/2016 – 31/12/2029 |

| Pollutant | Averaging Period | Limit Value ($\mu g/m^3$) | Limit Value (ppb) | Frequency of Exceedance | Compliance Date |
|---|---|---|---|---|---|
| | 1 year | 15 | - | 0 | 01/01/2030 |
| Ozone ($O_3$)[(e)] | 8 hours | 120 | 61 | 11 | Immediate |
| Lead (Pb) [(f)] | 1 year | 0.5 | - | 0 | Immediate |
| Carbon monoxide (CO)[(g)] | 1 hour | 30,000 | 26,000 | 88 | Immediate |
| | 8 hour (1 hour averages) | 10,000 | 8,700 | 11 | Immediate |
| Benzene ($C_6H_6$) [(h)] | 1 year | 5 | 1.6 | 0 | 01/01/2015 |

a) *The reference method for the analysis of $SO_2$ shall be ISO 6767*
b) *The reference method for the analysis of $NO_2$ shall be ISO 7996*
c) *The reference method for the determination of the particulate matter fraction of suspended particulate matter shall be EN 12341*
d) *The reference method for the analysis of $PM_{2.5}$ shall be EN14907*
e) *The reference method for the analysis of ozone shall be the UV photometric method as described in ISO 13964*
f) *The reference method for the analysis of lead shall be ISO 9855*
g) *The reference method for analysis of CO shall be ISO 4224*
h) *The reference methods for benzene sampling and analysis shall be either EPA compendium method TO-14 A or method TO-17*

### 3.5.1 National Dust Control Regulations

The National Dust Control Regulations (GN R.827), which were promulgated on 1 November 2013, define acceptable dust fall rates for residential and non-residential areas as listed in Table 7.

**Table 7: Acceptable dust fall rates**

| Defined areas | Dust fall rate ($mg/m^2/day$ over a 30 day average) | Permitted frequency of exceedance |
|---|---|---|
| Residential areas | Dust fall < 600 | Two per annum (not in sequential months) |
| Non-residential areas | 600 < Dust fall < 1200 | Two per annum (not in sequential months) |

Although Exxaro will not require an atmospheric emission licence for its proposed Grootegeluk Turfvlakte Expansion Project, it will have to operate within the NAAQS and the National Dust Control Regulations.

### 3.5.2 Priority Areas

Sections 18 to 20 of NEM: AQA deal with the establishment of Priority Areas in so-called “hot-spot” areas of South Africa where ambient air quality standards are often exceeded or may often be exceeded. The establishment of a Priority Area is intended to achieve the following:

- It effectively allows for the concentration of limited air quality management capacity (human, technical and financial) for dealing with acknowledged problem areas in order to obtain measurable air quality improvements in the short, medium and long term;

- It prescribes a cooperative governance regime by effectively handing-up air quality management authority to the tier of government that can provide leadership and coordination; and
- It allows for "cutting edge" air quality management methodologies that take into account all contributors to the air pollution problem, i.e. air-shed air quality management.

The Grootegeluk Turfvlakte Expansion project area, as part of the Grootegeluk Mine area, is located within the Waterberg-Bojanala Priority Area (WBPA). The WBPA was declared a priority area by the Minister of Water and Environmental Affairs on 15 June 2012 (Government Gazette No. 35435). The declaration was in response to the predicted NAAQS exceedances in the area and trans-boundary emissions sources and air pollution impacts spanning the Waterberg District Municipality and Bojanala Platinum District Municipality (Golder, 2020a).

### 3.5.3 Other Applicable Legislation

- National Environmental Management: Biodiversity Act, Act 10 of 2004
- Environment Conservation Act, Act 73 of 1989
- Conservation of Agricultural Resources Act, Act 43 of 1983
- National Forest Act, Act 84 of 1998
- Limpopo Environmental Management Act, Act 7 of 2003
- Fertilisers, Farm Feeds, Agricultural Remedies and Stock Remedies Act, Act 36 of 1947
- National Veld and Forest Fire Bill, 10 July 1998
- National Heritage Resources Act, Act 25 of 1999

## 4.0 NEED AND DESIRABILITY OF PROPOSED ACTIVITIES

Internationally, coal is the most widely used primary fuel. It is estimated that about 36 percent of the total fuel consumption for the world's electricity production is from coal (Department of Energy , 2018).

In South Africa, the electricity sector is dominated by the national utility Eskom, being the primary supplier that generates approximately 90% of the electricity used in the country. The remaining 10% is generated by municipalities, redistributors and private generators (Department of Energy , 2019). Eskom owns and operates a number of coal-fired, gas-fired, hydro and pumped storage power stations, as well as one nuclear power station. The Medupi and Matimba coal-fired power stations are situated next to the Grootegeluk Coal Mine and proposed Grootegeluk Turfvlakte Expansion project area. Grootegeluk Coal Mine produces approximately 22Mt power station coal that is transported directly to these two power stations via a 7 km conveyor in terms of the existing supply contract (Grootegeluk, 2020).

The Department of Energy reports in its 2019 Energy Sector Report that coal fired power stations are still the dominant in terms of power generating capacity, with 83% in 2018, until such time that other means of power generation, such as nuclear and renewables, becomes more established.

The ever-rising costs of traditional fossil fuels-based energy and the continuous drive towards renewable and cleaner energy sources, sun and wind energy are viable options for South Africa. South Africa's Renewable Energy Independent Power Producers Procurement Programme (REIPPPP) has attracted substantial investment (equity and debt) to the value of R209.7 billion, with 20% being foreign investment (IPPPP An Overview, 2019 as cited by (Department of Energy , 2019)). The aim of the REIPPPP is to bring additional power into the electricity system through private sector investment in wind, solar, biomass and small hydro technologies. However, it will take some considerable time before coal can be totally phased out as a source of electricity production.

The Department of Energy (2019) states that South Africa has the 5th largest recoverable coal reserves in the world, estimated at 66.7 billion tons (DMR, 2016 as cited by (Department of Energy , 2019)). In addition to supplying the local economy, approximately 24 percent of South Africa's production is exported (Department of Energy , 2019). The coal is exported mainly through the Richards Bay Coal Terminal, making South Africa the fourth-largest coal exporting country in the world (Department of Energy , 2018).

# 5.0 MOTIVATION FOR THE PREFERRED DEVELOPMENT FOOTPRINT WITHIN THE APPROVED SITE INCLUDING A FULL DESCRIPTION OF THE PROCESS FOLLOWED TO REACH PREFERRED SITE ALTERNATIVE

Mining can take place only within the area for which a mining right is obtained and no alternative site for mining is possible. Several alternative sites and layouts for the supporting infrastructure are possible and may be explored, taking into consideration economic viability, practicality and environmental characteristics.

## 5.1 Project Alternatives

In terms of Regulation 50 (d) of the MPRDA Regulations R. 527 under the Mineral and Petroleum Resources Development Act, Act 28 of 2002, an environmental impact assessment report must include *inter alia* the following:

> *"(d) A comparative assessment of the identified land use and development alternatives and their potential environmental, social and cultural impacts."*

Alternatives considered for the proposed project are as follows:

### 5.1.1 Opencast vs Underground Mining

Due to faulting in the Grootegeluk area, Benches 9A and B and Bench 11 protrude quite shallow and therefore high-quality coal can be mined at a favourable stripping ration by means of opencast mining. In addition, underground mining of the Turfvlakte reserve, which is a comparatively small reserve to the Grootegeluk reserve, would be un-economical and thus the opencast option is preferred.

Coal mining at the Grootegeluk Coal Mine is also by means of opencast mining and all existing infrastructure and fleet will be used in support of mining the Turfvlakte reserve, supporting the proposed opencast mining method as being the most economical alternative method.

### 5.1.2 Technology and mining approach

The description provided in Section 2.5 reflects the most suitable opencast mining approach for this particular orebody.

### 5.1.3 Location of infrastructure

An initial site layout was provided by Grootegeluk Coal Mine illustrating the proposed siting of Pit 1, Pit 2, haul roads, topsoil stockpile and the servitude for supporting infrastructure. The initial site layout was provided to all the specialists for use during the impact assessment phase.

The Wetland assessment (Section 10.3.9) identified pans in areas reserved for infrastructure placement. To minimise the impact on these pans, the proposed infrastructure layout was adjusted, where possible. A section of the haul roads was realigned and the footprints of the topsoil stockpile and servitude for supporting infrastructure were adjusted to avoid some of the pans. Figure 10 illustrates the original site layout versus the adjusted site layout.

The preferred and final location and layout of the pits and supporting infrastructure for the Grootegeluk Turfvlakte Expansion Project, as shown in Figure 7, was chosen with particular economic, environmental and logistical considerations in mind, as set out in Section 2.5 of this report.

### 5.1.4 Mine Plan

Grootegeluk Coal Mine is considering two options for the mining of Pit 1 and Pit 2. The preferred option is to mine Pit 1 and then Pit 2 to produce 1.5 million tonnes per annum run of mine (ROM) coal over a period of sixteen (16) years. Pit 1 will be mined from year 1 to 11. Mining of Pit 2 will commence in year 12 and ceases in year 16 (Figure 8).

The alternative option is to mine the two pits concurrently, with Pit 1 being mined from year 1 to 4 and Pit 2 from year 1 to 7, to produce 3 million tonnes per annum ROM coal over a period of 7 years (Figure 9).

### 5.1.5 Closure Alternatives

Closure-related alternatives are limited due to the fact that no permanent mining-related infrastructure will be constructed, and operational aspects are limited to the two open pits and a topsoil stockpile. The following two alternatives were considered and assessed (Golder, 2020b):

#### *5.1.5.1 Open Pit Mining Areas*

- Completely backfill open pits after roll-over mining has concluded: This alternative would require that suitable material be sourced from an off-site source (the nearest potential source being Grootegeluk Dump 6), as a pronounced materials deficit for this purpose would exist at closure because all the interburden and discard will be backfilled into the Grootegeluk open pit during operations. For this reason, this alternative is considered non-feasible, as the cost of trucking backfill material from Dump 6 into the pit voids that will remain at closure would be prohibitively expensive.
- Make safe the remaining open pit voids at closure and allow to re-water in a controlled manner (preferred alternative): The expectation is that the pit water quality after closure will be relatively good, given that the majority of potential contaminating material, namely the discard and interburden, will be used as backfill at Grootegeluk Coal Mine. If additional measures are taken to limit the rate of oxidation of the remaining potential acid-forming material, such as lining the pit shell and walls above the exposed coal seams, this water could potentially be beneficially used for post-closure uses, or to support ecological processes and/or aquatic habitat provision.

#### *5.1.5.2 Supporting Infrastructure*

All coal mined at the Grootegeluk Turfvlakte Expansion Project will be taken to the Grootegeluk beneficiation plants for processing. The Turfvlakte open pit operations will entail limited temporary support infrastructure such as offices, haul and other roads and water provision. This infrastructure will have no further use after mining and will therefore be decommissioned and removed from site and/or rehabilitated once the Turfvlakte mining operations have concluded. No specific alternatives for closure were identified in this regard.

### 5.1.6 Postponement of mining project

Exxaro is proposing to mine the Turfvlakte coal reserves located on the eastern side of the farm Turfvlakte 463 LQ as part of the Grootegeluk mining activites. The coal reserves and proposed mining area are located within the existing Grootegeluk mining right area.

Postponing the mining of the Turfvlakte coal reserves would not affect the mining right, since Grootegeluk Coal Mine is already in possession of a valid mining right to mine the coal reserves within the permitted area, but it could result in Exxaro being unable to serve its markets optimally. Furthermore, the economics of mining the reserve are particularly attractive should mining take place while the Grootegeluk Coal Mine infrastructure is in place.

### 5.1.7 No Project Option

The coal situated in the Turfvlakte area is considered to be export quality coal. If these reserves are left unmined, the economic benefits to Exxaro and its employees as well as the associated socio-economic benefits to the local communities and businesses would not materialise.

The area will remain a natural habitat, albeit cut off from the surrounding agricultural areas by the surrounding industrial areas. This will, however, be temporary for, as long as there is a demand for coal, there will be a drive to mine it.

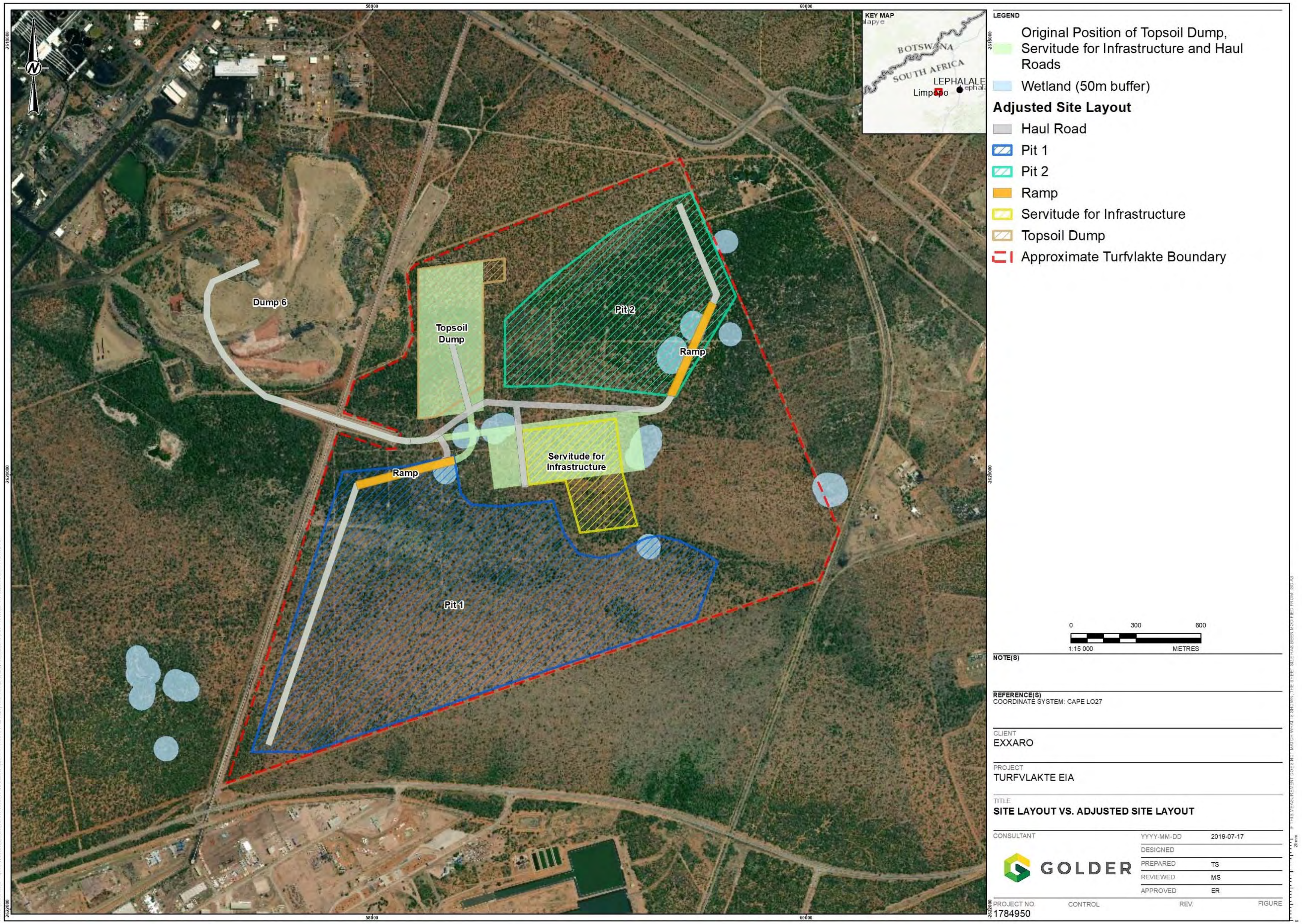



**Figure 10: Original site layout versus adjusted site layout**

# 6.0 DETAILS OF THE PUBLIC PARTICIPATION PROCESS FOLLOWED

This section provides an overview of the public participation process to be undertaken during the EIA.

## 6.1 Objectives of Public Participation

The principles that determine communication with society at large are included in the principles of the National Environmental Management Act (NEMA) (Act No. 107of 1998, as amended) and are elaborated upon in General Notice 657, titled *"Guideline 4: Public Participation" (Department of Environmental Affairs and Tourism, 19 May, 2006), which states that: "Public participation process means a process in which potential interested and affected parties (I&APs) are given an opportunity to comment on, or raise issues relevant to, specific matters."*

**Opportunities for Comment**

Documents are made available at various stages during the EIA process to provide stakeholders with information, further opportunities to identify issues of concern and suggestions for enhanced benefits and to verify that the issues raised have been considered.

Public participation is an essential and regulatory requirement for an environmental authorisation process, and must be undertaken in terms of Regulations 39 to 44 of the Environmental Impact Assessment (EIA) Regulations GN R.982 (December 2014). Public participation is a process that is intended to lead to a joint effort by stakeholders, technical specialists, the authorities and the proponent/developer who work together to produce better decisions than if they had acted independently.

The public participation process is designed to provide sufficient and accessible information to Interested and Affected Parties (I&APs) in an objective manner and:

***During the Scoping Phase to enable them to:***

- Raise issues of concern and suggestions for enhanced benefits;
- Verify that their issues have been recorded;
- Assist in identifying reasonable alternatives;
- Comment on the plan of study of specialist studies to be undertaken during the impact assessment phase; and
- Contribute relevant local information and traditional knowledge to the environmental assessment.

***During the impact assessment phase to assist them to:***

- Contribute relevant information and local and traditional knowledge to the environmental assessment;
- Verify that their issues have been considered in the environmental investigations; and
- Comment on the findings of the environmental assessments.

***During the decision-making phase:***

- To advise I&APs of the outcome, i.e. the authority decision, and how the decision can be appealed.

## 6.2 Identification of I&APs

I&APs were initially identified through a process of networking and referral, obtaining information from Golder's existing stakeholder database, liaison with potentially affected parties in the study area, newspaper advertisements and a registration process involving completion of a registration and comment sheet. The registration sheet encouraged I&APs to indicate the names of their colleagues and friends who may also be interested in participating in the public participation process.

The initial stakeholder database used to announce Exxaro's proposed project for the mining of coal on the farm Turfvlakte 463 LQ near Lephalale comprised a total of 267 stakeholders (see APPENDIX C) representing the various sectors of society listed below:

- Government (national, provincial and local);
- Environmental NGOs;
- Conservation Agencies;
- Agricultural Bodies;
- Community Representatives and CBOs;
- Business and Commerce; and
- Other.

## 6.3 Register of I&APs

The NEMA Regulations (GN R.326) distinguish between I&APs and registered I&APs.

I&APs, as contemplated in Section 24(4)(d) of the NEMA include: *"(a) any person, group of persons or organisation interested in or affected by an activity; and (b) any organ of state that may have jurisdiction over any aspect of the activity".*

In terms of the Regulations:

*"An EAP managing an application must open and maintain a register which contains the names, contact details and addresses of:*

- All persons who; have submitted written comments or attended meetings with the applicant or EAP.
- All persons who; have requested the applicant or EAP managing the application, in writing, for their names to be placed on the register.
- All organs of state which have jurisdiction in respect of the activity to which the application relates.

A register for I&APs has been opened and is updated throughout the EIA process.

As per the EIA Regulations, consultation during the Impact Assessment phase will take place with **registered I&APs**. Stakeholders who were involved in the initial consultation and who attend the public meetings during the Scoping Phase have been added to the register.

## 6.4 Public participation during Scoping

This section provides a summary of the public participation process followed during the Scoping Phase of the EIA.

### 6.4.1 Announcement of the proposed project

#### *6.4.1.1 Draft Scoping Report*

The Draft Scoping Report was available for comment for a period of 30 days from ***Monday 27 January 2020 until Tuesday 25 February 2020*** at the public places in the project area listed in the table, upon request from the Public Participation Office of Golder Associates, or it could be downloaded from Golder's website:

*https://www.golder.com/global-locations/africa/ south-africa-public-documents/.* The comment period was extended to 9 March 2020 due to civil unrest in the area.

**Table 8: Public Places used during the Scoping Phase**

| PUBLIC PLACE | CONTACT PERSON | CONTACT NUMBER |
|---|---|---|
| **Lephalale Public Library**<br>Corner Joe Slovo Lane and Douwater Road, Lephalale | Ms Hazel Mashaba | 014 762 1453 |
| **Lephalale Police Station (SAPS)**<br>3 Herman Street, Lephalale | Colonel Ramakgwakgwa | 014 762 1000 |
| **Marapong Public Library**<br>916 Phukubye Street, Marapong | Mr Sophonia Petja | 014 762 1617 |
| **Golder Associates Africa, Midrand** | Ms Mabel Qinisile | (011) 254 4800 |
| **The Golder Associates Africa website** | *https://www.golder.com/global-locations/africa/south-africa-public-documents/* | |

The proposed project was announced on 24 January 2020 and stakeholders were invited to participate in the EIA and public participation process and to pass on the information to friends/colleagues/neighbours who may be interested and to register as I&APs.

The proposed project was announced as follows:

- Distribution of the Draft Scoping Report (DSR) and a letter of invitation to participate to all I&APs on the initial database, accompanied by a registration, comment and reply sheet that was mailed/emailed to the entire stakeholder database. Copies of the announcement documents are attached as APPENDIX D**.**
- A notification of the proposed project was also distributed via bulk SMS to all I&APs with mobile numbers on the initial stakeholder database.
- The abovementioned documents were made available at the public places listed in Table 8 and could be downloaded from the Golder website: *https://www.golder.com/global-locations/africa/ south-africa-public-documents/.*
- An advertisement was published in the Mogol Post on 24 January 2020 (APPENDIX E)
- Site notices were placed at the entrance to the proposed project site and at visible places at the boundary of the property (APPENDIX E)
- I&APs were invited to attend either of the public meetings, as follows:

  **Date: Tuesday 25 February 2020**

  **Time: 10:00 am – 12:00pm**

  **Venue: Mogol Club, Lephalale, George Wells Street, Lephalale**

  OR

**Date: Tuesday, 25 February 2020**

**Time: 14:00 – 16:00**

**Venue: Mogolo Academy, 175 Mosethla Street, Marapong, Lephalale**

The meeting in Marapong was specifically arranged as a result of requests from community members during previous EIA meetings that were held in Lephalale only. Disappointingly however, no I&APs attended this meeting.

The minutes of the meeting held at the Mogol Club in Lephalale were sent to meeting attendees and are available to others upon request.

The issues raised at the meeting have been incorporated into the Comment and Response Report that is included in APPENDIX G.

**Note:** *During previous stakeholder consultation processes Golder were advised to announce future EIA projects in the area also via the local radio station. However, a recent consultation with one of the NGOs in Lephalale revealed that the local radio station had closed down in 2019 and Golder were advised to put a site notice of the proposed project at the entrance to the Spar in Lephalale.*

#### 6.4.1.2 Final Scoping Report

The DSR was be updated after the expiry of the public review period and the Final Scoping Report (FSR) was submitted to the DMRE on 16 March 2020. The FSR was posted to Golder's website for I&APs information. The DMRE accepted the Scoping Report on 10 September 2020 (APPENDIX F).

## 6.5 Public Participation Plan - Public Consultation during Level 1 of the National State of Disaster as a result of the Covid-19 epidemic.

Government Notice (GN. R. 650) published by the Department of Environment, Forestry and Fisheries (DEFF) (Government Gazette No. 43412) on Friday 5 June 2020, in terms of the Disaster Management Act (Act 57 of 2002), outlined directions regarding measures to address, prevent and combat the spread of COVID-19, relating to National Environmental Management Permits and Licences. A key requirement contained in these Regulations, is the requirements stipulated when conducting public participation; *"Prepare a written public participation plan, containing proposals on how the identification of and consultation with all potential I&APs will be ensured in accordance with regulation 41(2)(a) to (d) of the EIA Regulations or proposed alternative reasonable methods as provided for in regulation 41(2)(e) of the EIA Regulations, for purposes of the application and submit such plan to the competent authority"*.

A proposed Public Participation Plan, to be implemented during the EIA phase of the Grootegeluk Turfvlakte Expansion Project, was submitted to the DMRE on 17 September 2020 for approval. The DMRE issued an approval of the proposed Public Participation Plan on 7 October 2020.

## 6.6 Public participation during the Impact Assessment Phase

Public participation during the impact assessment phase of the EIA entails a review of the findings of the EIA, presented in the draft EIA Report and Environmental Management Programme (EMPr), and the volume of specialist studies. This report is available for public comment for a period of 30 days from **Monday, 26 October 2020** to **Wednesday 25 November 2020**, as set out in the text box on page vii of this report.

The availability of the draft EIA/EMP report for public comment have been announced as follows:

- Registered I&APs received a letter notifying them of the commencement of the impact assessment phase and an invitation to contribute comments, questions, or suggestions for enhanced benefits on the findings of the specialist studies and EMPr (APPENDIX D. In view of the COVID-19 restrictions and to protect the safety of stakeholders, Golder have distributed the letter by email and a short notice via bulk SMS.

- The report, executive summary and its appendices is available on Golder's website (https://www.golder.com/global-locations/africa/south-africa-public-documents/).
- The executive summary of the report is also available as a separate document for those I&APs who do not have the time nor data to download the entire report as per request.
- In addition, Golder has published an advertisement regarding the start of the impact assessment phase in the Mogol Post newspaper, on **Friday, 23 October 2020** (APPENDIX E); and site notices has been placed along the access road and at the entrance to the Exxaro Grootegeluk Coal Mine.
- Inform and consult with the public regarding the project and the associated processes. These will be a combination of a one-on-one meeting with Lephalale Municipality, focus group meetings with key community leaders at Lephalale and Marapong community. These meetings will comply with the current COVID-19 regulations of not more than 50 people, wearing of face masks, hand sanitizer at the door and seating arrangements.
- Notices regarding the proposed project (not copies of the actual documents) have been placed at the following publicly accessible place for potential I&APs to view:

| Name of publicly accessible place | Address |
|---|---|
| Lephalale Public Library | Corner Joe Slovo and Douwater Roads, Lephalale |
| Lephalale Police Station (SAPS) | 3 Herman Street, Lephalale |
| Marapong Public Library | 916 Phukubye Street; Marapong |
| Golder Associates (Pty) Ltd Office | Building 1, Maxwell Office Park, Magwa Crescent, Waterfall City, Midrand, 1865 |

After completion of the 30-day public comment period, all the issues, comments and suggestions raised on the draft EIA/EMPr will be added to the Comment and Response Report that will accompany the Final EIA/EMPr. The Final EIA/EMPr will be submitted to the DMRE for a decision about the proposed project.

The Integrated Water and Waste Management Plan (IWWMP) will be submitted to the Department of Water and Sanitation (DWS), by means of its online application portal, in support of the Water Use Licence Application.

### 6.6.1 Announcement of Lead Authority's Decision

Once the DMRE has taken a decision about the granting of a mining right, the Public Participation Office will immediately notify I&APs of this decision and of the opportunity to appeal. This notification will be provided as follows:

- A letter will be sent, personally addressed to all registered I&APs, summarising the DMRE's decision and explaining how to lodge an appeal should they wish to; and
- An advertisement to announce the Lead Authority's decision will be published in the Mogol Post, if so required by the authorities.

# 7.0 ENVIRONMENTAL ATTRIBUTES AND DESCRIPTION OF THE BASELINE RECEIVING ENVIRONMENT

## 7.1 Geology

### 7.1.1 Regional Geology

Based on the 1:250 000 Geological Map Series 2326 Ellisras, Council for Geoscience, the regional geology in the area is characterised by the igneous and sedimentary rocks of the Karoo Supergroup (Golder Associates Africa , 2017) (Figure 12). The Grootegeluk Turfvlakte Expansion Project is situated on the southern portion of the Limpopo Depression, a relatively small corridor between the Limpopo River in the west and the Palala-Pietersburg Plateau in the east (Golder, 2020d).

The Grootegeluk Turfvlakte Expansion project area is located on the Waterberg Coal Field and includes all the major units of the Karoo Supergroup (Table 9), comprising from surface of the Stormberg Group, Beaufort Group, Ecca Group and the Dwyka group forming the basement (Figure 13).

**Table 9: Stratigraphy of the Karoo Super Group**

| Group | Formation (SACS – 1980) | Formation (Cilliers 1951) | Representative Rock Type | Average Thickness |
|---|---|---|---|---|
| **Stormberg** | Drakensberg Basalt | Drakensberg | Lava, purplish to red, amygdaloidal | 95m |
| | Clarens Sandstone | Cave Sandstone | Sandstone, fine grained, white to yellow-brown to reddish | 80m |
| | Elliot | Red Beds | Mudstone, red to chocolate brown, clayey | 90m |
| | Molteno | Molteno | Sandstone, white, medium to coarse grained, scattered pebbles | 15m |
| **Beaufort** | Beaufort | Beaufort | Mudstone, purple and greenish grey, alternating at top, light grey at base | 90m |
| **Ecca** | Volksrust Shale | Upper Ecca | Intercalated shale and bright coal | 60m |
| | Vryheid | Middle Ecca | Sandstone and grit, inter-calated carbonaceous shale, siltstone, few thick coal seams, mainly dull | 55m |
| | Pietermaritzburg Shale | Lower Ecca | Shale and sandstone, grit in lower portions | 150m |
| **Dwyka** | Dwyka | Dwyka | Tillite | 3m |

The Waterberg Coal Field covers an area of approximately 88 km (east to west) and 40 km north-south. The coalfield also extends westward into Botswana. The Waterberg Coal Field is part of the late Palaeozoic to early Mesozoic (100-200 Ma) Erathems of the Karoo Supper Group. The coalfield is fault-bounded and forms a graben structure. The Eenzaamheid Fault forms the southern boundary, with rocks of the Waterberg Group occurring to the south and the Karoo to the north. The northern boundary is delineated by the Zoetfontein Fault with Archaean granites outcropping north of the fault (Golder, 2017).

The coal seams of the Waterberg Coal Field occur in the Volksrust and Vryheid Formations of the Karoo Super Group. These are also referred to as the Grootegeluk and Goedgedacht Formations, respectively.

The coalfield is further subdivided by the Daarby Fault that delineates a shallower western part of the coalfield, which is suitable for opencast mining and a deep north-eastern part, which is not suitable for opencast mining. The Zoetfontein Fault was tectonically active before and during Karoo deposition, while the Eenzaamheid and Daarby faults, as most of the other faults in the Waterberg Coalfield, are younger than the Karoo Sequence.

Sedimentation occurred in a shallow east-west striking trough and the general direction of transport was ENE-WSW. Karoo sediments are deposited on the Waterberg Group in the southern portion of the coalfield, while the basement rocks to the north of the Zoetfontein Fault are Archaean rocks. The paleo-floor in the eastern portion consists of granite and basic rocks of the Bushveld Igneous Complex. Relatively few dolerite dykes outcrop in the south-eastern portion of the coalfield and no sills have been intersected in any of the exploration boreholes (Golder, 2017).

### 7.1.2 Structural Geology

Three major geological fault zones intersect the greater study area, i.e. Zoetfontein Fault (to the north of Grootegeluk mine), Daarby Fault(north – east trending fault) and Eenzaamheid Fault to the south of the Grootegeluk Turfvlakte Expansion project area, as well as several minor faults and fractures which have been delineated by Exxaro as indicated on Figure 13 (Golder, 2020d).

#### *7.1.2.1 Zoetfontein Fault*

The Zoetfontein Fault is a high angled east northeast – west southwest striking major fault. Significant post-Karoo displacement is evident and is known to be still seismically active; this resulted in the extensive downthrow to the north and sinistral horizontal movement. The basement complex consists of Archaean granite and gneiss, outcropping to the north of the fault zone (Golder, 2020d).

#### *7.1.2.2 Daarby Fault*

The Daarby Fault is a major north-east, then north-west trending fault, assumed to be part of one set of events because both “legs” of the fault exhibit the same throw and throw direction. Both faults have consequently been combined into the one name. The Daarby Fault is a normal fault with a downthrow of 360 m to the north and the fault dips at an angle of between 50º and 60º to the north, bringing up-thrown Beaufort and Ecca Group Formations to the south into contact with the down-thrown Letaba, Clarens, Elliott and Molteno Formations in the north.

#### *7.1.2.3 Eenzaamheid Fault*

The Eenzaamheid Fault, situated south of the Daarby fault, has a throw of 250 m to the north brining the upthrown Waterberg Group on the southern side of the fault into contact with the down-thrown Beaufort and Ecca Groups on the northern side of the fault. The dip angle of the Eenzaamheid Fault is near vertical. Evidence of a possible link between the Eenzaamheid and Daarby Faults exists from exploration boreholes on the farm Turfvlakte.

### 7.1.3 Local Geology

The Grootegeluk Turfvlakte Expansion project area is dominated by the geology of three major Karoo Super Group Formations, namely the Volksrust, the Vryheid and the Clarence Formations. The local geology of the

Waterberg Coal Field as found in the vicinity of the project area is presented in Figure 13 (provided by Exxaro).

The general stratigraphy of the Grootegeluk Turfvlakte Expansion project area consists of weathered formation which is approximately 25 to 30m thick and is made up of topsoil, calcrete, minor ferricrete, a sandy alluvium, weathered shale, clay and non-reactive carbonaceous material. A generalized stratigraphy for the Grootegeluk Turfvlakte Expansion project area is shown in Figure 11.

The overburden overlays minor occurrences of Volksrust Formation coals in the western portion of the project area that disappears to the east of the project area. These coal measures are predominately material from what is defined as Benches 4 and 5 at Grootegeluk mine. In the eastern portion of the farm, the Vryheid Formation lies directly under the overburden (provided by Exxaro). The thickness distribution of the overburden is shown in Figure 14 (provided by Exxaro).

| Description | | Thickness |
|---|---|---|
| Completely weathered, reddish brown to brown (where reworked with organic material), non-cohesive, aeolian sand with abundant quartz grains, upper most part of the profile. | | 29.35m |
| Hard to very hard, nodular, boulder or hardpan calcrete. Minor sporadic occurrences of ferricrete | | |
| Highly weathered, cream to brown and reddish brown in places, coarse grained to gravelly, loose to moderately cemented (calcified), with abundant quartz grains and quartz pebbles throughout the horizon. Some rounded Karoo siltstone/shale fragments, alluvial sand. | | |
| Highly weathered, yellowish brown and cream to brownish grey and light grey, fine grained, soft to slightly/moderately hard shale fragments and chips in a very fine powdery clay matrix, moulds in hand but has overall granular feel when moulded, weathered Karoo shales/siltstone | | |
| Highly to completely weathered, light yellow brown and cream to brownish grey, fine grained and powdery, minor very soft to clayey shale fragments, easily moulded when compressed in hand and stains hands when wet, weathered Karoo shales/siltstones. | | |
| Volkrust formation: Intercalated shale and bright coal layers. Only present in western portion of project area. | | 14.50m |
| Vryheid formation: Sandstone and grit, intercalated carbonaceous shale, siltstone, few thick coal seams, mainly dull | | 30.73m |

**Figure 11: Generalised Stratigraphy of Grootegeluk Turfvlakte Expansion Project Area (provided by Exxaro) (Golder, 2020d)**

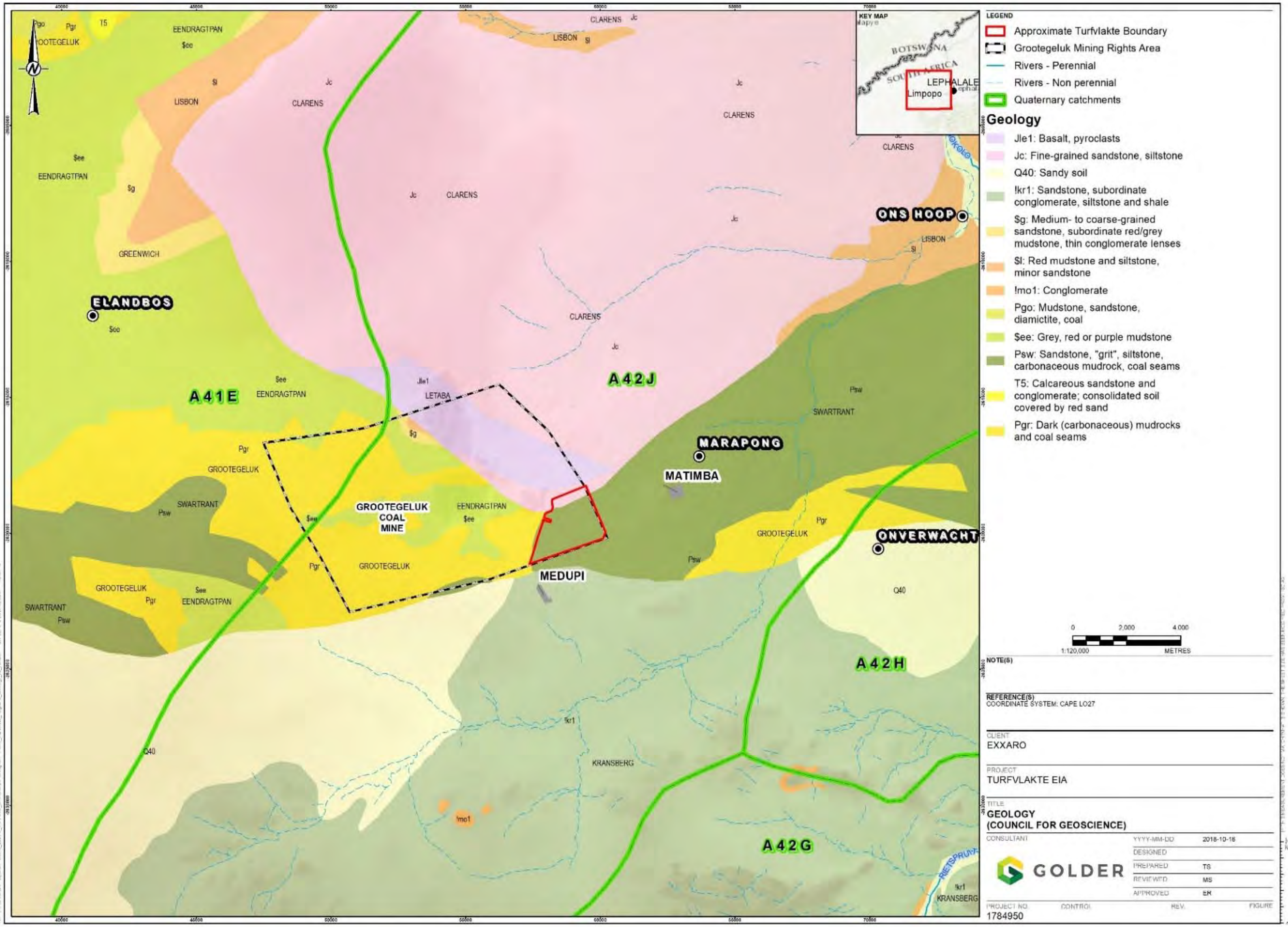



**Figure 12: Regional Geology**

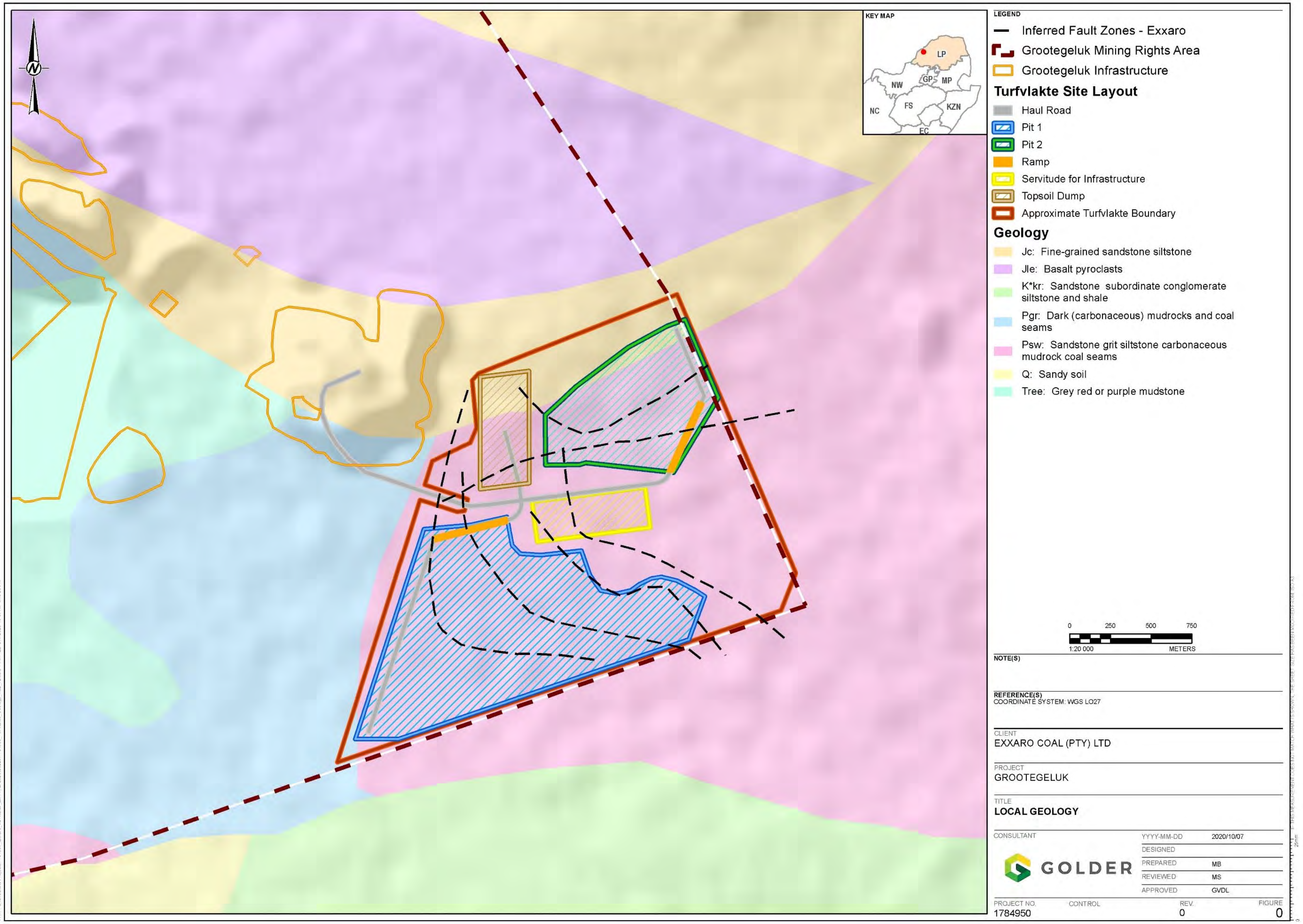



**Figure 13: Geology of the Grootegeluk Turfvlakte Expansion Project Area**

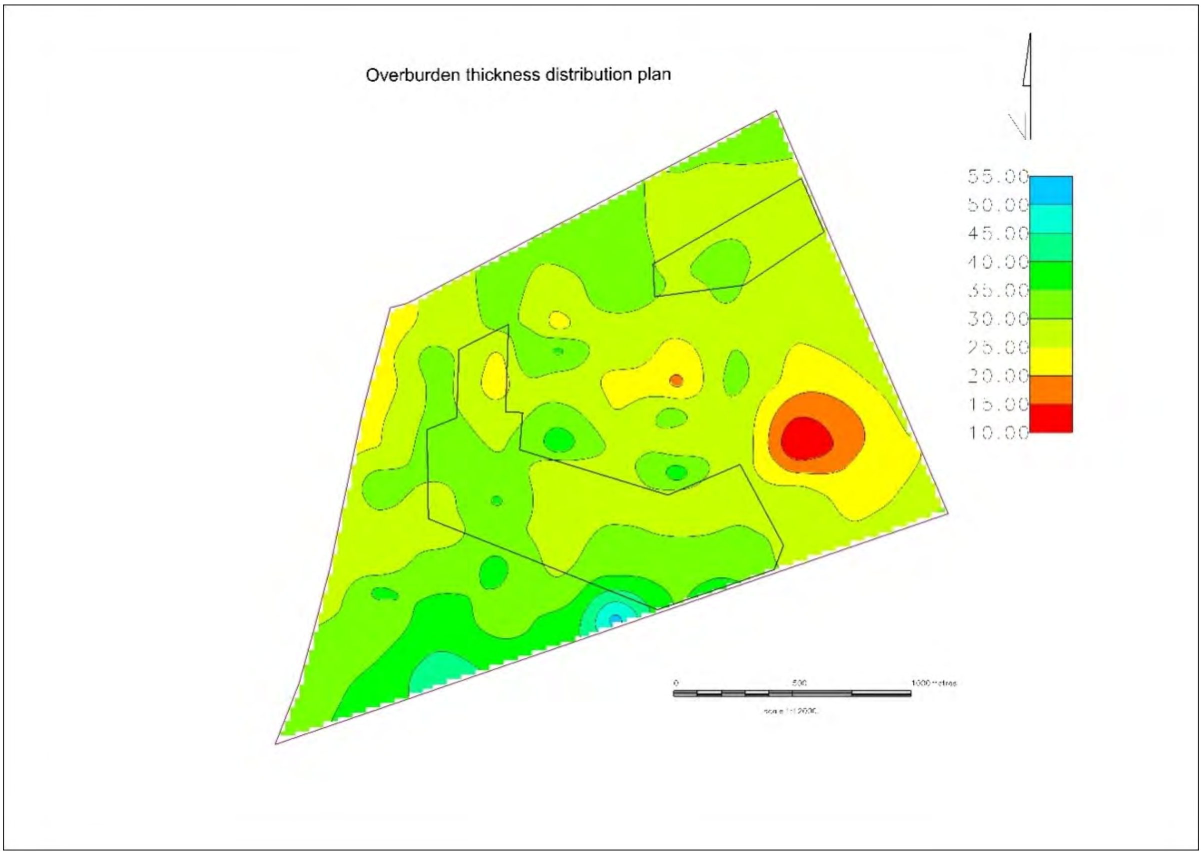



**Figure 14: Overburden Thickness Distribution (provided by Exxaro as cited by (Golder, 2020d))**

The full Waterberg coal succession does not occur on the project area. A number of factors contribute to this. These include but are not limited to (provided by Exxaro):

- Differential weathering of the coal measures of the Volksrust and Vryheid Formations.
- The project area is situated in a narrow corridor that is bounded by two regional faults namely the Daarby and Eenzaamheid Faults. These faults appear to have a number of smaller, sympathetic faults associated with them. These fault zones make the project area more structurally complex and may contribute to the disappearance of portions of the coal measures in the area. These faults have been inferred by Exxaro from exploration boreholes and the geological model Figure 13 (Golder, 2020d).

## 7.2 Climate

The proposed Grootegeluk Turfvlakte Expansion project area is located in the Waterberg region of South Africa which falls within the subtropical high-pressure belt. The mean circulation of the atmosphere over the subcontinent, except for near the surface, is anti-cyclonic throughout the year. The synoptic patterns affecting the typical weather experienced at the mine owe their origins to the subtropical, tropical and temperate features of the general atmospheric circulation over South Africa. The highest temperatures are typically experienced during the summer months of December, January and February, and the lowest during the winter months of June, July and August (Golder, 2020c).

### 7.2.1 Temperature

The Grootegeluk Turfvlakte Expansion Project is located within an area classified as semi-arid, dry, and hot in terms of the Köppen climatic classification (Hatfield Consultants and AHT Group AG, 2020 as cited by

(Golder, 2020g)). Average temperatures in the region range from a minimum of approximately 5°C in June and July, to a maximum of approximately 33°C in January and December (Table 10).

**Table 10: Average temperatures in the Lephalale area (https://en.climate-data.org/location/26819/)**

| Parameter | January | February | March | April | May | June | July | August | September | October | November | December |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Avg. Temperature (°C) | 26 | 25.2 | 23.8 | 21.1 | 17.4 | 14 | 14.1 | 17 | 21.3 | 23.5 | 24.7 | 25.6 |
| Min. Temperature (°C) | 19.5 | 18.9 | 16.9 | 13.4 | 8.2 | 4.4 | 4.5 | 7.6 | 12.4 | 15.6 | 17.8 | 18.9 |

### 7.2.2 Rainfall

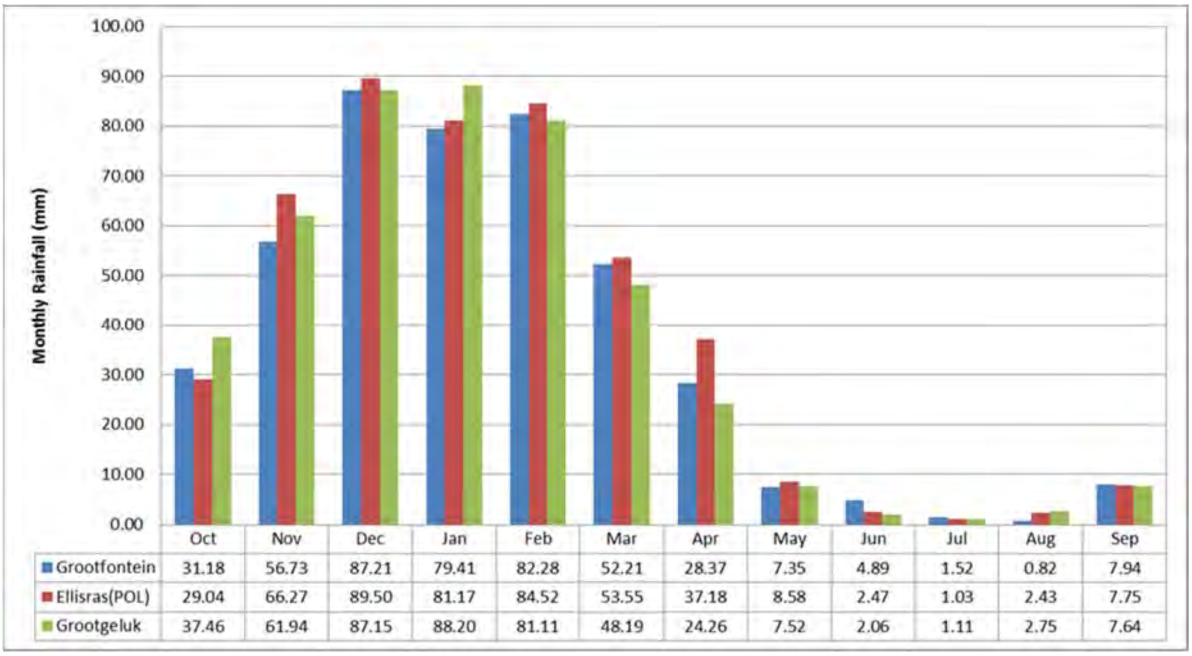
The Grootegeluk Turfvlakte Expansion Project is located within the Limpopo River Basin, which experiences extremely variable climatic and hydrological regime characterised by floods and droughts. Rainfall is highly variable within and between seasons, with a short but intense rain season.

Data from three rainfall stations in close proximity to the project area, with reasonably long and reliable records, were analysed and are presented in Table 11.

From the data analysed, it was observed that the same trend is present in both wet and dry seasons, as illustrated in Figure 15. The wet season is from October to March and the dry season from April to September, with the maximum average rainfall recorded in December and the minimum average rainfall recorded in July (Golder, 2020c).

**Table 11: Metadata for the rain stations**

| Station Name | Station No | Distance | Latitude | Longitude | Record | Patched Data | Reliability | MAP | Altitude |
|---|---|---|---|---|---|---|---|---|---|
| | | **km** | **Degrees** | **Degrees** | **Years** | **%** | **%** | **mm** | **mamsl** |
| **Grootfontein** | 0674429 W | 18.796 | 23.39 | 27.45 | 44 | 57.9 | 42.1 | 440 | 853 |
| **Ellisras (POL)** | 0674400 W | 17.102 | 23.41 | 27.44 | 33 | 66.2 | 33.8 | 463 | 837 |
| **Grootegeluk** | 0674100 W | 0.000 | 23.40 | 27.34 | 24 | 76.9 | 23.0 | 449 | 908 |




| | Oct | Nov | Dec | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Grootfontein | 31.18 | 56.73 | 87.21 | 79.41 | 82.28 | 52.21 | 28.37 | 7.35 | 4.89 | 1.52 | 0.82 | 7.94 |
| Ellisras(POL) | 29.04 | 66.27 | 89.50 | 81.17 | 84.52 | 53.55 | 37.18 | 8.58 | 2.47 | 1.03 | 2.43 | 7.75 |
| Grootgeluk | 37.46 | 61.94 | 87.15 | 88.20 | 81.11 | 48.19 | 24.26 | 7.52 | 2.06 | 1.11 | 2.75 | 7.64 |

**Figure 15: Average monthly rainfall for the stations analysed (Golder, 2020c)**

## 7.2.3 Evaporation

The nearest Symons (S)-Pan Evaporation station to the Turfvlakte farm (A4E007) has a Mean Annual Evaporation (MAE) of 1 844 mm/year. Mean monthly evaporation values are presented in Figure 11. It is important to note that the mean annual evaporation is almost 4 times higher than the rainfall.

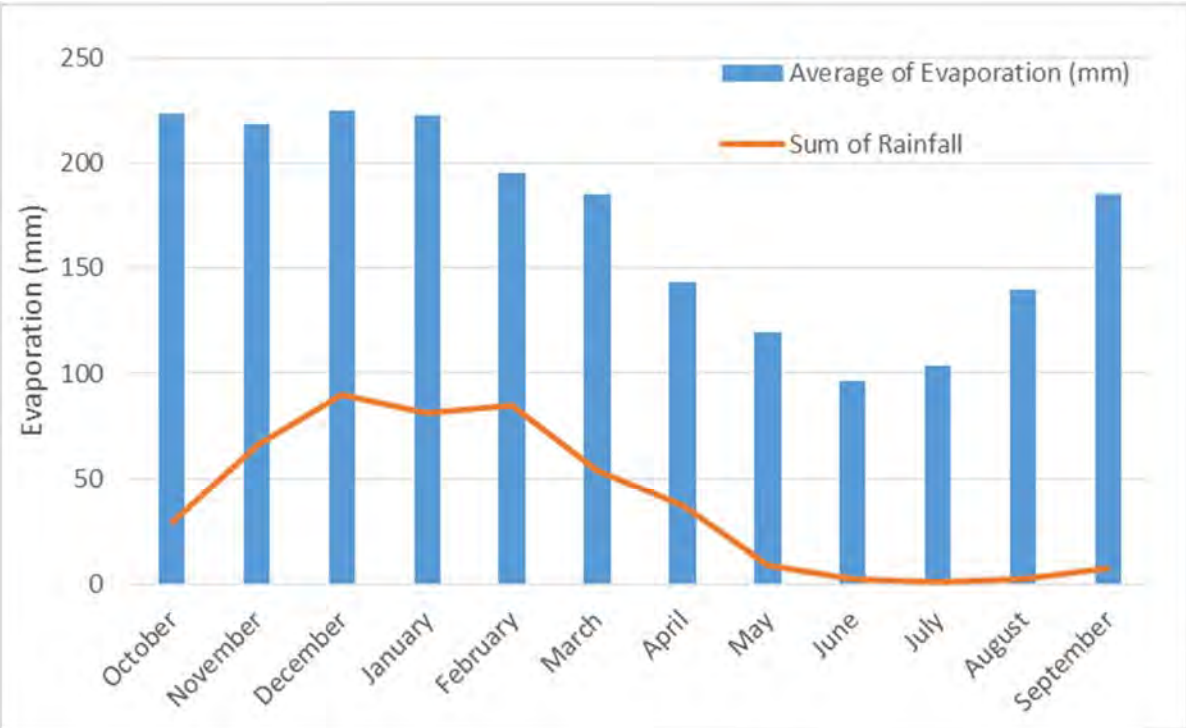



**Figure 16: Average monthly evaporation measurements for the Lephalale area (Golder, 2020c)**

### 7.2.4 Wind Speed and Direction

Winds at the Grootegeluk Turfvlakte Expansion project area are expected to originate from the north-east to east-north-easterly sector (Figure 17). Wind speeds are moderate, averaging 3.2 m/s with a low percentage (10%) of calm conditions (<1 m/s).

The seasonal and diurnal wind roses are provided in Figure 12.

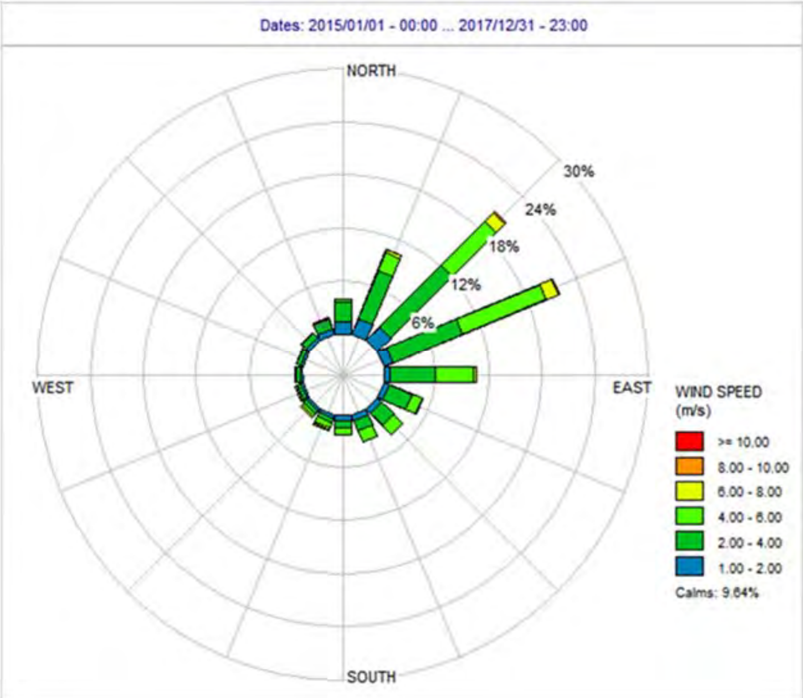



**Figure 17: Period (2015 - 2017) modelled wind rose for the Grootegeluk Turfvlakte Expansion project area (Golder, 2020a)**

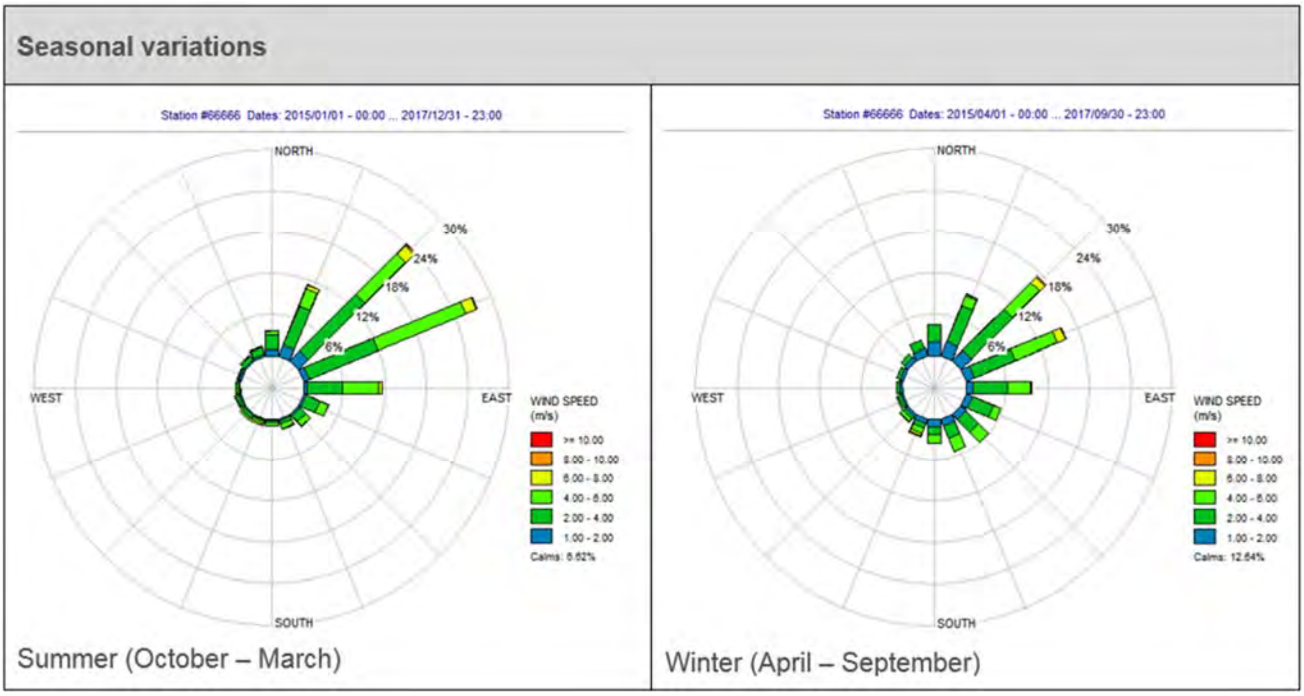



**Figure 18: Seasonal variations in wind speed and direction (Golder, 2020a)**

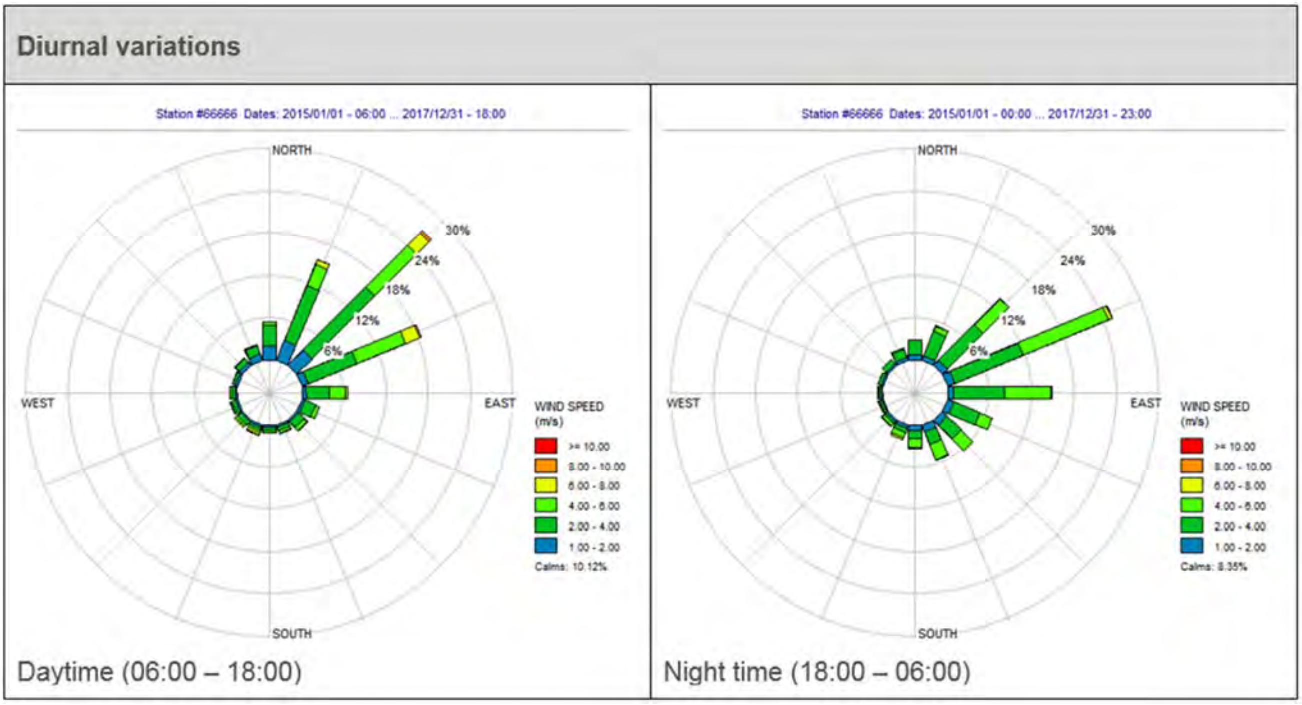



**Figure 19: Diurnal variations in wind speed and direction**

### 7.2.5 Extreme Weather Events

The Grootegeluk Turfvlakte Expansion project area is located within the Waterberg-Bojanala Priority Area (WBPA).

## 7.3 Air Quality

### 7.3.1 Priority Area

The Grootegeluk Turfvlakte Expansion project area is located within the Waterberg-Bojanala Priority Area (WBPA) (Figure 20).

### 7.3.2 Land Use and Sensitive Receptors

The region is characterised by natural bushveld, interspersed with plots of cultivated land, small scale farming and protected natural reserves, as illustrated in Figure 21. The Grootegeluk Coal Mine, and the neighbouring Eskom power stations, Medupi and Matimba, are prominent features in the local landscape.

Potential sensitive receptors in the vicinity of the current Grootegeluk Coal Mine and the proposed Grootegeluk Turfvlakte Expansion Project mining operations and the future Thabametsi Mine, include dispersed farmhouses, lodges, towns and natural reserves. The Manketti Lodge is the sensitive receptor in closest proximity, 400 m north-east of the proposed Turfvlakte Pit 2, of the proposed project area. The towns of Marapong, 4 km east of the Grootegeluk Coal Mine, and Onverwacht, 10 km east of Grootegeluk Coal Mine, host a number of schools and hospitals. The combined habitation of the two neighbouring towns are approximately 26 000 people. Table 12 lists a selection of representative receptor sites surrounding the Grootegeluk Coal Mine and the proposed Thabametsi and Turfvlakte mining operations and the future Thabametsi mine. The location of the receptor sites is illustrated in Figure 21.

**Table 12: Selected representative receptor locations**

| Number | ID | Name | X | Y | South | East |
|---|---|---|---|---|---|---|
| 0 | MAN | Manketti Lodge | 559704 | 7382428 | -23.66782 | 27.58550 |

| Number | ID | Name | X | Y | South | East |
|---|---|---|---|---|---|---|
| 1 | VIL | Village | 561063 | 7383287 | -23.66001 | 27.59879 |
| 2 | DIT | Ditheku Primary (Marapong) | 562976 | 7384216 | -23.65154 | 27.61751 |
| 3 | MAR | Marapong Private Hospital | 563100 | 7383440 | -23.65854 | 27.61876 |
| 4 | NEL | Nelson Skop Primary (Marapong) | 563854 | 7383540 | -23.65761 | 27.62615 |
| 5 | SED | Sedibeng School for the Deaf (Onverwacht) | 567943 | 7379416 | -23.69469 | 27.66643 |
| 6 | FAR | Farm house NE | 561418 | 7389535 | -23.60355 | 27.60201 |
| 7 | GOE | Goedenhoop 4570 | 552506 | 7387090 | -23.62596 | 27.51475 |
| 8 | GRA | Graaffwater 4562 | 552136 | 7388001 | -23.61774 | 27.51108 |
| 9 | ELA | Elandsbosch 2601 | 540835 | 7388273 | -23.61561 | 27.40030 |
| 10 | MAS | Massenberg 3050 | 542716 | 7384120 | -23.65307 | 27.41886 |
| 11 | HOO | Hooikraal 3150 | 545894 | 7378122 | -23.70716 | 27.45021 |
| 12 | BUF | Buffelsjagt 3170 | 547057 | 7375644 | -23.72951 | 27.46169 |
| 13 | TIE | Tierkop NR/ Vergulde Helm 3210 | 550506 | 7377127 | -23.71601 | 27.49548 |
| 14 | KRO | Kromdraai 6900 | 554915 | 7374607 | -23.73863 | 27.53883 |
| 15 | WEL | Wellington 5190 | 561926 | 7373877 | -23.74496 | 27.60764 |
| 16 | HAN | Hanglip 5083 | 561482 | 7380495 | -23.68521 | 27.60301 |

### 7.3.3 Sources of Air Pollution

With the Grootegeluk Coal Mine, Matimba and Medupi Power Stations, and Marapong and Lephalale residential areas in areas surrounding the Grootegeluk Turfvlakte Expansion project area, the following key sources of air pollution were identified:

- Coal mining
- Power generation
- Domestic fuel burning
- Brick making
- Vehicle emissions
- The entrainment of dust on unpaved roads

#### 7.3.3.1 Coal mining

Coal mining operations are prominent emission sources in the WBPA, with the most relevant operation the Grootegeluk Coal Mine. Activities at the mining operations that result in the entrainment/suspension of particulate matter, include but are not limited to:

- Vehicles used on unpaved and paved roads;
- Blasting;
- Overburden stripping;
- Ore and overburden materials handling;
- Crushing and screening of ore; and
- Wind entrainment from stockpiles, waste rock dumps and tailings storage facilities.

When fresh coal is loaded onto a stockpile, the potential for dust emission is at a maximum. Fine coal particles are easily disaggregated and released to the atmosphere upon exposure to air currents, either from coal transfer itself or from high winds. As the coal pile ages, the potential for dust emissions is greatly reduced as moisture causes aggregation and cementation of fines to the surface of larger particles (USEPA (2006) as cited by (Golder, 2020a).

Carbon oxides, hydrocarbons, sulphuric gases and hydrogen are potentially emitted from coal stockpiles. The potential sources of these gases include degassing, low temperature oxidation and, in extreme cases, spontaneous combustion.

Coal beds contain reservoirs of gases, mainly carbon dioxide ($CO_2$) and methane ($CH_4$). These gases are stored on the internal surface of organic matter or within the molecular structure of the coal. From the moment that coal is exposed to air, it is subject to low temperature oxidation (weathering) by atmospheric oxygen. This process can be sustained if the heat produced by the exothermic oxidation cannot be sufficiently dissipated by heat transfer within the stockpile. Temperatures are therefore generally higher and atmospheric pressures lower than those occurring in the coal beds. These conditions are ideal for degassing. In addition to the $CO_2$ and $CH_4$ emitted in the degassing process, dimethylsulphide (DMS) is produced from lignite (IEA Clean Coal Centre (2013) as cited by (Golder, 2020a).

Spontaneous combustion is caused when coal oxidizes and airflow is insufficient to dissipate the heat. During combustion, the reaction between coal and the air produces oxides of carbon, including $CO_2$, oxides of sulphur ($SO_x$), and various oxides of nitrogen ($NO_x$). Because of the hydrogenous and nitrogenous components of coal, hydrides and nitrides of carbon and sulphur are also produced during the combustion process. These include hydrogen cyanide (HCN), sulphur nitrate ($SNO_3$) and other toxic substances including: arsenic, lead, mercury, nickel, vanadium, beryllium, cadmium, barium, chromium, copper, molybdenum, zinc, selenium and radium (World Coal Institute (2008) as cited by (Golder, 2020a).

Fugitive dust and fine particulates generated at the current Grootegeluk Coal Mine and proposed Turfvlakte and Thabametsi mining operations are anticipated to have the largest impact on ambient air quality

#### 7.3.3.2 Power Generation

The coal reserves in the region have led to establishment of the following power generating infrastructure:

- Matimba coal fired power station, approximately 5 km east-south-east of the Grootgeluk Coal Mine;
- Medupi coal fired power station, approximately 5 km south of the Grootegeluk Coal Mine; and

- Power stations in Botswana, located approximately 100 km from Lephalale.

The air pollutants released as a result of the high temperature combustion process at coal-fired power stations primarily include particulates ($PM_{10}$ and $PM_{2.5}$), $SO_2$, $NO_x$, nitric oxide (NO), $NO_2$, CO, $CO_2$, nitrous oxide ($N_2O$), and trace amounts of mercury.

The non-combustible portion of the fuel remains as solid waste. The coarser, heavier waste is called bottom ash and is extracted from the burner, and the lighter, finer portion is fly ash, usually emitted as particulates through the stack and resulting in the formation of particulate matter which is liberated to the atmosphere via a stack (post scrubbing at most power stations) (Golder, 2020a).

#### *7.3.3.3 Domestic Fuel Burning*

Households within nearby towns and communities are likely to use coal, wood and paraffin for space heating and/or cooking purposes. Emissions from these communities are therefore anticipated to impact the region, especially during the winter period due to the increased demand for space heating.

Domestic fuel burning of coal emits a large amount of gaseous and particulate pollutants including sulphur dioxide, heavy metals, total and respirable particulates, inorganic ash, carbon monoxide, polycyclic aromatic hydrocarbons (PAHs), and benzo(a)pyrene. Pollutants arising due to the combustion of wood include respirable particulates, $NO_2$, CO, PAHs, particulate benzo(a)pyrene and formaldehyde. The main pollutants emitted from the combustion of paraffin are $NO_2$, particulates, CO and PAHs.

#### *7.3.3.4 Brick making*

Emissions generated during the brick making process are mainly generated during the handling of raw materials, processing, plant maintenance and the maintenance of pollution control equipment.

The primary source of dust is the materials handling process, including the pulverising, screening, and storage of raw materials. Pollution control emissions from the clay industry include dust accumulated in baghouses, and the solid residues from wet scrubbers (where applicable) used to treat nitrogen oxide emissions, and to control acid gases and trace combustion products when burning low quality fuels. Plant maintenance emissions consist primarily of waste oils and solvents generated from a range of mechanical equipment (NPi (1998) as cited by (Golder, 2020a).

#### *7.3.3.5 Vehicle Emissions*

Air pollution generated from vehicle emissions may be grouped into primary and secondary pollutants. Primary pollutants are those emitted directly to the atmosphere as exhaust emissions whereas, secondary pollutants are formed in the atmosphere as a result of atmospheric chemical reactions, such as hydrolysis, oxidation, or photochemical reactions. The primary pollutants emitted typically include $CO_2$, CO, hydrocarbons (including benzene, 1.2-butadiene, aldehydes and PAHs), $SO_2$, $NO_x$ and particulates. Secondary pollutants formed in the atmosphere typically include $NO_2$, photochemical oxidants such as $O_3$, hydrocarbons, sulphur acid, sulphates, nitric acid, sulphates, nitric acid and nitrate aerosols (USEPA (1995) as cited by (Golder, 2020a).

The quantity of pollutants emitted by a vehicle depends on specific vehicle related factors such as vehicle weight, speed and age; fuel-related factors such as fuel type (petroleum or diesel), fuel formulation (oxygen, sulphur, benzene and lead replacement agents) and environmental factors such as altitude, humidity and temperature (Samaras and Sorensen (1999) as cited by (Golder, 2020a).

Pollutants emitted from heavy off-highway vehicles include:

- CO - produced as a result of incomplete combustion;

- $NO_x$ – produced from the oxidation of nitrogen at high temperature and pressure in the combustion chamber;
- $SO_2$ - produced from the combustion of sulphur in diesel; and
- PM - produced from the incomplete combustion of the diesel, additives in fuels and lubricants, and worn material that accumulate in the engine lubricant.

#### 7.3.3.6 Vehicle Entertainment of Dust on Unpaved Roads

Vehicle entrained dust emissions from paved and unpaved roads represent a potentially significant source of fugitive dust in the region. Particulate emissions from paved roads occur when loose, spilt material on the road surface becomes suspended as vehicles travel across the roads surface and or when fine particulates are blown from the transported load. At industrial and construction sites the surface loading is continually replenished by spillage of material from unpaved roads and vehicles (USEPA (1995) as cited by (Golder, 2020a).

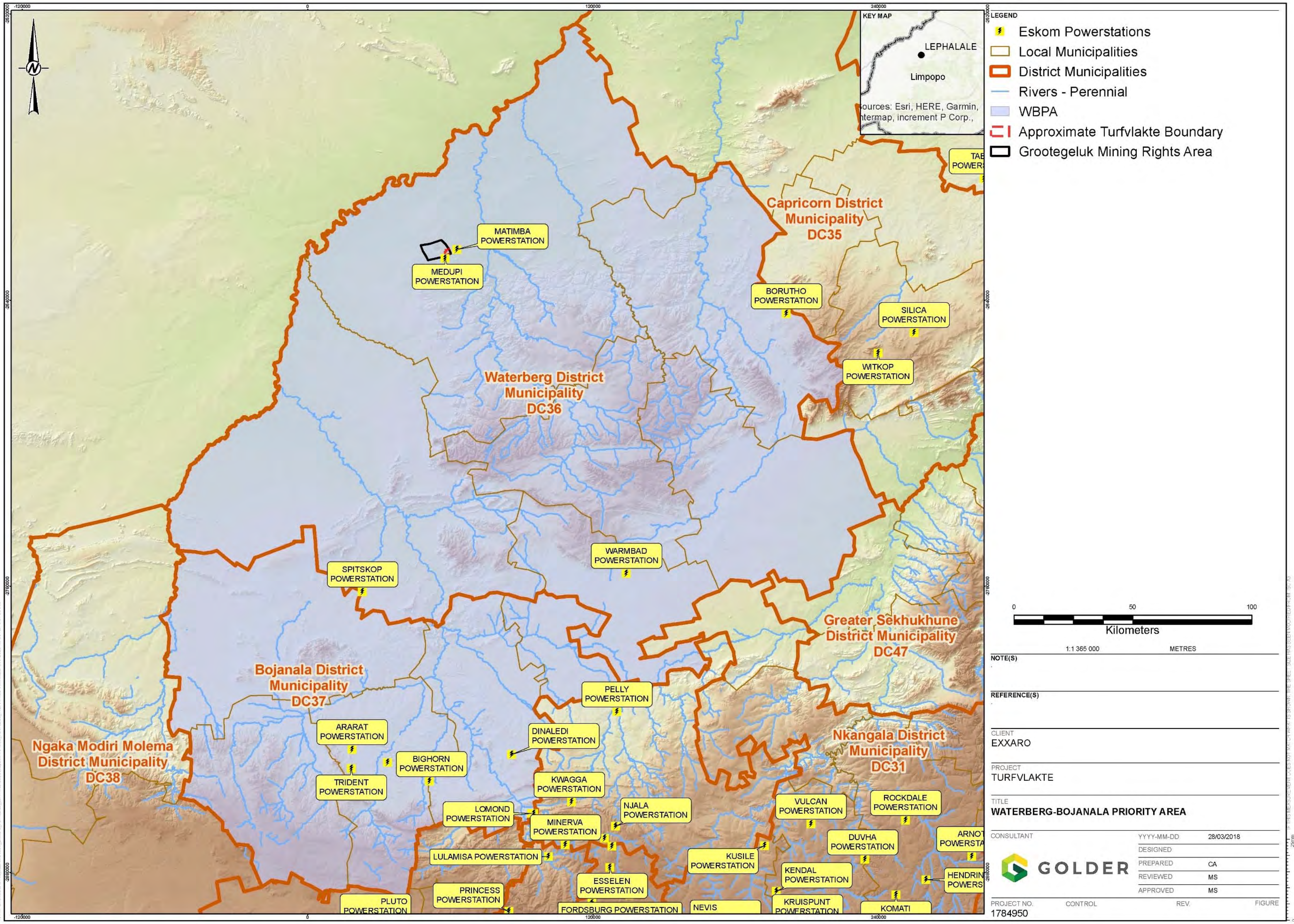



**Figure 20: Waterberg-Bojanala Priority Area (WBPA)**

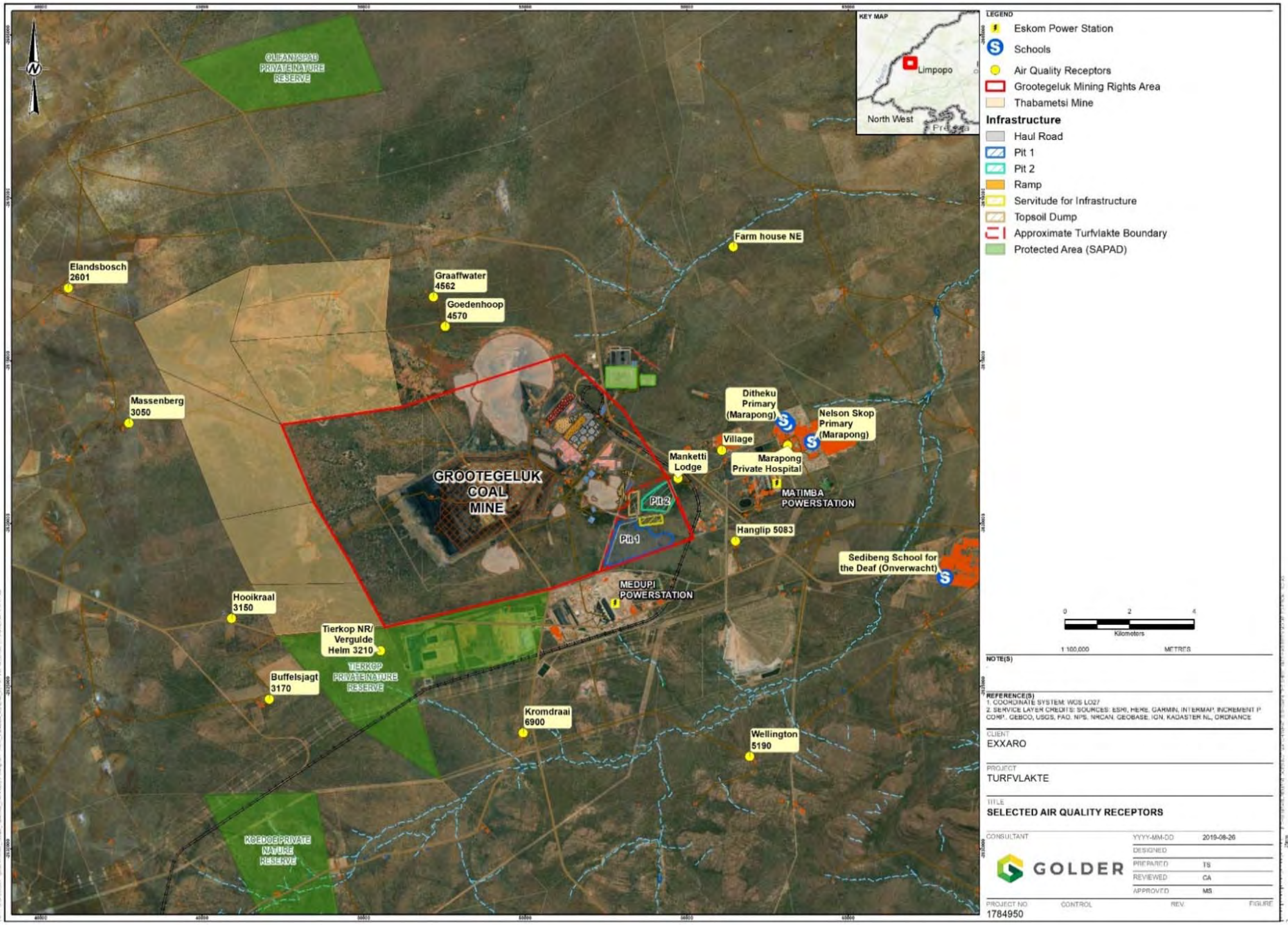



**Figure 21: Surrounding land use and potential receptors[1]**

[1] Refer to Section 7.7.1.2.1 for additional information on the Tierpoort Private Nature Reserve and the Medupi Power Station overlapping on the above map.

The surface of an unpaved road is unprotected from both the weight of a vehicle as well as the wind turbulence generated by the vehicle. The wheels of vehicles pulverise the surface and thus loosen material from the road, generating fine dust particles. This loosened material can then be lifted from the road surface a by turbulent air currents created as the vehicle is moving. The effect of this turbulent wake is maintained sometime after the vehicle has passed. The quantity of dust emissions from an unpaved road therefore varies linearly with the volume of traffic.

### 7.3.4 Ambient Air Quality Monitoring

#### *7.3.4.1 Dust Fallout*

A dust fallout monitoring network, consisting of 12 single dust fallout buckets has been established at points along the fence-line and boundary of the Grootegeluk Coal Mine (Figure 22).


**Figure 22: Grootegeluk Coal Mine dust fallout monitoring locations (Exxaro Grootegeluk, (2018) as cited by (Golder, 2020a))**

The dust fallout data for the period January to December 2018 is illustrated in Figure 23. One exceedance of the non-residential limit was recorded in the period. The exceedance was recorded in November at monitoring point GGD 04, located to the west of the Grootegeluk Coal Mine pit. Spoiled samples were recorded at GGD04 during the monitoring period, primarily as a result of animal/human interruptions.

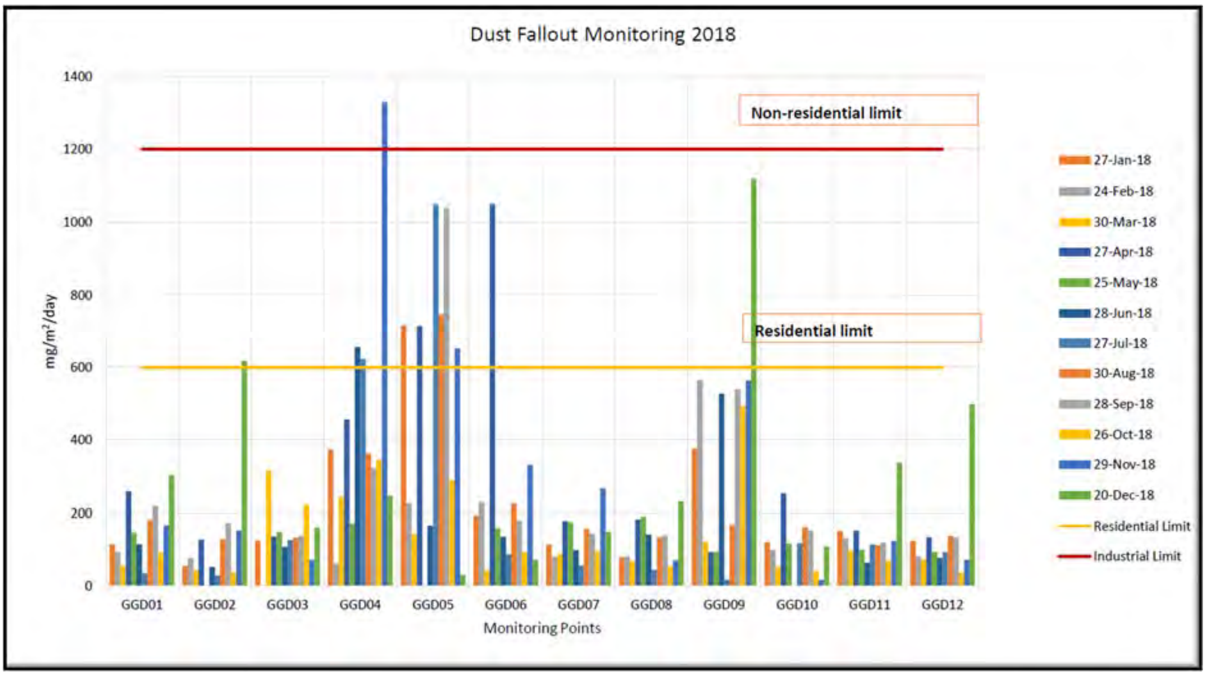



Figure 23: Dust fallout monitoring results for January to December 2018

### 7.3.4.2 Fine Particulates

Fine particulate monitoring is undertaken at the Medupi coal fired power station (~5 km east-south-east of the Grootegeluk Coal Mine). This data is published to the South African Air Quality Information System (SAAQIS) and is available for public use. The daily average validated fine particulate data for 01 January 2017 – 31 December 2017 was extracted from the SAAQIS site to determine the baseline ambient fine particulate loads in the region.

$PM_{2.5}$ results indicated two peaks in March and September 2017 (Figure 24). These peaks were considered outliers and distorted the graphical output to the extent that the ‘typical’ concentrations were no longer visible. Data for the period 1 April 2017 - 31 August 2017 (excluding these outliers) was therefore assumed to be representative of typical ambient conditions (Figure 25). Concentrations measured during this time fluctuated frequently from 5 µg/m$^3$ to 30 µg/m$^3$ with average concentrations of approximately 15 µg/m$^3$ (roughly 40% of the NAAQS) (Golder, 2020a).

$PM_{10}$ results indicated peaks in September 2017 at Medupi (Figure 26). Again, these peaks were considered outliers and distorted the graphical output to the extent that the ‘typical’ concentrations were no longer visible. Data from 1 January – 31 August were therefore selected for the Medupi power station (Figure 27). Concentrations measured at Medupi fluctuated frequently from 5 µg/m$^3$ to 70 µg/m$^3$ with average concentrations of approximately 30 µg/m$^3$ (roughly 40% of the NAAQS) (Golder, 2020a).

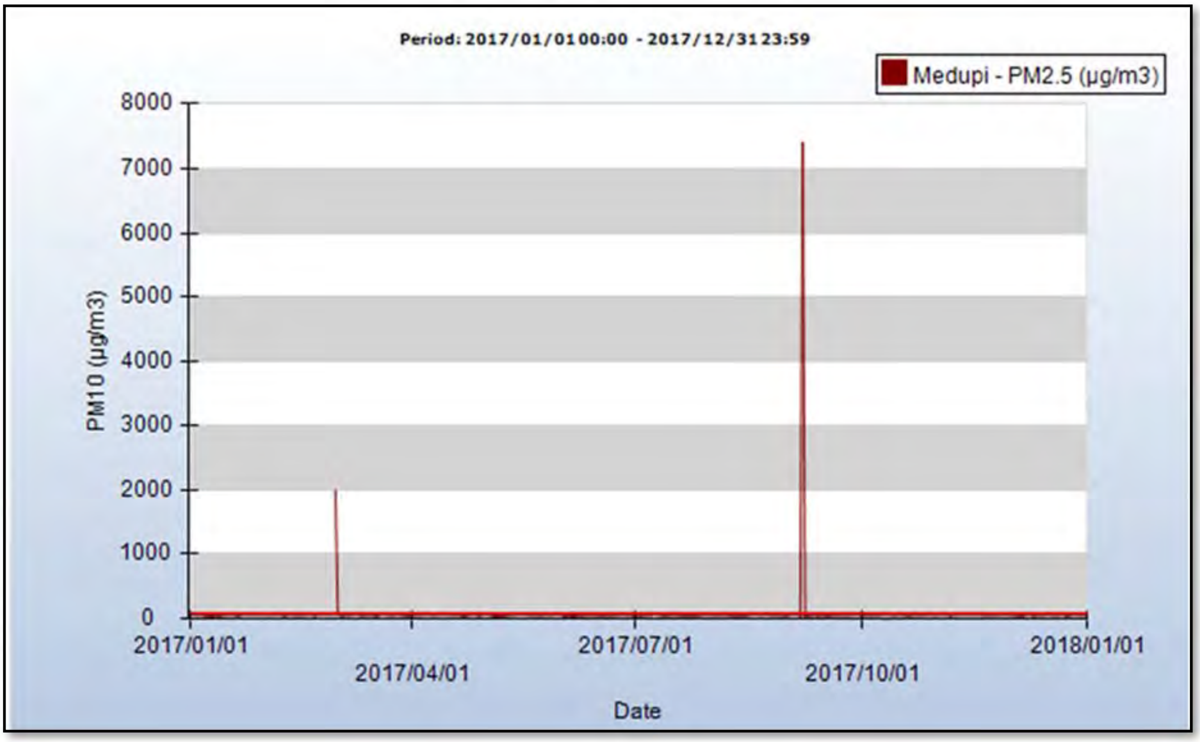



**Figure 24: Daily average $PM_{2.5}$ data for 1 January 2017 - 31 December 2017, measured at the Medupi Power Station (www.saaqis.org.za)**

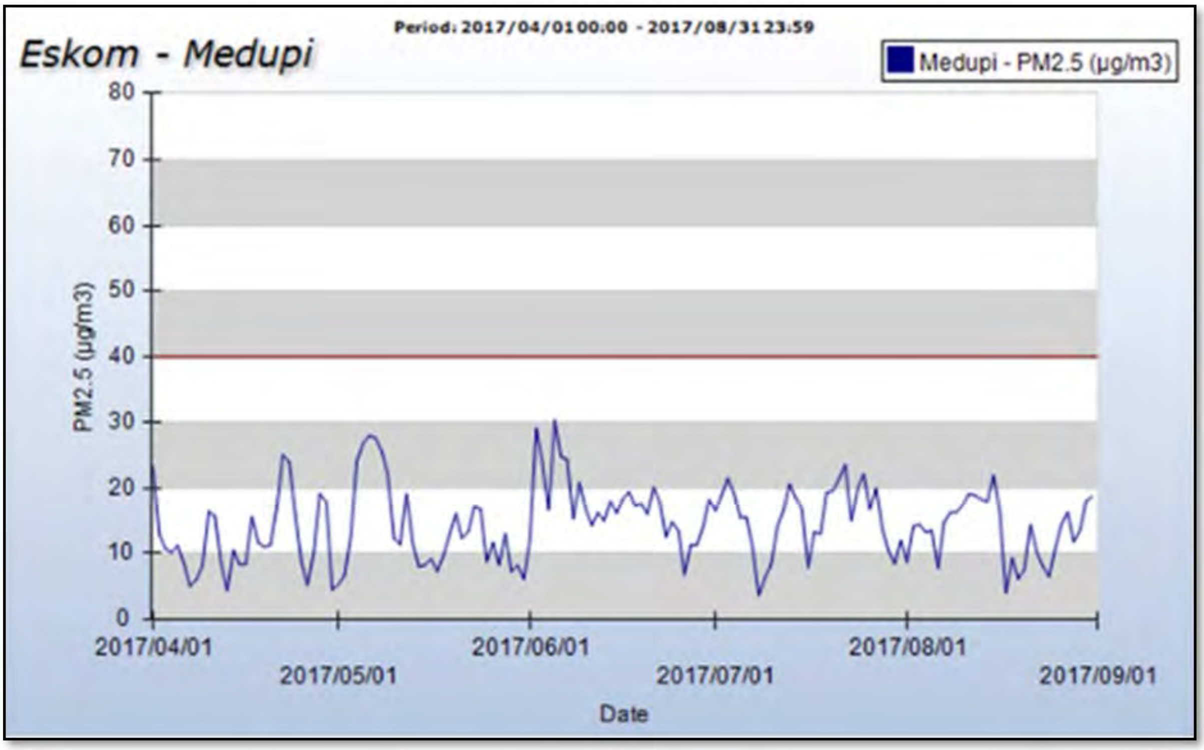



**Figure 25: Daily average PM2.5 data for 1 April 2017 - 31 August 2017, measured at the Medupi Power Station (www.saaqis.org.za)**

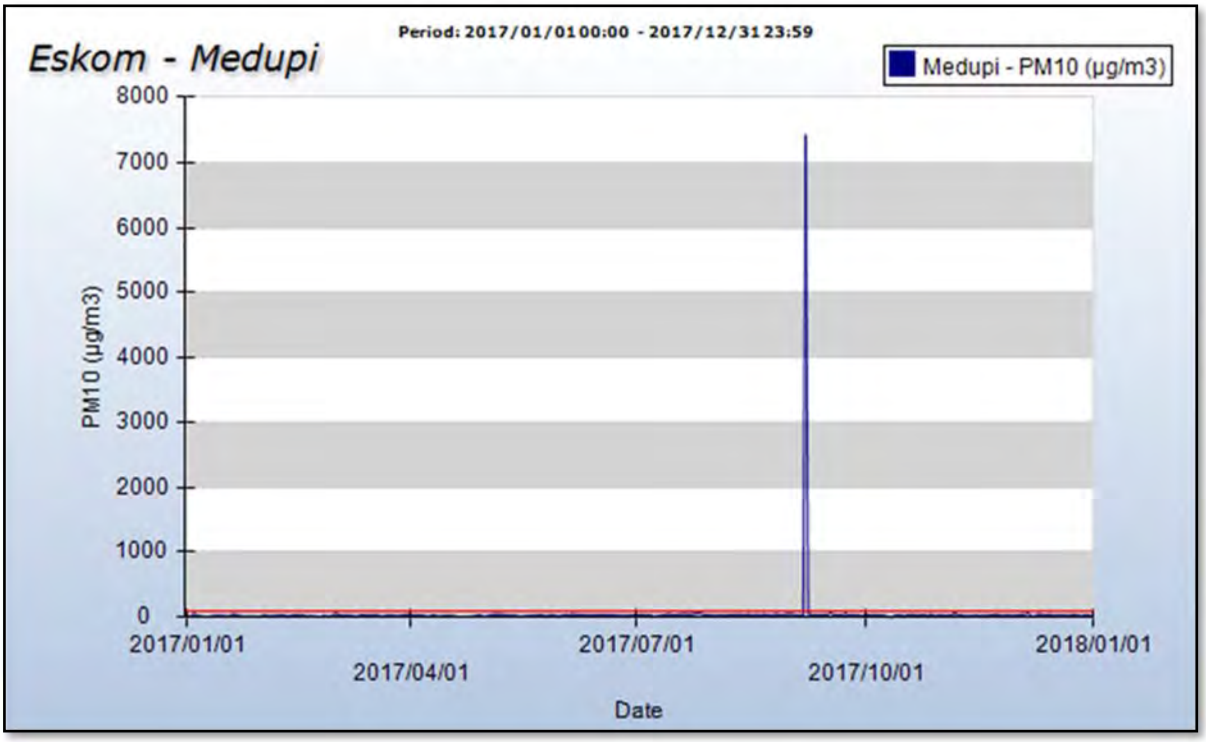



**Figure 26: Daily average $PM_{10}$ data for 1 January 2017 - 31 December 2017, measured at the Medupi Power Station (www.saaqis.org.za)**

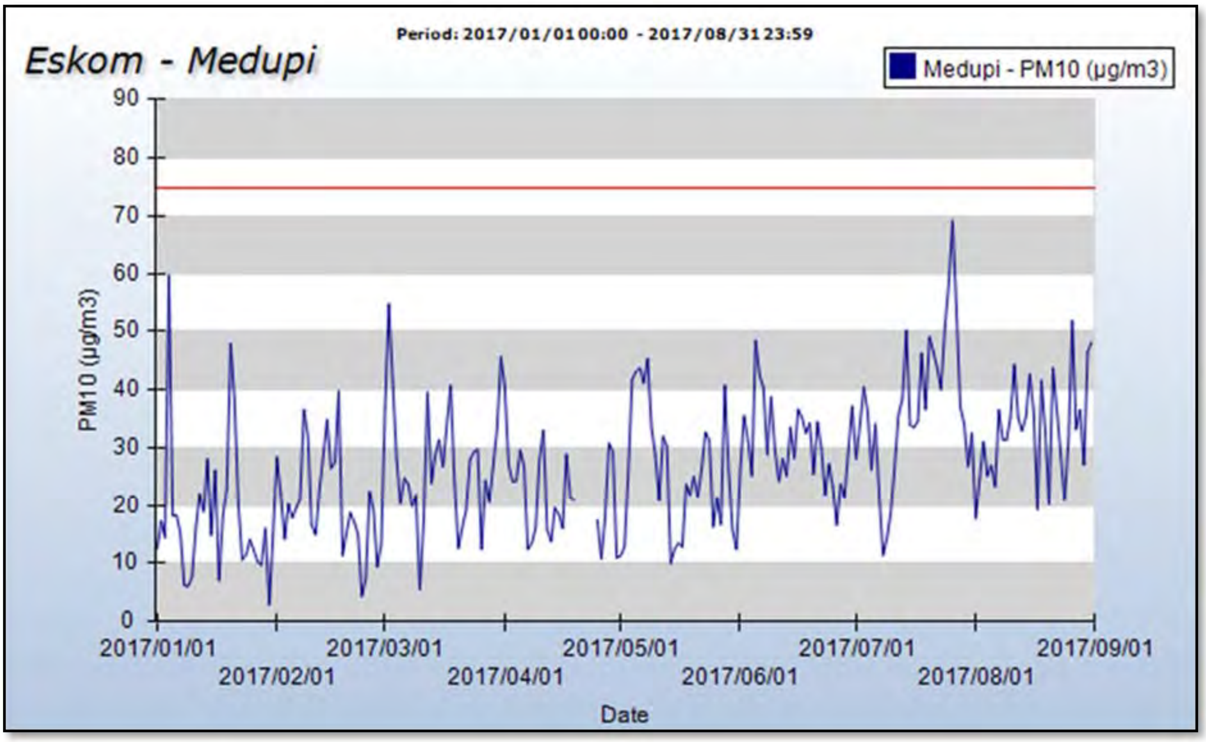



**Figure 27: Daily average $PM_{10}$ data for 1 January 2017 - 1 September 2017, measured at the Medupi Power Station (www.saaqis.org.za)**

## 7.4 Topography

The general topography of the area is described as “Plains”, with slopes that vary between 0 and 3%. Elevation around the mine varies from 900 to 922 m above sea level. The area is generally featureless except for elevation differences caused by Nelsonkop (922 m) in the north and the Waterberg range (3,600 m) in the south. Drainage appears to be in an east-north-easterly direction towards the Mogol River and consists mainly of dry sandy gullies such as the “Sandloopspruit” (Figure 28).

The Mogol River is approximately 810 m above sea level, while the mine is approximately 900 m above sea level. This results in an almost negligible gradient of 90:21000 m or 0.0043 %. General topographical drainage appears to be in an east-north-easterly direction towards the Mogol River. No natural drainage channels occur on the mine area, except for Sandloopspruit which is located approximately 1 km north of the mine’s slimes dams. Due to the flat topography, highly permeable sands and the absence of any surface water drainage courses, the mine has no direct impact on the surface hydrology of the Mogol Catchment (Golder, 2014).

The surface effects concerning the adjacent Grootegeluk mining operation are:

- The open pit area exposed for mining activities is approximately 852 ha;
- Several discard dumps covering a total of about 1000 ha with heights varying between 40 and 60 meters;
- Office and workshop buildings, together with other infrastructure in the mining area occupy a further 10 ha;
- The slimes dams north of the beneficiation plant cover about 100 ha at a height of approximately 25 m; and
- A number of borrow pits were made in the area to obtain construction materials, inter alia for road building.

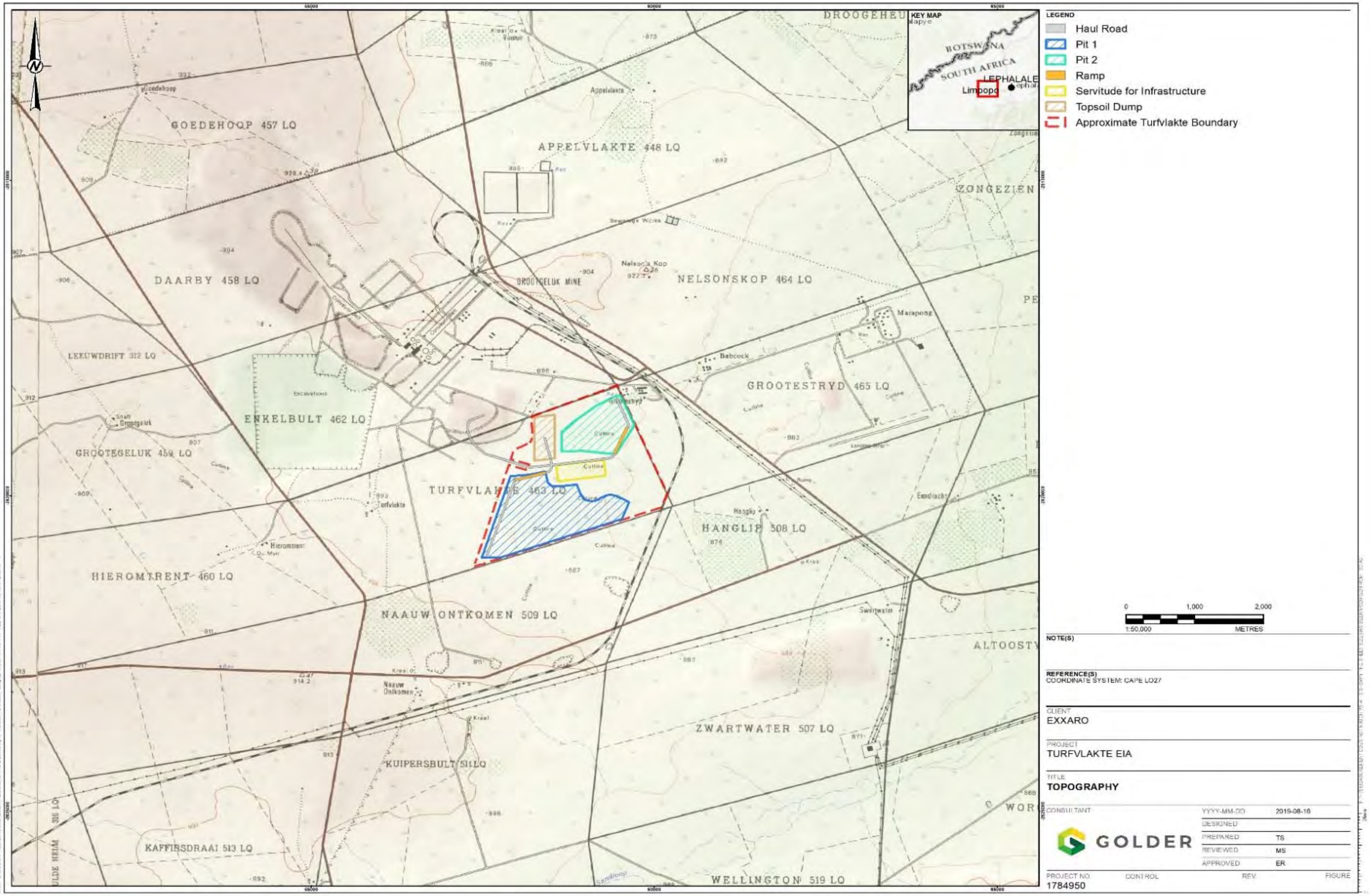



**Figure 28: Topography of the regional area**

## 7.5 Soil Land Use and Land Capability

### 7.5.1 Regional soils, land capability and land use

This section summarises key baseline conditions as set out in the soil, land use and land capability assessment specialist report (Golder, 2019a). The specialist report is included in APPENDIX P.

The Grootegeluk Turfvlakte Expansion project area comprises of land types Ae252 and Ah85, as derived from the land type memoirs and associated maps of 2326 Ellisras (Peterson and Haarhoff, 1976-2006). A reconnaissance land type survey on a scale of 1:250 000 was conducted in the early 1970s to compile inventories of the natural resources of South Africa in terms of soil, climate and terrain (Golder, 2019a).

The Ae252 land type consists of approximately 84% of the study area, whereas land type Ah85 occupies approximately 16%. The Ae252 land type comprises 79% of the Hutton soil form and 11% of the Mispah soil form. The Ah85 comprises of 46% of Hutton, 43% Clovelly, 5% Fernwood, 4% Avalon and 2% of the Mispah soil forms respectively.

### 7.5.2 Soil sampling

The soil samples were only collected from distinctively different modal profiles comprising of A and B horizons or saprolite and were submitted for laboratory analysis. The analysis was conducted according to methods set out in the Handbook of Standard Testing for Advisory purposes (Soil Science Society of South Africa, 1990). Soil samples were analysed for the following parameters:

- Three (3) fraction particle size (sand, silt and clay) analysis;
- Ammonium acetate (at pH 7) extractable cations (Ca, Mg, K and Na);
- Walkley- Black Organic Carbon;
- Total Nitrogen (by LECO);
- Bray-1 Phosphorus; and
- pH and EC.

### 7.5.3 Soil classification

The soil types occurring within the project area are indicated in Table 13, and illustrate in Figure 24 below.

**Table 13: Detailed soil map legend of the project area**

| Soil Map Unit | Master Horizons | Depth (cm) | Brief description | Diagnostic Horizon | Coverage (ha) | Coverage (%) |
|---|---|---|---|---|---|---|
| Hu3100 SaLm<br><br>Hutton (Hu3100) | A1 | 0-20 | Slightly moist; 100% very dark grey (5YR3/1); fine sandy loam, apedal, gradual smooth boundary | Orthic | 394.74 | 21.64 |
| | B1 | 20-80 | Dry; 100% reddish brown (5YR4/4); fine loamy sand, apedal, moderately compact, gradual smooth boundary | Red apedal | | |
| | B2 | 80-120 | Dry; 100% light reddish brown (5YR6/3); apedal; fine loamy sand | Red apedal | | |

| Soil Map Unit | Master Horizons | Depth (cm) | Brief description | Diagnostic Horizon | Coverage (ha) | Coverage (%) |
|---|---|---|---|---|---|---|
| Hu3200 SaLm<br><br>Hutton (Hu3200) | A1 | 0-31 | Dry; 100% dark reddish brown (5YR3/2); fine sandy loam, apedal, gradual smooth boundary | Orthic | 2.26 | 0.12 |
| | B1 | 31-80 | Dry; 100% reddish yellow (5YR6/8); fine loamy sand, apedal, with 5-10% small quartz stone; gradual transition | Red apedal | | |
| | B2 | 80-90+ | Dry; reddish yellow (5YR6/8); fine loamy sand, apedal, with 20-30% calcrete nodules and quartz stones | Red apedal | | |
| Hu3100** Sa<br><br>Hutton (Hu3100) | A | 0-20 | Slightly moist, 100% dark brown (2.5YR3/6), apedal, fine, sandy loam; gradual smooth boundary | Orthic | 36.58 | 2.01 |
| | B1 | 20-32 | Dry, 100% light brown (2.5YR5/6), apedal, fine, loamy sand; smooth transition | Red apedal | | |
| | B2 | 32-50 | Dry, 100% red (2.5YR4/8), apedal, fine, sand; refusal on hardened soil layer | Red apedal | | |
| Hu1100 Sa<br><br>Hutton (Hu1100) | A | 0-35 | Dry; reddish brown (5YR5/4); fine sand, apedal, single grain, gradual smooth boundary | Orthic | 1.56 | 0.09 |
| | B1 | 35-122 | Dry; reddish yellow (5YR6/6); fine sand, apedal, abrupt transition | Red apedal | | |
| | C | 122+ | Ferricrete | Hard Plinthic | | |
| Cv1100 Sa<br><br>Clovelly (Cv1100) | A1 | 0-45 | Slightly moist; reddish brown (5YR5/4); fine sand, single grain; smooth transition | Orthic | 188.96 | 10.36 |
| | B1 | 45-120 | Dry; reddish brown (5YR6/6); fine sand, single grain; loose | Yellow-brown apedal | | |
| Cv3100<br><br>Clovelly (Cv3100) | A | 0-52 | Dry; 100% dark reddish brown (5YR5/3); fine loamy sand, apedal; smooth transition | Orthic | 32.7 | 1.79 |
| | B1 | 52-110 | Dry; 100% yellow red (5YR5/8); fine loamy sand, apedal, abrupt transition | Yellow-brown apedal | | |
| | C | 110+ | Ferricrete | Hard Plinthic | | |
| Py1000 SaLm | A1 | 0-34 | Moist; dark reddish grey (10R4/1); fine loamy sand; single grain; non-hardened free lime; smooth transition | Orthic | 151.17 | 8.29 |

| Soil Map Unit | Master Horizons | Depth (cm) | Brief description | Diagnostic Horizon | Coverage (ha) | Coverage (%) |
|---|---|---|---|---|---|---|
| Plooysburg (Py1000) | B2 | 34-50 | Dry; reddish yellow (7.5YR); fine loamy sand; strongly effervescent calcrete gravel | Red apedal | | |
| | C | 50+ | Calcrete | Hardpan carbonate horizon | | |
| Py1000** SaLm<br><br>Plooysburg (Py1000) | A1 | 0-7 | Slightly moist, brown (2.5YR4/6); fine sandy loam with black concretions; smooth transition | Orthic | 42.52 | 2.33 |
| | B1 | 7-50 | Dry; red (2.5YR4/8); apedal, fine sandy loam, gradual transition | Red apedal | | |
| | B2 | 50-80 | Dry; red (2.5YR5/6); apedal, fine sandy clay loam; strongly effervescent calcrete gravel | Red apedal | | |
| | C | 80+ | Calcrete | Hardpan carbonate horizon | | |
| Ad2111 SaLm<br><br>Addo (Ad2111) | A1 | 0-11 | Moist; 100% dark greyish brown (10YR4/2); fine loamy sand with small quartz stone; smooth transition | Orthic | 17.95 | 0.98 |
| | B1 | 11-46 | Dry; 100% greyish brown (10YR5/2); fine loamy sand; apedal; with carbonate concretions; effervescent with 10% HCl; gradually smooth boundary | Neocarbonate | | |
| | C | 46-120 | Dry; 100% light brownish grey (10YR6/2); fine sand; apedal with abundant indurated carbonate concretions; violently effervescent | Soft Carbonate horizon | | |
| Partially Disturbed Areas<br><br>(Hutton) (Hu3100 Sa) | A | 0-30/35 | Coal discard | Fill material | 92.43 | 5.07 |
| | B | 30/35-110 | Dry, 100% red (10R4/6); fine grained, apedal, sand; gradual transition | Red apedal | | |
| | C | 110-200+ | Highly weathered and friable shale | Saprolite | | |
| Disturbed Areas | Areas with built-up mining infrastructure | | | | 848.86 | 46.53 |
| Existing Road | Existing light and heavy vehicular road | | | | 6.45 | 0.35 |

| Soil Map Unit | Master Horizons | Depth (cm) | Brief description | Diagnostic Horizon | Coverage (ha) | Coverage (%) |
|---|---|---|---|---|---|---|
| Dry Pan | A | 0-20 | Dry; 100% very dark grey (2.5Y3/1); fine sandy loam; apedal; with yellow mottles; gradual transition | Carbon enriched orthic A | 7.99 | 0.44 |
| | B1 | 20-50 | Dry; 100% very dark grey (2.5Y3/1); fine sandy clay without clearly developed ped surfaces | Carbon enriched orthic A | | |
| Waterbody | Artificial dam | | | | 0.13 | 0.01 |
| **Total** | | | | | **1824.3** | **100** |

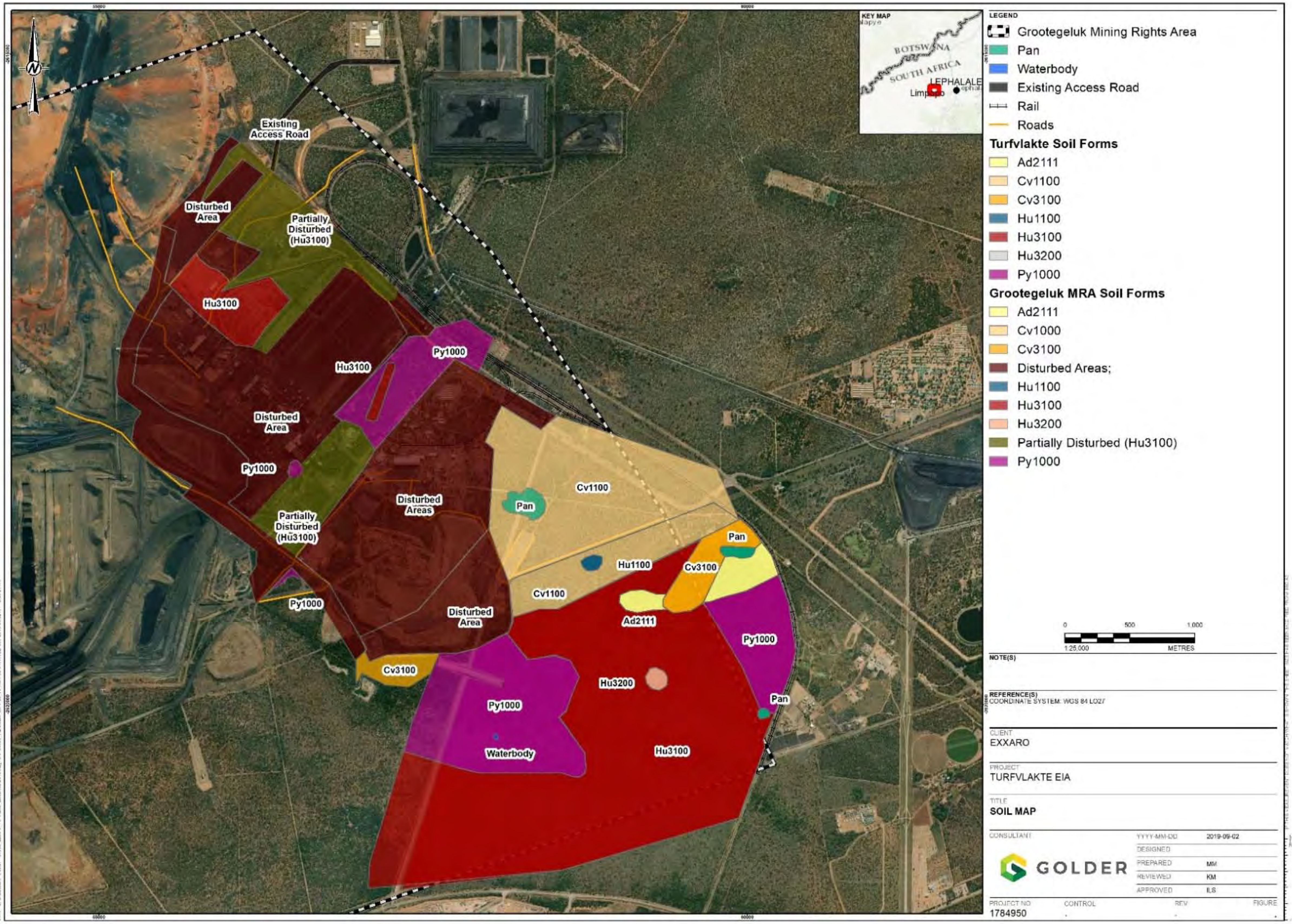



**Figure 29: Distribution of different soil types observed at Grootegeluk Turfvlakte Expansion project area**

### 7.5.4 Land Capability

The land capability classification was undertaken at a national scale, utilising the land type data on a scale of 1:250 000 (Schoeman et.al. (2000) as cited by (Golder, 2019a).

The soil capability classes are derived from the evaluation of terrain (field observations) and soil factors (soil properties). Most soils observed are classified as $S_3$ due to the moderate to high erosion hazard (E3) except for Plooysburg (Py1000) soil form classified as $S_4$ due to mechanical limitation (M4). The soil erodibility (K-factor) was estimated as > 0.45 t ha h $ha^{-1}$ $MJ^{-1}$ $mm^{-1}$, with certain topsoil having higher erodibilities (0.65 t ha h $ha^{-1}$ $MJ^{-1}$ $mm^{-1}$ for certain of the Hutton soils). The calculated soil erodibility indicates that the topsoil are inherently prone to erosion.

For the land capability, the evaluation of the climatic factors alongside the soil capability is required (Note: Land capability, considers the restrictions for rain-fed cropping and thus needs to consider the climatic factors which may limit for rain-fed crop production).

In comparison to the National Land Capability, which indicates that at least 64% of the project area has moderate land capability (Table 14), the local level assessment, completed in 2019 (Golder, 2019a), classified the area has not suitable for the production of annual crops (Table 15). It is important to note that the scale (1:50 000 – 1:100 000) of the National Land Capability data is not appropriate for site specific impact assessment. Thus, information obtained from a more detailed field survey (1:25 000): and soil analysis allows for a more refined interpretation of the land capability.

**Table 14: National Land Capability rating for the Grootegeluk Turfvlakte Expansion Project Area**

| Land Capability Value | Area (%) | Land Capability Description |
|---|---|---|
| 5 | 0% | Low |
| 6 | 17% | Low to Moderate |
| 7 | 3% | |
| 8 | 64% | Moderate |
| 9 | 16% | Moderate to High |

**Table 15: Soil capability classification and Land capability classification**

| Soil Code | Sample ID | Terrain Factors | | Soil Factors | | | | Soil Capability Class | Climatic Factors | Land Capability Classes |
|---|---|---|---|---|---|---|---|---|---|---|
| Units | | Erosion hazard (E) | Flood hazard (F) | Effective depth (D) | Texture (T) | Internal drainage (W) | Mechanical Limitations (M) | | Effective precipitation & Temperature | |
| Hu3100 LmSa | 7-1 | E3 | F2 | D1 | T2 | W1 | M2 | $S_3$ | C5 | V |
| | 7-2 | | | | | | | | | |
| | 7-3 | | | | | | | | | |

| Soil Code | Sample ID | Terrain Factors | | Soil Factors | | | | Soil Capability Class | Climatic Factors | Land Capability Classes |
|---|---|---|---|---|---|---|---|---|---|---|
| Units | | Erosion hazard (E) | Flood hazard (F) | Effective depth (D) | Texture (T) | Internal drainage (W) | Mechanical Limitations (M) | | Effective precipitation & Temperature | |
| | 7-4 | | | | | | | | | |
| Hu3100 ** Sa | OB1-1<br>OB1-2<br>OB1-3 | E3 | F2 | D3 | T2 | W1 | M3 | $S_3$ | C5 | V |
| Hu3200 SaLm | 3-1<br>3-2<br>3-3 | E3 | F2 | D2 | T2 | W1 | M2 | $S_3$ | C5 | V |
| Hu1100 Sa | 24-1<br>24-2 | E3 | F2 | D1 | T2 | W1 | M2 | $S_3$ | C5 | V |
| Cv1100 Sa | 23-1<br>23-2 | E3 | F2 | D1 | T3 | W1 | M1 | $S_3$ | C5 | V |
| CV3100 SaLm | 26-1<br>26-2<br>26-3 | E3 | F2 | D1 | T1 | W1 | M2 | $S_3$ | C5 | V |
| Ad2111 SaLm | 19-1<br>19-2<br>19-3<br>19-4 | E3 | F2 | D1 | T2 | W1 | M2 | $S_3$ | C5 | V |
| Py1000 LmSa | 31-1<br>31-2 | E3 | F2 | D3 | T2 | W2 | M4 | $S_4$ | C5 | V |
| Py1000** SaLm | OB4-1<br>OB4-2<br>OB4-3 | E3 | F2 | D2 | T1 | W5 | M4 | $S_3$ | C5 | V |

## 7.6 Land Use

The current land use was delineated as per the information obtained from the recent areal imagery (Google Earth imagery dated 23 June 2017) and field observations. Most of land within the proposed mining areas are used for game farming and farm roads (99%) with the remainder of the area used for transportation (crossing bridge to Grootegeluk mine) and commercial land-use (Manketti Lodge). The land use within the Grootegeluk mine comprises of mining land use.

A summary of land use units counts and associated map units including their approximate spatial extent are presented in Table 16.

**Table 16: Land Use types and approximate percentage occurrences**

| Map Unit | Primary Land Use | Secondary Land Use | Unit Count | Area (%) |
|---|---|---|---|---|
| A | Agricultural Purposes | Game Farming and farm roads | 1 | 99 |
| C | Commercial Purposes | Game Lodge | 1 | 0.7 |
| T | Transport Purposes | Overhead bridge crossing | 1 | 0.3 |
| M | Mining Purposes | Mining infrastructure | 1 | |
| **Total** | | | **4** | **100** |

## 7.7 Terrestrial Ecology

This section summarises baseline conditions as set out in the terrestrial ecology impact assessment specialist report (Golder, 2019c). The report contains more comprehensive information pertaining to this section and is included in APPENDIX M.

The Grootegeluk Turfvlakte Expansion project area is located in the Limpopo Sweet Bushveld (ref. SVcb19) vegetation type of the savanna biome (Mucina & Rutherford, 2006) (Figure 32). The attributes of the savanna biome and the Limpopo Sweet Bushveld are described as follows.

The savanna biome is the largest biome in South Africa, covering approximately 35% of the country's land surface. Savannas are characterised by a dominant grass layer, over-topped by a discontinuous, yet distinct woody plant component. Primary determinants of savanna composition, structure and functioning are fire, a distinct seasonal climate, substrate type, and browsing and grazing by large herbivores (Scholes & Walker, 1993). Compositionally, Africa's savannas are distinguished as either fine-leafed savannas or broad-leafed savannas. The distribution of these forms is based primarily on soil fertility; fine-leafed savannas occur on nutrient rich soils and are dominated by microphyllous woody species of the *Mimosaceae* family (most commonly *Acacias*[2]). These savannas have a productive and diverse herbaceous layer that is dominated by grasses, and can support large populations of mammalian herbivores (Scholes & Walker, 1993).

Conversely, broad-leafed savannas usually occur on nutrient poor soils and are dominated by macrophyllous woody species from the *Combretaceae* family (common genera: *Combretum* & *Terminalia*). Compared to fine-leafed savannas, broad-leafed savannas are less productive and support a lower herbivore biomass (Scholes & Walker, 1993).

[2] Members of the African *Acacia* genus have been parsed into the genera *Vachellia* and *Senegalia* (Kull and Rangan, 2012). The Acacia name however, has been retained by many scholars as a colloquial and collective term for Africa's iconic thorn trees.

Limpopo Sweet Bushveld extends northwards from the lower reaches of the Crocodile and Marico Rivers to the Limpopo Valley and into Botswana. This vegetation type is dominated by elements of Low & Robelo's (1996) Sweet Bushveld and Acocks (1953) Arid Sweet Bushveld (Mucina & Rutherford, 2006).

Limpopo Sweet Bushveld is characterised by undulating or irregular plains dominated by open woodland. A number of tributaries of the Limpopo River traverse this vegetation type (Mucina & Rutherford, 2006).

### 7.7.1 National and Provincial Conservation Considerations

#### *7.7.1.1 Limpopo Conservation Plan*

The Limpopo Sweet Bushveld extends over approximately 1 200 513 ha, of which, about 6.9% has been transformed and 0.6% is protected. Limpopo Sweet Bushveld is considered Least Threatened by both the national and provincial biodiversity assessment despite the poor level of formal protection (Limpopo Conservation Plan V2, 2013). According to the Limpopo Conservation Plan's mapping of critical biodiversity areas (CBA), the study area is located on land designated as 'Ecological Support Area 1' (Figure 31). This designation characterises both natural and degraded land that supports CBAs by maintaining ecological processes. The advocated management objective of such land is to limit biodiversity loss by maintaining ecosystem functioning and connectivity, and listed incompatible land uses include, *inter alia*, mining and industry (Limpopo Conservation Plan V2, 2013).

#### *7.7.1.2 Protected Areas*

##### 7.7.1.2.1 Nature Reserve and Conservation Areas

A number of statutorily declared nature reserves, as well as informal conservation areas are present in the broader region surrounding the study area. These include, *inter alia* (distance from the Grootegeluk Turfvlakte Expansion Project to boundary of the reserve is indicated in km):

- Marakele National Park (65 km)
- D'Nyala Nature Reserve (17 km)
- Welgevonden Private Nature Reserve (57 km)
- Koedoe Private Nature Reserve (12km)

None of these conservation areas fall within a 10 km and/or 5 km radius of areas to consider in terms of the EIA Regulations Listing Notice 3 (GN R. 324 of 07 April 2017.

The neighbouring Tierkop Private Nature Reserve is located to the southwest of the proposed Grootegeluk Turfvlakte Expansion project area. The reserve was designated around the 1960's and is located on the farms Eenzaamheid 687 LQ Portion 0 and Vergulde Helm 321 LQ Portion 0. The farm Eenzaamheid 687 Portion 0 was acquired by Eskom Holdings Limited for the construction of the Medupi Power Station (Figure 30). The remaining section of the Tierkop Private Nature Reserve is therefore located on the farm Vergulde Helm 321 LQ Portion 0, owned by HJL Hills Boerdery (Pty) Ltd. It is illustrated in Figure 30 that the undeveloped and remaining portion of the Tierkop Private Nature Reserve falls outside the 5 km radius and therefore activities listed in terms of GN R. 324 is not applicable to the Grootegeluk Turfvlakte Expansion Project.

##### 7.7.1.2.2 Important Bird Areas

The Waterberg System Important Bird Area (IBA) is approximately 1 321 450 ha in extent, comprising the whole Waterberg plateau and dominates the region to the south-east of the study area. The IBA supports populations of several globally and regionally threatened species, including *inter alia*, a significantly large colony of between 800-850 pairs of Cape Vulture (*Gyps coprotheres)* (Marnewick, Retief, Theron, Wright, & Anderson, 2015).

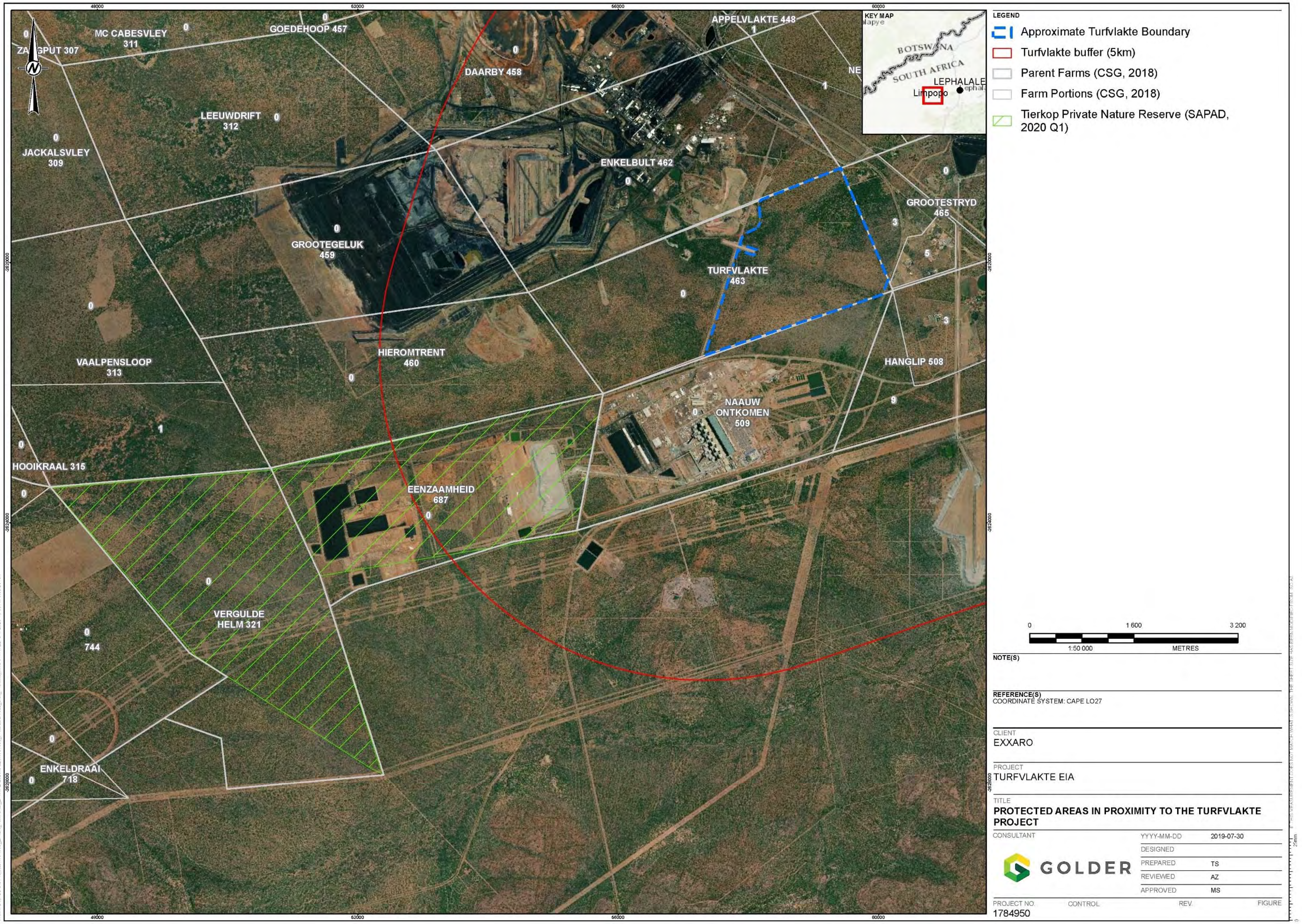



**Figure 30: Protected areas in close proximity to the Grootegeluk Turfvlakte Expansion Project**

#### 7.7.1.2.3 Waterberg Biosphere Reserve

The Waterberg Biosphere Reserve occupies approximately 650 000 ha of the Waterberg district, 30 km to the south of the Grootegeluk Turfvlakte Expansion project area. The concept of biosphere reserves is fairly recent and has been recognised by UNESCO as a means to promote the conservation and sustainable use of land within a particular area. The Waterberg Biosphere Reserve is recognised by UNESCO (Golder, 2019c).

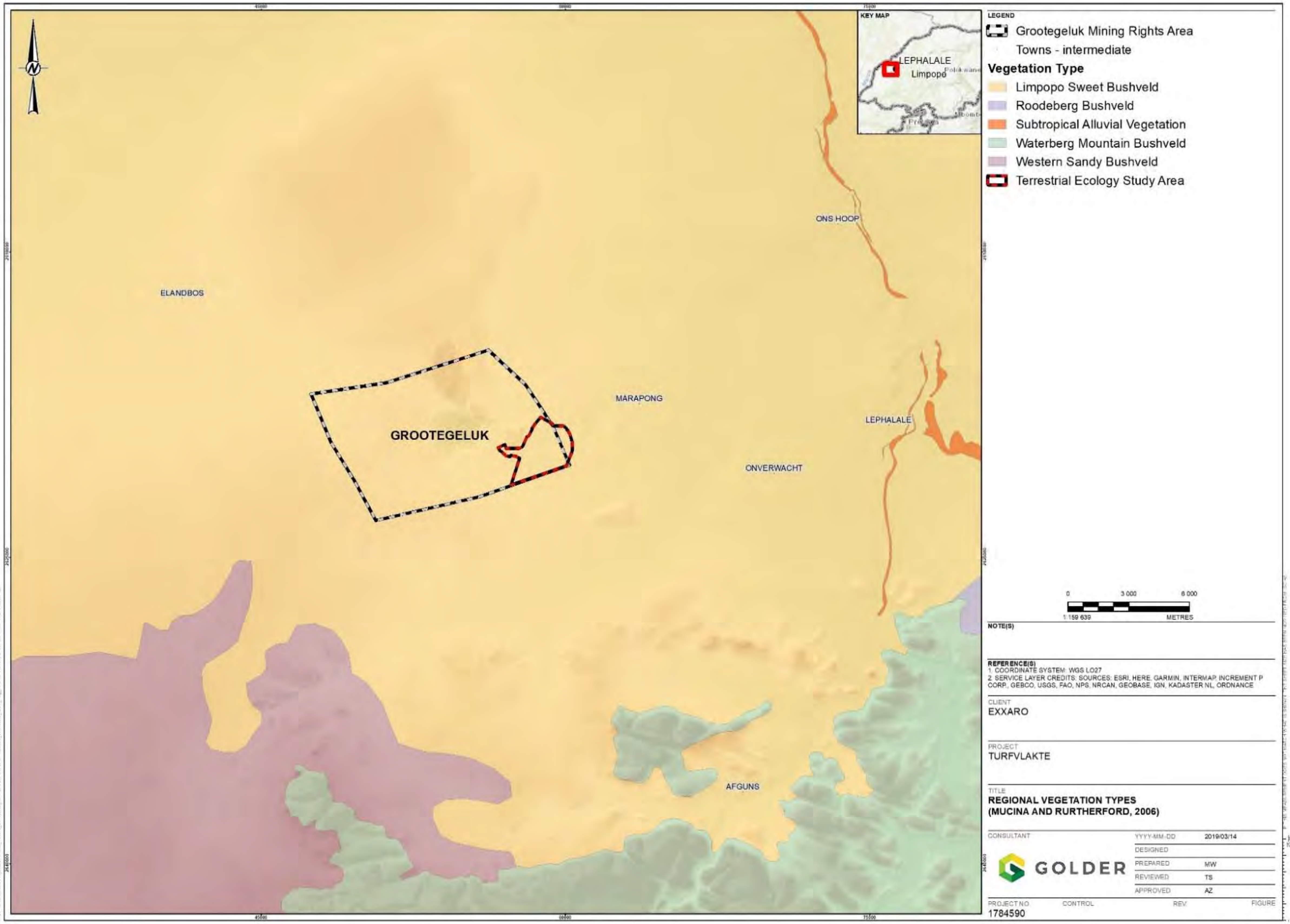



**Figure 31: Study area in relation to Mucina & Rutherford's (2006) regional vegetation types**

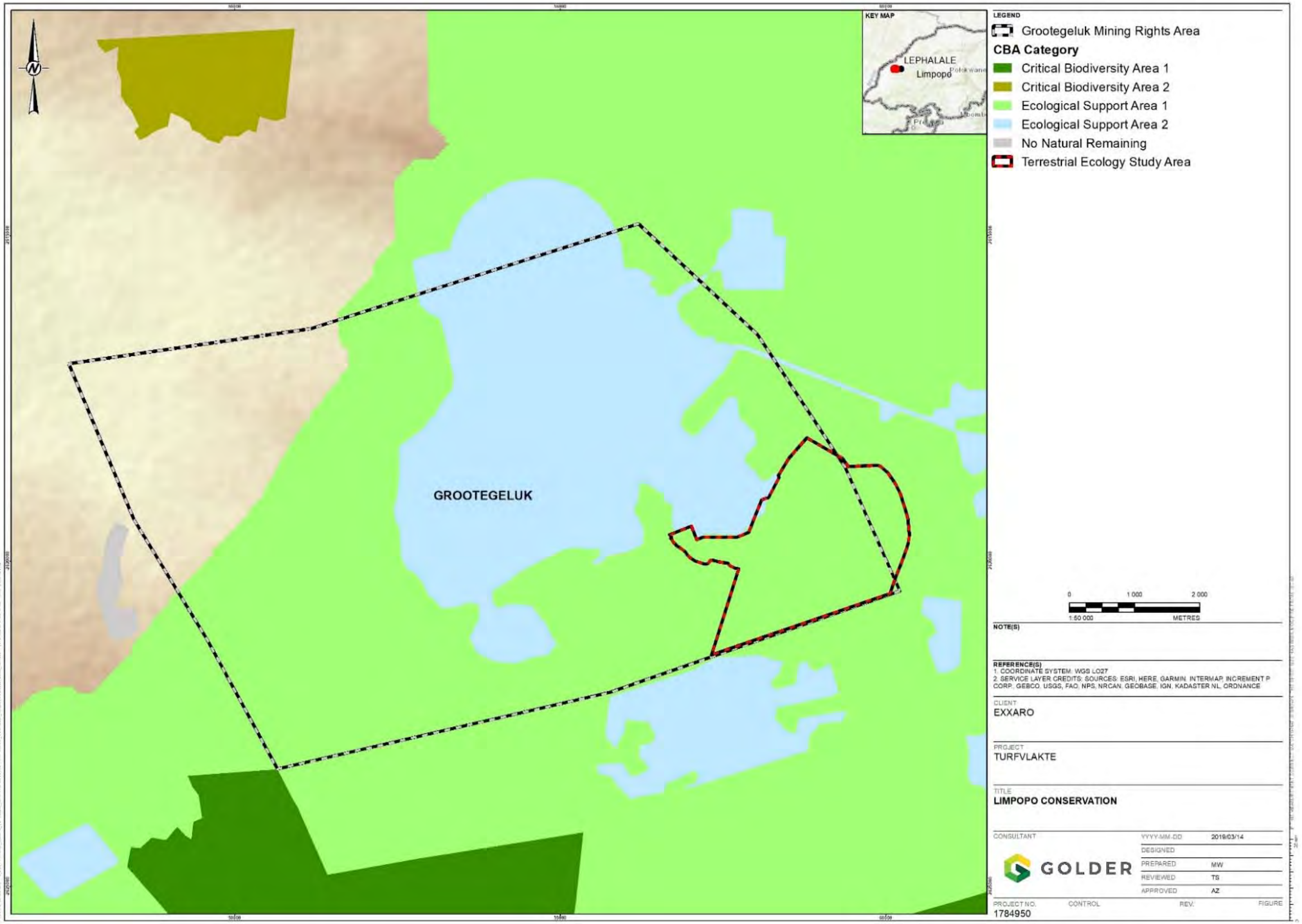



**Figure 32: Limpopo Conservation Plan (2013)**

### 7.7.2 Flora Assessment

#### *7.7.2.1 Vegetation Communities*

In many African savannas, soil properties at a landscape scale vary between 'upland' and 'bottomland' areas, with clay content generally increasing downslope. This influences soil moisture availability and soil fertility, which in turn, affect vegetation patterns that typically manifest as a predictable topographically-linked soil vegetation sequence, known as a catena (Du Toit et al., 2003; Scholes and Walker, 1993).

Although the topography of the study area is generally flat, a slight gradient along a north-west to south-east axis is present. The north-west is an 'upland area' (approx. 890 mamsl) and is characterised by deep sandy soils with low (<5%) clay content, and a dominance of broad-leafed vegetation. Conversely, the south-east is a 'low-land' area (approx. 878 mamsl), characterised by more clayey soils (>5%) and a prevalence of fine-leafed woody species.

Five vegetation communities were identified in the study area. These were recognised based primarily on diagnostic woody species and overall vegetation structure, with the structural classification broadly in line with Edwards (1983).

Identified vegetation communities are:

- Short Open *Vachellia tortilis* Bushveld;
- Tall *Senegalia nigrescens* Bushveld;
- Open *Combretum apiculatum – Terminalia sericea* Bushveld;
- *Spirostachys africana - Vachellia grandicornuta* Woodland; and
- *Euclea undulata* Thicket.

A map showing the spatial distribution of vegetation communities across the study area is provided in Figure 33.

#### *7.7.2.2 Depressions / Pans and Borrow Pits*

This section provides a brief summary of the natural pans and other wetland-type features in the study area as it relates to the ecological characteristic of the area and is summarised from the GroundTruth (2018) draft report discussed in Section 7.8 and included in APPENDIX T. The location of pans and artificial water holes / borrow pits within the study area are shown in Figure 34 (pans not in the study area for the terrestrial ecology assessment are not shown):

- Natural pans in the study area are rainfall dependent, yet most are connected via a dendritic drainage network (i.e. preferential flow paths, not actual streams);
- Most pans are bare mud dominated features, and did not support wetland vegetation. Seasonal vegetation, however, was recorded in the wetter areas of the large pans;
- The pans were rated as being in 'good condition' (B Category);
- Vegetated pans were observed to be favoured foraging sites for herbivores during the dry season field visit (Pers. Obs); and
- The features numbered 12 and 13 in Figure 24 are former borrow pits that hold water. It is understood that no. 13 is licensed under Section 21 of the mine's WUL (Golder, 2019c).

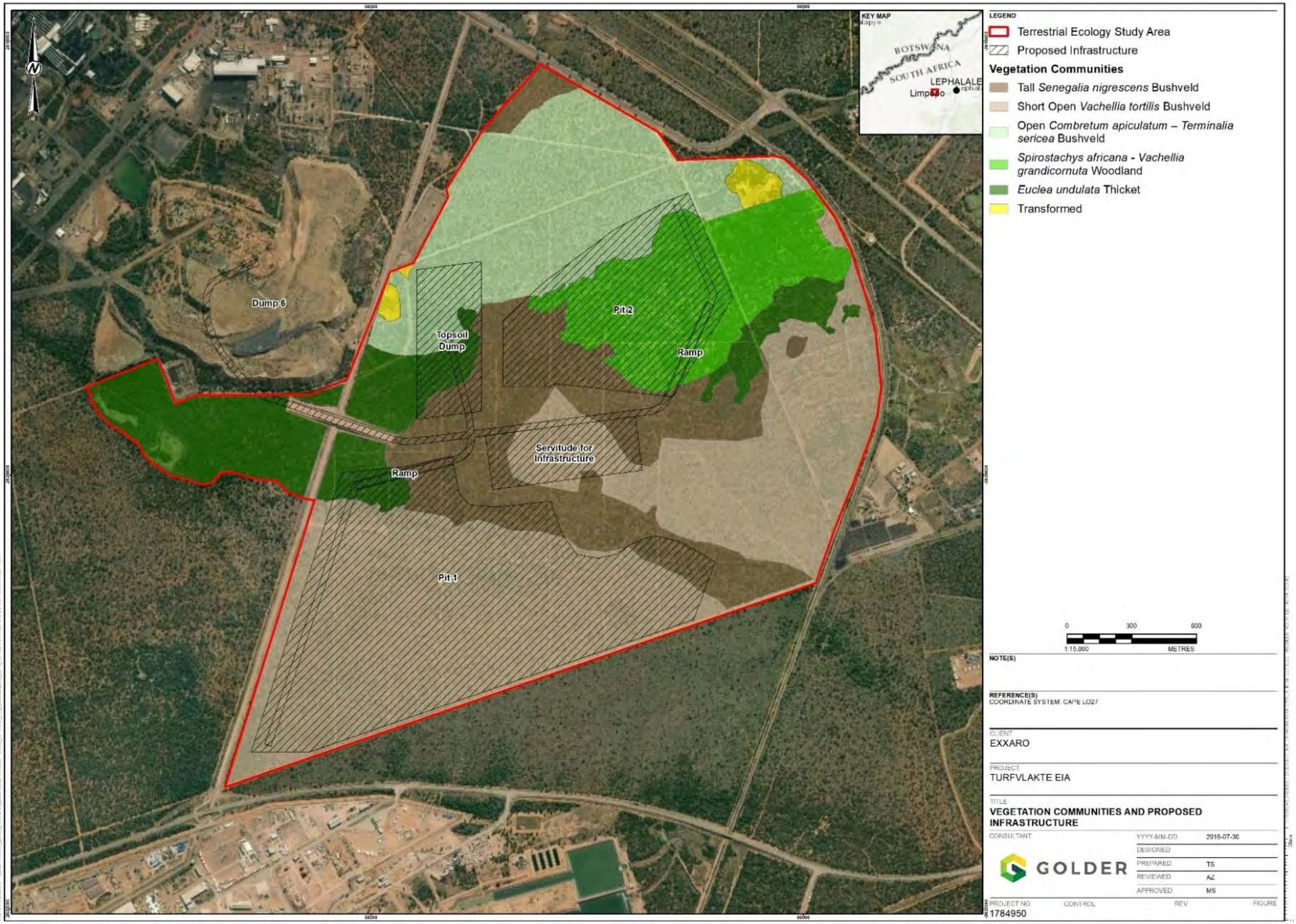



**Figure 33: Vegetation map for the Grootegeluk Turfvlakte Expansion Project study area**

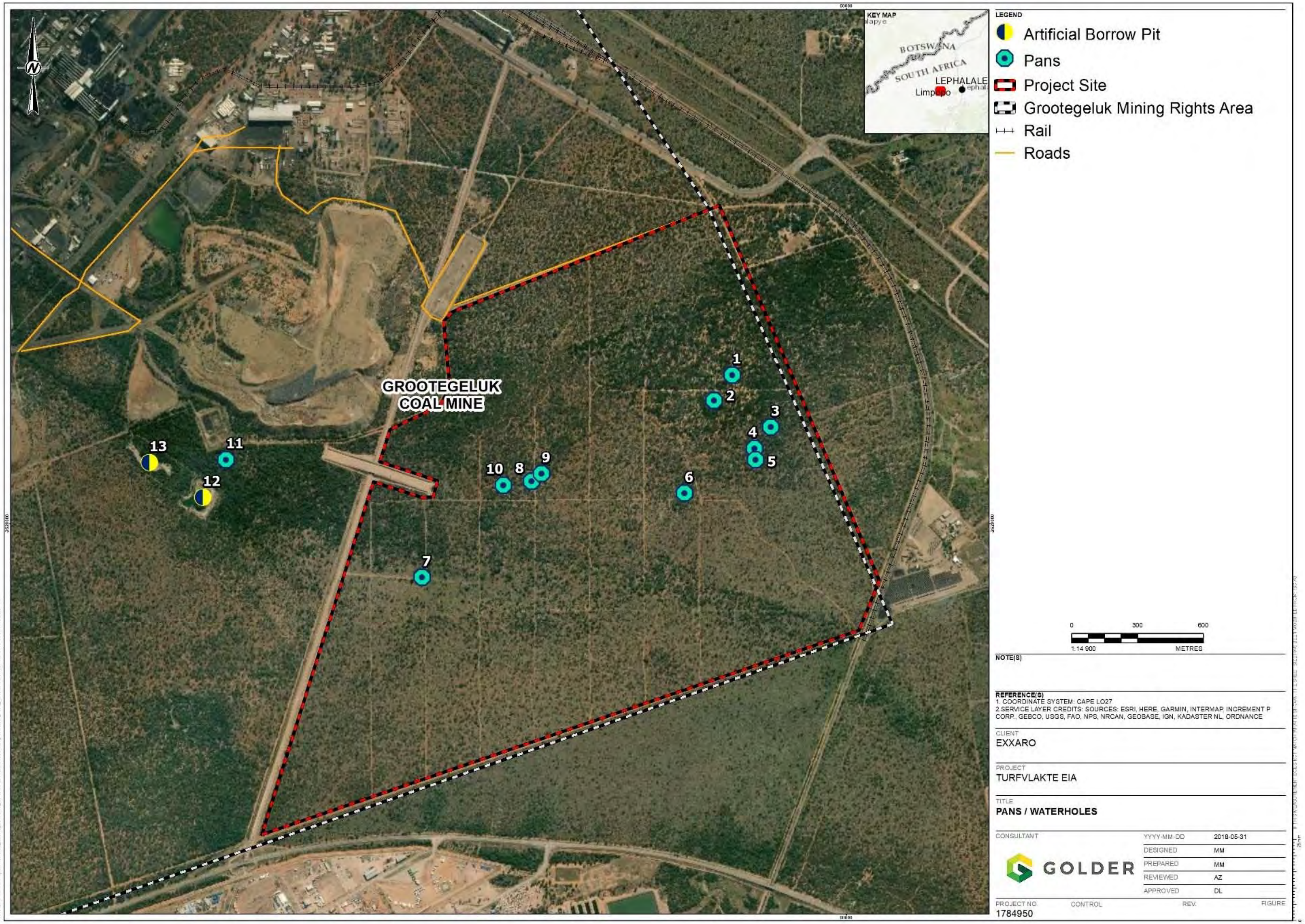



**Figure 34: Pans/waterholes in the study area (No's. 7, 11, 12 & 13 are artificial and/or receive supplementary water)**

### 7.7.2.3 Red List and Protected Flora

Nine floral species of conservation importance were recorded in the study area during the field programme – refer to the last column in Table 17. These comprise mostly protected trees, with *Combretum imberbe* and Vachellia erioloba particularly abundant throughout the study area, and *Spirostachys Africana* dominant in the *Spirostachys africana - Vachellia grandicornuta* Woodland community.

*Schinziophyton rautanenii* (Manketti trees) are known to occur in the bushveld surrounding Grootegeluk Coal Mine (see NSS, 2011 as cited by (Golder, 2019c)). This species was not recorded in the study area during the field visit, and although it is not listed as threatened or protected, its South African range is small and restricted to the Lephalale region of Limpopo Province. It should thus be considered a sensitive species and managed accordingly.

*Boscia foetida* trees were also noted to be common in the study area. These, however, were determined to be *Boscia foetida* subsp. *rehmanniana*, not *Boscia foetida* subsp. *minima*. The latter subspecies is listed as a protected species in the Limpopo Province.

**Table 17: Flora of conservation importance recorded or potentially occurring in the local study area**

| Species (Scientific Name) | Red List Status Regional Status (SANBI 2017) | Protected Tree Species (National Forest Act 1998) | Limpopo Province - Protected Species (2003) | Observations- 2018 Field Programme |
|---|---|---|---|---|
| *Acalypha caperonioides var. caperonioides* | Data Deficient – Taxonomic Problems | - | - | - |
| *Adansonia digitata* | - | Protected | Protected | - |
| *Adenium oleifolium* | - | - | Protected | - |
| *Aloe cf zebrina* | - | - | Protected | - |
| *Boscia albitrunca* | - | Protected | - | Recorded |
| *Combretum imberbe* | - | Protected | - | Recorded |
| *Corchorus psammophilus* | Vulnerable | - | - | - |
| *Elaeodendron transvaalense* | Near Threatened | Protected | - | Recorded |
| *Eulalia aurea* | Near Threatened | - | - | - |
| *Euphorbia waterbergensis* | Rare | - | - | - |
| *Schinziophyton rautanenii* | - | - | - | - |
| *Sclerocarya birrea subsp. caffra* | - | Protected | - | Recorded |
| *Securidaca longepedunculata* | - | Protected | - | Recorded |
| *Spirostachys africana* | - | - | Protected | Recorded |

| Species (Scientific Name) | Red List Status Regional Status (SANBI 2017) | Protected Tree Species (National Forest Act 1998) | Limpopo Province - Protected Species (2003) | Observations- 2018 Field Programme |
|---|---|---|---|---|
| *Stapelia gigantea* | - | - | Protected | - |
| *Vachellia erioloba* | - | Protected | - | Recorded |

#### 7.7.2.4 Medicinal Flora

Thirteen floral species recorded in the study area have medicinal/traditional value. These are listed, along with a brief description of their medicinal and traditional utility, in Table 18.

**Table 18: Medicinal floral species recorded in the study area**

| Floral Species | Traditional Uses |
|---|---|
| *Asparagus laricinus* | Rhizomes and fleshy roots are used for a variety of ailments including tuberculosis, kidney complaints and rheumatism. |
| *Datura strumarium* | Commonly used to relive asthma and reduce pain. Infusions area also used as an aphrodisiac. |
| *Dichrostachys cinerea* | Various parts of this plant are used to treat body pain, elephantiasis, syphilis and leprosy, amongst others. |
| *Elaeodendron transvaalense* | Bark infusion is taken to clean the stomach and to treat intestinal cramps and diarrhoea. |
| *Elephantorrhiza burkei* | Underground rhizomes used to treat diarrhoea, dysentery other stomach disorders and haemorrhoids. |
| *Euclea undulata* | Root infusions used as a remedy for heart diseases and headache and toothache. |
| *Gomphocarpus fruticosus* | Crushed leaves used to treat headaches, while roots are reported to relive stomach cramps and general body ache. |
| *Ricinus communis* | Leaf infusions are used as a purgative medicine. |
| *Sansevieria aethiopica* | Used to treat ear infection, earache and toothache. Also used as a remedy to treat diarrhoea. |
| *Sclerocarya birrea* | Various stomach and digestive ailments are treated with bark. The fruit of this tree is also widely eaten and used to produce beverages. |
| *Securidaca longepedunculata* | Chewed roots relieve toothache, while decoctions can be used to alleviate chest issues. |

| Floral Species | Traditional Uses |
|---|---|
| *Terminalia sericea* | Root decoctions are used as a remedy for stomach complaints, diarrhoea and pneumonia, as well as applied as an eye lotion. |
| *Ziziphus mucronata* | Bark and leaves are used as an expectorant in coughs and chest ailments, while roots extracts are used to treat diarrhoea and dysentery. |

*Source: Uses as described by Van Wyk et al. (2009) as cited by* (Golder, 2019c)

#### 7.7.2.5 Listed Alien Invasive Flora

Seven CARA and NEMBA listed alien invasive species were recorded in the study area during the wet-season field visit (Table 19). These were not abundant and were mainly confined to scattered individual plants growing at localised sites where disturbance had occurred.

**Table 19: CARA and NEMBA listed alien invasive species recorded in the study area**

| Scientific Name | Common Names (English / Afrikaans) | CARA (1983) | NEMBA (2004) |
|---|---|---|---|
| *Cereus jamacaru* | Queen of the night / nagblom | 1 | 1b |
| *Datura stramonium* | Common Thorn-apple / Olieboom | 1 | 1b |
| *Flaveria bidentis* | Smelter's Bush | - | 1b |
| *Melia azedarach* | Syringa / Sering | 3 | 1b |
| *Opuntia ficus-indica* | Sweet Prickly Pear | 1 | 1b |
| *Opuntia cf. humifusa* | Large-flowered Prickly Pear | 1 | 1b |
| *Ricinus communis* | Castor-oil Plant / Kasterolieboom | 2 | 1b |

### 7.7.3 Fauna Assessment

#### 7.7.3.1 Mammals

Twenty five mammal species comprising ten managed species and 16 free-roaming species were recorded in the study area during the 2018 field programme (Table 20) (25 and 18 taxa recorded during the wet and dry season field surveys, respectively) (Golder, 2019c).

Managed species refers to those taxa that form part of actively bred and managed 'game' populations in the study area, and include, inter alia; Sable Antelope (*Hippotragus niger*), Impala (*Aepyceros melampus*), Gemsbok (Oryx gazelle), Waterbuck (*Kobus ellipsiprymnus*), Giraffe (*Giraffa camelopardalis*) and Burchell's Zebra (*Equus quagga*).

Free-roaming mammals are those that form part of self-sustaining, natural populations. These species are generally not restricted by farm boundaries and are able move across the landscape in accordance with their life-cycle requirements. In the study area such taxa comprise small ungulates like the Steenbok (*Raphicerus campestris*) and Warthog (*Phacochoerus africanus*), but also the large Greater Kudu (*Tragelaphus strepsiceros*), as well as many smaller mammals such as, inter alia, Tree Squirrel (*Paraxerus capapi*), Scrub Hare (*Lepus saxatilis*), Vervet Monkey (*Ceropithecus pygerythrus*) and Banded Mongoose (*Mungos mungo*).

In a previous assessment of the greater Manketti Game Reserve (area of approx. 22 000 ha) a total of 48 mammal species were documented (see NSS (2011) as cited by (Golder, 2019c)), while the historical distribution maps in Monadjem et al. (2001) and Stuart and Stuart (2007), as cited by (Golder, 2019c), indicate that up to 85 mammal species potentially occur in the study area, with the majority of these being small taxa (e.g. rodents). Based on these sources, and an appreciation of the extent and condition of available natural habitat in the study area, the expected mammal species richness for the study area is considered to be higher than the 25 recorded during the field programme.

**Table 20: Mammals recorded in the study area during the field programme**

| Family | Scientific Name | Common Name | 2018 Field Programme | |
|---|---|---|---|---|
| | | | Wet Season Survey | Dry Season Survey |
| Bovidae | *Hippotragus niger* | Sable Antelope | X | X |
| | *Kobus ellipsiprymnus* | Waterbuck | X | X |
| | *Aepyceros melampus* | Impala | X | X |
| | *Tragelaphus strepsiceros* | Greater Kudu | X | X |
| | *Raphicerus campestris* | Steenbok | X | |
| | *Tragelaphus scriptus* | Bushbuck | X | X |
| | *Oryx gazella* | Gemsbok | X | X |
| | *Sylvicapra grimmia* | Grey Duiker | X | X |
| | *Tragelaphus angasii* | Nyala | X | X |
| Canidae | *Canis mesomelas* | Black-back Jackal | X | X |
| Cercopithecidae | *Cercopithecus pygerythrus* | Vervet Monkey | X | X |
| | *Papio cynocephalus urisinus* | Chacma Baboon | X | X |
| Equidae | *Equus quagga* | Plains Zebra | X | |
| Felidae | *Felis silvestris lybica* | African Wild Cat | X | |
| Galagidae | *Galago moholi* | Southern Lesser Galago | X | |
| Giraffidae | *Giraffa camelopardalis* | Giraffe | X | X |
| Herpestidae | *Mungos mungo* | Banded Mongoose | X | X |
| | *Galerella sanguinea* | Slender Mongoose | X | |
| | *Atilax paludinosus* | Water Mongoose | X | |

| Family | Scientific Name | Common Name | 2018 Field Programme | |
|---|---|---|---|---|
| | | | Wet Season Survey | Dry Season Survey |
| Hystricidae | *Hystrix africeaustralis* | Porcupine | X | X |
| Leporidae | *Lepus saxatilis* | Scrub Hare | X | X |
| Muridae | *Tatera brantsii* | Highveld gerbil | X | X |
| Rhinocerotidae | *Ceratotherium simum* | White Rhino | X | |
| Sciuridae | *Xerus inauris* | Tree Squirrel | X | X |
| Suidae | *Phocochoerus africanus* | Warthog | X | X |

#### 7.7.3.1.1 Mammals of Conservation Importance

Despite being abundant across its range, the Steenbok (*Raphicerus campestris*) is listed as protected under the Limpopo Environmental Management Act, (2003). This species was observed on several occasions in the study area.

A White Rhino (*Ceratotherium simum*) midden and tracks were also recorded close to the proposed haul road location, to the west of the conveyor corridor during the wet season field visit. This species is listed as Near Threatened on the national Red List and protected and specially protected on the NEMBA ToPS List (2013) and Limpopo Environmental Management Act (2003), respectively.

An additional 20 species of conservation importance potential occur in the study area based on previous studies and known distribution records (Table 21).

**Table 21: Mammals of conservation importance recorded or potentially occurring in the study area**

| Family | Scientific Name | Common Name | Conservation Status | | | Probability of Occurrence |
|---|---|---|---|---|---|---|
| | | | Red List (2016) Regional Status | NEMBA TOPS List (2013) | Limpopo Protected Species (2003) | |
| Bovidae | *Raphicerus campestris* | Steenbok | - | - | Protected | Recorded |
| Canidae | *Lycaon pictus* | African Wild Dog | Endangered | Endangered | - | Unlikely |
| | *Otocyo megalotis* | Bat-eared Fox | - | Protected | Protected | Possible |
| Erinaceidae | *Atelerixs frontalis* | South African Hedgehog | Near Threatened | - | Protected | Possible |

| Family | Scientific Name | Common Name | Conservation Status | | | Probability of Occurrence |
|---|---|---|---|---|---|---|
| | | | Red List (2016) Regional Status | NEMBA TOPS List (2013) | Limpopo Protected Species (2003) | |
| Felidae | *Acinonyx jubatus* | Cheetah | Vulnerable | Vulnerable | Protected | Unlikely |
| | *Leptailurus serval* | Serval | Near Threatened | Protected | Protected | Possible |
| | *Panthera pardus* | Leopard | Vulnerable | Protected | Protected | Possible |
| Hyaenidae | *Hyaena brunnea* | Brown Hyaena | Near Threatened | Protected | Protected | Probable |
| | *Proteles cristatus* | Aardwolf | - | - | Protected | Possible |
| Leporidae | *Pronolagus randensis* | Jameson's Red Rock Rabbit | - | - | Protected | Unlikely |
| Manidae | *Manis temminckii* | Pangolin | Vulnerable | Vulnerable | Specially protected | Possible |
| Muridae | *Dasymys incomtus* | Water Rat | Near Threatened | - | - | Unlikely |
| Mustelidae | *Mellivora capensis* | Honey Badger | - | - | Protected | Probable |
| | *Poecilogale albinucha* | African Striped Weasel | Near Threatened | | | Unlikely |
| Orycteropodidae | *Orycteropus afer* | Aardvark | - | Protected | Specially protected | Probable |
| Rhinocerotidae | *Ceratotherium simum* | White Rhino | Near Threatened | Protected | Specially protected | Recorded |
| Rhinolophidae | *Rhinolophus clivosus* | Geoffroy's Horseshoe Bat | Near Threatened | - | - | Possible |
| | *Rhinolophus darlingi* | Darling's Horseshoe Bat | Near Threatened | - | - | Possible |

| Family | Scientific Name | Common Name | Conservation Status | | | Probability of Occurrence |
|---|---|---|---|---|---|---|
| | | | Red List (2016) Regional Status | NEMBA TOPS List (2013) | Limpopo Protected Species (2003) | |
| | *Rhinolophus hildebrandtii* | Hildebrandt's Horseshoe Bat | Near Threatened | - | - | Possible |
| Vespertilionidae | *Miniopterus natalensis* | Schreiber's Long-fingered Bat | - | - | - | Probable |
| Viverridae | *Civettictis civetta* | African Civet | - | - | Protected | Probable |
| Source: Distributions based on range and habitat preferences presented in Stuart and Stuart (2007) and Monadjem *et al.* (2001) | | | | | | |

### 7.7.3.2 Birds

Owing to the abundance and diversity of natural habitat, northern Limpopo Province has a rich bird assemblage. This is reflected in the designation of the entire Waterberg plateau as an Important Bird Area (IBA) (*sensu.* BirdLife South Africa, 2015 as cited by (Golder, 2019c)).

A total of 89 bird species were documented in the study area during the 2018 field programme. During the wet season survey 79 species were recorded, while 53 species were observed during the dry season.

Recorded birds include many common bushveld species, such as Crested Francolin (*Dendroperdix sephaena*), Natal Spurfowl (*Pternistis natalensis*), Cape Turtle Dove (*Streptopelia campicola*), Common Ostrich (Struthio camelus), Southern Red-billed Hornbill (Tockus erythrorhynchus), Southern Yellow-billed Hornbill (*Tockus leucomelas*), Rattling Cisticola (*Cisticola chiniana*), Red-backed Shrike (*Lanius collurio*) and Black-backed Puffback (*Dryoscopus alba*), amongst others. The absence of natural on-site water bodies is reflected in a few aquatic birds being observed, and surprisingly, very few raptors were recorded, despite them being well represented in the SABAP2 data. White-backed Vulture (*Gyps africanus*) were observed flying over the study area. This species is of conservation importance, and although no vulture nests were observed in the study area, its presence highlights the importance of natural habitat across the broader regional landscape for the conservation of White-backed Vulture and several other species.

#### 7.7.3.2.1 Birds of Conservation Importance

Records of the ADU - SABAP2 (2011) indicate that 14 bird species of conservation importance potentially occur in the study area (Table 22). The presence of a number of these may be transitory and dependent on factors such as stochastic resource availability (e.g. mammal carcasses for vultures).

**Table 22: Birds of conservation importance recorded and potentially occurring in the study area**

| Family | Scientific Name | Common Name | Conservation Status | | | Probability of Occurrence |
|---|---|---|---|---|---|---|
| | | | Red List (2016) Regional Status | NEMBA TOPS List (2013) | Limpopo Protected Species (2003) | |
| Accipitridae | *Polemaetus bellicosus* | Martial Eagle | Endangered | Vulnerable | Specially Protected | Possible |
| | *Aquila verreauxii* | Verreaux's Eagle | Vulnerable | - | Protected | Possible |
| | *Aquila rapax* | Tawny Eagle | Endangered | Vulnerable | Protected | Probable |
| | *Gyps africanus* | White-backed Vulture | Critically Endangered | Protected | Protected | Recorded (wet season) |
| | *Gyps coprotheres* | Cape Vulture | Endangered | Vulnerable | Specially Protected | Probable |
| | *Terathopius ecaudatus* | Bateleur | Endangered | Vulnerable | Specially Protected | Probable |
| | *Torgos tracheliotus* | Lappet-faced Vulture | Endangered | Vulnerable | Protected | Probable |
| Ciconiidae | *Ciconia abdimii* | Abdim's Stork | Near Threatened | - | Protected | Unlikely |
| | *Ciconia nigra* | Black Stork | Vulnerable | - | Protected | Unlikely |
| | *Leptoptilos crumeniferus* | Marabou Stork | Near Threatened | - | Protected | Possible |
| | *Mycteria ibis* | Yellow-billed Stork | Endangered | - | Protected | Possible |
| Coraciidae | *Coracias garrulus* | European Roller | Near Threatened | - | Protected | Probable |
| Otididae | *Ardeotis kori* | Kori Bustard | Near Threatened | Protected | Specially protected | Probable |
| Sagittariidae | *Sagittarius serpentarius* | Secretarybird | Vulnerable | - | Protected | Probable |

### 7.7.3.3 Herpetofauna (Reptiles and Amphibians)

Six reptiles and four amphibian species were observed in the study area during the 2018 field programme (Table 23):

- Five reptiles were recorded during the wet season field visit, while only one additional taxon (Southern African Python *natalensis*) was recorded during the dry season field visit; and

- Four amphibian species were recorded during the wet season field visit, with only the Eastern Olive Toad (*Amietophrynus garmani*) subsequently re-recorded for the dry season field visit.

Recorded reptiles include Southern African Python (*Python natalensis*)[3], Southern Tree Agama (*Acanthocercus atricollis atricollis*), Common Rough-scaled Lizard (*Meroles squamulosa*), Southern Rock monitor (*Varanus albigularis albigularis*), Leopard Tortoise (*Stigmochelys pardalis*), and the Marsh Terrapin (*Pelomedusa subrufa*), while the recorded amphibians are Eastern Olive Toad (*Amietophrynus garmani*), Red Toad (*Schismaderma carens*), Sand Frog (*Tomopterna cf. tandyi*) and Foam Nest Frog (*Chiromantis xerampelina*).

**Table 23: Herpetofauna recorded in the study area during the 2018 field programme**

| Family | Scientific Name | Common Name | 2018 Field Programme | |
|---|---|---|---|---|
| | | | Wet Season Survey | Dry Season Survey |
| **Reptiles** | | | | |
| Agamidae | *Acanthocercus atricollis* | Southern Tree Agama | X | |
| Lacertidae | *Meroles squamulosa* | Common Rough-scaled Lizard | X | |
| Pelomedusidae | *Pelomedusa subrufa* | Marsh Terrapin | X | |
| Pythonidae | *Python natalensis* | Southern African Python | | X[5] |
| Testudinidae | *Stigmochelys pardalis* | Leopard Tortoise | X | |
| Varanidae | *Varanus albigularis* | Rock Monitor | X | |

[3] Anecdotal report of a Python at Manketti Lodge during field visit.

| Family | Scientific Name | Common Name | 2018 Field Programme | |
|---|---|---|---|---|
| | | | Wet Season Survey | Dry Season Survey |
| **Amphibians** | | | | |
| Bufonidae | *Amietophrynus garmani* | Eastern Olive Toad | X | X |
| | *Schisaderma carens* | Red Toad | X | |
| Pyxicephalidae | *Tomopterna cf tandyi* | Tandy's Sand Frog | X | |
| Rhacophoridae | *Chiromantis xerampelina* | Foam Nest Frog | X | |

#### 7.7.3.3.1 Herpetofauna of Conservation Importance

Golder (2019c) sates that seven reptile species potentially occurring in the study area are of conservation importance. Of these, one is Red Listed, two are protected under the NEMBA ToPS List (2013), while the others are endemic or near endemic (refer to Table 24).

Of amphibians potentially occurring in the study area, the Giant Bullfrog (*Pyxicephalus adspersus*) is of conservation importance. This species is listed as Protected according to the Limpopo Environmental Management Act (2003). Giant Bullfrogs has previously been recorded in the 2327DA QDS according to the ADU - Virtual Museum (2015) and NSS, (2011), as cited by (Golder, 2019c), recorded it in their scan of the Manketti Game Reserve. It is therefore probable that it is present in the shallow depressions/pans that are scattered throughout the study area.

**Table 24: Reptiles of conservation importance potentially occurring in the study area**

| Family | Scientific Name | Common Name | Conservation Status | | | | Probability of Occurrence |
|---|---|---|---|---|---|---|---|
| | | | Red List (2014) Regional Status | NEMBA TOPS List (2013) | Limpopo Environmental Management Act (2003) | Endemic Status | |
| Cordylidae | *Platysaurus guttatus* | Dwarf Flat Lizard | - | - | Protected | Endemic | Unlikely |
| | *Platysaurus minor* | Waterberg Flat Lizard | - | - | Protected | Endemic | Unlikely |
| | *Smaug breyeri* | Waterberg Dragon Lizard | - | - | Protected | Endemic | Possible |
| | *Smaug vandami* | Van Dam's Dragon Lizard | - | - | Protected | Endemic | Possible |

| Family | Scientific Name | Common Name | Conservation Status | | | | Probability of Occurrence |
|---|---|---|---|---|---|---|---|
| | | | Red List (2014) Regional Status | NEMBA TOPS List (2013) | Limpopo Environmental Management Act (2003) | Endemic Status | |
| Crocodylidae | *Crocodylus niloticus* | Nile Crocodile | Vulnerable | Vulnerable | Specially Protected | - | Unlikely |
| Gekkonidae | *Pachydactylus affinis* | Transvaal Gecko | - | - | Protected | Endemic | Probable |
| Pythonidae | *Python natalensis* | Southern African Python | - | Protected | Protected | - | Recorded |
| Note: All reptiles, except *Varanus* spp., and non-listed snakes, are considered protected under the Limpopo Environmental Management Act (2003). | | | | | | | |

### 7.7.3.4 Arthropods

Thirteen Arthropods were recorded in the study area as a result of targeted sampling conducted during the 2018 field programme (Table 25). One recorded species is of conservation importance, namely the South African Horned Baboon Spider (*Ceratogyrus darlingi*). Only a single silk-lined burrow was observed during the field survey; however considering the suitability of habitat, it is expected that this species, as well as Golden-brown Baboon Spider (*Augacephalus junodi*) (previously recorded at Grootegeluk Coal Mine), are probably fairly abundant in the study area.

Based on available literature, six other taxa from the Families *Theraphosidae* and *Scorpionidae* may potentially occur in the study area (Table 26). These should also be considered of conservation value.

**Table 25: Targeted arthropod taxa recorded in the study area**

| Family | Scientific Name | Common Name |
|---|---|---|
| Theraphosidae | *Ceratogyrus darlingi* | South African Horned Baboon Spider |
| Carabidae | *Thermophilium homoplatum* | Two-spotted Ground Beetle |
| Heteronemiidae | *Marensis rufolineatus* | Grass Stick Insect |
| Scarabaeidae | *Pachylomerus femoralis* | Flattened Giant Dung Beetle |
| Scarabaeidae | *Anachalos convexus* | Plum Dung Beetle |
| Formicidae | *Pachycondyla tarsata* | African Stink Ant |
| Formicidae | *Anoplolepis custodeins* | Pugnacious Ant |
| Bothuridae | *Parabuthus transvaalicus* | Transvaal Fat-tailed Scorpion |

| Family | Scientific Name | Common Name |
|---|---|---|
| Solifugae (order) | - | Red Roman/Sun Spider |
| Salticidae | *Brancus muticus* | Jumping spider sp. |
| Termitidae | *Odontotermes badius* | Fungus-growing Termite |
| Tenebrionidae | *Gonocephalum tibialis* | Armoured Darkling Beetle |
| Reduviidae | - | Assassin Bug |

**Table 26: Arthropods of conservation value recorded and potentially occurring in the study area**

| Class: Arachnida | Scientific Name | Common Name |
|---|---|---|
| Infra Order: Mygalomorphae Family: Theraphosidae (Baboon Spiders) | *Augacephalus breyeri* | Hectorspruit Golden Brown Baboon Spider |
| | *Augacephalus junodi* (recorded Exxaro, 2014) | Golden-brown Baboon Spider |
| | *Brachionopus pretoriae* | Baboon Spider species |
| | *Ceratogyrus darling* (Recorded 2018 wet-season survey) | South African Horned Baboon Spider |
| | *Idiothele nigrofulva* | Baboon Spider species |
| Order: Scorpionides Family: Scorpionidae (Burrowing Scorpions) | *Opistophthalmus glabrinfrons* | Yellow-legged Creeping Scorpion |
| | *Opistophthalmus carinatus* | Robust Burrowing Scorpion |
| | *Opistophthalmus wahlbergii* | Wahlberg's Burrowing Scorpion |
| Source: Leeming (2003) and Dippenaar-Schoeman (2014). | | |

## 7.8 Wetlands

This section sets out a summary of the baseline conditions detailed in the wetland delineation and assessment report compiled by GroundTruth (Pty) Ltd (GroundTruth, 2018), included in (APPENDIX T).

The following wetland systems were identified during the dry and wet season site visits:

- Artificial systems:
  - A watering hole, located to the east of the existing coal conveyor, is currently still being actively maintained as a source of water for the wildlife within that portion of the reserve. The system covers an area of approximately 0.12ha. This watering hole is the only source of water for the wildlife during the dry seasons, as the natural systems are considered to be seasonal in nature (GroundTruth, 2018).

- A borrow pit and the Voëltjie Dam are located to the west of the existing coal conveyor and cover an area of approximately 2.01 ha. As with the watering hole, the Voëltjie dam is also artificially maintained through additional water inputs, whilst the calcrete borrow pit only receives water through rainwater inputs. Voëltjie dam is maintained by Mokolo river catchment water being pumped to the facility. The turbidity within the dams was recorded as zero. Voëltjie dam is currently licensed as a clean water facility and serves as a potable source of water for the wildlife within the game reserve as per to the Exxaro Grootegeluk WUL.

- Wetland habitat:
  - Nineteen wetlands within the study area are wetland habitat, i.e. not artificially created and/or sustained. These systems cover an area of approximately 1.64 ha, and range in size from 0.003 ha to 0.275 ha. However, the majority of the systems are less than 0.1 ha in extent (GroundTruth, 2018). Based on the integrity assessment, the wetlands are considered to be equivalent to 1.34 hectares of functional wetland habitat.

Together the freshwater ecosystems within the proposed Grootegeluk Turfvlakte Expansion Project mining area cover approximately 3.77 ha or 0.86 % of the study area (Figure 35 and Figure 36).

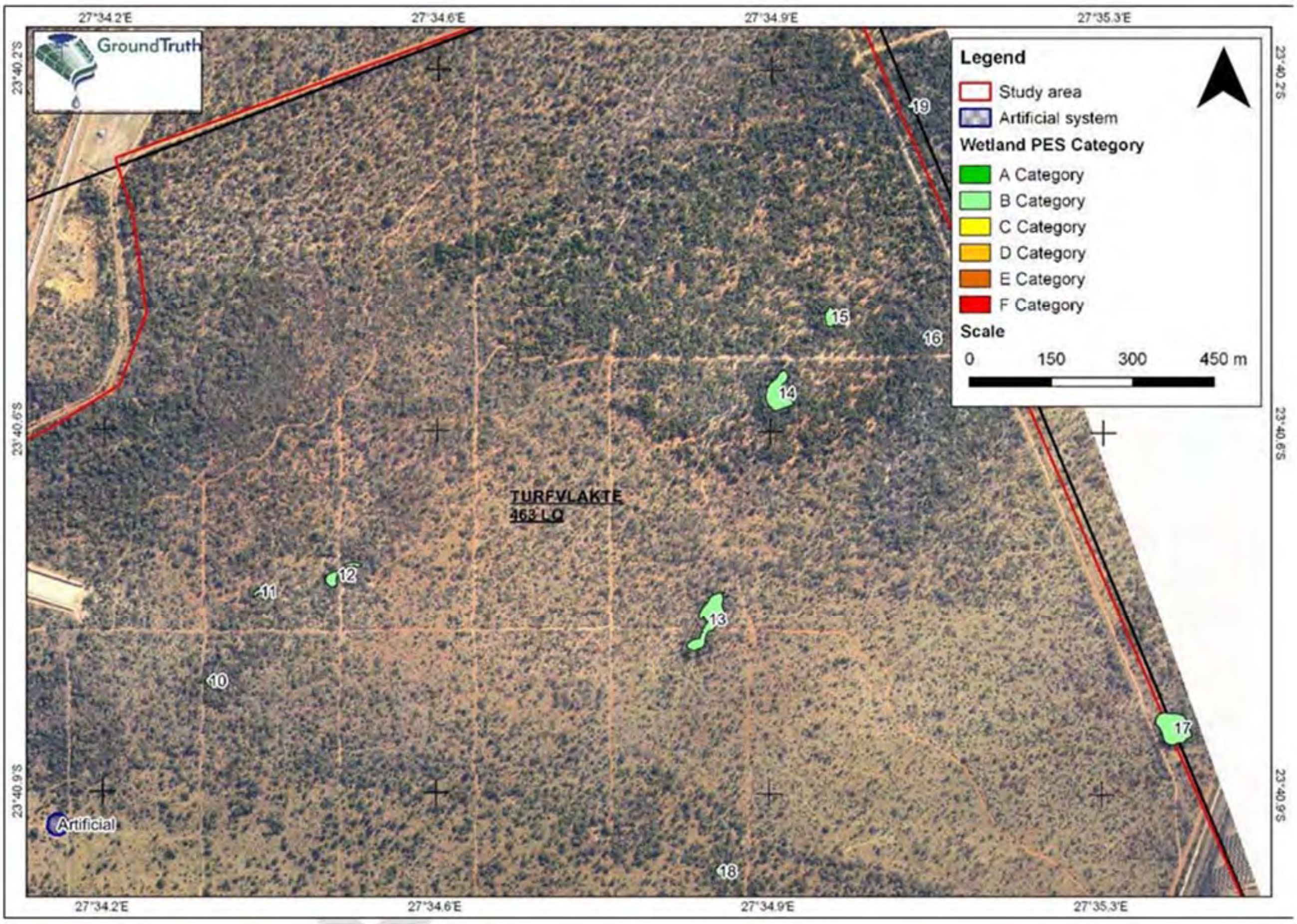



**Figure 35: Overview of the identified wetlands located to the east of the coal conveyor, their associated numbering and PES category for the current pre-mining scenario (GroundTruth, 2018)**

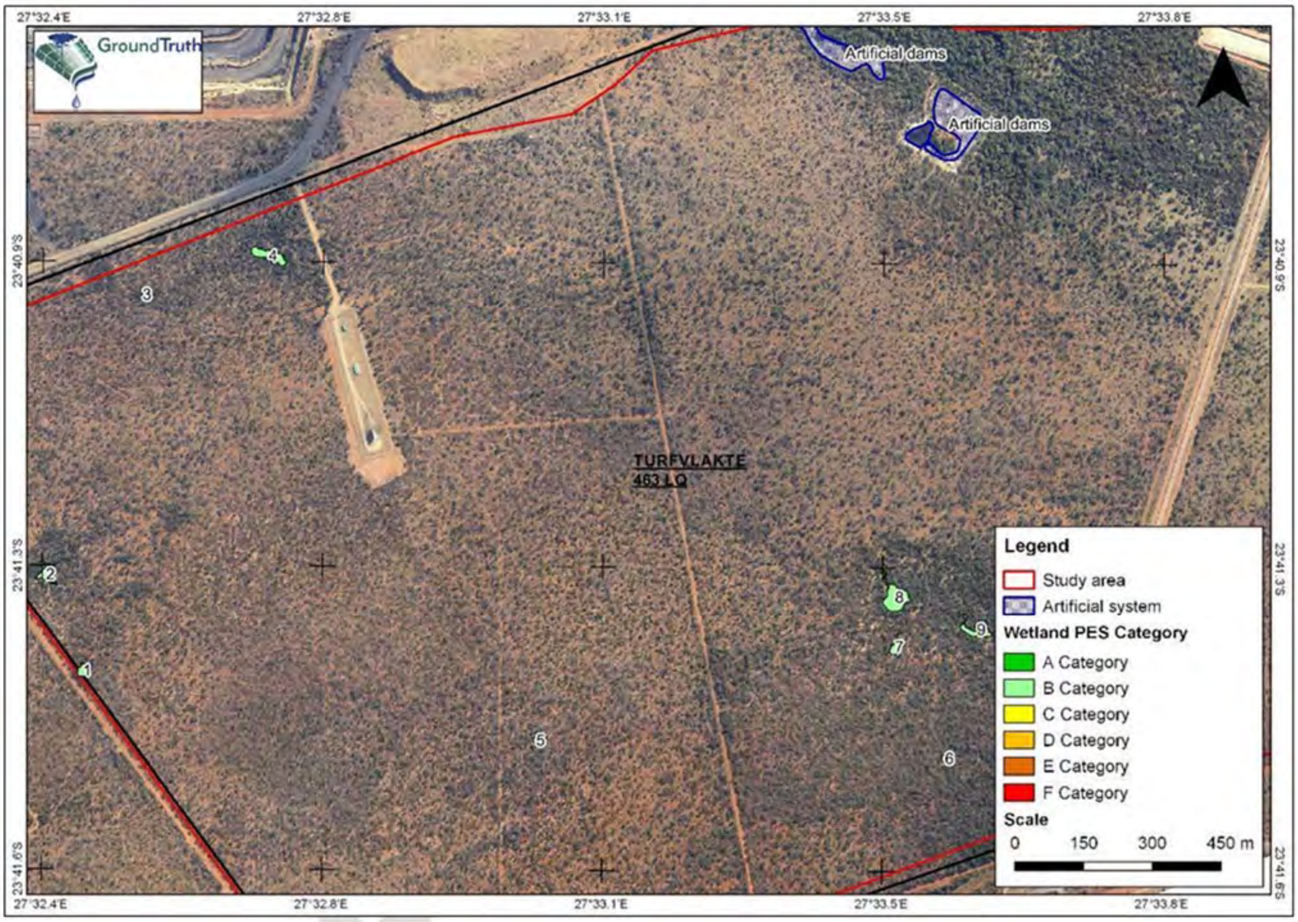



**Figure 36: Overview of the identified wetlands located to the west of the coal conveyor, their associated numbering and PES category for the current pre-mining scenario (GroundTruth, 2018)**

To allow for the differentiation between wetland systems and the prioritisation of systems either for conservation or management purposes, the wetlands were classified in accordance with the South African National Biodiversity Institute's (SANBI) wetland classification system (2009) (Table 27) (Ollis et al. 2013 as cited by (GroundTruth, 2018)). However, for the purpose of assessing the Hydrogeomorphic (HGM) units, Kotze et al. (2007), as cited by (GroundTruth, 2018), was used to classify the wetland systems as HGM units rather than Level 4 of the SANBI system. The HGM unit types defined by Kotze et al. (2007) differ from SANBI (2009), with the river classification being excluded and flat wetlands being grouped with the depression wetlands. All of the wetlands that were assessed have been classified as pans/depressions (Table 27).

**Table 27: A description of the onsite wetlands based on the SANBI (2009) classification and Kotze et al. 2007, as cited by (GroundTruth, 2018)**

| System (Level 1) | Bioregion (Level 2) | | Landscape Unit (Level 3) | HGM Unit (Level 4) | Description of HGM Units (Kotze *et al.*, 2007) |
|---|---|---|---|---|---|
| Inland systems | Central Bushveld Group (SVcb) Bioregion | 4 | Flat landscape unit | **Depressions (including Pans)** | |
| | | | | Pans | A basin shaped area with a closed elevation contour that allows for the accumulation of surface water (*i.e.* it is inward draining). It may also receive sub-surface water. An outlet |

| System (Level 1) | Bioregion (Level 2) | Landscape Unit (Level 3) | HGM Unit (Level 4) | Description of HGM Units (Kotze *et al*., 2007) |
|---|---|---|---|---|
| | | | | is usually absent, and therefore this type is usually isolated from the stream channel network. |

According to the available NFEPA wetlands and rivers coverage, there are no Freshwater Ecosystem Priority Areas (FEPA) within the study area (Figure 37). Only the Sandloop River, located to the south of the study area, is considered to be a FEPA system, however, none of the wetlands identified within the study area drain towards the south.

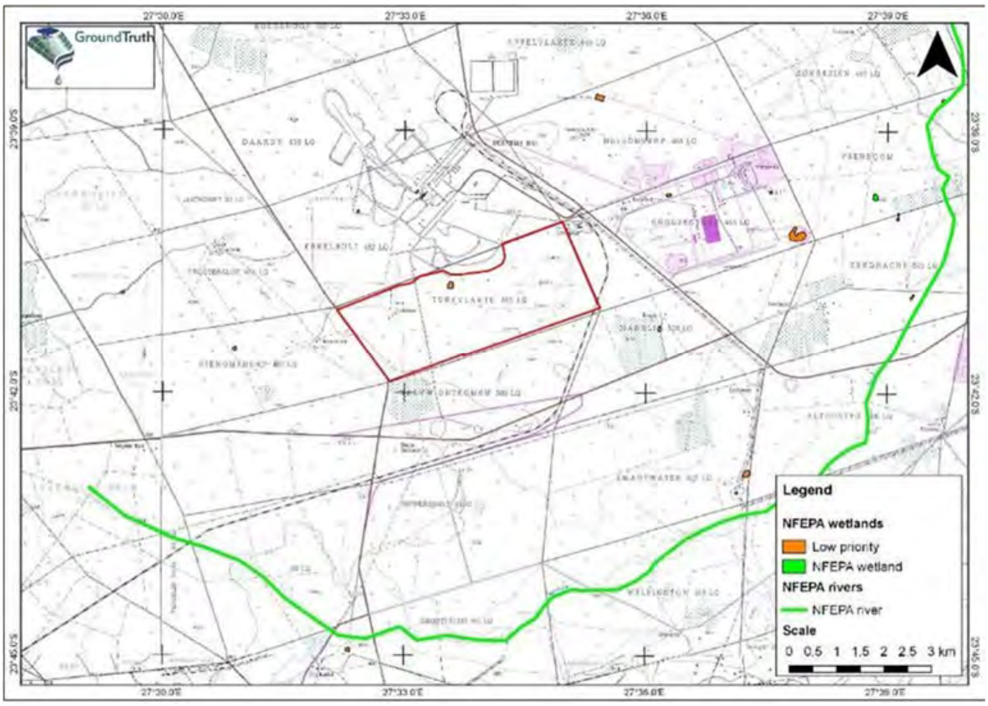



**Figure 37: Overview of NFEPA systems (Nel et al. 2011) within the greater study area (GroundTruth, 2018).**

## 7.9 Surface Water

### 7.9.1 Water Management Area

The Grootegeluk Coal Mine and Grootegeluk Turfvlakte Expansion project area is situated in the A42J quaternary catchment of the Limpopo Water Management Area (WMA) (Figure 38). The main surface water resource in the quaternary catchment is the Sandloopspruit, which flows east-north-east to join the Mokolo River approximately 40 kilometres south of the Limpopo River (Golder, 2020c).

### 7.9.2 Local Water Resources

The Grootegeluk Turfvlakte Expansion project area is located in an area with topography mainly consisting of plains, with slopes that vary between 0% and 3%. Drainage appears to be in an east-north-easterly direction towards the Mokolo River and consists mainly of dry sandy gullies such as the Sandloopspruit (Golder (2013) as cited by (Golder, 2020c).

The Mokolo River is approximately 810 m above sea level, while the mine is approximately 900 m above sea level. This results in an almost negligible gradient of 90:21000 m or 0.0043%. No natural drainage channels occur on the Grootegeluk Coal Mine area, except for Sandloopspruit which is located approximately 4.2 km south west of the Grootegeluk Pit. It flows west to east to the south of the study area past the Medupi Power Station and then north-east before its confluence with the Mokolo River approximately, 16 kilometres north of the Town of Lephalale.

Due to the flat topography, highly permeable sands and the absence of any surface water drainage courses, the Grootegeluk Turfvlakte Expansion project area is approximately five kilometres from the Sandloopspruit with no direct route or drainage lines emanating from the site to the river. The only surface water resources in the study area are those illustrated as pans in Figure 34.

### 7.9.3 Water Users

The main water users in the local area are domestic water users form the Town of Lephalale and the Marapong Village, east of the Grootegeluk Turfvlakte Expansion project area in the Southern Regions of the Lephalale Local Municipality. These areas receive water from the Mokolo Dam via the Wolfenfontein storage dam. The Grootegeluk Coal Mine, the Medupi and the Matimba Power Stations also receive water from this source. Limited groundwater is currently used (Golder, 2020c).

Non-consumptive water uses practiced in the area include discharge from domestic wastewater treatment works (WWTW), specifically the Marapong WWTW that discharge to the Sandloop (downstream of the study area) (Figure 38).

### 7.9.4 Water Quality Monitoring Points

Due to the absence of natural surface water features at the Grootegeluk Coal Mine and the Grootegeluk Turfvlakte Expansion project area, there are no surface water quality or quantity monitoring points in the immediate area. The Department of Water and Sanitation (DWS) has several monitoring points on the Mokolo River at the sites described in Table 28 and illustrated in Figure 39.

**Table 28: Surface Water Monitoring Points**

| Site ID | Description | Longitude | Latitude |
|---|---|---|---|
| DWS_190201 | Mokolo River upstream Town of Lephalale | 27.74528 | -23.68738 |
| DWS_190297 | Mokolo River downstream Town of Lephalale | 27.75953 | -23.65222 |
| DWS_90334 | Mokolo River upstream Sandloop confluence | 27.74194 | -23.59917 |
| DWS_190198 | Mokolo River downstream Sandloop confluence | 27.68271 | -23.36407 |

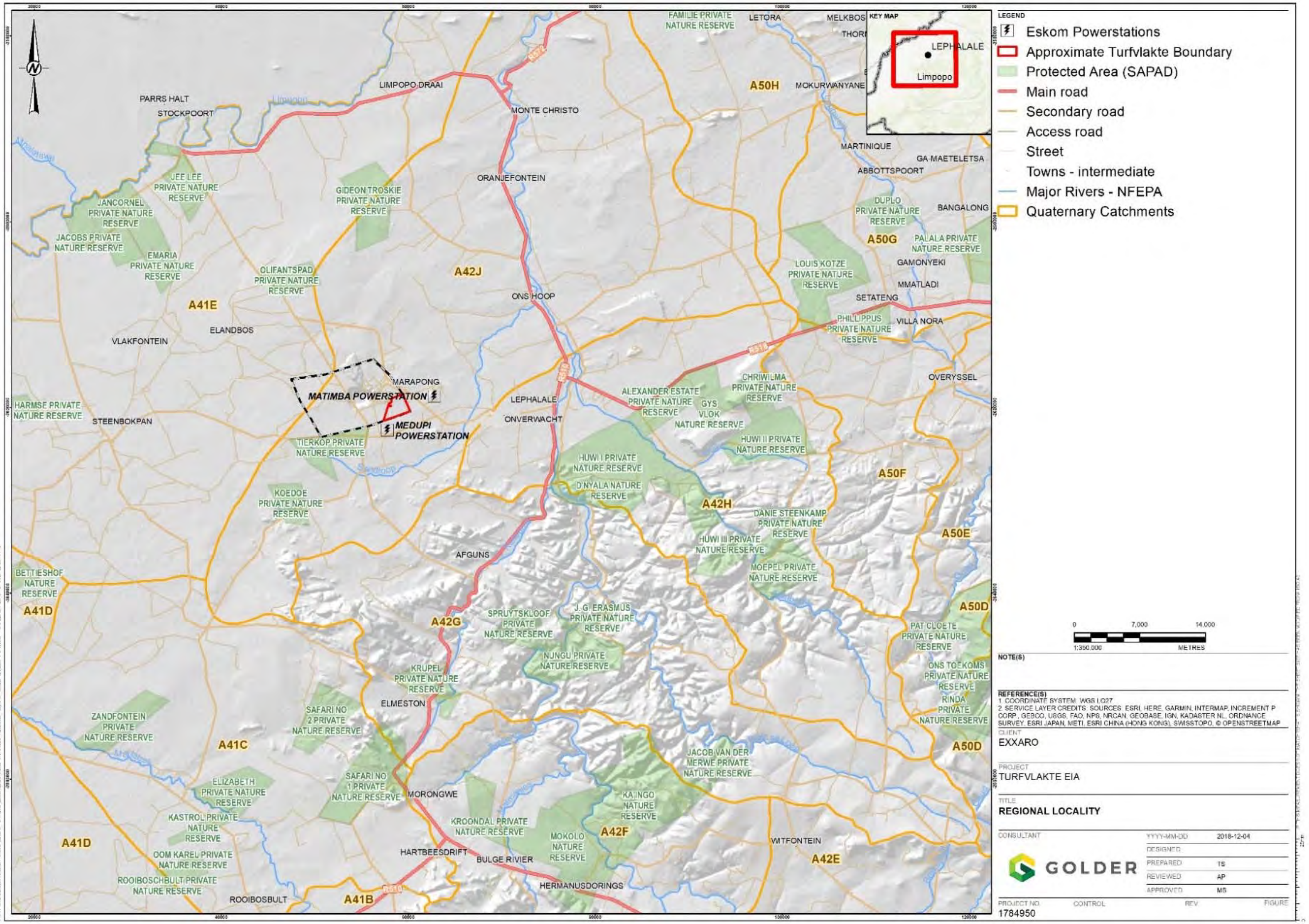



**Figure 38: Regional Locality indicating the position of the project area within the Quaternary Catchment**

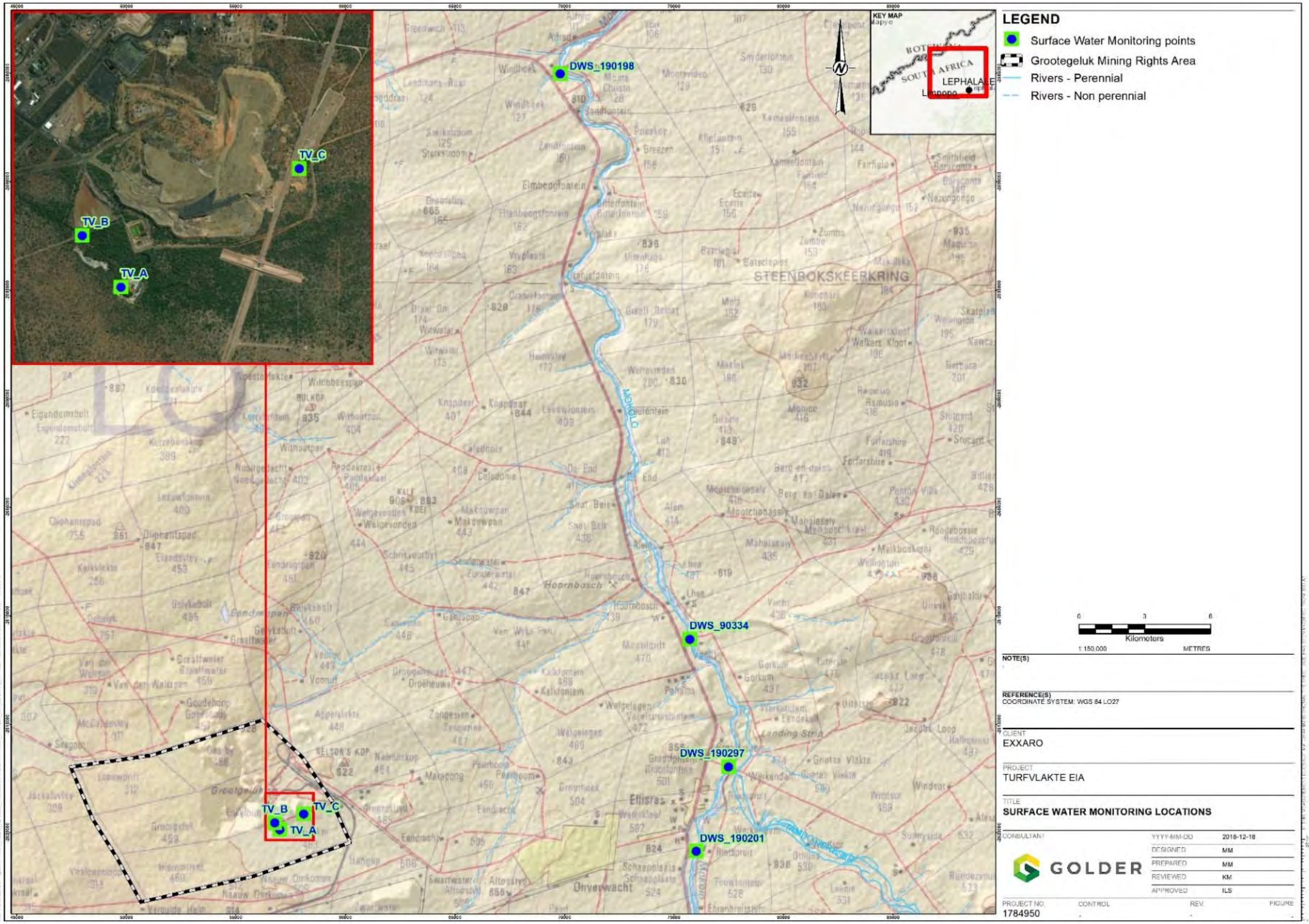



**Figure 39: Surface water monitoring points**

# 7.10 Groundwater

## 7.10.1 Hydrogeology

### 7.10.1.1 Regional Aquifer Classification and Borehole Yield

The aquifer at the Grootegeluk Turfvlakte Expansion project area is classified as a minor aquifer system, as defined by Hydrogeological Map Series published by DWAF (1996). The small western part of the Grootegeluk Turfvlakte Expansion project area aquifer is classified as a fractured aquifer zone whereas the greater part (proposed locality of Pit 1 and Pit 2) is classified as intergranular and fractured. Both aquifer zones have an average borehole yield between 0.5l/s, which are typical of the Karoo Super Group (Figure 40).

### 7.10.1.2 Aquifer Classification

Based on the drilling results, provided by Exxaro, two aquifer systems are distinguished at the Grootegeluk Turfvlakte Expansion project area in the Karoo Supergroup namely:

- Top weathered aquifer system; with an average thickness of ~ 28m. The average water level is about 24 metres below ground level (mbgl) which means that the weathered zone is saturated and water-bearing; and
- Fractured secondary aquifer system; with an average thickness of ~ 15m below the weathered aquifer system and is characterised by secondary fractures resulting in preferential flow paths for the groundwater flow and possible contaminant migration.

### 7.10.1.3 Top Weathered Aquifer

Borehole logs received from Exxaro indicate that the top part of the rock formation is composed of a weathered aquifer system of variable thickness. The depth of weathering ranges from 14.25 to 36.05 (mbgl) with an average weathering depth of 28.3mbgl.

These weathered deposits comprise of top soil, calcrete, minor ferricrete, a sandy alluvium, weathered shale, clay and non-reactive carbonaceous material (Exxaro (2018) as cited by (Golder, 2020d)).

### 7.10.1.4 Fractured Secondary Aquifer

The major aquifer type in the greater Turfvlakte project investigation area is characterised by secondary fractures and weathering zones that essentially control groundwater flow and mass transport. The most important characteristics of fractures are the relatively high transmissivity with relatively low storage properties. In contrast, the matrix blocks between the fractures or fracture zones have very low to zero transmissivity but may have significantly higher storability. The combination of the fracture and matrix properties result in significant flow and mass transport velocities (>> 100 m/d) through the fractures while sorption by the aquifer and storage of water and contaminants occur in the matrix (Roux (2009) as cited by (Golder, 2020d)).

Water strikes depths encountered during the Exxaro Drilling Programme (2017-2018) range from 20 to 39 mbgl with and average strike depth of 28.7 mbgl. Blow yield measured during the drilling programme ranges from 0.13 to 3.49 l/s with an average yield of 0.68l/s.

The Daarby Fault represents one of the major structures controlling the regional hydrogeology as it has been identified to be a barrier to groundwater flow (Roux (2003) as cited by (Golder, 2020d)). Groundwater levels on either side of the fault differ considerably, up to 100 m.

Although the Daarby Fault is characterised as a no-flow boundary in a regional context, field investigations have indicated that small amounts of seepage could take place across the fault, from the northern to the southern compartment. Steenekamp (2001) predicted the transmissivity of the fault to be approximately 0.01m$^2$/d.

Basalt is usually characterised by insignificant transmissivity and storability values. However, field investigations indicate that the Letaba Basalt (north of the Daarby Fault) is fractured and weathering occurred between successive lava flows. Aquifer tests conducted on a number of boreholes located in the basalt indicated that the T-values range between 0.7 to 380 $m^2$/d, with an average of 62 $m^2$/d (Environmental Resource Management , 2011).

The lower contact between the Letaba Formation and the Clarens Formation is represented by an erosion surface with yield between 2 l/s and 12.7 l/s. ERM postulates that the highest mobility of contaminants will be associated with this layer (Environmental Resource Management , 2011).

#### *7.10.1.5 Aquifer Thickness*

The aquifer thickness depends strongly on the type of aquifer in the area, especially in the case of fractured bedrock aquifers. Because secondary, fractured rock aquifers occur in the Grootegeluk Turfvlakte Expansion project area, aquifer thickness depends strongly on the presence, depths and orientations of the fractures or fracture systems through which flow takes place. The depths at which water yielding fractures are intersected in the Turfvlakte area vary significantly from 20 to 39 mbgl (Exxaro 2017-2018).

In the Stormberg basalt aquifer to the north of the Daarby Fault, much of the formation is weathered and fracturing occurs throughout the rock thickness. To the south of the Daarby Fault in the Ecca and Beaufort Groups sandstones and shales, very limited fracturing has occurred in general and groundwater flow is restricted to post-depositional faulting and associated fracturing (Golder, 2017).

### 7.10.2 Groundwater Level and Flow Direction

The published Groundwater Resource Map Series – Sheet 2 (DWAF, 1995), indicates the water level to be between 20 to 40mbgl (Figure 41).

The regional groundwater flow directions were towards the Mokolo and Limpopo Rivers as they are the primary receptors in the project area.

### 7.10.3 Regional Aquifer Recharge

From the published hydrogeological maps (DWAF 1996) the average recharge of the greater northern part of Grootegeluk Turfvlakte Expansion project area is shown as between 5 and 10mm per annum, whereas the southern part is shown as between 10 and 15mm per annum (Figure 42).

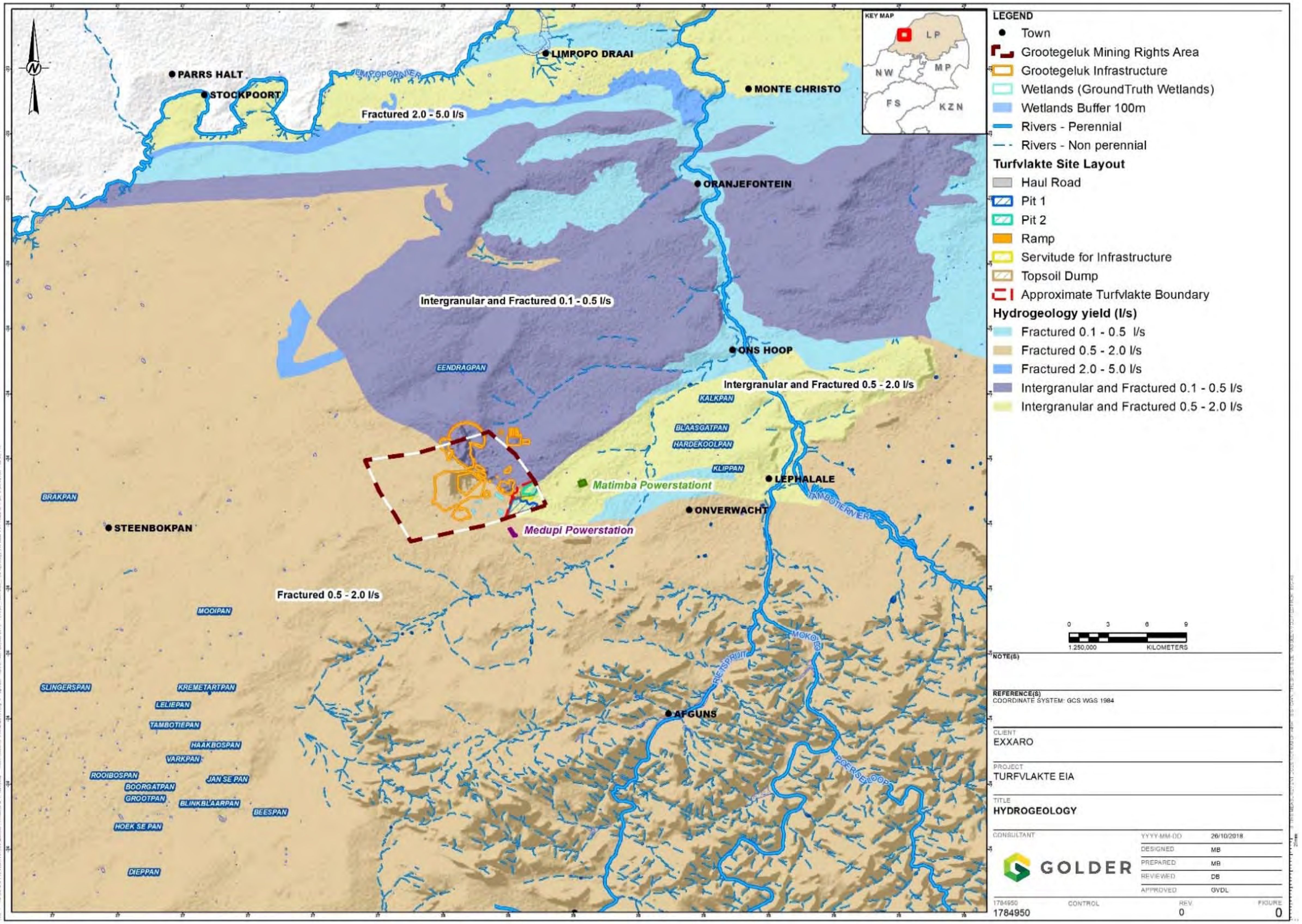



**Figure 40: Hydrogeology and Average Borehole Yield**

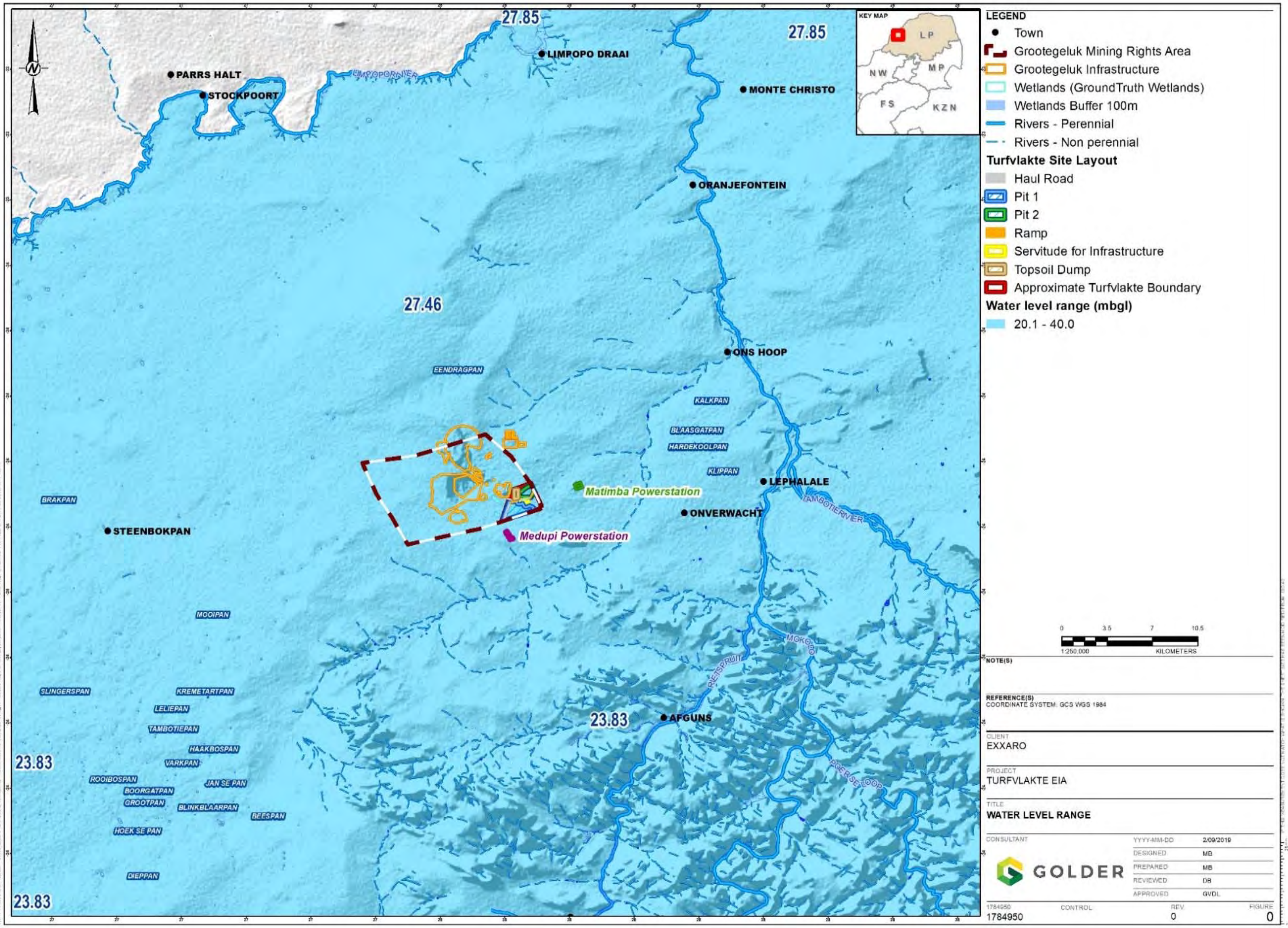



**Figure 41: Average Groundwater Levels**

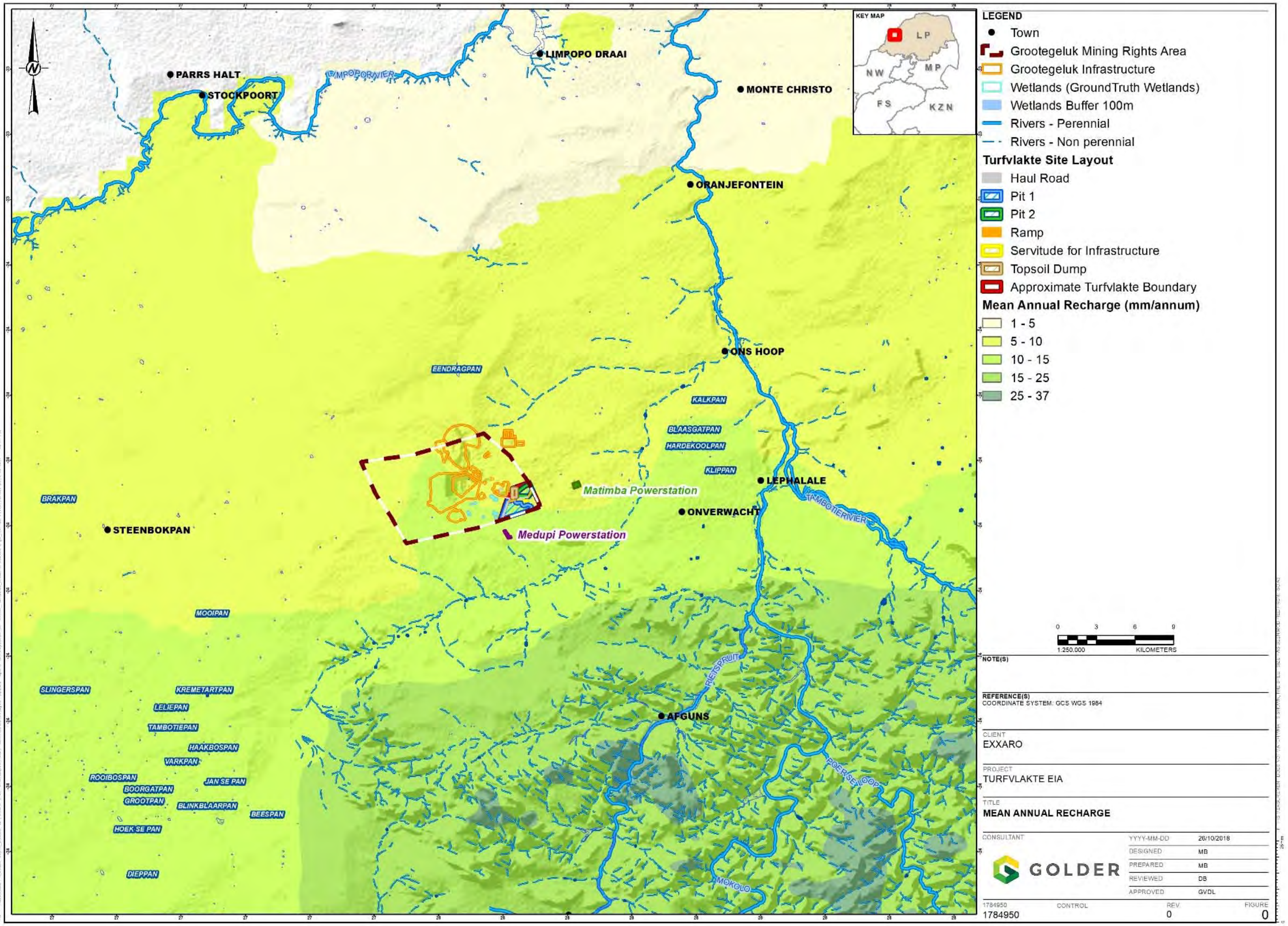



**Figure 42: Groundwater Mean Annual Recharge (Vegter (1996) as cited by (Golder, 2020d)**

## 7.11 Noise

Current pre-project baseline noise levels were measured by dBAcoustics (dBAcoustics, 2019) at the points illustrated in Figure 43 and listed in Table 29. The measuring points were selected to be representative of the prevailing ambient noise levels for the study area and included all the noise sources such as distant mining activities, power station noise, traffic and domestic noise.

**Table 29: Baseline Noise Monitoring Points**

| Position | Latitude | Longitude | Remarks |
|---|---|---|---|
| 1 | 23°39.503' | 27°35.703' | Northern side of Marapong. Distant Matimba power station audible. |
| 2 | 23°39.706' | 27°37.086' | Marapong residential area. Distant Matimba power station audible. |
| 3 | 23°39.982' | 27°37.447' | Marapong boundary behind Matimba power station. Power station noise audible. |
| 4 | 23°39.336' | 27°40.775' | Lephalale Agricultural Holdings. Distant Matimba power station audible. |
| 5 | 23°39.739' | 27°42.571' | Lephalale Agricultural Holdings (Horse riding school). Distant Matimba power station audible. |
| 6 | 23°40.540' | 27°41.250' | Residential area at Lephalale. Domestic type noise. |
| 7 | 23°41.832' | 27°39.871' | Residential area. Distant traffic audible. |
| 8 | 23°43.663' | 27°41.403' | Mabula Lodge. Distant humming sound audible. |
| 9 | 23°44.285' | 27°39.402' | South east of the proposed Turfvlakte. Distant plant audibles. |
| 10 | 23°43.703' | 27°35.591' | Eskom nature reserve. Far distant Medupi plant audible. |
| 11 | 23°44.508' | 27°34.812' | Eskom nature reserve. Far distant Medupi plant audible. |
| 12 | 23°45.872' | 27°31.589' | Kumanati Lodge. Distant Medupi plant audible. |
| 13 | 23°46.536' | 27°28.939' | Lephalale game traders. Agricultural activities audible. |
| 14 | 23°43.216' | 27°24.179' | Taaibosch. Insects and birds audible. |
| 15 | 23°42.446' | 27°27.036' | Along Steenbokpan Road Traffic – 10 vehicles not included in results. |
| 16 | 23°42.493' | 27°29.772' | West of Grootegeluk mine. Distant Grootegeluk mine audible. |
| 17 | 23°42.052' | 27°29.481' | West of Grootegeluk mine. Distant Grootegeluk mine audible. |
| 18 | 23°40.462' | 27°28.492' | West of Grootegeluk mine. Distant Grootegeluk mine audible. |
| 19 | 23°39.289' | 27°27.915' | West of Grootegeluk mine. Distant Grootegeluk mine audible. |
| 20 | 23°36.065' | 27°31.313' | Along gravel road. Insects and birds. |
| 21 | 23°37.078' | 27°33.555' | Along gravel road. Insects and birds. |

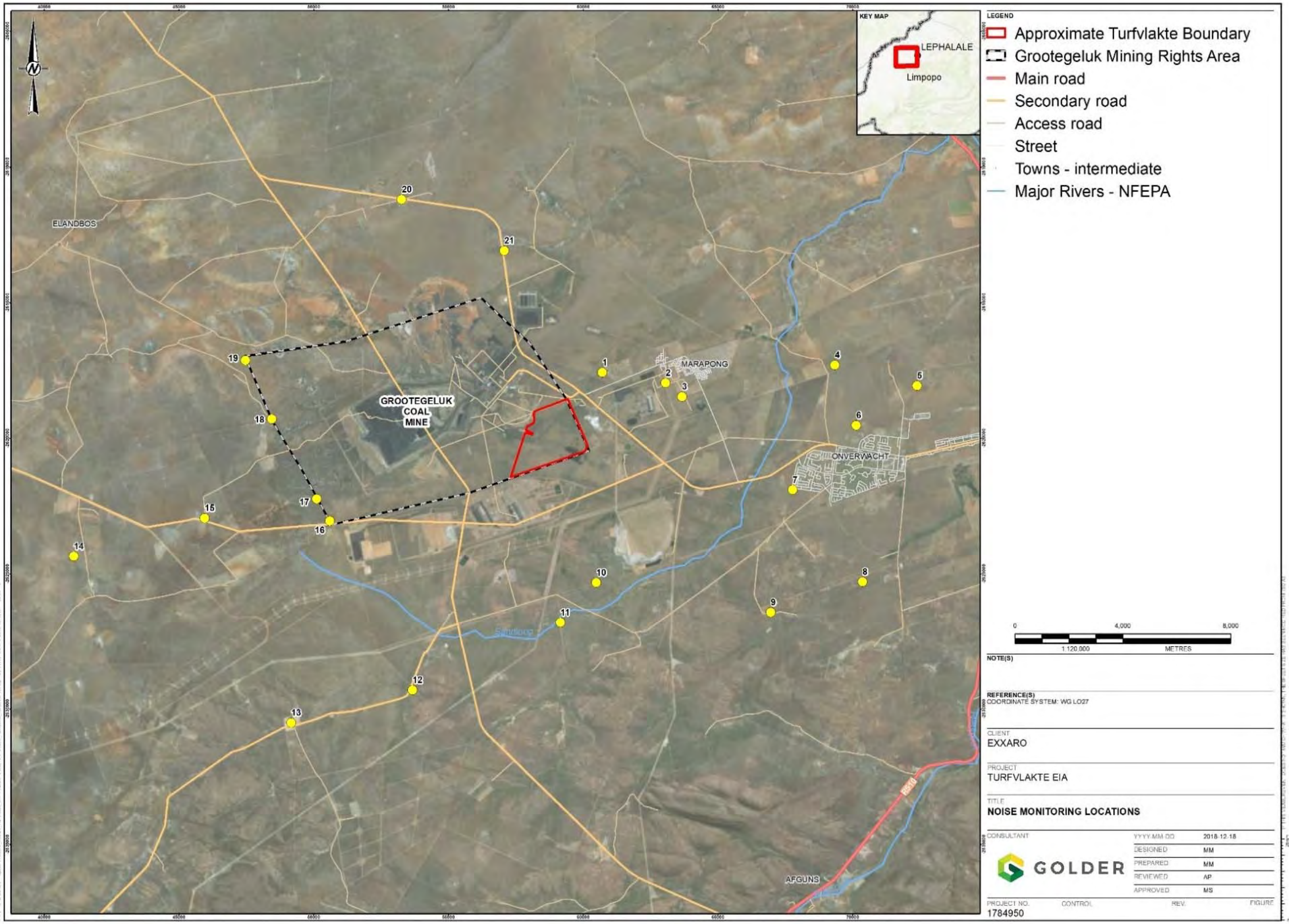



**Figure 43: Noise baseline measuring points**

The work was performed in accordance with:

- South African National Standards - SANS 10103 of 2008 – the measurement and rating of environmental noise with respect to land use, health, annoyance and speech communication.
- Department of Environment Affairs: Noise Control Regulations promulgated under the Environment Conservation Act, (Act No. 73 of 1989), Government Gazette No. 15423, 14 January 1994.
- Environmental, Health and Safety Guidelines of the IFC of the World Bank. The recommended noise level for a noise sensitive area is 55.0dBA during the day and 45.0dBA during the night; and
- South African National Standards - SANS 10210 of 2004. This national standard is used when calculating or predicting increased road traffic noise during new developments.

The baseline noise monitoring provided the following insight into the study area:

- There is a continuous to intermittent flow of traffic along the tarred feeder roads to the east and south of the proposed Grootegeluk Turfvlakte Expansion Project mining area.
- The tarred feeder road immediately east of the proposed mining area was used by traffic and heavy-duty trucks.
- The gravel road leading to the south of the proposed mining area was used on an intermittent basis.
- Domestic type noise, traffic and noise from the Matimba power station contribute to the prevailing ambient noise levels.
- Domestic activities, traffic noise, birds and insects contribute to the prevailing ambient noise levels in the residential areas of Lephalale; and
- Wind and weather conditions play an important role in noise propagation.

## 7.12 Visual

The wider study area is characterised by a mixture of completely transformed and developed land associated with the adjacent Grootegeluk Coal Mine, Eskom Power Stations, the Marapong residential area as well as large tracts of undeveloped natural bushveld, under either game or livestock management. A number of statutorily declared nature reserves and informal conservation areas are present in the broader region (Golder, 2019d).

### 7.12.1 Visual Characteristics of the Project Area

The Grootegeluk Turfvlakte Expansion project area comprises natural bushveld with negligible levels of transformation and disturbance that are limited to a network of game viewing vehicle tracks (Figure 44). Several small exploration drill pads were observed on site (Golder, 2019d).

**Figure 44: View across the Grootegeluk Turfvlakte Expansion project site from the elevated conveyor bridge (Note Medupi Power Station and the conveyor linking Medupi to Grootegeluk Coal Mine) (Golder, 2019d)**

The topography of the project area is generally flat, with slight undulations associated with drainage features.

Golder (2019d) describes the vegetation in the project area as fairly open and characterised by a well-developed tree component (tree height generally ranging from 2 m to 5 m), comprising both fine-leafed and broad-leafed species, and an herbaceous layer consisting of both grasses and forbs. Patches of dense, closed vegetation were observed in the project area.

## 7.13 Sites of Archaeological and Cultural Significance

The Grootegeluk Turfvlakte Expansion project area is located in an area covered by consistent level sandy plains with open savannah bush. A solitary kopje, Nelsonskop, occurs near the project area and is associated with human occupation in the past. A few scattered pans occur around the project area whilst agricultural fields are more prominent to the south of the area (Pistorius, 2020).

Pistorius (2018) states that the Turfvlakte project area was sparsely populated by humans in the past. However, occupation started at an early period resulting in the presence of humans in the area over a long-time span but on a limited scale. Occupation occurred from the Stone Age, hundreds of thousands of years ago, throughout the Early Iron Age which covers the first millennium AD and the Historical Period which commenced with the arrival of the first colonial hunters, traders and farmers.

## 7.14 Palaeontology

The Grootegeluk Turfvlakte Expansion project area is situated on the Grootegeluk Formation close to Lephalale.

The Karoo Supergroup is renowned for its fossil wealth. It is marked as Undifferentiated Strata of the Karoo Supergroup, but correlates with the Vryheid Formation (Pe, Pv), Ecca Group and the Grootegeluk Formation, which is rich in plant fossils such as the *Glossopteris* flora, represented by stumps, leaves, pollen and fructifications. This formation is early to mid-Permian (Palaezoic) in age and consists of sandstone, shaley sandstone, grit, conglomerate, coal and shale. Coal seams are present in the Grootegeluk Formation within the sandstone and shale layers of the horsts and grabens. Fossils are mainly present in the grey shale which is interlayered between the coal seams (Kent (1980), Visser (1989) as cited by (Fourie, 2018)).

## 7.15 Traffic

The Grootegeluk Turfvlakte Expansion project site is accessed *via* the existing Grootegeluk Mine entrance which is accessible from Road D2001 at the intersection with the road to Marapong. The intersection of D2001, which provides access to both Grootegeluk Coal Mine and Marapong, is signalised.

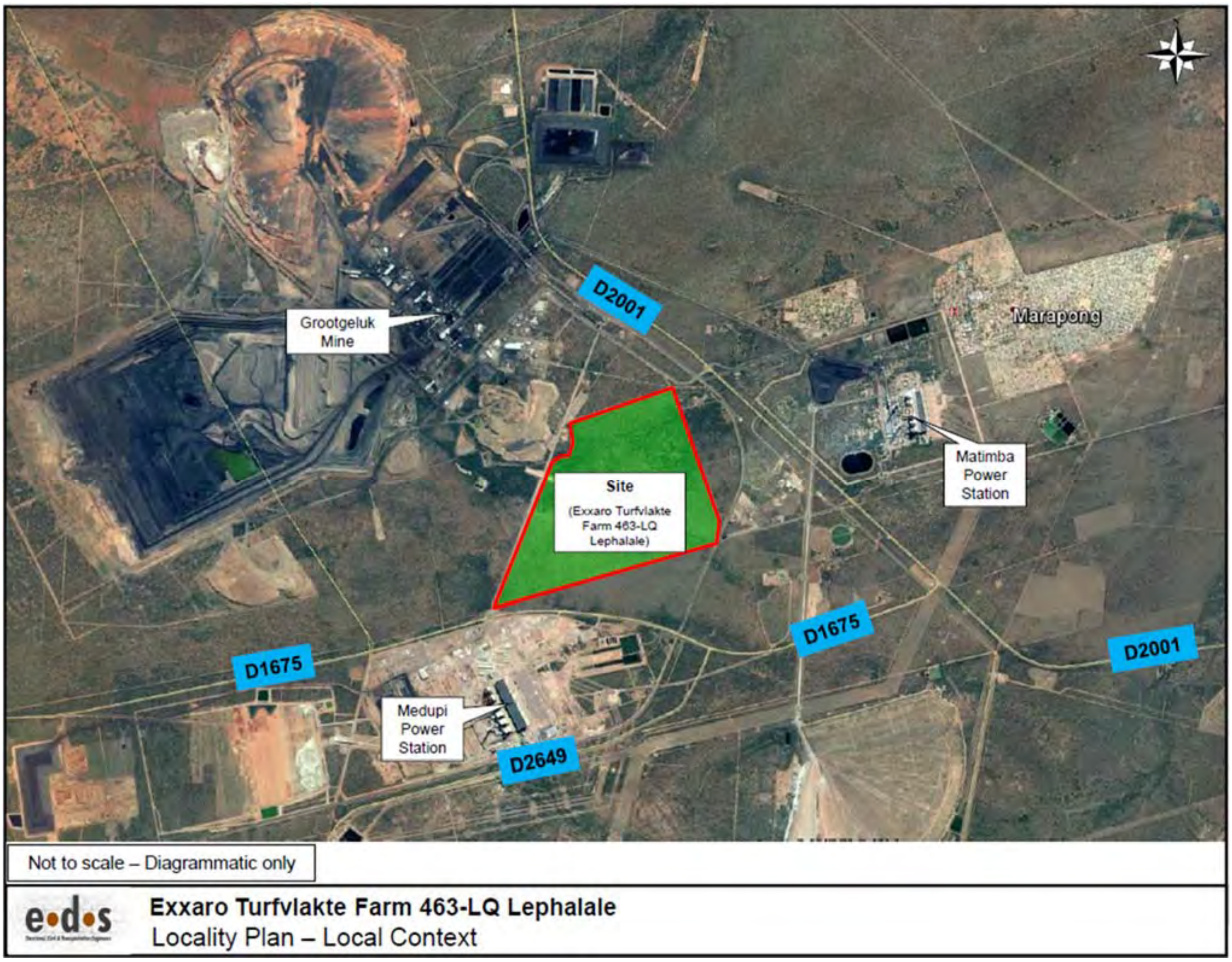



**Figure 45: Major roads in the vicinity of the Grootegeluk Turfvlakte Expansion project area (EDS, 2018)**

## 7.16 Social

### 7.16.1 Socio-economic Demographics

#### *7.16.1.1 Population and Ethnicity*

The population within the Lephalale Local Municipality increased significantly from 115 767 in 2001 to 140 240 in 2016. Table 30 shows the population profile taking into consideration ethnicity and gender. Ntila & de Waal (2020) states that according to the official census of 2011, the number of households in the Lephalale Local Municipality increased from 20 277 in 2001 to 29 880 in 2011. In 2016, the number of households increased to 43002. The official census of 2011 indicated that the Lephalale Local Municipality household size increased from 3.5 to 3.9. The Lephalale Local Municipality 2019/20 IDP indicates a smaller average household size of 3.2. The official census of 2011 indicated a 35.8% population increase between 2001 and 2011, reaching 115,767 in 2011). According to the Lephalale Local Municipality 2019 IDP, the 2019 population is estimated at 140,240, a growth rate of slightly more than 21% from 2011. Of interest, is that the 2019 working-age group (15-64) forms almost 69% of the population.

**Table 30: Population profile**

| | Black | Coloured | Indian | White | Other | Male % | Female % | Total |
|---|---|---|---|---|---|---|---|---|
| **Limpopo Province** | 97% | 0.2% | 0.2% | 2.5% | 0.1% | 50% | 50% | 5 391 455 |
| **Waterberg District Municipality** | 91.2% | 0.5% | 0.4% | 7.6% | 0.3% | 52% | 48% | 679 316 |
| **Lephalale Local Municipality** | 91% | 0.1% | 0.3% | 7.9% | 0.3% | 51% | 49% | 115 767 |
| **Ward 3** | 86.6% | 0.6% | 0.1% | 12.5% | 0.5% | 52% | 48% | 11 138 |

### 7.16.1.2 Education

The percentage of individuals in the Limpopo Province with no formal education has shown a decreasing trend since 2011, from 8.9% down to 6% in 2016 (Golder, 2020f). In 2013, Statistics South Africa recorded 40% of the Limpopo population as having reached secondary education, but less than 10% had achieved post-matric qualifications.

The education levels in the area, as determined during the 2011 census, are shown in Table 31.

**Table 31: Education level**

| | No schooling | Some primary | Completed primary | Some secondary | Completed secondary | Higher |
|---|---|---|---|---|---|---|
| **Limpopo Province** | 17% | 12% | 4% | 36% | 27% | 8% |
| **Waterberg District Municipality** | 13% | 14% | 5% | 37% | 24% | 7% |
| **Lephalale District Municipality** | 10% | 13% | 5% | 40% | 24% | 8% |
| **Ward 3** | 14% | 19% | 9% | 38% | 14% | 6% |

** Statistics South Africa, 2011*

Challenges experienced by school-going children include poor road conditions, a lack of transport to schools, a lack of water or an inadequate supply thereof, a lack of provision for disabled learners to attend school, mismanagement of funds, overcrowding of classrooms and increased teenage pregnancies.

The Lephalale Local Municipality has 94 educational facilities in total. Generally, there is an educational facility within a 30-minute walking distance for 95% of the population, but primary schools are perceived to be more easily accessible than secondary schools. Secondary schools do not have sufficient numbers of mathematics, and science teachers and the area lacks technical high schools.

The Further Education and Training College is located in Onverwacht and caters for the training needs of the entire Waterberg District Municipality.

### 7.16.1.3 Economic Activities

Ntila & de Waal (2020) states that Lephalale the fastest growing town in the Waterberg district is, with an abundance of natural resources that provides the potential for entrepreneurship and economic development.

The economy is dominated by mining (platinum, iron ore, coal, diamonds), tourism and agriculture. The Waterberg District Municipality is the largest platinum producing area in the Limpopo Province. The growing energy demand drives the development of coal and petroleum production in the Lephalale area.

The coal resource in the Waterberg field is estimated at 76 billion tonnes, which is more than 40% of the national coal reserve. Mining is the highest GDP contributor to Gross Domestic Product (GDP) in the district at 47.4%.

The renowned Biosphere Reserve is found in the district.

The agricultural potential of the sector has not yet been reached. Until recently, the local economy was dominated by Exxaro's Grootegeluk Coal Mine and Eskom's Matimba Power Station. Lephalale is currently in the final stage of considerable public-sector investment, estimated at R140 billion over the past six years, for the construction of Medupi Power Station.

One of the government's key priorities is to increase economic growth and to promote social inclusion. The contribution of mining to the Lephalale Local Municipality GDP is major at 59.21%. Tourism, game farming, commercial hunting, red meat production and manufacturing also contribute significantly to the local economy.

The Gross Value Added (GVA) per sector of the economy within the Lephalale Local Municipality between 2008 and 2010 is shown in Table 32.

**Table 32: Gross Value Added per economic sector in Lephalale at constant 2005 prices (Rm)**

| Sector | 2008 | 2009 | 2010 | 2010 % |
|---|---|---|---|---|
| Agriculture, forestry, and fishing | 189 | 168 | 171 | 3.9 |
| Mining and quarrying | 1415 | 2456 | 3148 | 71.4 |
| Manufacturing | 81 | 62 | 63 | 1.4 |
| Electricity, gas, and water | 179 | 120 | 125 | 2.8 |
| Construction | 45 | 42 | 42 | 0.9 |
| Wholesale and retail trade, catering, and accommodation | 218 | 192 | 196 | 4.4 |
| Transport, storage, and communication | 191 | 185 | 193 | 4.4 |
| Community, social and personal services | 58 | 53 | 53 | 1.2 |
| Finance, insurance, real estate, and business services | 257 | 228 | 230 | 5.2 |
| General government | 196 | 184 | 190 | 4.3 |
| **Total** | **2829** | **3690** | **4411** | **100.0** |

*Source: Quantec, 2010 Regional Economic Database in Lephalale 2019/20 IDP*

The contribution of mining within the Lephalale Municipal area to the Waterberg District Municipality's GDP is significant at 59.21%. Electricity contributes 11.33% of the Waterberg District Municipality's GDP and Lephalale Local Municipality's contribution to the Waterberg electricity sector is 69.65%. The Medupi Power Station near Lephalale will have a notable influence on the future development of the area. The three economic clusters that are most relevant to Lephalale Local Municipality are firstly coal and petrochemical, secondly red meat and thirdly tourism.

Agriculture is the sector that employs the largest part of the workforce (38.85%) in the Waterberg District Municipality. It is followed by community services (15.71%). Tourism and manufacturing contribute to the local economy to a lesser extent.

The regional GVA for 2010 is shown in Table 33.

**Table 33: Regional Gross Value Added (2010)**

| Industry | WDM | LLM |
|---|---|---|
| Agriculture, forestry, and fishing | 3% | 4% |
| Mining and quarrying | 51% | 71% |
| Manufacturing | 3% | 1% |
| Electricity, gas, and water | 2% | 3% |
| Construction | 2% | 1% |
| Wholesale and retail trade, catering, and accommodation | 8% | 4% |
| Transport, storage, and communication | 8% | 4% |
| Finance, insurance, real estate, and business services | 12% | 5% |
| Community, social and personal services | 3% | 1% |
| General government | 9% | 4% |

*Source: Quantec, 2010*

The Lephalale municipality received an unqualified audit from the Auditor-General from 2014/15 to 2016/17. The 2017/18 audit was qualified.

### 7.16.1.4 Economic employment and income profile

The provincial and regional employment profile is summarised in Figure 46.

A large proportion of the people in Lephalale who qualify to be employed (i.e. within the working-age group, South African citizen or with appropriate work visa) are employed with either Exxaro Grootegeluk or Eskom. Exxaro currently employs 7 432 people of which 69% are from the Limpopo Province (both permanent and contractor employees).

The unemployment rate measures the percentage of employable people in the country's workforce who are over the age of 16 and who have either lost their livelihoods or have unsuccessfully sought jobs previously and are still seeking employment. This category also includes children, pensioners and disabled persons.

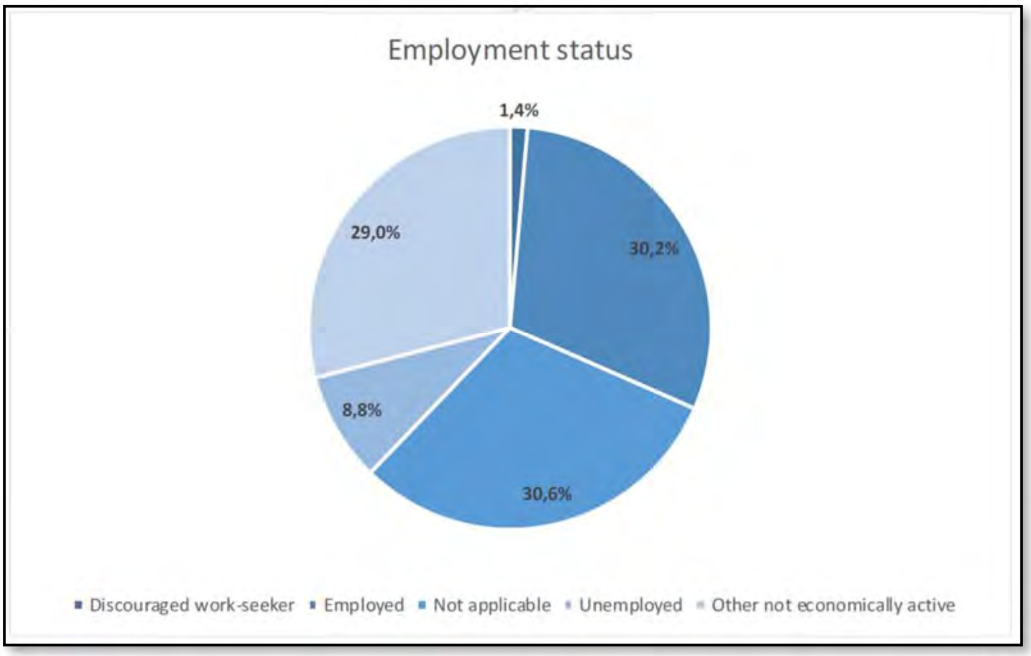



**Figure 46: Employment Profile in the Local Study Area (Statistics South Africa, 2018)**

About 60% of the population earn between R9 600 and R76 800 per year. The average for the Lephalale area is R30 000 per year (Figure 47).

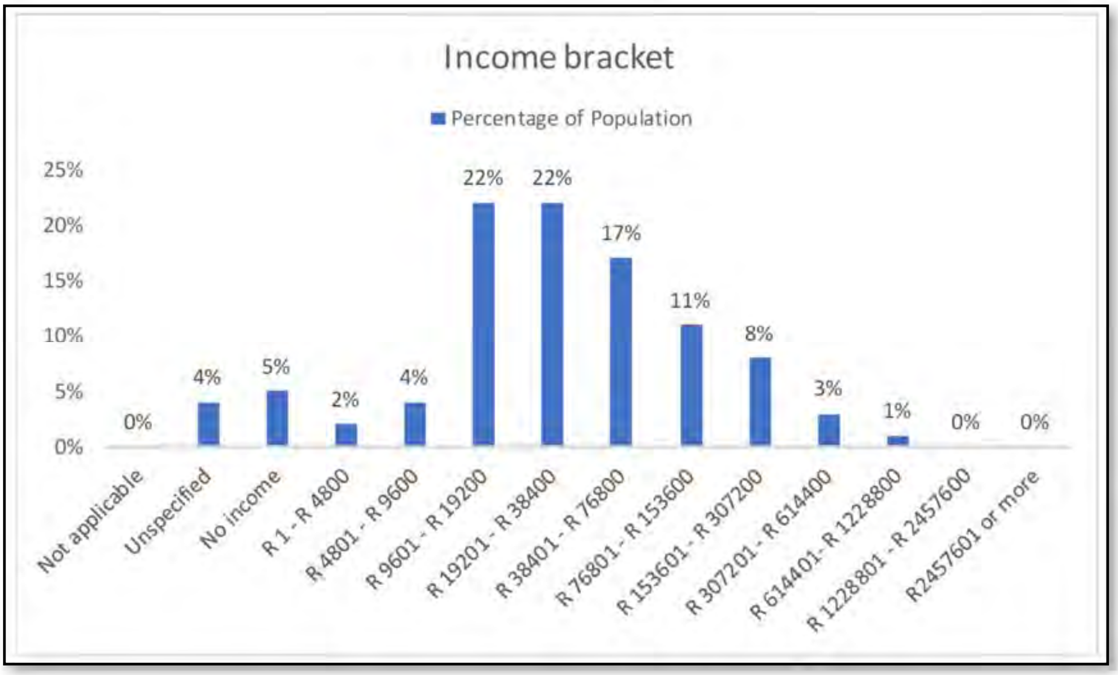



**Figure 47: Income Profile**

There was a significant increase in the population of Lephalale after 2012. Ntila & de Waal (2020) atributes this population increase to the construction of the Medupi Power Station and the expansion of the Waterberg coalfield. The Waterberg SEAT Report (2012) estimated the population in the Lephalale Local Municipality to be close to 94 000.

The community survey undertaken in 2016 recorded the population in the Lephalale Local Municipality as being 140 240. The population density in the area, at approximately 10.2 people/km$^2$, is lower than the national average of roughly 48.89 people/km$^2$.

## 7.16.2 Social and Physical Infrastructure

It is stated by Ntila & de Waal (2020) that the 2019 Local Municipality Annual Report states that primary health care is not a function of the Lephalale Local Municipality, but it is rather provided to the municipality by the district and the provincial departments.

Clinics in Lephalale offer primary health care, and there are five main clinics, equipped with mobile units, offering these services to the scattered villages and farms. They are responsible for the distribution of medicines, prenatal care for pregnant women, and testing for chronic diseases.

The ambulance service within the municipality is provided by the Provincial Department of Health and Social. Development and it is coordinated at the District. There are two ambulance centres in the municipality, located and based at the two hospitals within the municipal boundaries. The service centres are in Onverwacht at the Lephalale hospital and the satellite service centre at Witpoort Hospital. According to the Local Economic Development Strategy, the health care challenges in the Lephalale Municipality included, but were not limited to:

- Inadequate attraction and retention of skilled personnel as a result of the municipality's geographic location and lack of affordable accommodation.

- An influx of people into the municipality as a result of economic development has put more pressure on the referral centres, and the community members are not confident about the services provided at the primary health care centre; and
- Lack of adequate financial resources for the acquisition of advanced medical equipment. Patients seek medical attention when they are at an advanced stage of ailment, and this leads to high mortality rates in children and adults (Golder, 2020f).

### 7.16.3 Water and Sanitation

Ntila & de Waal (2020) rates service delivery in Lephalale as relatively high, with 73.2% of individuals receiving water from a regional or local service provider. Access to water may decrease further away from the central business district of the town. The water sources utilised by people within the Lephalale Municipal area are shown in Figure 48.

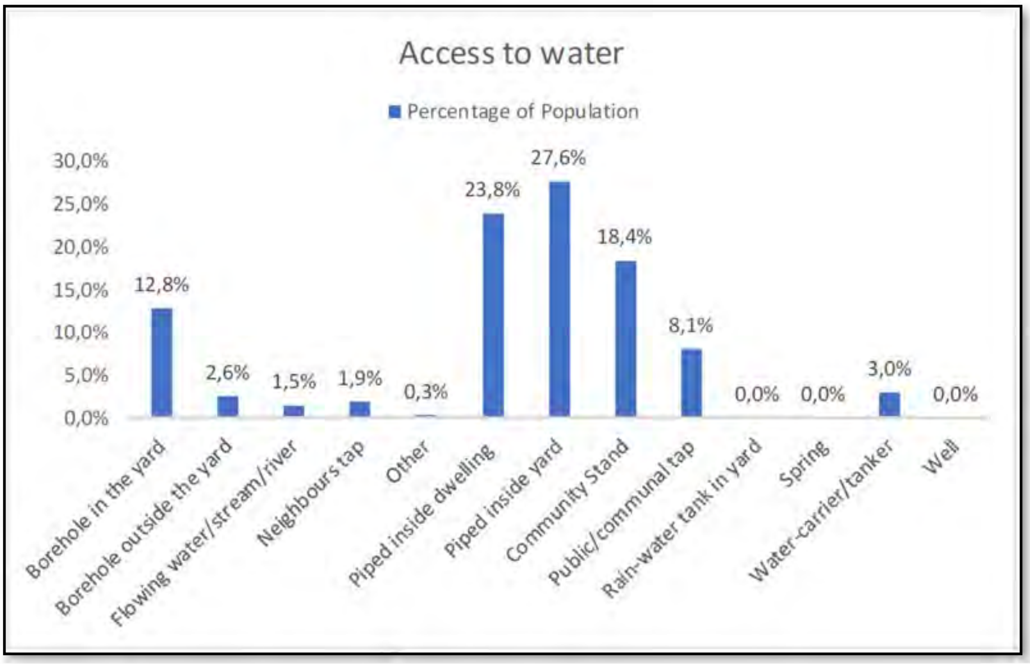



**Figure 48: Sources of water used by residents in Lephalale Municipal area**

The Lephalale Local Municipality lists the following challenges regarding water:

- The catchment in which the Mokolo Dam is located is currently in deficit.
- Dry boreholes due to lack of rain.
- Aged bulk infrastructure in rural and some urban areas.
- Illegal water connections in rural areas affect water availability.
- Non-availability of groundwater in rural areas.
- Unplanned growth of rural villages makes it difficult to provide water to all.
- Insufficient water supply to informal settlements and farms.
- Implementation of water conservation and water demand management programme.
- Insufficient budget for operation and maintenance of water infrastructure in rural villages.

The Lephalale Local Municipality is very aware that the availability of sanitation facilities promote not only the dignity of people but also improves their health. Areas without proper sanitation systems give rise to waterborne diseases like cholera, diarrhoea, typhoid, etc. The Lephalale Local Municipality ranked 108th in South Africa for flush toilets connected to a sewerage system. Only about 42.6% of the population have access to septic tank/French drain systems, or flushing or chemical toilets, which is almost double the rate of the Limpopo Province.

Lephalale is situated on relatively flat land. Sewers are installed at slopes exceeding the natural slope of the land and become so deep over relatively short distances, that the sewage must be pumped. There are 38 pumping stations in Onverwacht and Ellisras.

Sanitation in the rural areas consists of informal pit latrines or Ventilated Improved Pit Latrines. It is estimated that 5% of the households have no sanitation service. There is no waterborne sanitation in the rural areas, where the level of service varies from no service to a basic level of service.

Approximately 14 255 households require an improved sanitation system. The sanitation in Thabo-Mbeki and Thabo-Mbeki Ext 1 is mostly septic tanks with French drains. The Central Business District has access to full waterborne sanitation that drains into oxidation ponds, but it is operating at maximum capacity. The current situation is summarised in Figure 49 (Golder, 2020f).

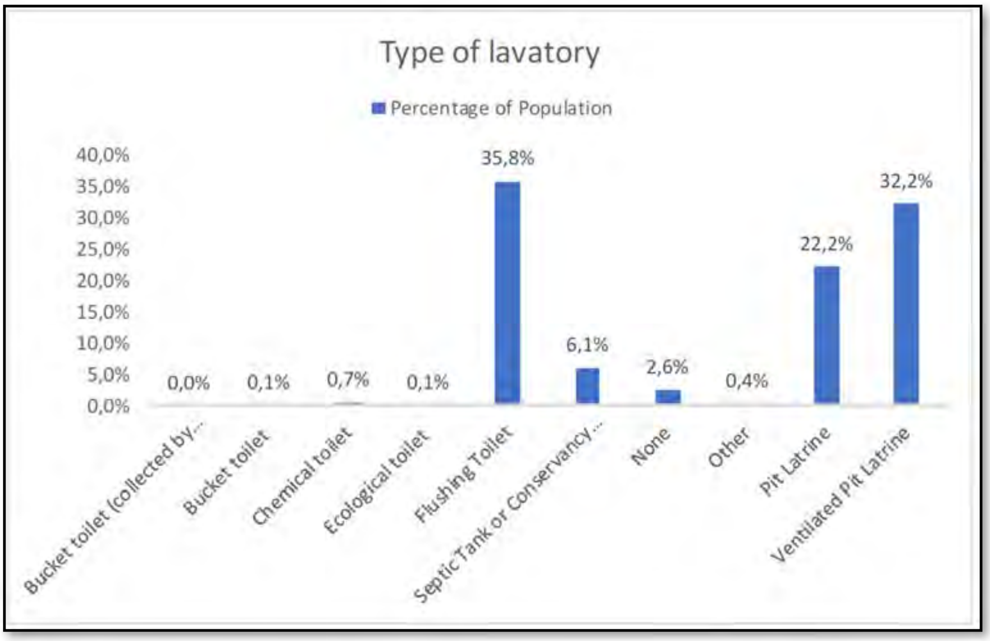



**Figure 49: Sanitation systems in the Lephalale Local Municipality**

Sanitation delivery challenges in the Lephalale area include:

i) Old infrastructure. About 94% of the waterborne sanitation infrastructure in the Municipality is more than 20 years old, and about 15% of the sanitation network has been identified as being in a poor to very poor condition. The system needs renewal and upgrading.

ii) Inadequate budget for operation and maintenance of sewer infrastructure.

iii) Insufficient capacity at wastewater treatment works.

iv) Organisational structure not strategically aligned to execute operational requirements.

v) Oxidation pond in Marapong operating above capacity.

### 7.16.4 Electricity

The sources of electricity utilised by people within the Lephalale Municipal area are shown in Figure 50. About 9.2% of the people, mainly those who live in villages further away from the central business district, do not have any access to electricity (Golder, 2020f).

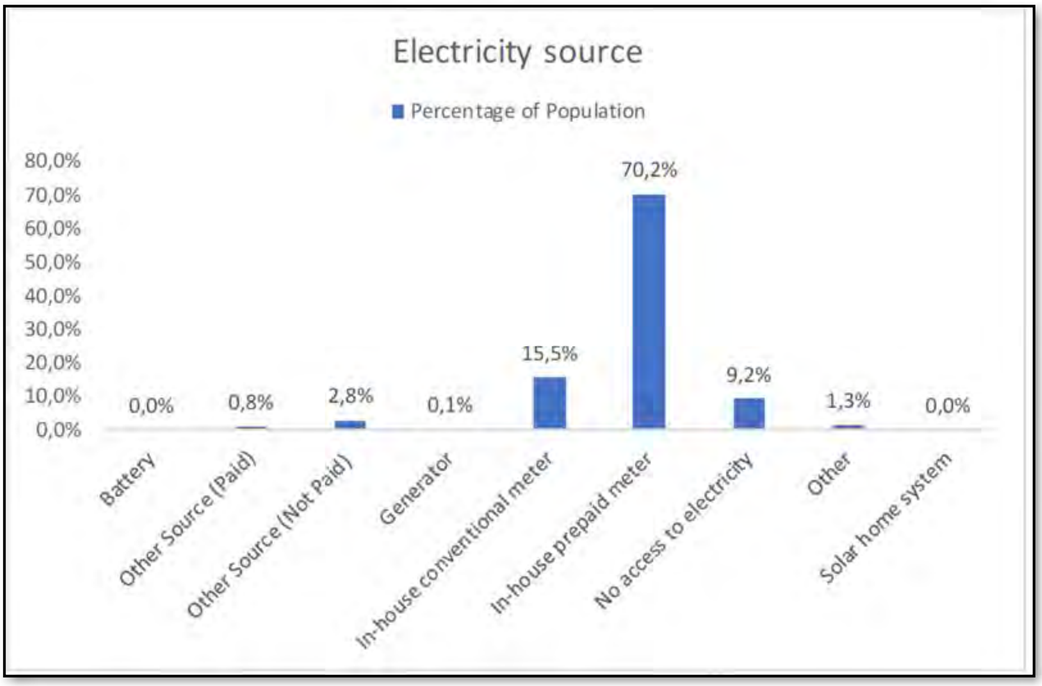



**Figure 50: Sources of electricity**

The electricity-related challenges for the Lephalale area include:

- Theft of copper cables, especially in rural areas
- Replacing copper cables on the internal electricity network with aluminium cables, which are less prone to theft
- An overhead line from Onverwacht and back from town to Onverwacht sub-station
- Poor response time to electricity breakdowns due to lack of resources (transport)
- Inconsistent Eskom billing the Municipality
- Unplanned housing extensions in rural villages and
- Lack of capacity in the maintenance department.

## 7.17 Baseline Greenhouse Gas Emissions

The following section presents a broad overview of South Africa's current GHG emissions profile. This section is largely based on GHG National Inventory Report, 2000-2015 (DEA, 2016 as cited by (Golder, 2020g)).

### 7.17.1 Gross and Net Emissions

In 2015, South Africa's gross emissions (exclude forestry and other land use ("FOLU")) was estimated to be 540.9 million tonnes carbon dioxide equivalent ("$MtCO_2e$") (Table 34). Gross emissions increased by approximately 101.6 $MtCO_2e$ from 439.2 $MtCO_2e$ in 2000 to 540.9 $MtCO_2e$ in 2015, with an average annual increase of 1.5%.

With the inclusion of FOLU, South Africa's net emissions was estimated to be 512.4 $MtCO_2e$ in 2015, approximately 28.5 $MtCO_2e$ (or 5.2%) less than gross emissions. Net emissions increased by approximately 86.2 $MtCO_2e$ from 426.2 $MtCO_2e$ in 2000 to 512.4 $MtCO_2e$ in 2015, with an average annual increase of 1.4%.

**Table 34: Gross and net emissions from 2000 to 2015 (DEA, 2016 as cited by (Golder, 2020g))**

| Year | Gross (with FOLU) | Net (without FOLU) |
|---|---|---|
| 2000 | 439.2 | 426.2 |
| 2001 | 438.2 | 423.8 |
| 2002 | 452.3 | 437.0 |
| 2003 | 473.9 | 460.8 |
| 2004 | 491.0 | 479.4 |
| 2005 | 488.7 | 477.8 |
| 2006 | 496.9 | 485.9 |
| 2007 | 523.8 | 514.5 |
| 2008 | 516.3 | 508.7 |
| 2009 | 521.2 | 510.2 |
| 2010 | 538.8 | 524.3 |
| 2011 | 522.9 | 511.4 |
| 2012 | 534.7 | 514.5 |
| 2013 | 554.7 | 527.5 |
| 2014 | 547.5 | 518.3 |
| 2015 | 540.9 | 512.4 |

### 7.17.2 Emissions Trends

#### *7.17.2.1 Carbon Dioxide*

In 2015, the gas which contributed the most to South Africa's gross emissions was $CO_2$, increasing slightly from 84% in 2000 to 85% in 2015 (Figure 51). Gross $CO_2$ emissions was estimated to be 459.4 $MtCO_2e$ in 2015, while net $CO_2$ was estimated to be 431.5 $MtCO_2e$. The energy sector is the largest contributor, accounting for approximately 92% of total $CO_2$ emissions in 2015.

#### *7.17.2.2 Methane*

$CH_4$ contributed approximately 9.4% to South Africa's gross emissions in 2015, decreasing slightly from 10.0% in 2000 (Figure 51). $CH_4$ emissions increased by 7.2 $MtCO_2e$ from 43.7 $MtCO_2e$ in 2000 to 51.0 $MtCO_2e$ in 2015. The waste sector and AFOLU livestock category were the largest contributors, accounting for approximately 36.7% and 55.0% of total $CH_4$ emissions, respectively.

### 7.17.2.3 Nitrous Oxide

$N_2O$ contributed approximately 4.5% to South Africa's gross emissions in 2015, decreasing slightly from 5.8% in 2000 (Figure 51). $N_2O$ emissions decreased by 1.1 $MtCO_2e$ from 25.5 $MtCO_2e$ in 2000 to 24.4 $MtCO_2e$ in 2015. The AFOLU and energy sectors were the largest contributors, accounting for approximately 84.5% and 10.7% of total $N_2O$ emissions, respectively.

### 7.17.2.4 Fluorinated Gases

The Fluorinated gases ("F-gases") include HFCs, PFCs, and $SF_6$. F-gas emissions contributed approximately 1.1% to South Africa's gross emissions in 2015, increasing from 0.2% in 2000 (Figure 51).

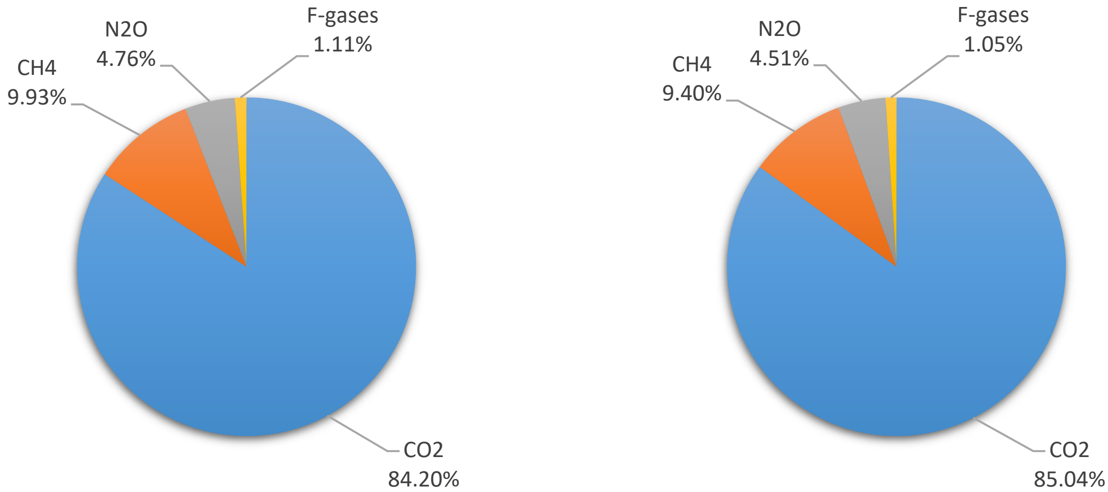



**Figure 51: Percentage contribution of each gas to net (left) and gross (right) emissions in 2015 (DEA, 2016)**

## 7.17.3 Sector Emissions

Table 35 presents a summary of sector emissions from 2000 to 2015.

### 7.17.3.1 Energy Sector

Total emissions from the energy sector was estimated to 429.9 $MtCO_2e$ in 2015, accounting for 79.5% of South Africa's total gross emissions. The 'energy industries' sub-sector was the main contributor, accounting for 60.4% of the emissions in the energy sector. This was followed by the 'transport' (12.6%), 'other sectors' (11.4%), and 'manufacturing industries and construction' (8.6%) sub-sectors. Emissions from the energy sector increased by 86.1 $MtCO_2e$ (or 25%) from 343.8 $MtCO_2e$ in 2000 to 429.9 $MtCO_2e$ in 2015.

### 7.17.3.2 Industrial Processes and Product Use

Total emissions from the industrial processes and product use ("IPPU") sector was estimated to 41.9 $MtCO_2e$ in 2015, accounting for 7.7% of South Africa's total gross emissions. The 'metal industry' sub-sector was the largest contributor, accounting for 73.9% of the emissions in the IPPU sector. This was followed by the 'mineral industries' (14.8%) and 'substitute ozone depleting substances' (8.3%) sub-sectors. Emissions from the IPPU sector increased by 7.8 $MtCO_2e$ (or 22.9%) from 34.1 $MtCO_2e$ in 2000 to 41.9 $MtCO_2e$ in 2015.

### 7.17.3.3 Agriculture, Forestry, and Other Land Use

Gross emissions from the AFOLU sector was estimated to be 50.5 $MtCO_2e$ in 2015, accounting for 9.2% of South Africa's total gross emissions. Net emissions from the AFOLU sector was estimated to be 37.5 $MtCO_2e$

in 2015, accounting for 4.1% of South Africa's total net emissions. The 'livestock' and 'aggregated and non-$CO_2$ emissions from land categories' sub-sectors contributed 27.7 $MtCO_2e$ and 21.2 $MtCO_2e$ respectively, while the 'land' and 'other' sub-sectors were both sinks (27.2 $MtCO_2e$ and 0.7 $MtCO_2e$, respectively). Gross emissions from the AFOLU sector decreased by 1 $MtCO_2e$ (or 2%) from 50.5 $MtCO_2e$ in 2000 to 49.5 $MtCO_2e$ in 2015, while net emissions from the AFOLU sector decreased by 16.5 $MtCO_2e$ (or 43.9%) from 37.5 $MtCO_2e$ in 2000 to 21.1 $MtCO_2e$ in 2015.

#### *7.17.3.4 Waste*

Total emissions from the waste sector was estimated to 19.5 $MtCO_2e$ in 2015, accounting for 3.6% of South Africa's total gross emissions. The 'solid waste disposal' sub-sector was the largest contributor, accounting for 80.7% of the emissions in the waste sector. This was followed by 'wastewater treatment and discharge' which contributed 17.5%. Emissions from the waste sector increased by 8.7 $MtCO_2e$ (or 80.2%) from 10.8 $MtCO_2e$ in 2000 to 19.5 $MtCO_2e$ in 2015.

**Table 35: Change in sector emissions from 2000 to 2015 (DEA, 2016 as cited by (Golder, 2020g))**

| Sector | Emissions ($MtCO_2e$) | | Change 2000 to 2015 | |
|---|---|---|---|---|
| | 2000 | 2015 | $MtCO_2e$ | % |
| Energy | 343.8 | 429.9 | 86.1 | 25 |
| IPPU | 34.1 | 41.9 | 7.8 | 22.9 |
| AFOLU (excl. FOLU) | 50.5 | 49.5 | -1 | -2 |
| AFOLU (incl. FOLU) | 37.5 | 21.1 | -16.5 | -43.9 |
| Waste | 10.8 | 19.5 | 8.7 | 80.2 |

# 8.0 POTENTIAL IMPACTS AND RISKS IDENTIFIED

The following potential impacts were identified during the scoping phase:

1) **Groundwater:** Abstraction of groundwater to enable open cast mining operations will result in the lowering of the groundwater table around the pits. The use of explosives and spillages of hydrocarbons could cause groundwater pollution. The project may be expected to have an impact of ***moderate*** significance on the groundwater regime and groundwater users during the life of the mine.

2) **Surface water:** Runoff from the topsoil stockpile could have a high silt load and runoff from the operational areas could be contaminated with hydrocarbons. Such dirty runoff from the project area could cause surface water pollution in the nearby pans. Without appropriate mitigation measures, the project could have a ***moderate*** impact on the surface water regime during the life of the mining operations.

3) **Ecology:** The project will result in the potential removal of protected trees and vegetation from the combined footprint area (opencast mining and infrastructure) of about 269 ha over time. Due to the destruction of their habitat, the game and current faunal population in the project area will have to be relocated until suitable habitat has been restored post rehabilitation. The long-term impact is expected to be ***moderate***.

4) **Air Quality:** Particulate mobilisation due to drilling, blasting, loading, hauling, stockpiling, backfilling and material storage has the potential for an impact of ***moderate*** significance on air quality within and in the vicinity of the project area, particularly in the downwind direction. Gaseous emissions due to blasting and the diesel engines on mining vehicles are expected to have an impact of ***low*** significance on air quality.

5) **Noise:** The noise impact could range from ***moderate*** to ***low*** significance during the mining operations. The noise from the mining machinery will be audible, but is not expected to exceed the daytime and night-time levels for urban districts, beyond the 500 m blast zone boundary and at some sensitive areas along the way as the mining front moves along the length of the ore deposit.

6) **Blasting and Vibration:** Ground vibration, air blast, fly rock and fumes are some of the potential impacts that could result from blasting operations. Structures in close proximity to the proposed open pits, such as the D1678 road, existing conveyors, bridges, pans, buildings and Manketti Lodge may experience impacts of ***moderate*** to ***high*** significance.

7) **Visual:** The infrastructure associated with the proposed Grootegeluk Turfvlakte Expansion Project will have a ***low*** visual impact at close range only due to the project area being located amongst the existing Grootegeluk Coal Mine and the Matimba and Medupi power stations.

8) **Cultural and heritage:** Unless unknown graves are unearthed during construction and mining, the expected impact on cultural and heritage resources is likely to be of ***negligible*** significance.

9) **Palaeontology:** Unless unknown fossils or palaeontological resources are unearthed during construction and mining, the expected impact on palaeontology is likely to be of ***negligible*** significance.

10) **Traffic:** The additional traffic as a result of the proposed mining operations could result in an impact of ***moderate*** significance on the roads users in the vicinity of the Grootegeluk Coal Mine; and

11) **Socio-economics:** The Grootegeluk Turfvlakte Expansion Project mining operations will utilise workforce from the existing Grootegeluk Coal Mine. The project will provide an additional contribution to the Lephalale LM's GDP. Given the significant contribution of mining to the local GDP, the impact is expected to be positive and of ***moderate*** significance.

## 9.0 IMPACT ASSESSMENT PROCESS AND METHODOLOGY

The overall process and methodology that was followed during the EIA phase was based on best practice guidelines and the requirements of South African legislation (specifically NEMA and MPRDA).

The scoping phase included the following activities:

- Project description and analysis of alternatives – inclusive of data review, red flag and constraints mapping, input to alternatives analysis and preferred layout planning.
- Analysis of existing information against the Project compliance criteria.
- Screening (legal and process review) – review of all applicable compliance criteria inclusive of South African legal and administrative requirements (see Section 3.1 to Section 0 above.;
- Environmental and Social Baseline Information review – carrying out desktop assessment and review, monitoring, data collection and fieldwork to determine the baseline conditions of the environment that could be affected by the proposed project.
- Scoping (identification of key issues and development of a plan of study for carrying out the impact assessment). The report was presented to the public and South African Government departments dealing with mining and environmental authorisations for comment from 27 January 2020 to 9 March 2020. The final Scoping Report was submitted to the DMRE on 16 March 2020; and
- Stakeholder Engagement – was undertaken throughout the Scoping process to record issues and comments received from the public. These issues and comments are integrated into the process and are considered in the impact assessment phase of the EIA.

The following activities were undertaken during the impact assessment phase of the EIA:

- Impact Assessment *via* specialist studies – evaluation of potential impacts and benefits of the project utilising qualitative and quantitative evaluation on environmental aspects and issues identified during the scoping phase.
- Environmental and Social Management Systems Development –establishment of a system for the management of environmental and social impacts supported by a number of action plans.
- Preparation of an EIA/EMPr report – documenting all processes and presenting the findings of the impact assessment. The EIA/EMPr report is available to the public and to the relevant South African government departments for comment from **Monday, 26 October 2020 until Wednesday, 25 November 2020**.
- Stakeholder Engagement – will continue throughout the remainder of the EIA process to record issues and comments received from I&APs. All issues and comments will be integrated into the process and considered during the EIA.
- The final EIA/EMPr report will be submitted to the DMRE for a decision on whether the project may proceed and if so, under what conditions; and
- Once a decision has been issued by the DMRE, registered I&APs will receive a letter announcing the decision and explaining the appeal process.

The overarching principles that guide the EIA include:

- **Sustainability** – development that meets the needs of the present generation without compromising the ability of future generations to meet their own needs.

- **Mitigation hierarchy** – The mitigation hierarchy describes a step-wise approach that illustrates the preferred approach to mitigating adverse impacts as follows (the governing principle is to achieve no net loss and preferably a net positive impact on people and the environment as a result of the Project):
  - The preferred mitigation measure is **avoidance**
  - Then **minimisation**
  - Then r**ehabilitation** or **restoration**; and
  - Finally, **offsetting** residual unavoidable impacts.
- Duty of care towards the environment and affected people.

The assessment of the impacts of the proposed activities was conducted within the context provided by these principles and objectives.

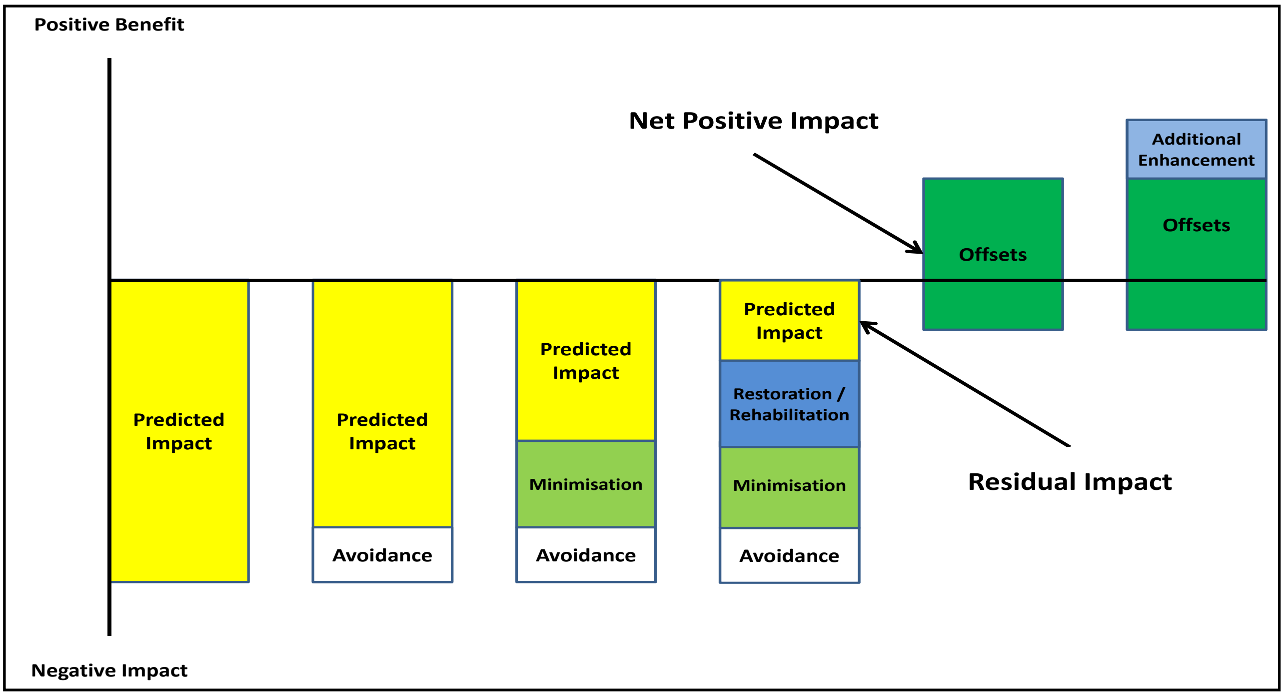



**Figure 52: Mitigation Hierarchy Adapted from BBOP, 2009**

## 9.1 National Environmental Screening Tool

The DEA has developed a web based environmental screening tool that can be accessed at https://screening.environment.gov.za/screeningtool to generate a report that shows environmental features and sensitivities near the proposed project and identifies recommended specialist studies. The use of the tool during the environmental authorisation process became compulsory on 4 October 2019. The Application for Environmental Authorisation form and the Environmental Screening Report generated for this application process are attached as APPENDIX Y.

The specialist studies identified in the screening report are listed in Table 36, together with comments on their applicability.

**Table 36: Specialist Studies Identified by Environmental Screening Tool.**

| No | Specialist assessment | Comments |
|---|---|---|
| 1 | Agricultural Impact Assessment | Included in this report under Section 10.3.4 |
| 2 | Landscape / Visual Impact Assessment | Included in this report under Section 10.3.12 |
| 3 | Archaeological and Cultural Heritage Impact Assessment | Included in this report under Section 10.3.14 |
| 4 | Palaeontology Impact Assessment | Included in this report under Section 10.3.15 |
| 5 | Terrestrial Biodiversity Impact Assessment | Included in this report under Section 10.3.7 |
| 6 | Aquatic Biodiversity Impact Assessment | No natural drainage channels occur on the Grootegeluk Coal Mine area and Turfvlakte project area, except for Sandloopspruit which is located approximately 4.2 km south west of the Grootegeluk Pit.<br><br>A wetland assessment is available under Section 10.3.9 |
| 7 | Hydrology Assessment | Included in this report under Sections 10.3.5 and 10.3.6 |
| 8 | Noise Impact Assessment | Included in this report under Section 10.3.10 |
| 9 | Radioactivity Impact Assessment | Not included in this report as radioactivity is not normally associated with coal mining operations. |
| 10 | Traffic Impact Assessment | Included in this report under Section 10.3.13 |
| 11 | Geotechnical Assessment | Geotechnical investigations were not included in the current scope and will be conducted by Exxaro, if required. |
| 12 | Climate Impact Assessment | Included in this report under Section 10.3.18. |

| No | Specialist assessment | Comments |
|---|---|---|
| 13 | Health Impact Assessment | A Health Impact Assessment was not included in the current scope. The proposed Turfvlakte mining opencast pits will be included in the Grootegeluk Coal Mine Health and Safety Management system and potential health impacts will be managed in accordance with existing procedures and protocols. |
| 14 | Socio-Economic Assessment | Included in this report under Section 10.3.16 |
| 15 | Ambient Air Quality Impact Assessment | Included in this report under Section 10.3.2 |
| 16 | Seismicity Assessment | A seismicity assessment was not included in the current scope. The proposed mining will take place in open pits to the depth of 88m and 109m respectively. |
| 17 | Plant Species Assessment | Included in this report under Sections 10.3.7 and 10.3.8 |
| 18 | Animal Species Assessment | Included in this report under Sections 10.3.7 |

## 9.2 Scoping Methodology

The methodology specifically adopted for the scoping phase included the following:

- Stakeholder consultation as required in terms of the EIA Regulations and as described in Section 6.0 of this report.
- Review of existing data.
- Fieldwork by the EIA specialist team to obtain additional baseline data.
- Discussions with the specialist team to identify key impacts and issues and to outline the plan of study.
- Compiling the scoping report.

## 9.3 Assumptions and limitations

The EIA is limited to the scope of the assessment outlined in more detail in Section 2.5 of this document.

Although all effort was made by the project team to identify all environmental and social aspects, impacts and mitigation measures, errors and omissions may have occurred. The environmental management programme (EMPr) that was developed as part of the EIA process will be a live document that must be adapted and updated as additional information, aspects or impacts are identified. An important objective of the EMPr is for the Grootegeluk Turfvlakte Expansion project team to continually improve environmental and social performance. Besides, according to South African legislation, the EMPr will need to be updated or amended with new information when there are significant changes during the life of the project.

Every effort was made to engage stakeholders to the extent possible, however not every stakeholder may have been consulted, or their comments may have been recorded erroneously. A grievance mechanism has been put in place through which stakeholders can raise grievances and continue to contribute their concerns and issues with the project team

## 9.4 Impact Assessment Methodology

The impact assessment was undertaken using a matrix selection process, the most used methodology, for determining the significance of potential environmental impacts/risks. This methodology incorporates two aspects for assessing the potential significance of impacts, namely severity and probability of occurrence, which are further sub-divided as follows (Table 37).

Table 37: Impact assessment factors

| Severity | | | Probability |
|---|---|---|---|
| Magnitude of impact | Duration of impact | Scale/extent of impact | Probability of occurrence |

To assess these factors for each impact, the following four ranking scales are used (Table 38):

Table 38: Impact assessment scoring methodology

| Value | Description |
|---|---|
| ***Magnitude*** | |
| 10 | Very high/unknown (of the highest order possible within the bounds of impacts that could occur. In the case of adverse impacts, there is no possible mitigation that could offset the impact, or mitigation is difficult, expensive, time-consuming or some combination of these. Social, cultural, and economic activities of communities are disrupted to such an extent that these come to a halt). |
| 8 | High |
| 6 | Moderate (impact is real, but not substantial in relation to other impacts that might take effect within the bounds of those that could occur. In the case of adverse impacts, mitigation is both feasible and easily possible. Social, cultural, and economic activities of communities are changed, but can be continued (albeit in a different form). Modification of the project design or alternative action may be required). |
| 4 | Low (impact is of a low order and therefore likely to have little real effect. In the case of adverse impacts, mitigation is either easily achieved or little will be required, or both. Social, cultural, and economic activities of communities can continue unchanged.) |
| 2 | Minor |
| ***Duration*** | |
| 5 | Permanent (Permanent or beyond closure) |
| 4 | Long term (more than 15 years) |
| 3 | Medium-term (5 to 15 years) |
| 2 | Short-term (1 to 5 years) |
| 1 | Immediate (less than 1 year) |
| ***Scale*** | |

| Value | Description |
|---|---|
| 5 | International |
| 4 | National |
| 3 | Regional |
| 2 | Local |
| 1 | Site only |
| 0 | None |
| ***Probability*** | |
| 5 | Definite/unknown (impact will definitely occur) |
| 4 | Highly probable (most likely, 60% to 90% chance) |
| 3 | Medium probability (40% to 60% chance) |
| 2 | Low probability (5% to 40% chance) |
| 1 | Improbable (less than 5% chance) |
| 0 | None |

Once these factors are ranked for each impact, the significance of the two aspects, occurrence and severity, is assessed using the following formula:

**SP (significance points) = (magnitude + duration + scale) x probability**

The maximum value is 100 significance points (SP). The impact significance was then rated as follows:

| | | |
|---|---|---|
| SP>60 | High environmental significance | An impact which could influence the decision about whether or not to proceed with the project regardless of any possible mitigation. |
| SP 30 - 60 | Moderate environmental significance | An impact or benefit which is sufficiently important to require management, and which could have an influence on the decision unless it is mitigated. |
| SP<30 | Low environmental significance | Impacts with little real effect and which will not have an influence on or require modification of the project design. |
| + | Positive impact | An impact that is likely to result in positive consequences/effects. |

For the methodology outlined above, the following definitions were used:

- **Magnitude** is a measure of the degree of change in a measurement or analysis (e.g., the severity of an impact on human health, well-being, and the environment), and is classified as none/negligible, low, moderate, high, or very high/unknown
- **Scale/Geographic** extent refers to the area that could be affected by the impact and is classified as site, local, regional, national, or international;

- **Duration** refers to the length of time over which an environmental impact may occur i.e. immediate/transient, short-term, medium term, long-term, or permanent
- **Probability** of occurrence is a description of the probability of the impact occurring as improbable, low probability, medium probability, highly probable or definite.

## 9.5 Assessment of potential impacts and risks

The findings of the specialist studies, which guided the selection of the preferred site layout alternative, are presented in Section 10.0 of this EIA report. The complete specialist reports are attached as appendices as per the respective references in Sections 10.3.1 to 10.3.17. The specialists' findings were used to assess the potential project impacts and risks during the respective project phases.

## 9.6 Positive and negative impacts of initial site layout

All infrastructure site layouts must avoid the sterilisation of the opencast minable coal reserves. They must therefore be located adjacent to, but not on the footprint of such reserves. The proposed location of the Grootegeluk Turfvlakte Expansion project infrastructure is situated within the Grootegeluk Coal Mine MRA and will be an expansion of the current mining activities. The proposed facility layout, as illustrated in Figure 7, has been optimised to ensure integration with the existing Grootegeluk mining area and access roads and to avoid sensitive areas, where possible.

See Section 5.1.3 for a discussion on the alternative layouts and their positive and negative impacts.

## 9.7 Possible mitigation measures and levels of risk

Refer to Section 7.17 for a summary of the potential impacts and risks that have been identified for the project. For a comprehensive description of recommended mitigation measures see Section 10.0 of this report.

Impacts identified during the environmental impact assessment and measures proposed to mitigate these impacts are set out in Table 61 to Table 63.

## 9.8 Motivation for not considering alternative sites

Not applicable. Alternative sites were considered as discussed in Section 5.0.

## 9.9 Statement motivating the preferred site location and site layout

The site and layout shown in Figure 5 and Figure 7 represents the best overall option as determined by environmental and cost considerations, as detailed in Section 5.0:

- **Environmental:** A number of pans are present in the areas originally reserved for infrastructure placement. The infrastructure layout was adjusted, where possible, to avoid some of the pans (Section 5.1.3); and
- **Cost:** The coal reserves and proposed mining area are located within the existing Grootegeluk mining right area. The proposed infrastructure to be established at surface in support of the coal mining operation includes haul roads connecting the proposed pits to the existing Grootegeluk Coal Mine operations. The interburden and coal mined from Pit 1 and Pit 2 will be transported to and handled at the existing Grootegeluk Coal Mine plants.

## 9.10 Process undertaken to identify, assess and rank impacts and risks imposed on preferred site

The process involved the assessment of impacts in accordance with South African regulatory requirements, best practice and guidelines as described in Section 0 of this report; public consultation as set out in

Section 6.0; assessment in accordance with methodologies described in Section 9.4 and an analysis of specialist investigations described in Section 0. Alternative infrastructure site locations and layouts or the preferred site were evaluated on the basis of the criteria set out in Section 5.1.

# 10.0 ENVIRONMENTAL IMPACT ASSESSMENT

The process involved impacts assessed in accordance with South African regulatory requirements, best practice and guidelines (domestic and international) as discussed in Section 0 of this report, public consultation as set out in Section 6.0, the methodologies described in Section 9.0 and the specialist investigations described in Section 10.0.

The proposed site layout has a potential to impact on some biophysical and socio-economic aspects of the local environment. One of the main purposes of the EIA process is to understand the significance of these potential impacts and to determine to what extent they can be minimised or mitigated. Based on experience with and past studies, supported by site-specific specialist studies, the impacts on the biophysical and socio-economic aspects can be predicted and appropriate mitigation measures can be formulated.

The EIA process for this project has been designed to comply with the requirements of the MPRDA and the EIA Regulations that commenced on 7 April 2017 (see Section 0). Cognisance has also been taken of the following key principles contained in the NEMA, which is South Africa’s framework environmental legislation:

- Sustainability – development that meets the needs of the present generation without compromising the ability of future generations to meet their own needs;
- Mitigation hierarchy – avoidance of environmental impact, or where this is not possible, minimising the impact and remediating the impact; and
- The duty of care of developers towards the environment.

The assessment of the impacts of the proposed Grootegeluk Turfvlakte Expansion Project opencast mining operations was conducted in accordance with these principles.

Based on the findings of the EIA, a comprehensive EMPr has been developed and should be implemented to control and minimise the impacts during construction, operation and decommissioning of the proposed mining operations.

## 10.1 Summary of Specialist Reports

A summary of the specialist reports that informed the impact assessment and final preferred site selection process is listed in Table 39.

**Table 39: Summary of Specialist reports**

| Specialist Studies Undertaken | Specialist recommendations that have been included in the EIA Report *(Mark with an X where applicable)* | Reference to applicable section of report where specialist recommendations have been included |
|---|---|---|
| Air Quality Assessment | X | Section 10.3.2, Table 66 to Table 68, APPENDIX H. |
| Noise Assessment | X | Section 10.3.10, Table 66 to Table 68, APPENDIX I. |
| Blasting and Vibration Assessment | X | Section 10.3.11, Table 66 to Table 68, APPENDIX J. |
| Visual Assessment | X | Section 10.3.12, Table 66 to Table 68, APPENDIX K. |
| Traffic Assessment | X | Section 10.3.13, Table 66 to Table 68, APPENDIX L. |
| Terrestrial Ecology and Protected Trees Assessments | X | Section 10.3.7, Table 66 to Table 68, APPENDIX M and APPENDIX N. |
| Wetland Assessment | X | Section 10.3.9, Table 66 to Table 68, APPENDIX O. |
| Soils, Land Use and Land Capability Assessment | X | Section 0, Table 66 to Table 68, APPENDIX P. |
| Cultural and Heritage Assessment | X | Section 10.3.14, Table 66 to Table 68, APPENDIX Q. |
| Palaeontological Assessment | X | Section 10.3.15, Table 66 to Table 68, APPENDIX R. |
| Socio-Economic Assessment | X | Section 10.3.16, Table 66 to Table 68, APPENDIX S. |

| Specialist Studies Undertaken | Specialist recommendations that have been included in the EIA Report *(Mark with an X where applicable)* | Reference to applicable section of report where specialist recommendations have been included |
|---|---|---|
| Groundwater Assessment | X | Section 10.3.6, Table 66 to Table 68, APPENDIX T. |
| Surface Water Assessment | X | Section 10.3.5, Table 66 to Table 68, APPENDIX U. |
| Greenhouse Gas Assessment | X | Section 10.3.17, APPENDIX V. |
| Rehabilitation and Closure | X | Section 14.0, APPENDIX W |
| Climate Change Assessment | X | Section 10.3.18, APPENDIX X |

## 10.2 Project Phases and Activities

The environmental impacts of the project were assessed for the:

- Pre-construction phase
- Construction phase
- Operational phase
- Decommissioning and Closure phase

Potential cumulative impacts were also identified and assessed, where applicable.

### 10.2.1 Pre-construction

The project is still in the pre-construction phase and will remain so until the DMRE grants an environmental authorisation. Until then, Exxaro will not undertake any physical project work on the site and will therefore not cause any environmental impacts.

### 10.2.2 Construction

The **Construction Phase** marks the beginning physical changes to the site. During this phase the following activities will take place:

- Surveying and pegging out of the construction areas for the open pits, haul roads, infrastructure laydown area and topsoil stockpile.
- Construction of the access road and stormwater management system (upslope diversion berms and clean water collection drains.
- Vegetation clearing, soil stripping and stockpiling.
- All earthworks required to prepare the infrastructure laydown area.

- Construction of project infrastructure as shown in Figure 7.
- Transportation and use of construction equipment.
- Topsoil removed prior to mining of the new area and stockpiled.
- Establishment of construction offices and other temporary infrastructure.
- Construction of haul roads; and
- Landscaping and re-vegetation of bare areas on the site.

It is anticipated that the construction phase will take approximately 12 to 15 months to complete.

### 10.2.3 Operation

The **Operational Phase** of the mine will include all the mining operations until the end of life of mine. Activities will comprise:

- Clearing and stockpiling of topsoil.
- Opencast pit mining.
- Coal and interburden handling and movement via haul trucks to Grootegeluk Coal Mine for beneficiation; and
- Overburden (hards and softs) will be loaded and transported to be placed on designated stockpiles at Grootegeluk Coal Mine.

The operational phase of the Grootegeluk Turfvlakte Expansion Project is expected to last 16 years if the preferred option is implemented and 7 years if the alternative option is implemented (see Section 2.5.2).

### 10.2.4 Decommissioning and Closure

The **Decommissioning and Closure Phase** will be in accordance with an agreed and approved closure plan for the proposed Grootegeluk Turfvlakte Expansion Project and could include:

- Demolition and removal of all surface infrastructure and disposal of rubble.
- Backfilling of the last opencast area with waste rock, overburden and stored topsoil, shaping and re-vegetating with locally indigenous plant species.
- Ripping and shaping all compacted areas to be free draining, followed by re-vegetation; and
- Re-vegetation of all bare areas on the project footprint with locally indigenous species.

Post-closure monitoring of environmental performance against the EMPr and permitting conditions for at least five years.

## 10.3 Findings of the Environmental Impact Assessment Studies

The sections below provide an assessment of each identified potentially significant impact and risk in relation to the abovementioned project phases. The assessment was undertaken in line with the impact assessment methodology detailed in Section 9.4.

### 10.3.1 Geology

#### *10.3.1.1 Construction*

Construction associated with the proposed mining activities will disturb only the near surface geology in a relatively small area and the impact is assessed as being of ***low (SP = 25)*** significance. No mitigation is possible during the construction stage.

#### *10.3.1.2 Operation*

Benches 9A and B and Bench 11 will be mined during the operational phase, resulting in a permanent impact of ***high (SP = 80)*** significance on the geology of the project area.

#### *10.3.1.3 Decommissioning and Closure*

The closure and rehabilitation phase will have no impact on the geology of the project area ***(SP = 0)***.

### 10.3.2 Air Quality

The assessment below is based on the air quality assessment attached as APPENDIX H.

#### *10.3.2.1 Standards and Guidelines*

The South African ambient air quality standards for common pollutants prescribe the allowable ambient concentrations of pollutants which are not to be exceeded during a specified time period in a defined area (Table 40). If the standards are exceeded, the ambient air quality is defined as poor and potential adverse health impacts may occur over time.

**Table 40: South African Ambient Air Quality Standards for Criterial Pollutants**

| Pollutant | Averaging Period | Limit Value ($\mu g/m^3$) | Limit Value (ppb) | Frequency of Exceedance | Compliance Date |
|---|---|---|---|---|---|
| $SO_2$ (a) | 10 minute | 500 | 191 | 526 | Immediate |
| | 1 hour | 350 | 134 | 88 | |
| | 24 hours | 125 | 48 | 4 | |
| | 1 year | 50 | 19 | 0 | |
| $NO_2$ (b) | 1 hour | 200 | 106 | 88 | |
| | 1 year | 40 | 21 | 0 | |
| $PM_{10}$ (c) | 24 hour | 75 | - | 4 | |
| | 1 year | 40 | - | 0 | |
| $PM_{2.5}$ (d) | 24 hours | 40 | - | 4 | 01/01/2016 – 31/12/2029 |
| | 24 hours | 25 | - | 4 | 01/01/2030 |

| Pollutant | Averaging Period | Limit Value ($\mu g/m^3$) | Limit Value (ppb) | Frequency of Exceedance | Compliance Date |
|---|---|---|---|---|---|
| | 1 year | 20 | - | 0 | 01/01/2016 – 31/12/2029 |
| | 1 year | 15 | - | 0 | 01/01/2030 |
| $O_3$ (e) | 8 hours (running) | 120 | 61 | 11 | Immediate |
| Lead (Pb) (f) | 1 year | 0.5 | - | 0 | |
| CO (g) | 1 hour | 30,000 | 26,000 | 88 | |
| | 8 hour (calculated on 1 hourly averages) | 10,000 | 8,700 | 11 | |
| Benzene ($C_6H_6$) (h) | 1 year | 5 | 1.6 | 0 | |

a. *The reference method for the analysis of $SO_2$ shall be ISO 6767*
b. *The reference method for the analysis of $NO_2$ shall be ISO 7996*
c. *The reference method for the determination of the particulate matter fraction of suspended particulate matter shall be EN 12341*
d. *The reference method for the analysis of $PM_{2.5}$ shall be EN14907*
e. *The reference method for the analysis of ozone shall be the UV photometric method as described in ISO 13964*
f. *The reference method for the analysis of lead shall be ISO 9855*
g. *The reference method for analysis of CO shall be ISO 4224*
h. *The reference methods for benzene sampling and analysis shall be either EPA compendium method TO-14 A or method TO-17*

### 10.3.2.2 National Dust Control Regulations

On 1 November 2013, the National Dust Control Regulations were promulgated under the NEMAQA and published in the Government Gazette No. 36974. The dust fall standard defines acceptable dust fall rates in terms of the presence of residential areas (Table 41).

**Table 41: Acceptable dust fall rates**

| Restriction areas | Dust fall rate ($mg/m^2/day$ over a 30-day average) | Permitted frequency of exceedance |
|---|---|---|
| Residential areas | Dust fall < 600 | Two per annum (not in sequential months) |
| Non-residential areas | 600 < Dust fall < 1200 | Two per annum (not in sequential months) |

The Grootegeluk Turfvlakte Expansion Project will not require an atmospheric emission licence for its proposed operations, but it will have to operate within the NAAQS and the National Dust Control Regulations, as is the case with the existing Grootegeluk Coal Mine operations.

It is important to note that, unlike $PM_{10}$ and $PM_{2.5}$ particles, dust fall constitutes a nuisance and not a health risk, as the coarser particles are trapped by the mucous membranes in the respiratory system and do not reach the lungs. They also settle within a few metres of the emission source under calm atmospheric conditions, whereas the finer particles can remain airborne for long periods and travel long distances.

#### 10.3.2.3 Construction

The degeneration of the ambient air quality due to increased nuisance dust and fine particulate levels is likely to occur as a result of land clearing, ground excavation and materials handling activities (tipping, loading and offloading) associated with the construction of the Turfvlakte infrastructure. Daily dust emissions will vary according to the level of activity, the type of operation and the meteorological conditions. The construction phase impacts may be intense however short-lived and largely limited to the immediate vicinity of the activity. Elevated ambient dust concentrations are generally considered to be a nuisance, however health impacts such as allergic inflammatory reactions, nasal congestion, and respiratory problems may be triggered in vulnerable individuals.

It is for these reasons; the impact is likely to have an impact of ***moderate (SP = 36)*** significance on nearby receptors (e.g. Manketti Lodge, owned by Exxaro). By implementing the following mitigation measures, these impacts may be reduced to one of ***low (SP = 27)*** significance:

- Contractors should take preventative measures to minimise complaints regarding dust nuisances (e.g. screening, dust control, timing, pre-notification of Interested and Affected Parties (I&APs));
- Wet suppression during materials handling activities.
- Wind speed reduction through sheltering (where possible).
- Wet suppression on construction access roads.
- Speed control.
- Avoidance of dust track-on onto paved routes used to transport construction materials; and
- Parking construction vehicles off travelled roadways.

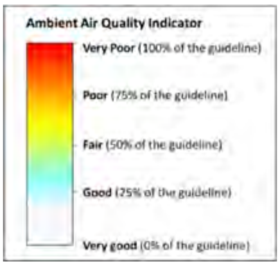
#### 10.3.2.4 Operation

Dust and fine particulate emissions are the key pollutants of concern. Dispersion simulations show that while the dust emission levels associated with the cumulative mine and rehabilitation activities are high, dust falls out rapidly, decreasing significantly with distance from the activity. Dust fallout levels at all receptors are predicted to remain low (i.e. < 30%) the residential area limit (600 mg/m$^2$/day) in both the mitigated and unmitigated cases (Table 42, Figure 53, Figure 54).

Fine particulate matter ($PM_{10}$) emissions are capable of greater dispersion. Maximum short term (daily average) $PM_{10}$ concentrations at surrounding receptors[4] are predicted to exceed the NAAQS (Table 42, Figure 55 - Figure 60). These exceedances are however considered infrequent (i.e. occurring fewer than 4 days per year). This is reflected in the long term (annual average) fine particulate concentrations which are predicted to remain below 70% the NAAQS at all receptor locations. It is for these reasons; the cumulative operations are likely to have an impact of ***high (SP = 64)*** significance on surrounding receptors before mitigation.

[4] Manketti Lodge, Goedehoop 4570, Graaffwater 4562, Massenberg 3050, Hooikraal 3150. Buffelsjagt 3170, and Tierkop NR/ Vergulde Helm 3210

**Table 42: Results of the cumulative dispersion simulation.**




| | Dust fallout mg/m$^2$/day | | PM$_{10}$ (µg/m$^3$) | | | | |
|---|---|---|---|---|---|---|---|
| | | | 24 hour (daily) | | Annual | | |
| | Unmitigated) Figure 53 | Mitigated Figure 54 | Unmitigated) Figure 55 | Mitigated Figure 56 | Unmitigated Figure 59 | Mitigated Figure 60 | |
| ***NAAQS*** | ***600*** | ***600*** | ***75*** | ***75*** | ***40*** | ***40*** | ***Receptor*** |
| MAN | 105.2 | 44.3 | 165.1 | 69.5 | 13.6 | 5.7 | Manketti Lodge |
| VIL | 31.7 | 13.3 | 48.2 | 20.3 | 3.5 | 1.5 | Village |
| DIT | 17.1 | 7.2 | 25.7 | 10.8 | 1.6 | 0.7 | Ditheku Primary |
| MAR | 15.0 | 6.3 | 26.0 | 10.9 | 1.7 | 0.7 | Marapong Private Hospital |
| NEL | 11.8 | 5.0 | 23.0 | 9.7 | 1.4 | 0.6 | Nelson Skop Primary |
| SED | 4.1 | 1.7 | 15.2 | 6.4 | 0.8 | 0.3 | Sedibeng School for the Deaf |
| FAR | 13.9 | 5.9 | 28.2 | 11.9 | 2.0 | 0.8 | Farmhouse NE |
| GOE | 103.2 | 43.4 | 157.0 | 66.1 | 23.2 | 9.8 | Goedehoop 4570 |
| GRA | 67.4 | 28.4 | 130.9 | 55.1 | 16.9 | 7.1 | Graaffwater 4562 |
| ELA | 10.9 | 4.6 | 30.9 | 13.0 | 4.2 | 1.8 | Elandsbosch 2601 |
| MAS | 32.3 | 13.6 | 53.2 | 22.4 | 9.9 | 4.2 | Massenberg 3050 |
| HOO | 158.6 | 66.8 | 107.8 | 45.4 | 26.0 | 10.9 | Hooikraal 3150 |
| BUF | 120.5 | 50.7 | 82.6 | 34.8 | 18.0 | 7.6 | Buffelsjagt 3170 |
| TIE | 159.0 | 66.9 | 111.6 | 47.0 | 28.4 | 11.9 | Tierkop NR/ Vergulde Helm 3210 |
| KRO | 35.3 | 14.9 | 44.3 | 18.6 | 6.4 | 2.7 | Kromdraai 6900 |
| WEL | 9.8 | 4.1 | 18.2 | 7.7 | 1.7 | 0.7 | Wellington 5190 |
| HAN | 20.6 | 8.6 | 47.4 | 19.9 | 3.2 | 1.3 | Hanglip 5083 |

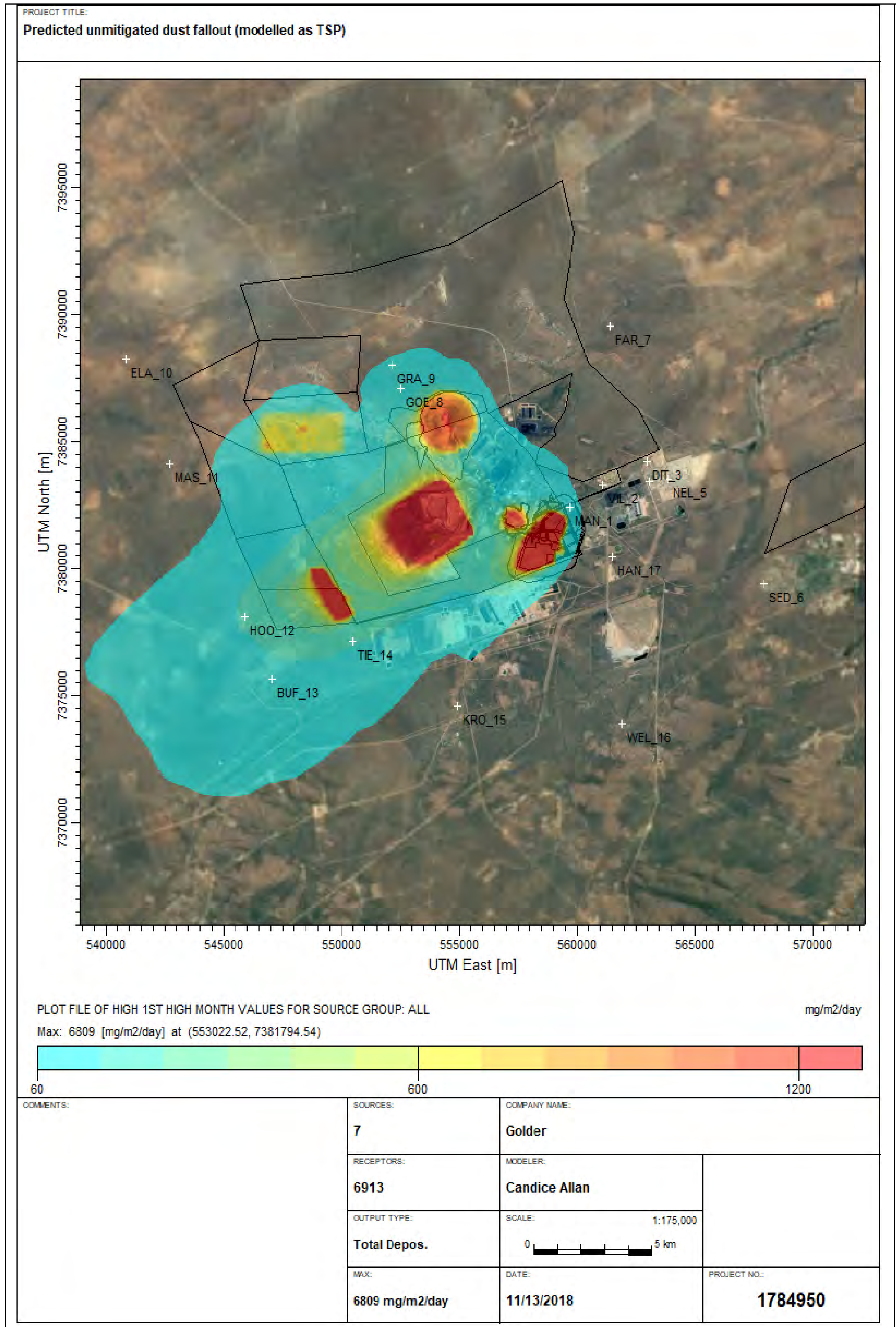



**Figure 53: Cumulative predicted unmitigated dust fallout (mg/m²/day) (modelled as TSP) from all mining operations**

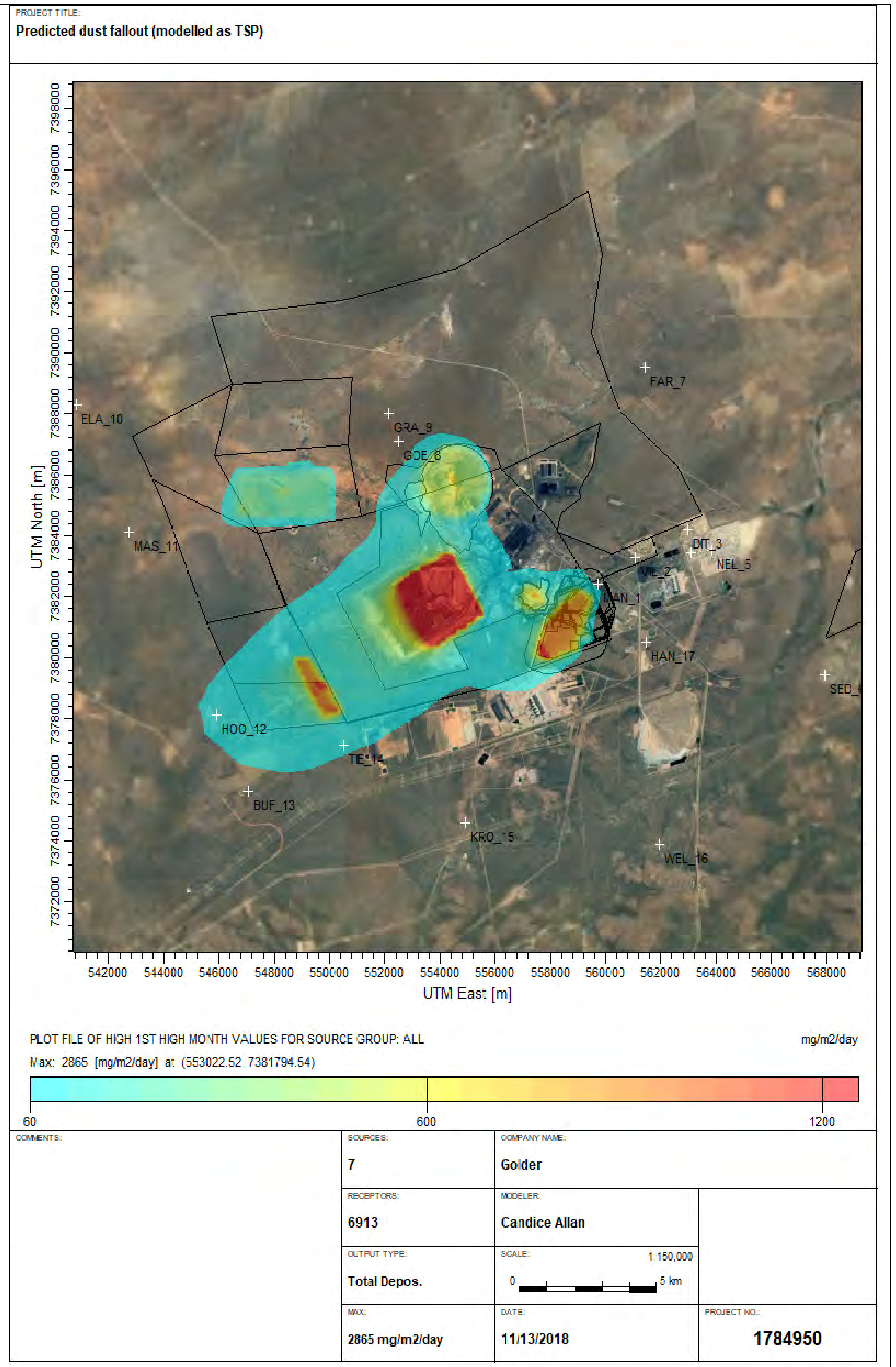



**Figure 54: Cumulative predicted mitigated dust fallout(mg/m²/day) (modelled as TSP) from all mining operations**

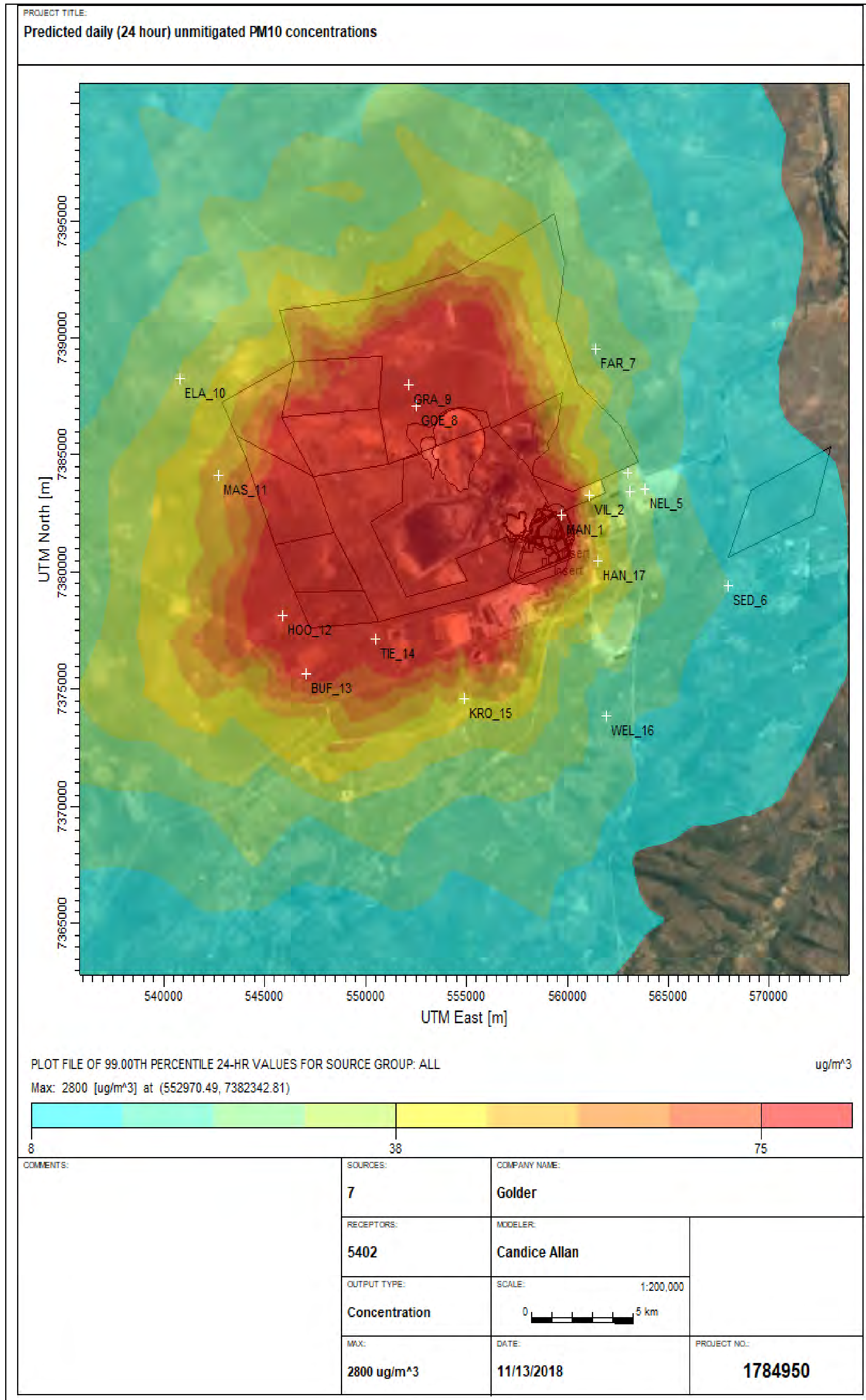



**Figure 55: Cumulative predicted unmitigated daily average PM₁₀ concentrations from all mining operations (ug/m^3)**

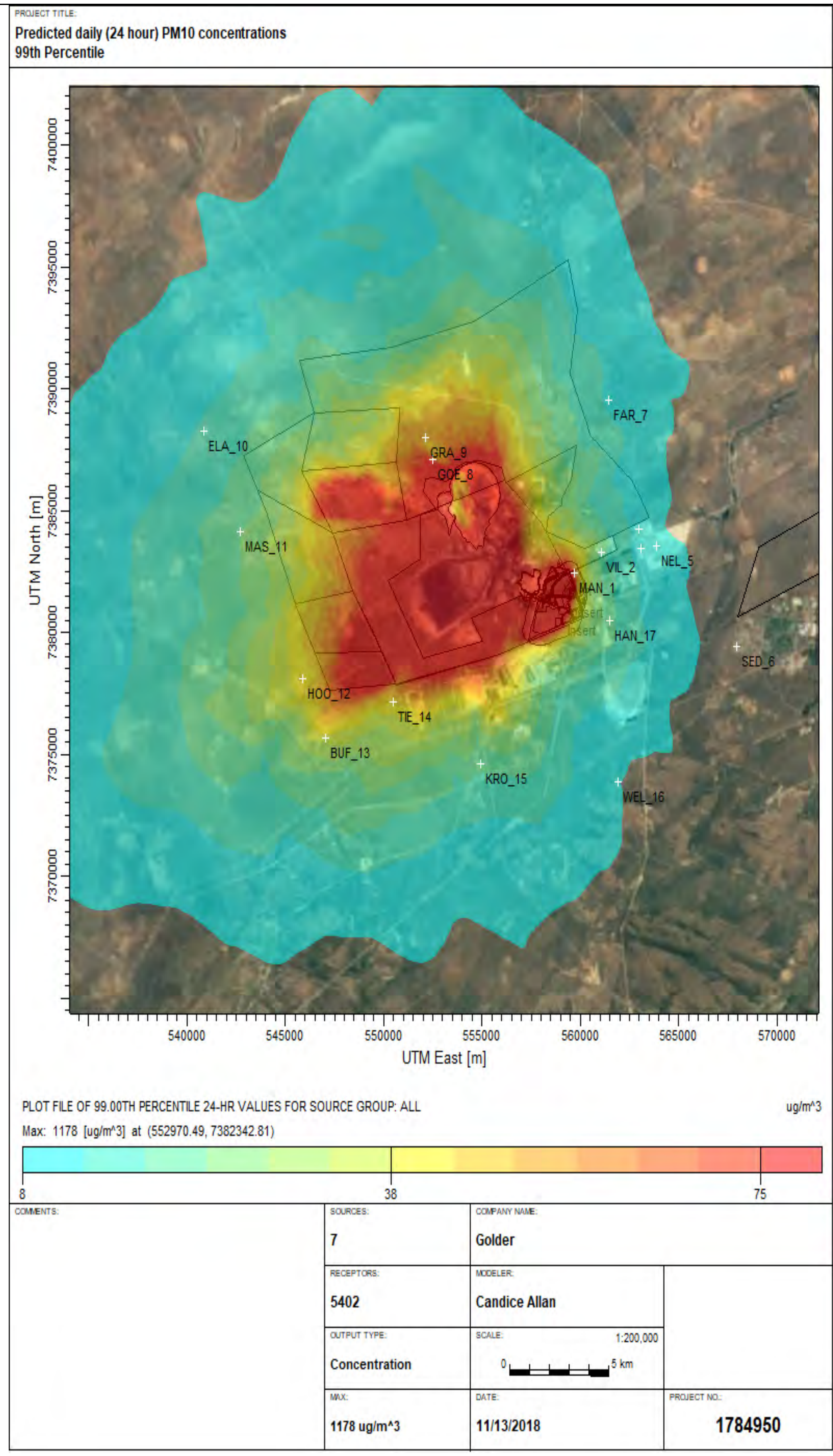



**Figure 56: Cumulative predicted mitigated daily average PM₁₀ concentrations from all mining operations (ug/m^3)**

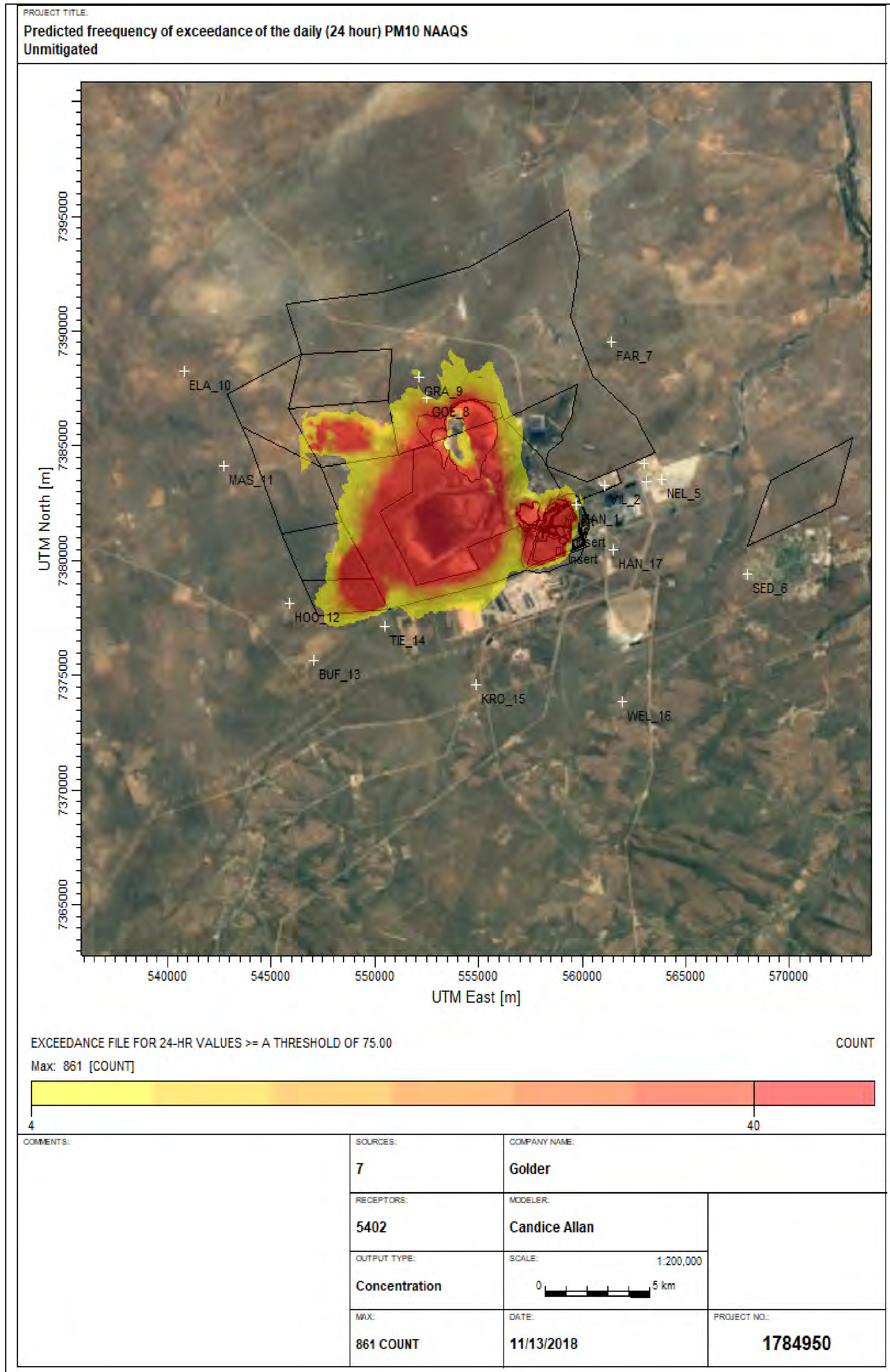



**Figure 57: Cumulative predicted frequency of exceedance of the daily average $PM_{10}$ NAAQS (unmitigated case) resulting from all mining operations**

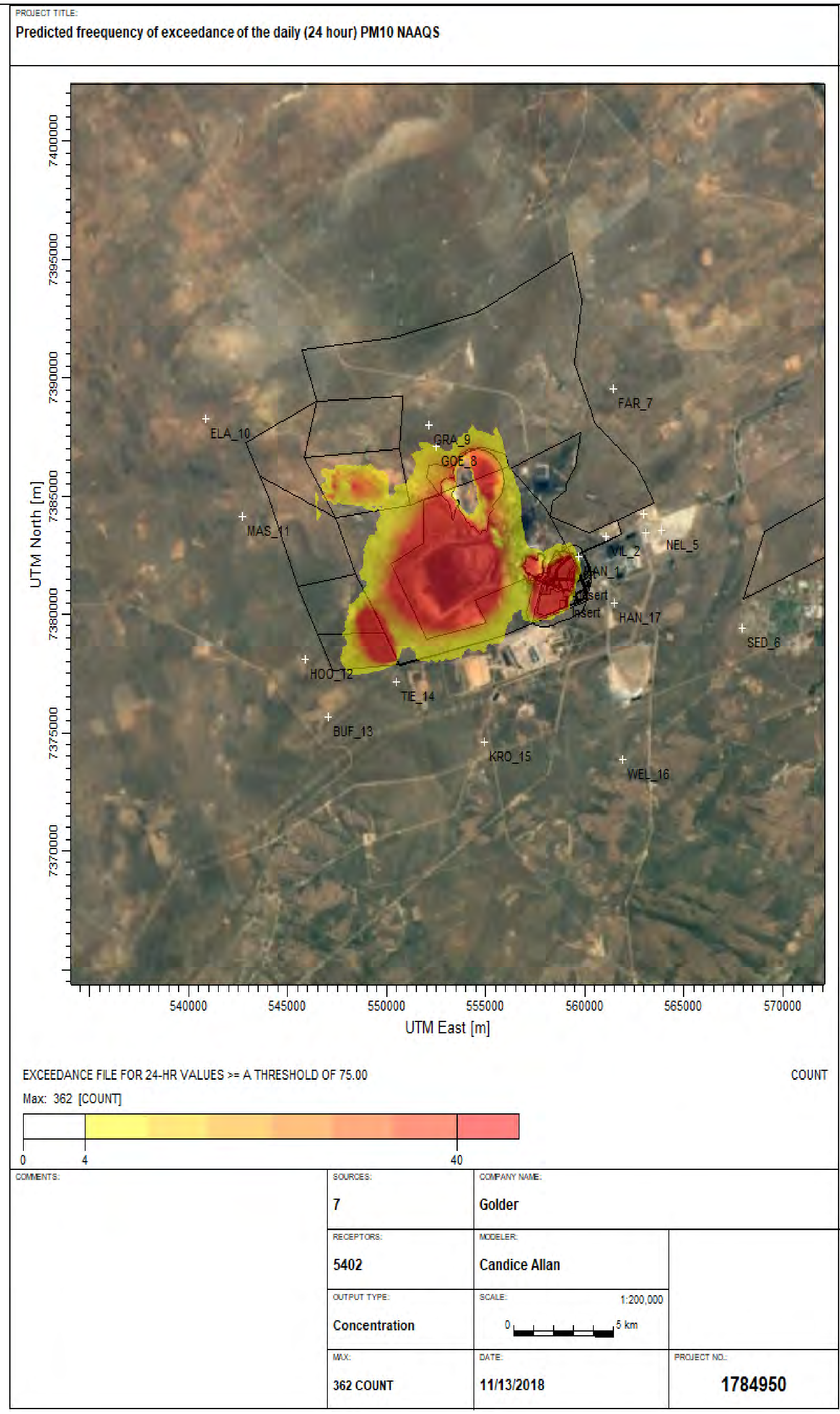



**Figure 58: Cumulative predicted frequency of exceedance of the daily average $PM_{10}$ NAAQS (mitigated case) from all mining operations**

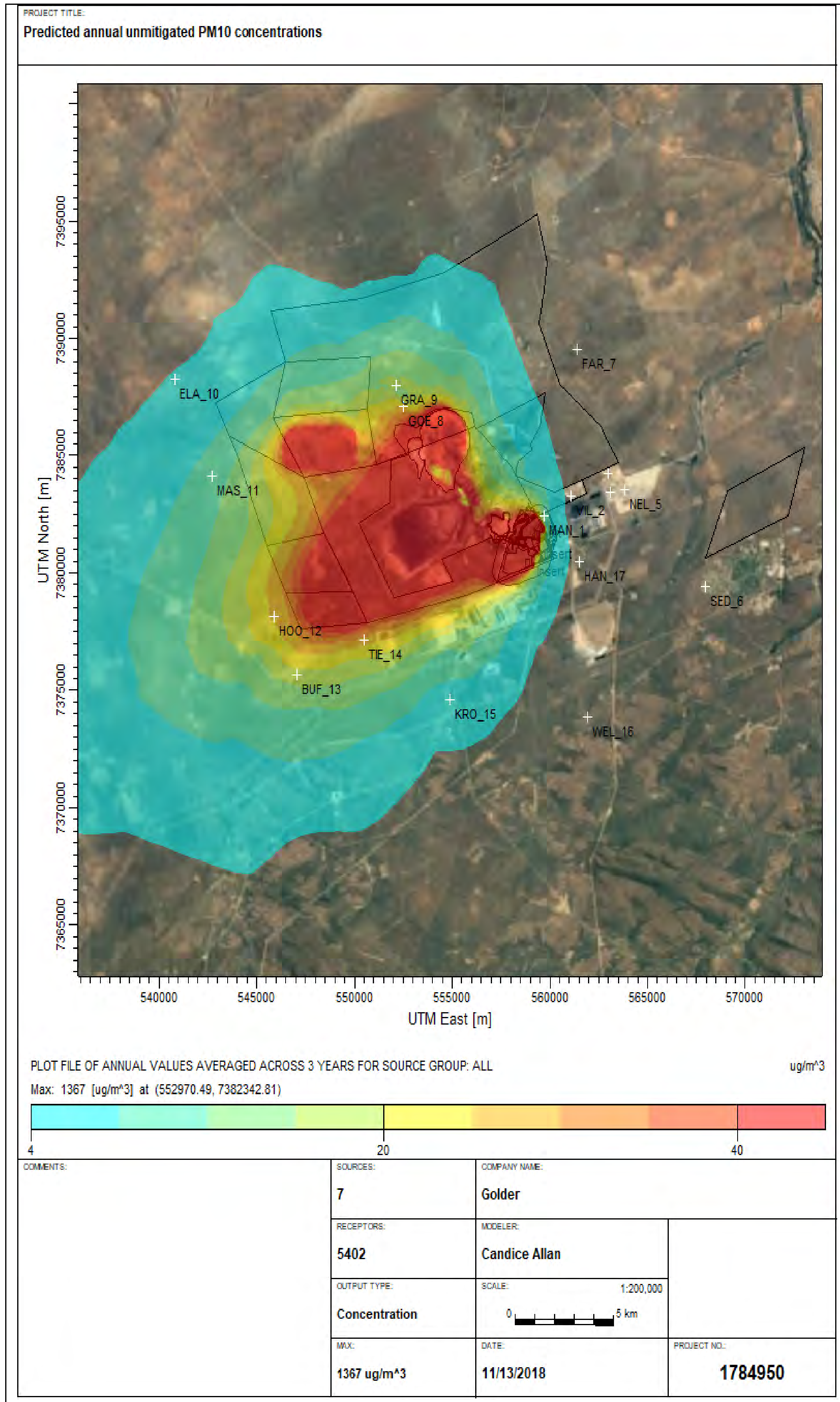



**Figure 59: Cumulative predicted unmitigated annual average $PM_{10}$ concentrations from all mining operations (ug/m^3)**

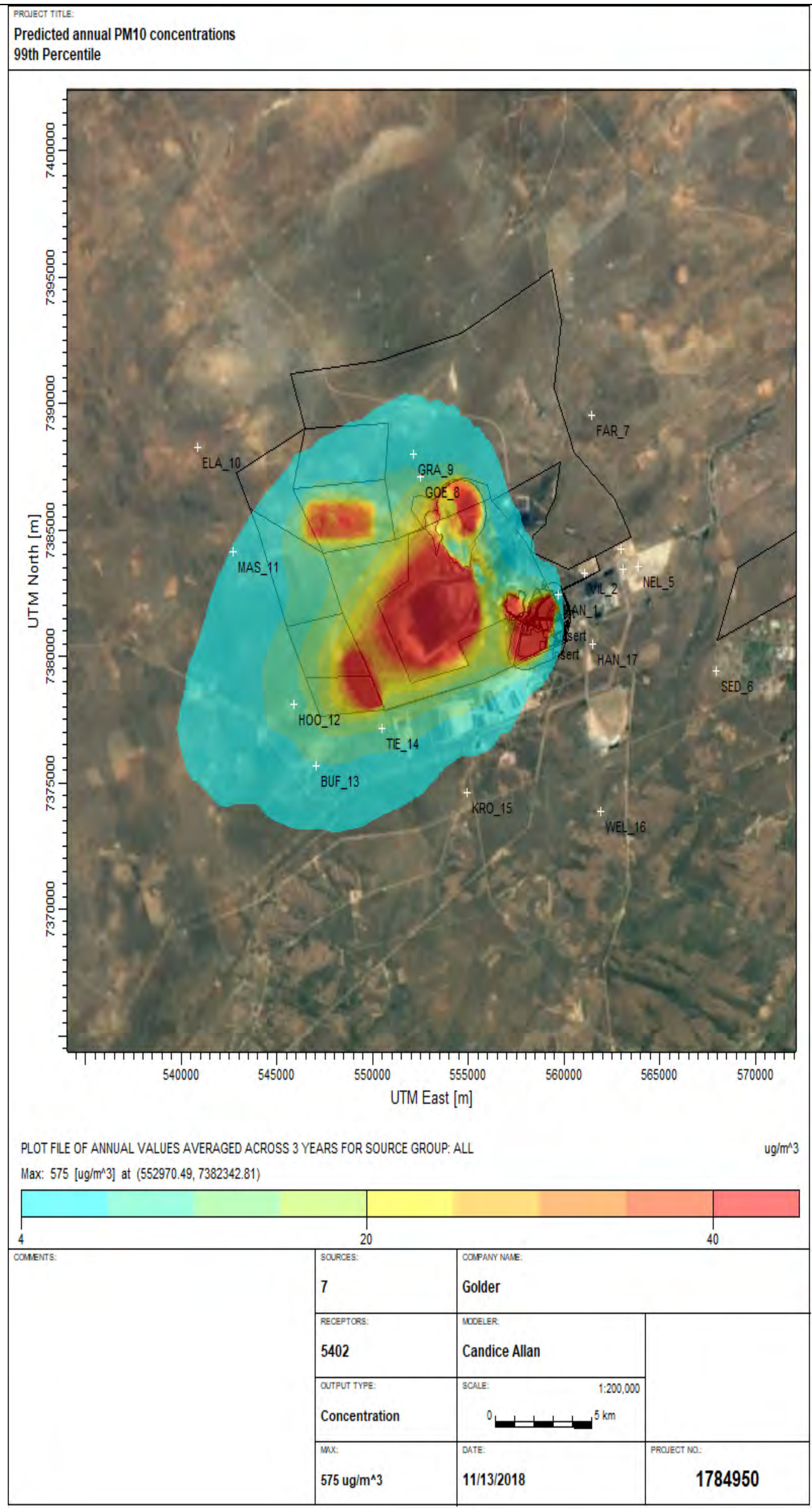



**Figure 60: Cumulative predicted mitigated annual average $PM_{10}$ concentrations from all mining operations (ug/m^3)**

While the impact of daily $PM_{10}$ emissions remains high at nearby receptors (Manketti Lodge, Goedehoop 4570 and Graaffwater 4562), concentrations will be notably reduced with the implementation of mitigation measures. In the mitigated case, concentrations are predicted to remain below the NAAQS at all selected receptors and are therefore anticipated to have an impact of ***moderate (SP = 44)*** significance.

Several control measures have the potential to significantly decrease dust and $PM_{10}$ emissions:

- Wet dust suppression on haul roads (~50% reduction in activity's emissions).
- Wet dust suppression on stockpiles, especially during the dry months (~50% reduction in activity's emissions).
- Reducing tipping heights and speeds from vehicles (~30% reduction in activity's emissions).
- Regular clean-up at loading areas to prevent further entrainment by wind or vehicles.
- Covering of WRD and stockpile surfaces with less erodible aggregate material (~70% reduction in activity's emissions).
- Implementing progressive revegetation (~90% reduction in activity's emissions).

#### 10.3.2.5 Decommissioning and Closure

Decommissioning of the Turfvlakte mine infrastructure will result in dust and fine particulate emissions associated with land clearing and materials/waste loading and offloading. These impacts are anticipated to be restricted to the site and will cease once the activity ceases; it will therefore be of ***moderate (SP = 36)*** significance.

Revegetation schemes during mining and post-closure should aim to return the vegetation cover to its pre-mining state or alternative acceptable sustainable land use. Dust and particulate emissions will return to natural levels once the open/ exposed areas are revegetated. By implementing the following mitigation measures during the decommissioning and closure activities, the short-term impacts can be reduced to an impact of ***low (SP = 27)*** significance:

- Contractors should take preventative measures to minimise complaints regarding dust nuisances (e.g. screening, dust control, timing, pre-notification of Interested and Affected Parties (I&APs)).
- Wet suppression during materials handling activities.
- Wind speed reduction through sheltering (where possible).
- Wet suppression on construction access roads.
- Speed control.
- Avoidance of dust track-on onto paved routes used to transport rehabilitation materials; and
- Parking construction vehicles off travelled roadways.

## 10.3.3 Topography

### *10.3.3.1 Construction*

Excavation of the storm water management channels and the construction of the diversion berms, office and workshops will result in topographical changes of ***moderate (SP = 40)*** significance, which cannot be mitigated. The changes will be reversible during decommissioning and closure.

### *10.3.3.2 Operation*

Opencast mining usually results in permanent topographical changes of ***high (SP = 70)*** significance by leaving behind large mining voids and stockpiles. For the Grootegeluk Turfvlakte Expansion Project, a topsoil stockpile will be present. The rollover mining method, by continuous backfilling and rehabilitation, will result in much smaller topographical changes over the life of the mine, thereby reducing the impact to one of ***moderate (SP = 40)*** significance.

### *10.3.3.3 Decommissioning and Closure*

A significant materials deficit will exist at closure, meaning that neither the open pits will be fully backfilled, leaving two large permanent voids having a permanent impact of ***high (SP = 70)*** impact after mine closure.

## 10.3.4 Soils, Land Use and Land Capability

The assessment below is based on the soil, land use and land capability assessment included in APPENDIX P.

### *10.3.4.1 Construction*

The construction activities described in Section 10.2.2 could lead to the potential impacts listed in Table 43, resulting in an overall impact of ***high (SP = 80)*** significance.

**Table 43: Anticipated activities and related soil and land use impacts for the construction phase**

| Anticipated activities | Potential effect on soil and land use |
|---|---|
| Vegetation clearance as project infrastructure are constructed | ■ Loss of **arable land** with land with medium agricultural potential<br>■ Loss or modification of current **land use** in areas of infrastructure development<br>■ Loss of soils through **erosion**<br>■ Loss of **soil nutrients** as a results of vegetation stripping<br>■ Loss of **soil organic matter** during vegetation stripping. |
| Topsoil stockpiling | ■ Loss of soils through **erosion**, particularly for topsoil stockpiles with unvegetated steep slopes<br>■ Homogenization of soil profiles, i.e. **loss of characteristic horizons.**<br>■ Loss and/or **reduction in soil biodiversity** in stockpiled soil.<br>■ Loss of **soil nutrients**, particularly for unvegetated topsoil stockpiles.<br>■ Loss of **soil organic matter** due to increased aeration (caused by soil disturbance) and subsequent organic matter decomposition. |

| Anticipated activities | Potential effect on soil and land use |
|---|---|
| | ■ **Modification** of existing **landscape** and **hydrological regimes**. |
| Construction of access roads, haul roads, stockpile area, laydown areas and substation | ■ **Burial of soil** / covering of soils by camp accommodation facility, haul roads, mine waste facilities and processing plant.<br>■ **Soil compaction** in areas where active heavy machinery will be mobilised for the development of the accommodation facility, mine infrastructure and associated utilities.<br>■ Increased run-off (and **erosion**) in compacted areas and **modification of natural infiltration**.<br>■ **Soil contamination** from hydrocarbon and chemical spills including sterilisation by cement pollutants. |
| Transportation and use of equipment | ■ Increased **soil compaction** and run-off at equipment and machinery laydown areas.<br>■ **Soil contamination** from hydrocarbon spills at equipment and machinery laydown areas; and vehicle workshop. |

The following mitigation measures are recommended to reduce the overall impact to one of ***moderate (SP = 60)*** significance:

- Procedures on land clearance, soils handling and rehabilitation plan to be adhered to.
- Ensure that the results from the pre-mining soil survey are used effectively for the stripping phase to lead to optimal stockpiling.
- Ensure that there is participation by a soil scientist in the stripping and stockpiling process.
- Limit vehicle traversing on stockpiles.
- Implement concurrent rehabilitation measures for soils and protect soil stockpiles from erosion by utilising soils erosion procedures.
- Minimise stockpile height to <3 m.
- Re-use stockpiled soil within as short a period as possible (within 3-5 years).
- Strip and stockpile soils from seasonal pans separately, ideally in a similar landscape position was its origin, i.e. valley bottom
- Final Project infrastructure, laydown and access areas will be clearly indicated in final construction plans provided to contractors/employees. The plans will consider environmental (soils) constraints.
- Access roads (etc.) will be planned to avoid sensitive areas.

- Contractors (in particular heavy machinery) will be restricted to designated areas as defined by the Environmental Department.
- Tracked vehicles will be utilised in soil clearance activities as per soil stripping and handling procedures.
- The extent of the fenced area will be minimised.
- Procedures on land clearance, soils handling and rehabilitation plan to be adhered to. Pre-clearance permits will be required prior to site clearance activities, which will be monitored by environmental personnel.
- All vehicles and machinery shall be kept in good working order and inspected on a regular basis for possible leaks and shall be repaired as soon as possible, if required.
- Repairs shall be carried out in a dedicated repair area only, unless in-situ repair is necessary as a result of a breakdown.
- Drip trays shall at all times be placed under vehicles that require in-situ repairs.
- Drip trays shall be emptied into designated containers only and the contents disposed of at a licenced hazardous material disposal facility.
- Develop detailed procedures for spills containment and soils clean up.
- Ensure proper handling of hazardous chemicals and materials (e.g. fuel, oil, cement, concrete, reagents, etc.) as per their corresponding Safety Data Sheets (SDS).
- Accidental spills (concrete, chemicals, process water, hydrocarbons, waste) need to be reported immediately so that effective remediation and clean-up strategies and procedures can be implemented; and
- Soil that is contaminated by fuel or oil spills, for example, from vehicles, will be collected to be treated at a pre-determined and dedicated location, or will be treated in situ, using sand, soil or cold coal-ash as absorption medium, or disposed at a certified hazardous waste site.

#### 10.3.4.2 Operation

The operational phase activities (Section 10.2.3) that could impact on the soils in the project area are listed in **Table 44**. Unmitigated, these could have an impact of ***high (SP = 80)*** significance.

**Table 44: Anticipated activities and related soil and land use impacts for the operational phase**

| Anticipated activities | Potential effect on soil and land use |
|---|---|
| Open pit development<br>Drilling and blasting | ■ Change in Land use<br>■ Soil disturbance due to excavation activities at pit location as well as in surrounding soils.<br>■ Loss of potentially arable land.<br>■ Modification of natural soil hydrological regimes.<br>■ *Potential effects on soil and land use with the development of the open pit may be similar to what is anticipated for construction phase.* |

| Anticipated activities | Potential effect on soil and land use |
|---|---|
| Hauling of coal and waste rock for storage in their respective storage facilities. | ■ **Soil contamination** from hydrocarbon spills from vehicles; and<br>■ **Soil contamination** from spillage/poor handling of product and waste rock outside the designated areas. |
| Progressive rehabilitation of facilities and areas which are no longer in use | ■ **Soil disturbance** due to earth moving activities.<br>■ **Loss of soil organic matter** due to increased aeration (caused by soil disturbance) and subsequent organic matter decomposition. |
| Transportation (hauling) of product and waste rock | ■ **Soil contamination** from spillage/poor handling of product and waste rock outside the designated areas. |
| Transportation and use of equipment | ■ Increased **soil compaction** and run-off at equipment and machinery laydown areas.<br>■ **Soil contamination** from hydrocarbon spills at equipment and machinery laydown areas; and vehicle workshop; |

The impact can be reduced to one of ***low (SP = 22)*** by implementing the following mitigation measures:

- Implement suitable measures on/around mining infrastructure to minimise soil contamination by controlling seepage and runoff.
- Ensure proper handling of hazardous chemicals and materials (e.g. fuel, oil, cement, concrete, reagents, etc.) as per their corresponding Safety Data Sheets (SDS).
- Implementing regular site inspections for materials handling and storage.
- Accidental spills (concrete, chemicals, process water, hydrocarbons, waste) need to be reported immediately so that effective remediation and clean-up strategies and procedures can be implemented.
- Soil that is contaminated by fuel or oil spills, for example, from vehicles, will be collected to be treated at a pre-determined and dedicated location, or will be treated in situ, using sand, soil or cold coal-ash as absorption medium or disposed at a certified hazardous waste site.

#### 10.3.4.3 Decommissioning and Closure

The decommissioning and closure activities described in Section 10.2.4 could lead to the potential impacts listed in **Table 45**, resulting in an overall impact of ***high (SP = 70)*** significance.

**Table 45: Anticipated activities and related soil and land use impacts for the decommission and closure phase**

| Anticipated activities | Potential effect on soil and land use |
|---|---|
| Removal of redundant infrastructure | ■ Spillage of chemical solutions during the dismantling of plant equipment, pipelines or pumps which were in contact with chemicals solution may **contaminate the soils**;<br>■ Spillage of diesel, oils and greases from the dismantled plant equipment, resulting in hydrocarbon contamination of exposed soils. (**soil contamination**) |
| Backfilling of Turfvlakte Pits | ■ Spilling of backfill material during haulage outside the designated areas. (**soil contamination**) |
| Grading of project site to ensure long-term drainage conditions on site | ■ **Soil compaction** in areas where active heavy machinery will be mobilised for the shaping of the final landform; and<br>■ **Loss of soil organic matter** due to increased aeration (caused by soil disturbance) and subsequent organic matter decomposition. |
| Soil placement and revegetation of project site, including reinstatement of seasonal pans | ■ Soil handling to convey soil from topsoil stockpile to project site for surface rehabilitation activities, may result in **degradation of soil quality** due to soil disturbance.<br>■ **Contamination** of soil by handling of soil with contaminated earth moving machinery (machinery previously used for handling mine waste such as waste rock or tailings material). |

By impacting the mitigation measures listed below, the residual impact can be reduced to one of ***moderate (SP = 33)*** significance.

- Ensure proper handling of hazardous chemicals and materials (e.g. fuel, oil, cement, concrete, reagents, etc.) as per their corresponding Safety Data Sheets (SDS);
- Dismantling of plant equipment and machinery should be carried out in designated appropriate facilities fitted with spillage containment, floors and sumps to capture any fugitive oils and greases.
- Conduct soil assessment to determine post decommissioning/closure soil quality on rehabilitated infrastructural footprint.
- Ensure proper handling and transportation of backfill material.
- Re-use stockpiled soil within as short a period as possible (within 3-5 years).

- Use appropriate soil handling machinery (NOT heavy earth moving equipment used for mining operations) to minimize compaction.
- Limit vehicle traversing on both stockpiles and rehabilitated areas as far as possible.
- Prepare rehabilitated areas properly and monitor regularly.
- Ensure that the newly created soil profile is free draining (except in re-instated seasonal pan areas); and
- Consider topsoil cover thickness similar to pre-mining topsoil depths (60% of project footprint has an average topsoil thickness of 20 cm). Stockpile topsoil and subsoil horizons separately and maintain stockpile soil quality.

### 10.3.5 Surface water

The assessment below is based on the surface water assessment attached as APPENDIX U.

#### *10.3.5.1 Stormwater Management*

The storm water management plan for the project was designed in accordance with the requirements of Regulation 704 of the NWA, as explained in Section 3.3. However, the mine has also requested that the stormwater management plan meet the Environmental, Health and Safety (EHS) Guidelines set by the World Bank Group. These guidelines state that permanent independent drainage installations should be designed so that they are not likely to spill more than once in 100 years (Golder, 2020c).

Therefore, the clean and dirty water catchments were identified based on the future land uses and mine layout. The surface water runoff originating from these areas were kept separate, with the clean water runoff being diverted into the environment and the dirty water being collected on-site. The stormwater channels were sized for the 1 in 100-year recurrence interval, 24-hour duration storm flood peaks; the channels were then checked against the 1 in 50-year recurrence interval, 24-hour duration storm.

Figure 61 illustrates the storm water management plan for the prosed Grootegeluk Turfvlakte Expansion Project mining infrastructure.

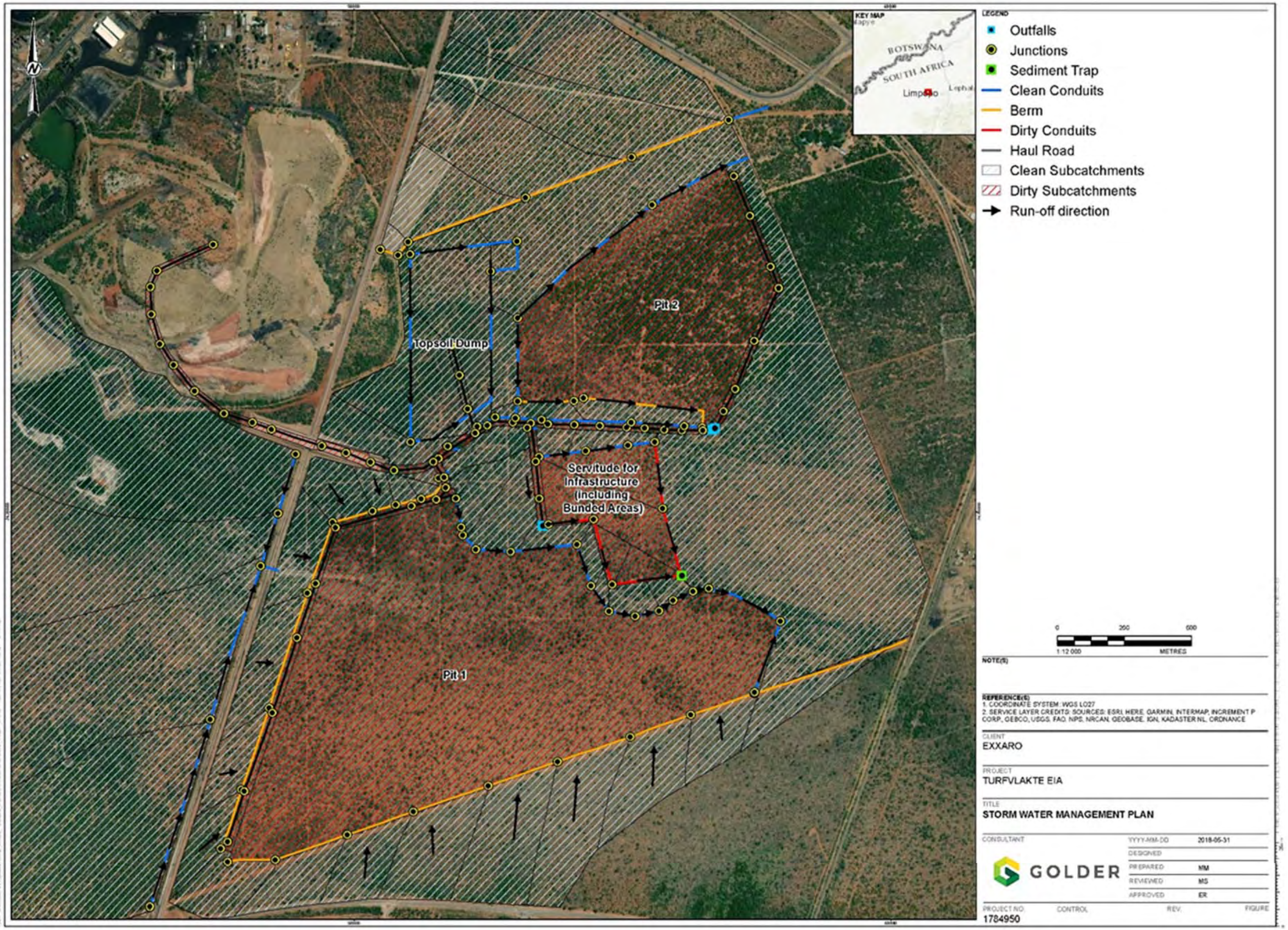



**Figure 61: Stormwater Management Plan**

### *10.3.5.2 Water Balance*

A high-level conceptual water balance was developed for the Grootegeluk Turfvlakte Expansion Project, taking into consideration the interconnection in terms of water management between the Grootegeluk Coal Mine and the project.

#### 10.3.5.2.1 Groundwater Ingress

Groundwater ingress data used in the model was supplied by GCS (refer to Groundwater Report in APPENDIX T) and is presented in Figure 62 and Figure 63.

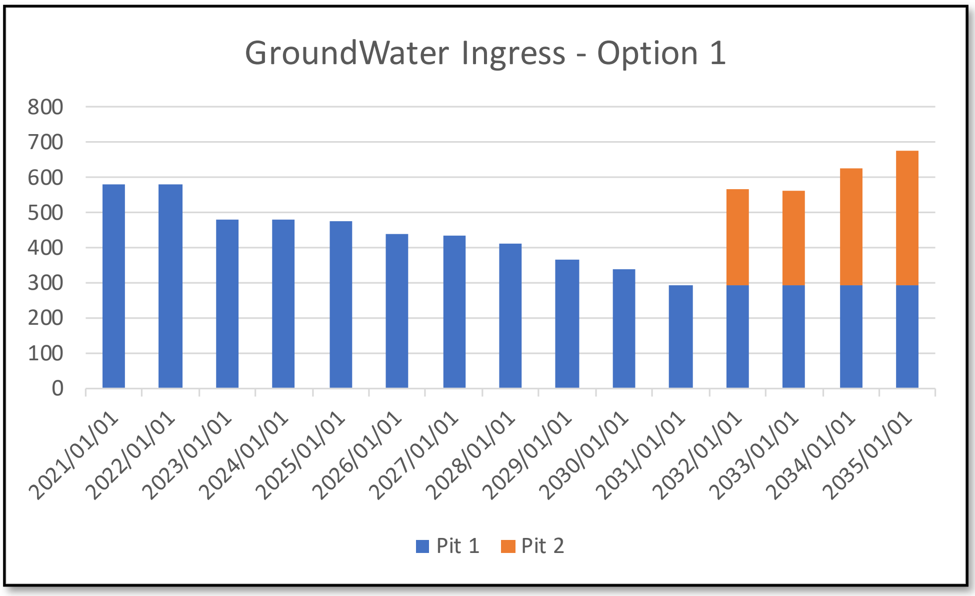



**Figure 62: Simulated groundwater ingress obtained for option 1 ($m^3$/day)**

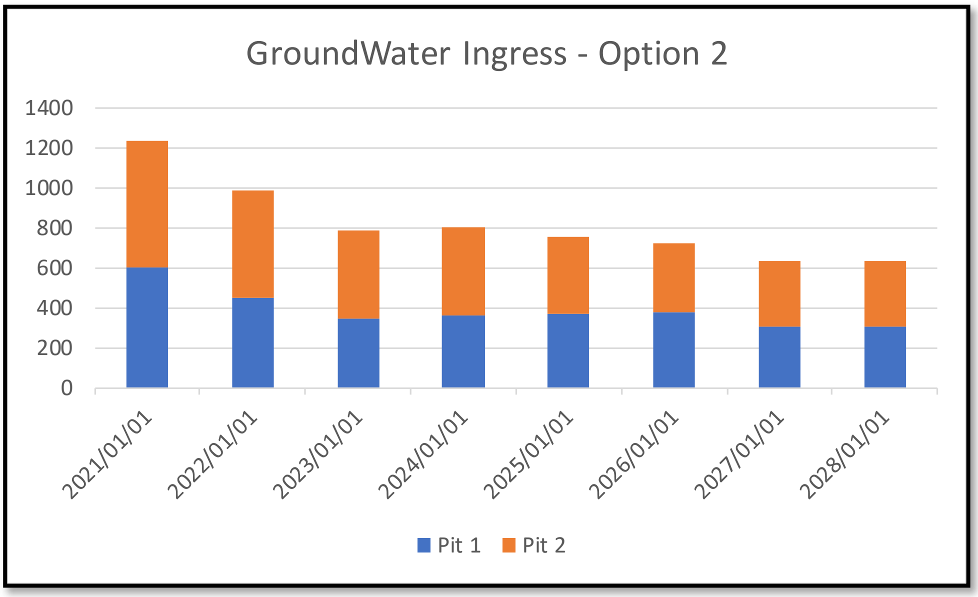



**Figure 63: Simulated groundwater ingress obtained for option 2 ($m^3$/day)**

### *Option 1: Mining at Pit 2 only commences after mining at Pit 1 is completed*

The model results indicate that an average 198 Ml/a (Figure 64) will be pumped from Turfvlakte Pit 1 and 23 Ml/a from the laydown area to the Grootegeluk mine during mining and 114 Ml/a (Figure 65) will be pumped from Pit 2 during mining.

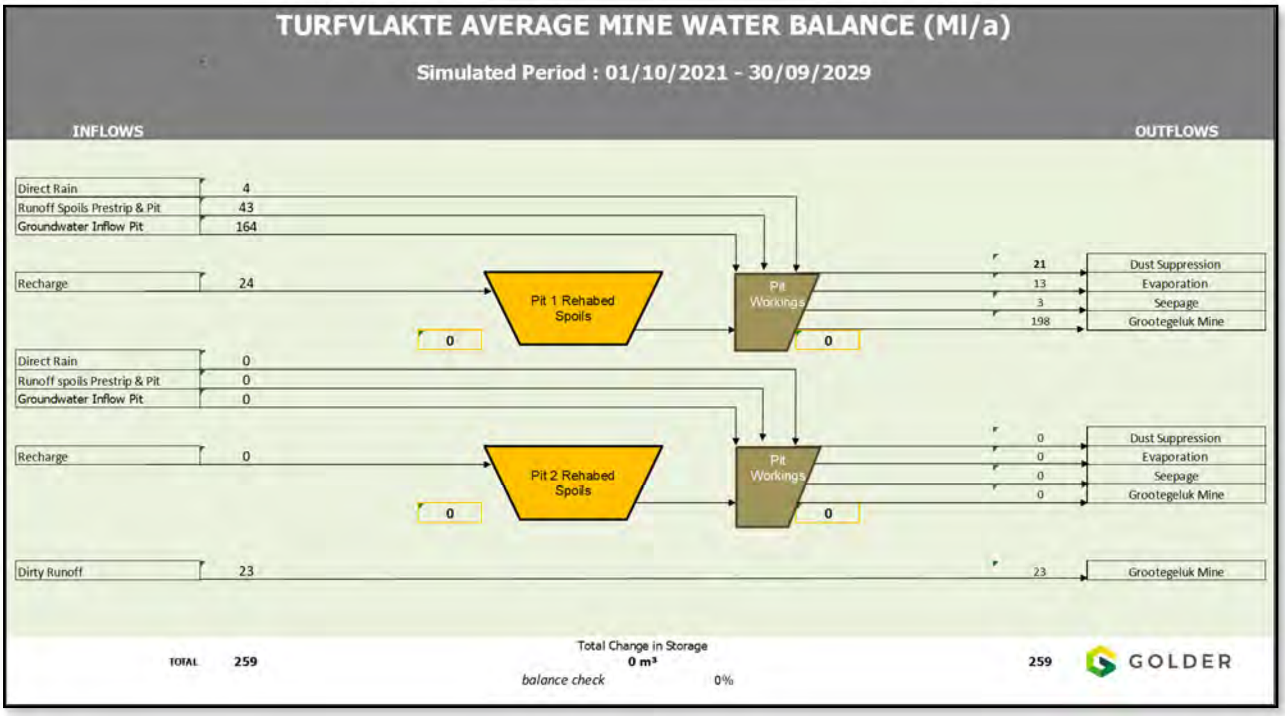



**Figure 64: Balance across the Grootegeluk Turfvlakte Expansion Project between 2021 and 2029 (Ml/annum) with pumping from Pit 1**

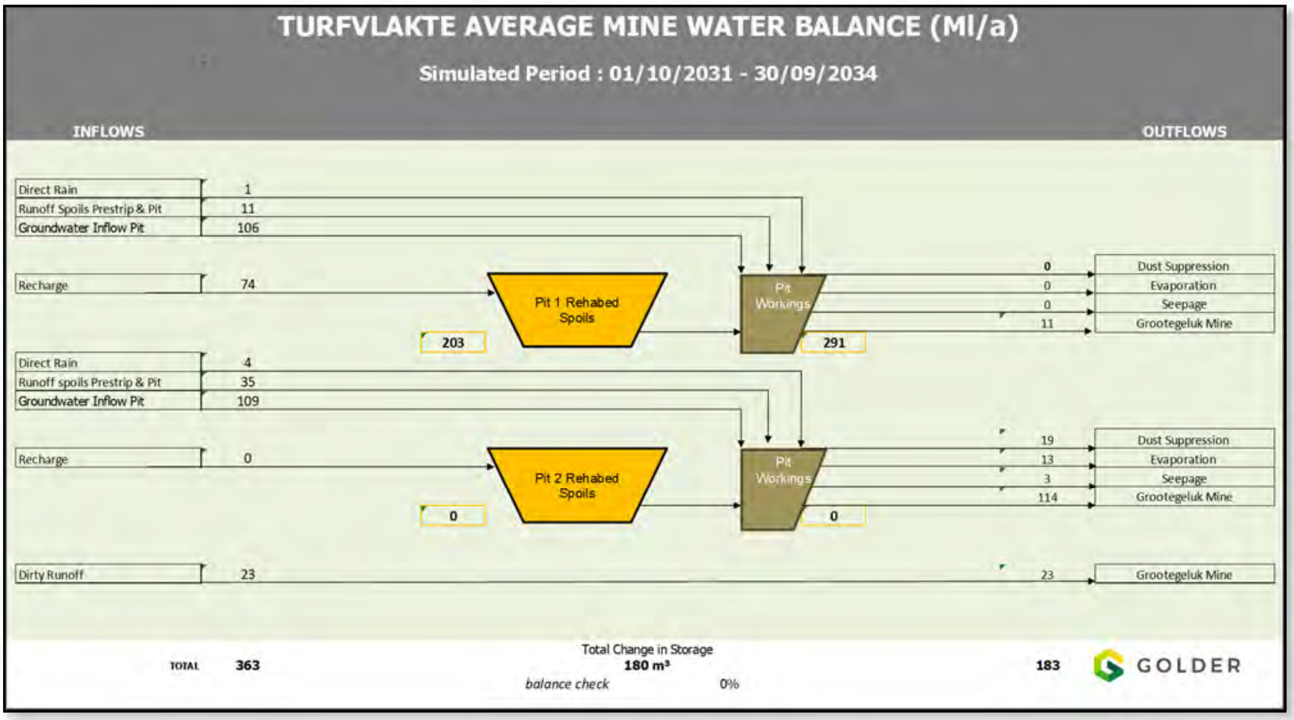



**Figure 65: Balance across the Grootegeluk Turfvlakte Expansion Project between 2031 to 2034 (Ml/annum) with pumping from Pit 2**

The average pumping profile for water pumped is illustrated in Figure 66. Water pumped to Grootegeluk Mine ranges from 163 $m^3$/day to 756 $m^3$/day on average.

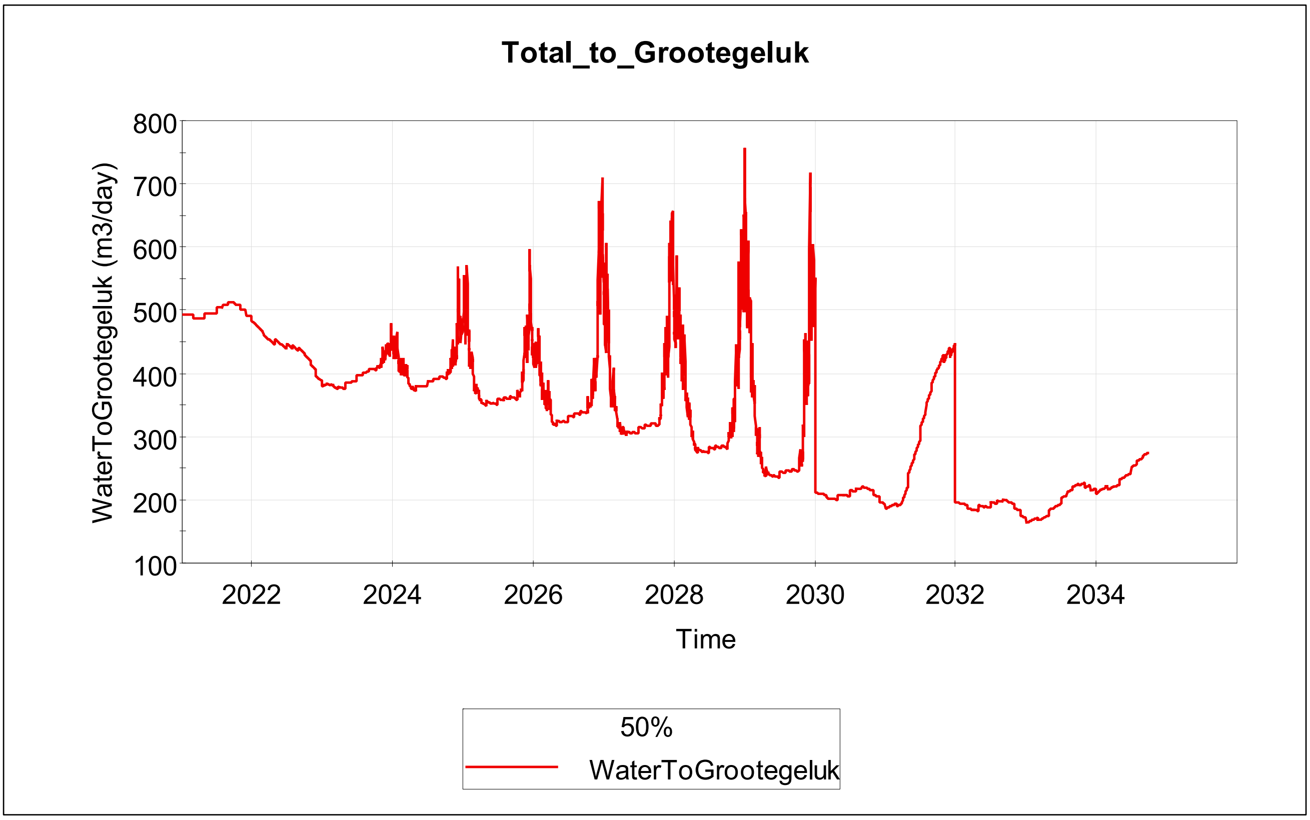



**Figure 66: Water pumped to Grootegeluk (50 percentile)**

### *Option 2: mining of Pit 1 and Pit 2 is carried out concurrently*

Results indicate that approximately 181 Ml/a from Pit 1, 195 Ml/a from Pit 2 and 23 Ml/a from the laydown area during the mining period (Figure 67)

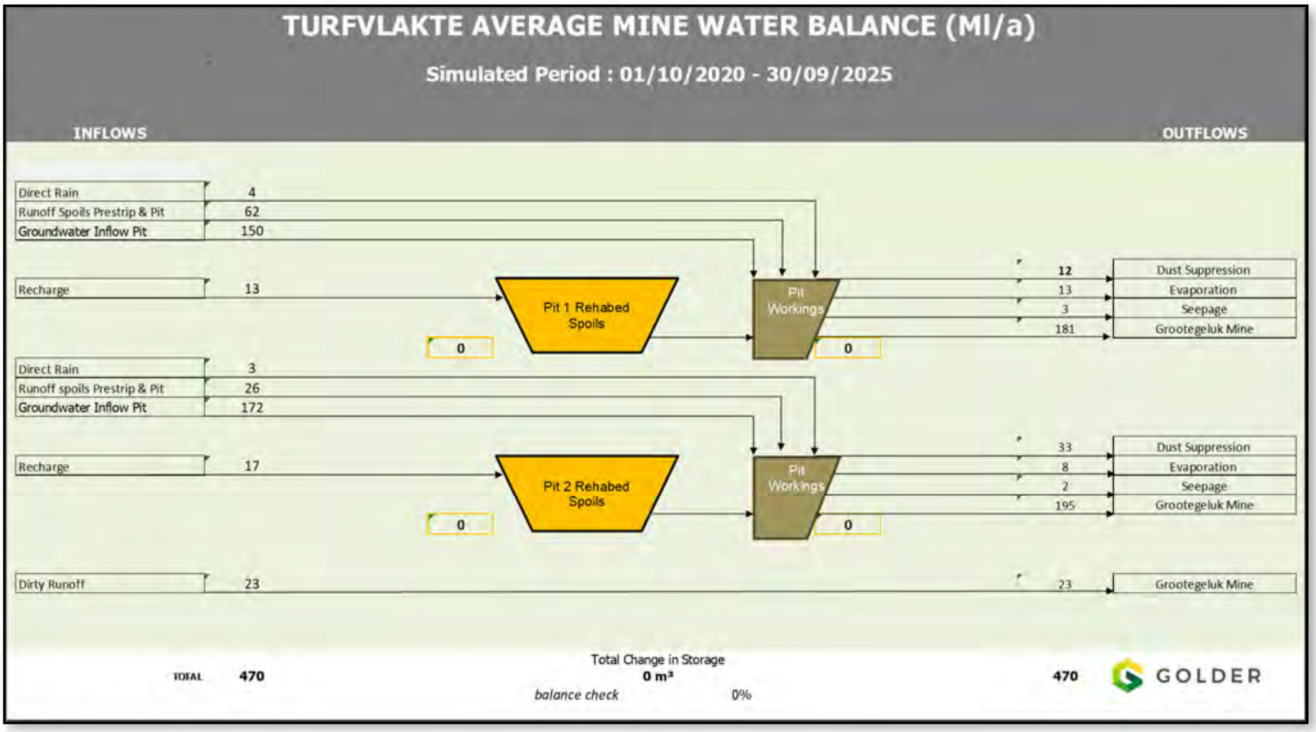



**Figure 67: Balance across the Grootegeluk Turfvlakte Expansion Project between 2020 to 2025 (Ml/a)**

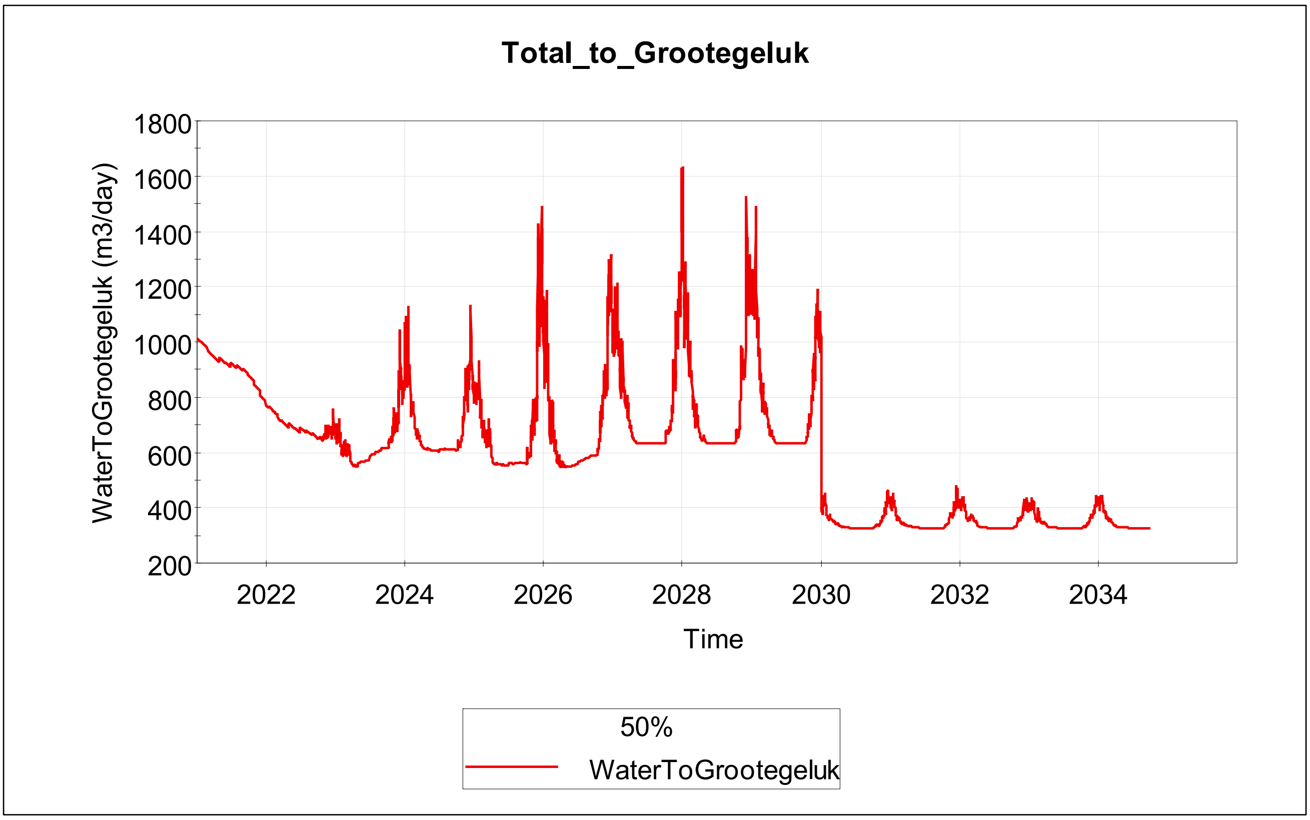



**Figure 68: Water pumped to Grootegeluk (50 percentile)**

The average pumping profile for water pumped is illustrated in Figure 68. Water pumped to Grootegeluk Mine ranges from 327 m$^3$/day to 1 637 m$^3$/day on average.

### 10.3.5.3 Construction

Clearing of the site will leave areas exposed. Rainfall data has indicated that the period for rainfall is from October to April with the highest rainfall being during December, January and February. As the rainfall events are also very often heavy downpours, erosion of exposed areas is likely. High sediment run-off can therefore be expected during rainfall events.

The laydown areas for the mining contractor is approximately 3 hectares (ha). It is expected to serve as a laydown area for the mining contractor to deploy from. Enough space has been allowed for the placement of the mining contractors' plant, trucks, equipment and offices. Contaminants from this area as well as from the areas in which the construction vehicles and equipment are being used, could include sediment and hydrocarbons.

During construction it is expected that the magnitude of the impact will be of ***moderate (SP = 40) significance*** due the fact that a large area will be cleared and potential hydrocarbon contamination from the equipment and trucks is likely. It has not been rated as high or very high due to the slope of the sire as well as the fact that the area is surrounded by features (roads, railway line, Eskom infrastructure) that would limit the flow to the Sandloop River. The impacts would therefore be limited to the site and more specifically the area identified for clearance during construction. The duration is likely to be short-term for the cleared areas, as revegetation takes place once infrastructure is complete, however medium-term for the laydown areas which will be used for haul trucks once construction is complete. By implementing the following mitigation measures, the impact will be reduced to one of ***low (SP = 24) significance***:

- Reduce areas that need to be cleared to limit high-sediment runoff.
- Avoid clearing during the months of November, December and January when short heavy downpours can be expected in order to limit erosion.
- Rehabilitate areas as soon as possible once construction is complete in an area.
- Ensure adequately designed berms and stormwater collection facilities to capture sediment before water is released to the environment. All storm water management systems should be compliant with Regulation GN 704. Potentially high pollution areas will be bunded. This is important as the laydown area will be kept after construction as the haul truck area; and
- Ensure immediate clean-up of hydrocarbon spills.

### 10.3.5.4 Operation

#### 10.3.5.4.1 Reduced area (run-off reduction)

Water falling on the Turfvlakte site will flow in a south easterly direction towards the Sandloop River. There may be some flow from the most northerly corner in a north easterly direction to the Sandloop River. It is however unlikely that much of it would reach the river due to the Medupi and Matimba Power Stations infrastructure, and the Marapong Village locality between the site and the Sandloop River on the southern and south eastern and western sides of the proposed development. This is also indicated by the large number of pans in this area, indicating that water is retained in the area. Flow from the western side of the site will also need to be diverted away from the mine operations. The topsoil storage area, west of Pit 2, will also cut off clean water draining across the site and is likely to also be a source of sediment during high rainfall events.

The area itself will reduce the catchment by 2.4% in addition to that already reduced by the Grootegeluk Mine area.

The magnitude is likely to be minor as the change in area is very small in relation to the catchment. The scale will be local over a period of 8 years during the operation of the mine and should be reduced as the area is rehabilitated. It is expected that this will have an impact of ***low (SP = 28) significance*** on the catchment. By implementing the following mitigation measures, the impact can be reduced to one of ***low (SP = 12) significance:***

- Design storm water management facilities to comply with regulation GN 704 so that clean water is diverted away from the mining operations and the topsoil storage area to the water resources, and that erosion around the topsoil storage area is limited.

#### 10.3.5.4.2 Contaminated run-off from haul roads

The interburden and coal mined from Pit 1 and Pit 2 will be transported to and handled at the existing Grootegeluk Coal Mine plants. Grootegeluk Coal Mine has existing haul roads that extend from the Phase 1 Strategic Stockpile at the South of GG1 tip close to the location of the Turfvlakte pits. There are also existing access roads that follow the rail track and extend around the proposed Grootegeluk Turfvlakte Expansion project area. Existing gravel roads will be upgraded if used for the Grootegeluk Turfvlakte Expansion Project. These include the gravel roads that link the current GG pit to Dump 6, located close to the Turfvlakte farm. Haul roads from the pits will be constructed. Contaminants here are likely to include coal fines at the loading points and hydrocarbons from equipment, and sediments from potential erosion impacts by storm water during high intensity storms. The impact is predicted to be of ***moderate (SP = 40) significance***. The following mitigation measures are recommended to reduce the impact to ***low (SP = 24) significance***:

- Operation and maintenance of the storm water management system to comply with GN704.
- Clean hydrocarbon spills immediately and dispose of the contaminated soil considering best practice and relevant legislation.

#### 10.3.5.4.3 Dewatering to allow mining in the pits to continue and disposal of water (excess pit water)

Based on the results of the groundwater study (APPENDIX T), it is indicated that water will accumulate in the pits. In addition, during storm events, there will be water that will need to be pumped. Water pumped from the pits will go to the pollution control dam (PCD) at Grootegeluk Coal Mine, and from there be reused in the plant or on the Grootegeluk Coal Mine operations. The PCD at Grootegeluk Coal Mine has been sized to contain the 1:50 year storm event and is adequately sized to include the excess water from Turfvlakte pits.

As there are no facilities outside of the pits, the impact significance has been rated as ***low (SP = 27)*** as it is likely to be of low magnitude, at a local scale for less than 7 years. The following measures are recommended to maintain the impact as ***low (SP = 18) significance***:

- Hydrocensus and groundwater modelling as discussed in Groundwater Report to assess which users may be impacted, and may require additional sources of water; and
- Maintained and operated the PCD at Grootegeluk Coal Mine, in accordance with the integrated water use licence conditions relevant to that mine.

### *10.3.5.5 Decommissioning and Closure*

#### 10.3.5.5.1 Reduced Area

As described in Section 10.3.5.4.1, the area that will be reduced is 2.4%. At closure and post-closure, the reduced area will be even less than this as areas are rehabilitated. The impact will therefore remain at ***low (SP = 21) significance***.

Closure options must ensure that clean and dirty water are separated, and clean water is diverted to the Sandloop River or pans in the area. Most of the area should be clean, and areas must be sloped to ensure adequate run-off that must be away from the Pit 1 void that will remain. This will ensure an impact of ***low (SP = 10) significance***.

##### 10.3.5.5.2 Run-off during Rehabilitation

As for construction, the run-off during the rehabilitation (decommissioning / closure) phase may contain contaminants, including hydrocarbons from equipment used, coal fines and sediment.

The impact significance of the run-off during rehabilitation is expected to be of ***moderate (SP = 36) significance*** as there is limited infrastructure and storage and no plant on this site. The following mitigation measures will reduce to impact to one of ***low (SP = 20) significance***:

- Areas cleared during rehabilitation, such as the topsoil stockpile must be revegetated with indigenous plants to prevent erosion and allow the area to return to a natural state.
- Areas will be sloped to ensure run-off towards the Sandloop and pans; and
- Monitoring of the water quality of the pans will continue until the trends indicate no changes.

##### 10.3.5.5.3 Final Open Void

Roll-over mining will take place. After the first 5 years of mining, backfilling will start, and the pits will be backfilled with discard, softs, overburden, hards and Bank 7A and B, and Bank 10. It is expected that voids will remain in the pits.

The water balance and groundwater model has indicated that the voids may fill with water. The water may be contaminated and should decant occur during the wet season, there is the potential for contamination of the pans in the area and the Sandloop River. The impact significance is predicted to be of ***moderate (SP = 33) significance***. By implementing the following mitigation measures, the impact can be reduced to ***low (SP = 20) significance***:

- Water quality monitoring of the water will need to be undertaken quarterly; and
- Pumping to Grootegeluk Coal Mine will need to continue should the water quality be unfit for discharge.

### 10.3.6 Groundwater

The assessment below is based on the groundwater assessment attached as APPENDIX O.

#### *10.3.6.1 Construction*

The clearing of the project footprint areas can increase infiltration rates of water to the groundwater system and increase aquifer vulnerability. The impact is expected to be of ***low (SP = 24) significance***. Mitigation is not possible and therefore groundwater monitoring should be to manage the potential impact.

The construction of the Grootegeluk Turfvlakte Expansion project infrastructure and the associated handling of waste and hydrocarbons are expected to have an impact of ***low (SP = 21)*** significance. The following measures are recommended to reduce it to an impact of ***low (SP = 12)*** significance:

All vehicles and machinery shall be kept in good working order and inspected on a regular basis for possible leaks and shall be repaired as soon as possible if required.

- Repairs shall be carried out in a dedicated repair area only, unless in-situ repair is necessary as a result of a breakdown.
- Drip trays shall at all times be placed under vehicles that require in-situ repairs.

- Drip trays shall be emptied into designated containers only and the contents disposed of at a licenced hazardous material disposal facility.
- Accidental spills (concrete, chemicals, process water, hydrocarbons, waste) need to be reported immediately so that effective remediation and clean-up strategies and procedures can be implemented.
- Soil that is contaminated by fuel or oil spills, for example, from vehicles, will be collected to be treated at a pre-determined and dedicated location, or will be treated in situ, using sand, soil or cold coal-ash as absorption medium.

### *10.3.6.2 Operation*

#### 10.3.6.2.1 Groundwater Quantity (Groundwater level drawdown)

The mine floor elevation will be below the general groundwater level during operations and will thus cause groundwater inflows into the two proposed open pit mining areas from the surrounding aquifers. The mining areas will have to be actively dewatered to ensure a safe working environment. Pumping water that seeps into the mine areas will cause dewatering of the surrounding aquifers and an associated decrease in groundwater level within the zone of influence of the dewatering cone.

The zone of influence of the dewatering cone depends on several factors including the depth of mining below the regional groundwater level, recharge from rainfall to the aquifers, the size of the mining area, and the aquifer transmissivity amongst others. The 3-D numerical groundwater flow model was used to simulate the development of the drawdown cone over time in the study area. The proposed mining schedules was also taken in consideration when calculating the drawdown, mining to seam B11sf (Bench 11) was proposed.

During the operational phase, it is expected that the main impact on the groundwater environment will be dewatering of the surrounding aquifer. In order to interpret the changing cone of groundwater depression as mining progresses, scenario modelling has been carried out, the simulated drawdown for 1.5 Mtpa preferred mining schedule is illustrated in Figure 70, while the 3 Mtpa alterative mining schedule can be seen in Figure 71.

The impact of groundwater drawdown due to the Grootegeluk pit has been excluded, in order to assess the Turfvlakte impact in isolation[5]. Refer to Section 17.6.5 for a discussion on the potential cumulative groundwater impacts taking into consideration the existing Grootegeluk Coal Mine pit. When assessing the 1.5 Mtpa preferred mining on Turfvlakte the extent of drawdown could reach ~1400 m to the east of the two open pits and ~1600 m to the west (which would merge with the Grootegeluk pit drawdown cone).

For the 3 Mtpa alterative mining schedule, the extent of drawdown could reach ~1100 m to the east of the two open pits and ~950 m to the west (which would merge with the Grootegeluk pit drawdown cone). The reduced impacted of the 3 Mtpa alterative mining schedule is due to the quicker mining progression and shorter mining period.

The impact on groundwater quantity as a result of dewatering of the groundwater system in the immediate vicinity of the workings will have be of ***moderate*** **(SP = 35)** significance.

The impact on groundwater levels do not extend across the Daarby Fault to the north or the Eenzaamheid Fault to the south, as seen in Figure 70 and Figure 71.

[5] The Turfvlakte Project was assessed in isolation in terms of its impacts, drawdown, post closure impacts, etc. However, as the existing numerical model for the Grootegeluk Coal Mine was used, the Grootegeluk Coal Mine Pit was still included in the model for the operational groundwater water balance.

No privately-owned boreholes were located in proximity to the proposed project. Therefore, it is not expected that the dewatering activities associated with the Turfvlakte mining will impact negatively on existing privately-owned boreholes nor on groundwater users off-site.

It is necessary to keep the Turfvlakte workings dry for mining and therefore direct mitigation is not possible. Groundwater monitoring should be used to confirm that the affected area remains within the predicted area and that no users will be affected. The potential impact can therefore be reduced to one of ***low (SP = 28)*** significance.

#### 10.3.6.2.2 Mine Inflow Volumes

The inflow into the opencasts for each mining cut was calculated from the numerical model. The computed inflow into each open pit at Turfvlakte was calculated as shown below in Figure 69 for the 1.5 Mtpa preferred mining schedule and in Figure 72 for the 3 Mtpa – Alternative mine schedule.

##### *10.3.6.2.2.1 1.5 Mtpa -Preferred schedule*

The 1.5 Mtpa preferred mining schedule entails the mining of Pit 1 from year 1 to year 11. The simulated groundwater inflow into open Pit 1 fluctuate between ~580 $m^3$/d and ~290 $m^3$/d (Figure 69). The pit floor depths in Pit 1 range from 46 mbgl in the north part to 77 mbgl in the southern/central part.

In Pit 2 located north east of Pit 1, mining also commences in year 12 and ceases in year 16. Mining depths range from ~39 mbgl in the south eastern part of the pit and deepens to 120 mbgl in the north-western part of the proposed pit. The simulated groundwater inflows ranged between ~270 and 380 $m^3$/d as seen in Figure 69.

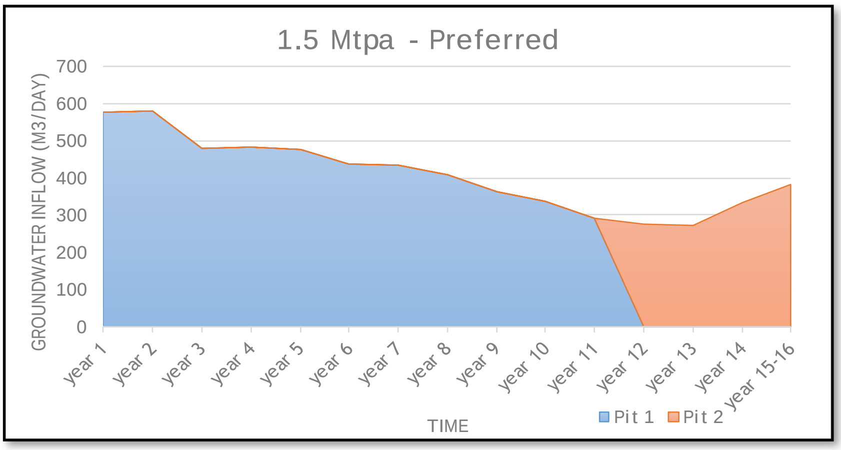



**Figure 69: Simulated Groundwater Inflows into the proposed Pit 1 and 2 open pits 1.5 Mtpa - Preferred option**

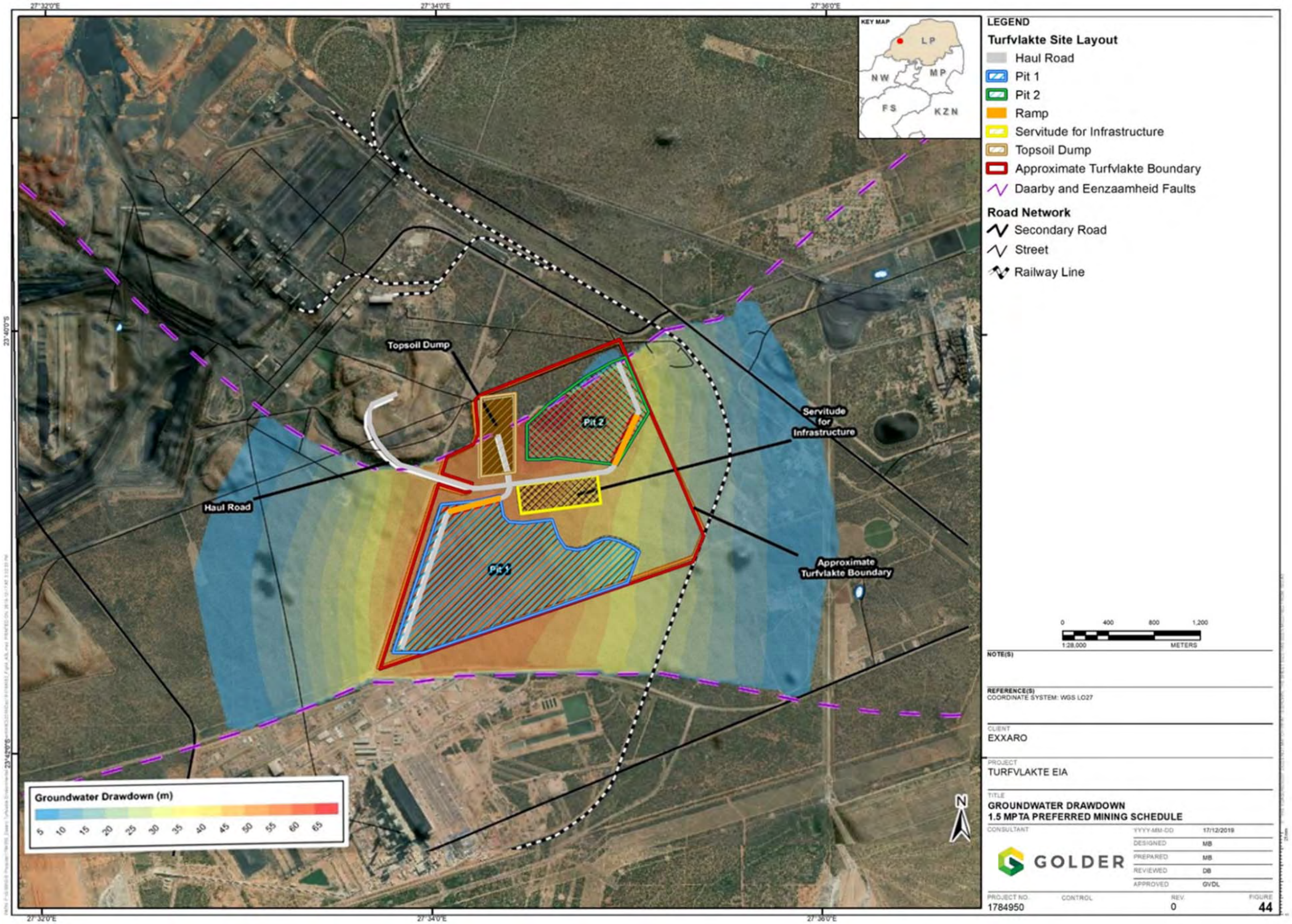



**Figure 70: Groundwater Drawdown in year 16 (1.5 Mtpa Preferred Mining Schedule)**

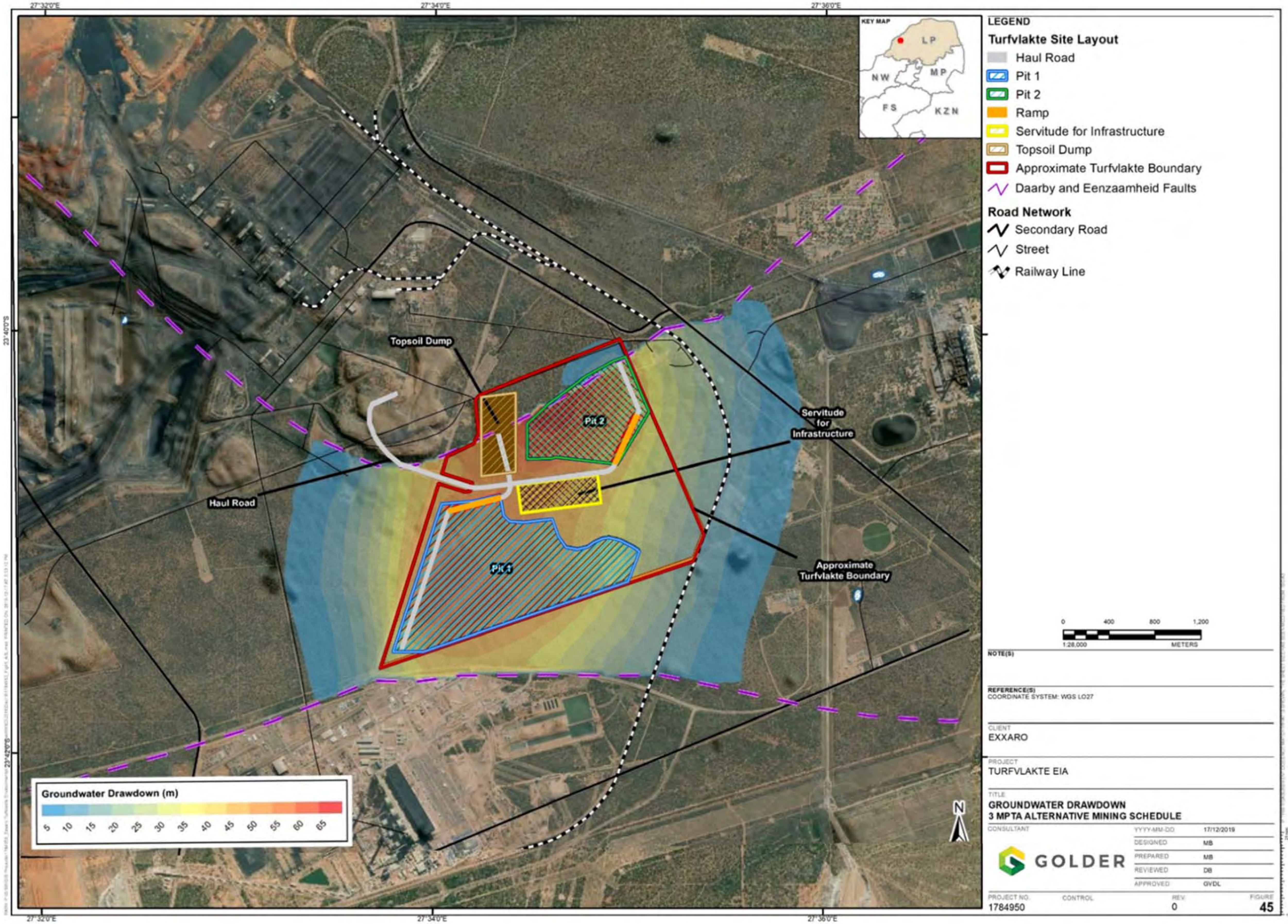



**Figure 71: Groundwater Drawdown in year 7 (3 Mtpa alternative mining schedule)**

### 10.3.6.2.2.2 3 Mtpa -Alternative Schedule

The 3 Mtpa alterative mining schedule entails the mining of both pits simultaneously, i.e. from year 1 to year 7. The simulated groundwater inflow into open Pit 1 fluctuate between ~590 $m^3$/d and ~300 $m^3$/d (Figure 72).

In Pit 2, where mining occurs concurrently with Pit 1 but only from year 1 to year 4, the simulated groundwater inflows ranged between ~640 and 440 $m^3$/d (Figure 72).

It is also important to view these volumes for the water make of the mine in relation to natural evaporation. Evaporation will take place over the total area of the open pits and could reduce the actual seepage volume.

It must be noted that these calculations have been performed using simplifying assumptions for homogeneous aquifer conditions. In reality groundwater inflows could deviate substantially from this. The inflows represent the correct order of magnitude, and the most likely range of inflow variation based on the uncertainties of the model.

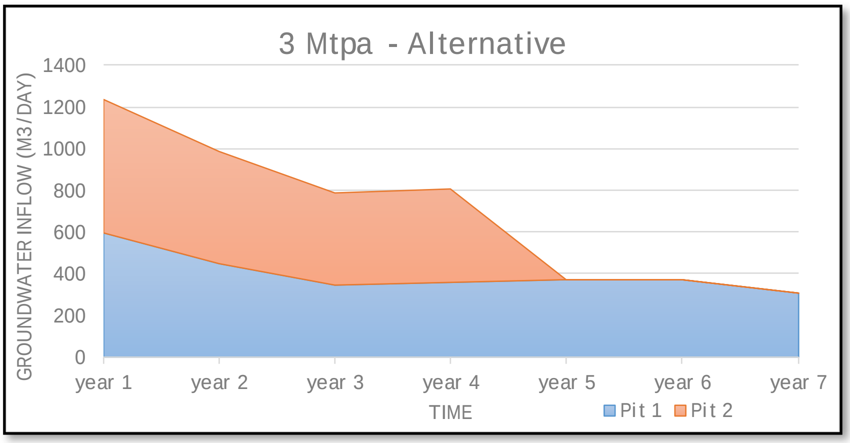



**Figure 72: Simulated Groundwater Inflows into the proposed Pit 1 and 2 open pits 3 Mtpa – Alternative option**

Exposure of geological strata in the open pit areas will result in a deterioration in quality of groundwater flowing into the open pit and the pit water, due to the ARD formation in some strata and the leaching of various major and trace elements from all strata. The impact on groundwater quality will be of ***moderate (SP = 40)*** significance. By keeping the pits as dry as possible to reduce contact time of water and oxygen with exposed rock will keep contamination to a minimum and reduce the impact to ***low (SP = 16)*** significance.

### 10.3.6.2.3 Groundwater Quality (Contamination of the surrounding aquifers)

The life of mine for the proposed mining at Turfvlakte is planned until 2035 for 1.5 Mtpa preferred mining schedule and 2027 for the 3 Mtpa alterative option. This allows sufficient time for chemical reactions to take place in the mined-out areas and other potential pollution sources to produce Acid Rock Drainage (ARD) conditions. There will also be leaching of hard and soft overburden deposited onto Dump 6 (but not carbonaceous interburden which could produce ARD). The impact on groundwater quality is expected to be of ***moderate (SP = 45)*** significance. By excluding the ARD-producing strata from placement on Dump 6, it will result in the seepage quality not being substantially changed and therefore reducing the impact to ***low (SP = 24)*** significance.

Groundwater flow directions south of the Daarby fault will be directed towards the mining areas due to the mine dewatering. Therefore, contamination will be contained within the mining area, and little contamination will be able to migrate away from the mining area.

Contamination from the mining areas is generally contained within the mining areas. The baseline study (Section 7.10) found that the groundwater quality of the boreholes, located in the middle of Turfvlakte and WBR46, are of poor quality. The environmental impact significance is expected to be of ***low*** significance.

#### 10.3.6.3 Decommissioning and Closure

The mining activities will be stopped, and the open pits will be backfilled with the available material. A final void will be left in both Pit 1 and Pit 2.

It is expected that all surface contamination sources (infrastructure) have been decommissioned and no longer acts as a source. No additional impacts on the groundwater in the project area are expected during the decommissioning phase.

#### 10.3.6.4 Post Closure Phase

Post closure of the open pit operations, the open pits are expected to be partly backfilled and vegetated, with final voids in Pit 1 and Pit 2. A flow gradient will exist towards both pits after closure due to the rehabilitated pits and final voids acting as a sink.

It is expected that water and oxygen will react with the backfilled material and as a result ARD will peak during this phase. The environmental impact significance is expected to be of ***moderate (SP = 36)*** significance.

##### 10.3.6.4.1 Groundwater Quality

Once the mining has ceased, ARD and leaching of trace elements is still likely to occur within the backfilled pits due to the contact of water and oxygen through natural process including rainfall and groundwater seepage. Once the ARD forming material is saturated, the formation of ARD is reduced. The partially backfilled Pit 1 and Pit 2 is likely to act as a contaminant sink post closure (i.e. contaminants could migrate toward pit post closure) and therefore no significant migration of the contaminants from the two partially backfilled pits is expected. The contaminants are generally confined to the pits post closure as can be seen in the Figure 73 and Figure 74 (50 year and 100 years post closure respectively).

No privately-owned boreholes located in the fractured Karoo aquifer is likely to be impacted based on the impact simulations.

The results must be viewed with caution as a layered homogeneous aquifer has been assumed. Heterogeneities in the aquifer are unknown and the effect of this cannot be predicted. Furthermore, no chemical interaction with the minerals in the surrounding bedrock has been assumed. As there may be some interaction and retardation of the plume, it is likely that this prediction will represent a worst-case scenario.

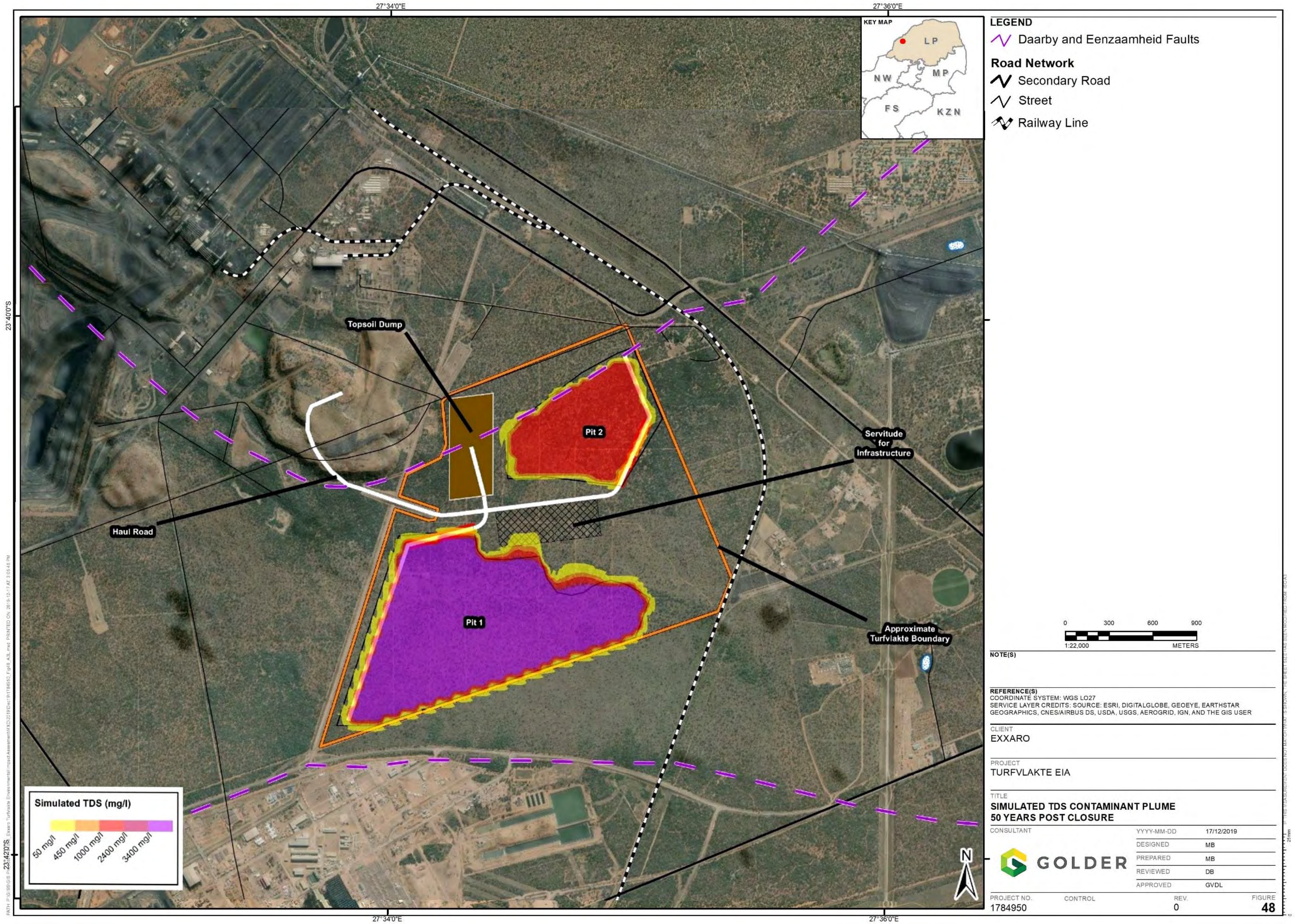



**Figure 73: Simulated TDS Contaminant Plume – 50 years post closure**

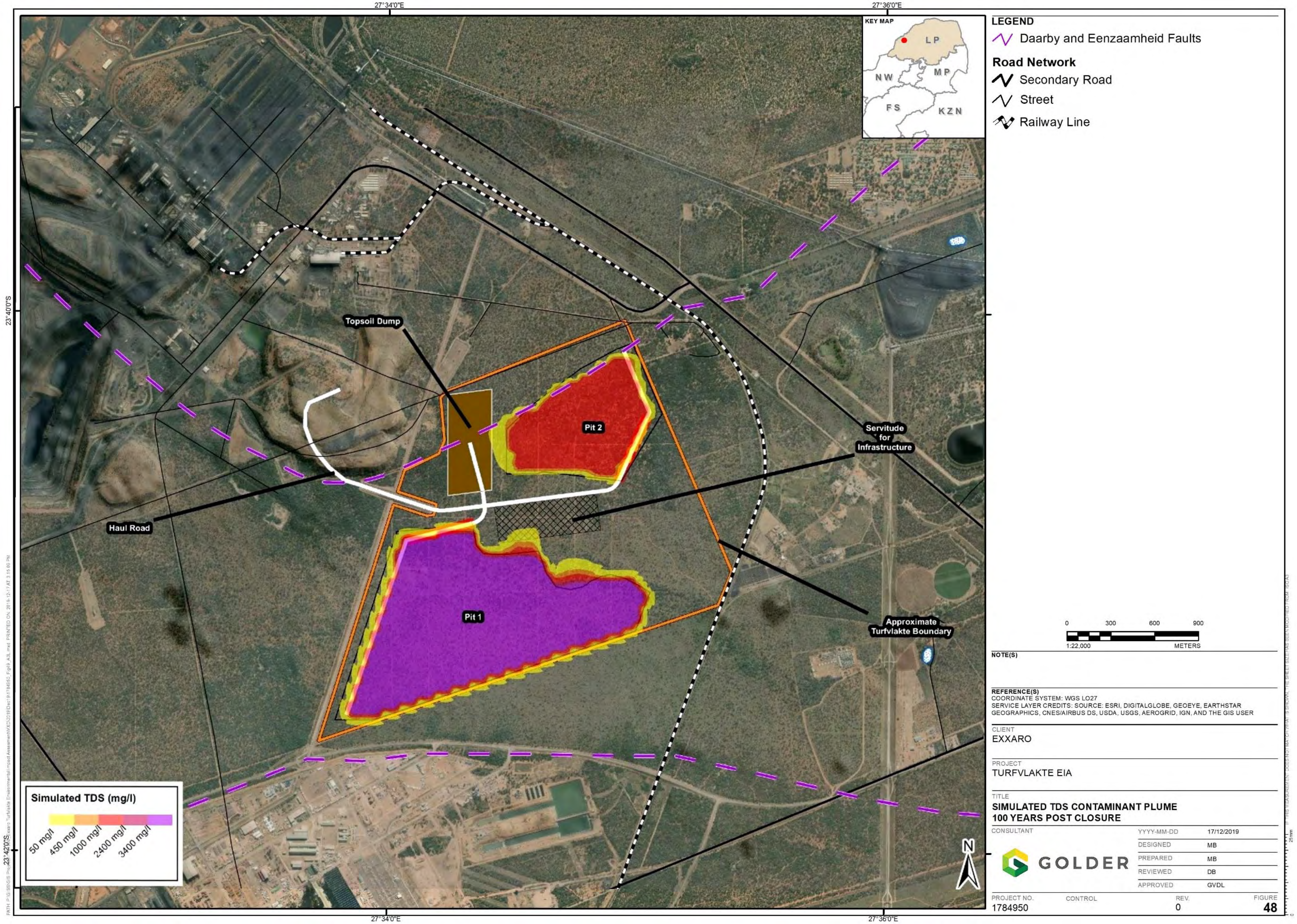



**Figure 74: Simulated TDS Contaminant Plume – 100 years post closure**

##### 10.3.6.4.2 Mine Water Level Recovery

Pit 1 and Pit 2 will be partially backfilled due to a material deficit resulting in final voids. Based on the mineral residue mass balance it was found that the void in Pit 1 would be 51% of the pit volume, while at Pit 2 the void would be 70% for the 1.5 Mtpa preferred mining schedule and 82% for the 3 Mtpa – Alternative mine schedule. The large void space is attributed to half of the mine waste being deposited on Dump 6 and within the Grootegeluk pit. Open water bodies/pit lakes will be present in both pits and evaporation losses will occur.

Decanting/surface discharge occurs when the mine water level in the rehabilitated and backfilled workings rebounds to a level above the topographic elevation, taking into consideration that subsurface seepage will occur, resulting in mine water discharging onto surface. Surface decanting refers to direct discharge of mine water to surface through backfilled material, voids, shafts, adits and other direct paths. Decant take place at the lowest topographic level that intersects the flow path and/or open pit.

Given the climatic and topographical environment at Turfvlakte, as well as the future presence of a final voids in Pit 1 and Pit 2; decant or surface discharge from the open pits are unlikely.

By flooding the mined areas as soon as possible, to minimise free oxygen reacting with remaining pyrite and by implementing groundwater monitoring to monitor plume movement trends, the potential impacts post closure can be reduced to ***low (SP = 18)*** significance.

### 10.3.7 Terrestrial Ecology

The discussion below is based on a terrestrial ecology impact assessment undertaken by Golder in 2019 (Golder, 2019c).

#### *10.3.7.1 Construction*

The construction activities will require stripping of vegetation in the areas required for pit and infrastructure development and will result in the disturbance of fauna and flora as a result of the following impacts:

##### 10.3.7.1.1 Habitat loss and degradation

Habitat loss refers to the direct removal of natural habitat. In terrestrial ecosystems, this occurs primarily through the clearing of indigenous vegetation coupled with earth works. The immediate impact is the destruction of individual plants and some faunal species within the development footprint. If remaining habitat is insufficient in size and heterogeneity to sustain ecological processes, a breakdown or impairment of ecosystem integrity and functioning at broader ecological scales can occur, leading to further losses of biodiversity.

Direct habitat loss constitutes the foremost impact of the proposed project, with approximately 265 ha of natural vegetation likely to be completely transformed. This will occur as a result of construction phase vegetation clearing for, *inter alia*, haul roads, open pits, stockpiles and other associated facilities.

It is anticipated that the small patches of vegetation that remain between or adjacent to transformation footprints will be subjected to edge-effect disturbances, such as alien invasive species establishment. The ecological integrity and conservation importance of all five identified vegetation communities is high. Accordingly, the significance of habitat loss is rated ***high (SP = 75)*** before mitigation. The following mitigation measures are recommended; however, the impact will remain of ***high (SP = 65)*** significance:

- Vegetation clearing should be restricted to the proposed development footprints only, with no clearing permitted outside of these areas.
- Areas to be cleared should be clearly demarcated to prevent unnecessary clearing outside of these sites.
- Removed topsoil should be stockpiled and used to rehabilitate disturbed areas.

- A suitable rehabilitation programme should be developed and implemented in all disturbed areas. The programme should include:
  - Concurrent rehabilitation, if possible.
  - Stabilisation and active revegetation of all disturbed areas using locally-occurring indigenous grass and tree species; and
  - Protected tree species should be included in the mix of revegetation species.

##### 10.3.7.1.2 Habitat fragmentation

Habitat fragmentation is caused when vegetation loss/disturbance results in the partitioning of habitat into smaller, discontinuous patches. This leads to altered habitat configuration that typically manifests as an increase in patch number and isolation, yet a decrease in overall patch size. These alterations change the ecological properties of remaining patches and can affect various ecological processes, such as flora propagule dispersal and fauna movement and migration (Golder, 2019c).

The study area constitutes an area of natural habitat surrounded by large, transformed sites (Grootegeluk Coal Mine, and the Matimba and Medupi Power Stations). It thus plays a role in maintaining local-scale habitat connectivity on an east-west axis. Habitat fragmentation caused by infrastructure development is thus likely to impede local fauna movement and affect other local-scale ecological processes. This impact is therefore rated an impact of ***high (SP = 75)*** significance before mitigation.

Successful rehabilitation during the closure phase can, however, create areas of secondary and supporting (corridor) habitat that may restore some landscape connectivity and function that was lost due to fragmentation. By implementing the mitigation measures listed under Section 10.3.7.1.2, this impact can be mitigated to one of ***moderate (SP = 55)*** significance.

#### *10.3.7.2 Establishment and spread of alien invasive species*

Disturbances caused by vegetation clearing and earth works can create conditions conducive to the establishment and rapid colonisation of alien invasive species. If left uncontrolled, alien species can spread exponentially, suppressing or replacing indigenous vegetation. This may lead to a breakdown in ecosystem functioning and a loss of biodiversity.

Seven alien invasive plant species were recorded in the study area during the field programme. Disturbance to natural vegetation may facilitate the spread of these, as well as several other invasive species that are known to occur in the area. This impact will be present throughout the life of the project but can be successfully mitigated through all phases by proactive management and rehabilitation.

The establishment and spread of alien invasive species is rated as having a ***moderate (SP = 60)*** impact prior to mitigation but can be reduced to ***low (SP = 16)*** significance by implementing the following mitigation measures:

An alien invasive species control programme must be developed and implemented on-site during all phases of the proposed project. It is recommended that the programme include:

- A combined approach using both chemical and mechanical control methods.
- Periodic follow-up treatments, informed by regular monitoring.
- Monitoring should take place in disturbed areas, as well as adjacent undisturbed areas.
- Rehabilitate all sites that are disturbed by construction phase activities, as per the rehabilitation programme; and

- Rehabilitate all disturbed footprints during the closure and rehabilitation phases, as per the rehabilitation programme.

#### 10.3.7.2.1 Mortality and disturbance of Fauna

Large-scale development projects in wildlife-rich savanna areas may negatively affected fauna, as follows:

- Most large or mobile fauna will move-off to avoid disturbances caused by construction activities. However, smaller and less mobile species may be trapped, injured and killed during vegetation clearing and earth works. Fauna that are of particular concern in this regard include:
  - Fossorial[6] mammals (e.g. moles, rodents).
  - Nesting birds; ground and tree nests; and
  - Reptiles and amphibians.

Other common causes of fauna injury, death or disturbance during all project phases include:

- Vehicle-wildlife collisions along haul and access roads.
- Hunting, snaring and poisoning of larger fauna by mine workers and contractors.
- Fauna becoming trapped/caught in mine infrastructure, such as fences, excavations and storage dams.
- Blasting, vibrations and noise (sensory disturbances) can negatively affect fauna, particularly nesting and roosting birds; and
- Artificial lights can disrupt nocturnal species, such as bats, which can cause changes in community characteristics.

The study area has a rich faunal assemblage, and it is anticipated that vegetation clearing and earth works during construction may cause injury or death to several less mobile taxa (e.g. tortoises, nesting birds).

This impact is rated ***moderate (SP = 48)*** prior to mitigation but can be reduced to a ***low*** (SP = 14) significance with the following proactive long term management measures:

##### *10.3.7.2.1.1 Death/injury during vegetation clearing and earth works*

- Prior to construction:
  - Large mammals (e.g. antelope, zebra and giraffe) should be actively relocated to unaffected portions of the Manketti Nature Reserve or elsewhere.
  - Temporary corridors should be created by strategically removing fence portions to allow smaller mammals to disperse from the Grootegeluk Turfvlakte Expansion Project to the adjacent Manketti Game Reserve during construction.
  - An ECO should be on-site during vegetation clearing to monitor and manage any wildlife-human interactions. The ECO should be trained in inter alia, snake handling; and
  - As appropriate, fences should be erected to prevent fauna gaining access to construction and operational areas, such as open trenches and voids.

[6] Organism adapted to digging and life underground.

#### *10.3.7.2.1.2 Vehicle-wildlife collisions*

- A low speed limit (recommended 20 - 40 km/h) should be enforced on site to reduce wildlife-collisions.

#### *10.3.7.2.1.3 Hunting, snaring and poisoning*

- The handling, poisoning and killing of on-site fauna by mine workers and contractors must be strictly prohibited; and
- Employees and contractors should be made aware of the presence of, and rules regarding, fauna through suitable induction training and on-site signage.

#### *10.3.7.2.1.4 Noise, vibrations and lights*

- General noise abatement equipment should be fitted to machinery and vehicles; Noise shields, including earth berms, should be constructed around sites of noise origin.
- Dust suppression using water bowsers should be undertaken on all mine’s roads and other sites where dust entrainment occurs.
- Plan the lighting requirements of facilities to ensure that lighting meets the need to keep the site secure and safe, without resulting in excessive illumination. Possible options include:
  - Zoning of areas of high and low lighting requirements.
  - Using motion-activated lights as opposed to permanent lights; and
  - Reducing height and angle of lights.

### 10.3.7.2.2 Loss and disturbance of Fauna of conservation importance

During all phases of the proposed project, but particularly during the construction phase, fauna of conservation importance may be killed or disturbed, either through the loss of viable habitat or through direct impacts, as discussed in Section 10.3.7.2.1 above.

Aestivating and burrowing taxa such as Giant Bullfrog (*Pyxicephalus adspersus*) and Baboon spiders (Family *Theraphosidae*) are particularly vulnerable to construction activities. This impact is rated ***moderate (SP = 48)*** before mitigation but can be reduced to ***low (SP = 14)*** significance by implementing the following mitigation measures:

- The ECO should be present during any disturbance (earth works) of pans/ depressions to monitor for the presence of Giant Bullfrog. If this species is detected, construction activities should cease until an appropriate and approved management plan is developed.
- Prior to construction, a grid survey for Baboon spider nests should be conducted, and any taxa encountered should be relocated to adjacent undeveloped, natural areas.
- Suitably qualified/trained experts should be appointed to apply for and undertake the necessary Threatened or Protected Species (TOPS) permit and registration application process, rescue and relocation operations prior to the start of the construction activities; and
- Also refer to the mitigation measures listed in Section 10.3.7.2.1.

### 10.3.7.2.3 Loss and disturbance of Flora of conservation importance

During vegetation clearing and earth works, flora of conservation importance may be cleared/removed or damaged.

Nine floral species of conservation importance were recorded during the field programme. Of these, three protected tree species are particularly abundant throughout the study area:

- *Vachellia erioloba* is abundant in all vegetation communities, except the *Spirostachys africana* - *Vachellia grandicornuta* Woodland.
- *Combretum imberbe* is abundant in the Short Open *Vachellia tortilis* Bushveld and Tall *Senegalia nigrescens* Bushveld communities; and
- *Spirostachys africana* is a co-dominant species in *Spirostachys africana* - *Vachellia grandicornuta* Woodland, but rarely occurred outside this vegetation community.

All plants of conservation importance occurring within proposed development footprints will be cleared during the construction phase. This impact is rated ***high*** (SP = 65) before mitigation. The application of the following mitigation measures reduces the rating score of this impact; however, it remains of ***moderate (SP = 45)*** significance:

- Prior to construction, all areas designated for vegetation clearing should be clearly marked and surveyed for flora of conservation importance by a trained botanist.
- Based on the results of the survey, rescue/destruction permits must be obtained from the relevant authority before vegetation clearing commences:
  - A permit to clear *Boscia albitrunca*, *Combretum imberbe*, *Elaeodendron transvaalense, Sclerocarya birrea* subsp. *caffra, Securidaca longepedunculata* and *Vachellia erioloba* should be obtained from the Department of Agriculture, Forestry and Fisheries (DAFF).
  - A permit to clear *Spirostachys africana* should be obtained from the Limpopo Department of Economic Development, Environment and Tourism (LEDET).
  - As far as possible and practical, smaller herbaceous plants of conservation concern should be rescued and relocated to adjacent undisturbed areas. Relocation permits for herbaceous plants will need to be obtained from the LEDET.
- As far as possible, cleared protected trees should be used rather than allowed to stand and decompose. The following potential uses are listed as examples:
  - The wood of *Spirostachys africana* (Tamboti) is highly noxious and not suitable for use as a fuel (i.e. firewood). However, the timber is highly sought after by furniture makers. Exxaro should investigate supplying cleared Tamboti trees to a timber merchant as an alternative to disposal; and
  - The wood of *Vachellia erioloba* (Camel Thorn) is hard and is a valuable source of fuel (firewood and charcoal). Exxaro should investigate supplying cleared Camel Thorn trees to local communities as an alternative energy source.
- Protected trees should be included in the mix of revegetation species used during rehabilitation:
  - Exxaro should investigate developing an on-site nursery to manage the propagation and growing of protected trees.
  - Where possible, it is recommended that seeds should be collected from protected trees, growing on local Exxaro owned properties, such as in Manketti Game Reserve; and
  - Propagation should be optimally timed to ensure that trees are the correct size and maturity to survive out planting during rehabilitation.

#### *10.3.7.3 Operation*

##### 10.3.7.3.1 Mortality and disturbance of Fauna and Flora

The mining operations will involve the stripping of vegetation in advance of the mining front and the temporary stockpiling of topsoil.

A number of operational activities may also cause disturbances the fauna in the area, including blasting, noise and artificial lighting. We note however, that the current levels of such disturbances in the immediate vicinity is high on account of the operations of Grootegeluk Mine, Matimba and Medupi.

Moreover, fauna may also be killed or injured during the operation phase through, *inter alia*, vehicle collisions. This impact is rated ***moderate (SP = 48)*** prior to mitigation but can be reduced to a ***low (SP = 16)*** significance with proactive long term management by implementing the mitigation measures detailed in Section 10.3.7.2.1.

##### 10.3.7.3.2 Establishment and spread of alien and invasive species

The establishment and spread of alien invasive species during the operational phase remains an impact of ***moderate (SP = 45)*** significance prior to mitigation but can be reduced to ***low (SP = 16)*** significance by implementing the mitigation measures in Section 10.3.7.2.

#### *10.3.7.4 Decommissioning and Closure*

Backfilling the mining voids, water collection channels, removal of infrastructure, ripping, top-soiling, fertilising and re-vegetating will again create the opportunity for the establishment and spread of alien invasive species, creating in impact of ***moderate (SP = 60)*** significance. By implementing the mitigation measures in Section 10.3.7.2, the impact can be reduced to one of ***low (SP = 16)*** significance.

### 10.3.8 Protected Trees

Several protected tree species were identified during the 2018 terrestrial ecology assessment that was conducted in the proposed Grootegeluk Turfvlakte Expansion project area. The survey was undertaken as part of the broader environmental impact assessment process for the proposed project (Golder, 2019b). The focus of the assessment was to determine the number of protected trees that may be impacted by the proposed project, and for which clearing permits would need to be obtained from the relevant competent authorities.

The total area under investigation was approximately 615 ha of which 265 ha will be disturbed developed. Due to the size of the study area, it was not practical to undertake a full count of all possible protected trees. The ecologist therefore conducted a sample count (by using belt-transects) and extrapolated collected data to determine the estimated number of protected trees that may be impacted. The details of the field methods are available in the specialist report included in APPENDIX N.

A total of 1373 trees were recorded using the transect method. Table 46 presents a summary for each protected tree species, while Table 47 listed the number of each species recorded along transects in each vegetation community.

The most abundant protected tree species recorded were *Vachellia erioloba* and *Spirostachys africana*:

- *Vachellia erioloba* is the most widespread, occurring abundantly in most vegetation communities and areas sampled (n=660); and
- *Spirostachys africana* is highly dominant in the *Spirostachys africana* - *Vachellia grandicornuta* Woodland vegetation community (n=579), but was rarely found in other communities.

*Combretum imberbe* was the next most commonly recorded (n=96), and like *V. erioloba* occurred in most of the surveyed areas.

Three *Securidaca longepedunculata* trees were recorded in the Open *Combretum apiculatum – Terminalia sericea* Bushveld vegetation community during the wet season terrestrial ecology field survey. But it was not subsequently recorded while walking the protected tree transects.

**Table 46: Number of trees sampled along transects during the 2018 protected tree assessment**

| Species (Scientific Name) | Number of Sampled trees (D) |
|---|---|
| *Boscia albitrunca* | 15 |
| *Combretum imberbe* | 96 |
| *Elaeodendron transvaalense* | 22 |
| *Sclerocarya birrea* subsp. *caffra* | 1 |
| *Spirostachys africana* | 579 |
| *Vachellia erioloba* | 660 |
| **Total Sampled** | **1373** |

**Table 47: Number of protected trees recorded along the transects in each of the vegetation communities**

| Vegetation Community | *Vachellia erioloba* | *Boscia albitrunca* | *Combretum imberbe* | *Elaeodendron transvaalense* | *Spirostachys africana* | *Sclerocarya birrea subsp. caffra* |
|---|---|---|---|---|---|---|
| *Euclea undulata* Thicket | 144 | | 11 | | | |
| Open *Combretum apiculatum – Terminalia sericea* Bushveld | 129 | | | | 1 | 1 |
| Short Open *Vachellia tortilis* Bushveld | 263 | 10 | 58 | | | |
| *Spirostachys africana - Vachellia grandicornuta* Woodland | 13 | 1 | 1 | 22 | 574 | |
| Tall *Senegalia nigrescens* Bushveld | 111 | 4 | 26 | | 4 | |
| **Sub Total** | **660** | **15** | **96** | **22** | **579** | **1** |

Table 48 presents the estimated number of each protected tree species occurring within the impacted area (ha) of the different vegetation communities based on extrapolation. The results of the transect method (aggregated sub-totals from Table 48) indicate that approximately 7440 protected trees are located within proposed Grootegeluk Turfvlakte Expansion project infrastructure footprints. *Vachellia erioloba* (n=2560), *Spirostachys africana* (n=4207) and *Combretum imberbe* (n=436) are the most abundant impacted protected species, based on extrapolation.

The approximate number of trees that will be impacted within each vegetation community by the various infrastructure components, based on extrapolation, is presented in Table 49. *Securidaca longepedunculata* was not recorded during the focused protected tree survey. However, three specimens were recorded in the Open *Combretum apiculatum – Terminalia sericea* Bushveld vegetation community during the field work for the terrestrial ecology assessment. As a precaution, it was included in the summary table.

**Table 48: Estimated number of protected trees occurring in impacted areas of each vegetation community using the extrapolation factors**

| Vegetation Community | *Vachellia erioloba* | *Boscia albitrunca* | *Combretum imberbe* | *Elaeodendron transvaalense* | *Spirostachys africana* | *Sclerocarya birrea* subsp. *caffra* |
|---|---|---|---|---|---|---|
| *Euclea undulata* Thicket | 403 | | 31 | | | |
| Open *Combretum apiculatum – Terminalia sericea* Bushveld | 284 | | | | 2 | 2 |
| Short Open *Vachellia tortilis* Bushveld | 1368 | 52 | 302 | | | |
| *Spirostachys africana - Vachellia grandicornuta* Woodland | 95 | 7 | 7 | 161 | 4190 | |
| Tall *Senegalia nigrescens* Bushveld | 411 | 15 | 96 | | 15 | |
| **Sub Total** | **2560** | **74** | **436** | **161** | **4207** | **2** |

**Table 49: Summary of the approximate number of protected occurring within proposed Grootegeluk Turfvlakte Expansion project infrastructure footprints, incl. *Securidaca longepedunculata*.**

| Species (Scientific Name) | Approximate Number of Affected Trees |
|---|---|
| *Boscia albitrunca* | 74 |
| *Combretum imberbe* | 436 |
| *Elaeodendron transvaalense* | 161 |
| *Sclerocarya birrea* subsp. *caffra* | 2 |
| *Securidaca longepedunculata* | 3[i] |
| *Spirostachys africana* | 4207 |
| *Vachellia erioloba* | 2560 |
| **Total** | **7443** |

Protected trees were generally abundant in all areas surveyed during the assessment, and it is expected that those occurring within proposed development footprints will need to be cleared during the construction phase of the proposed project. Predicated on the foregoing analysis, the proposed project will potentially impact 7443 protected trees. The impact on the identified protected trees will be of ***high (SP = 70)*** significance and will remain high throughout the life of the project.

It is therefore necessary to apply for a protected tree-clearing permit from the National Authority, i.e. Department of Agriculture, Forestry and Fisheries (DAFF) for all species, except *Spirostachys africana,* and the provincial authority, i.e. Limpopo Department of Economic Development, Environment and Tourism (LEDET) for this species which is not permitted by DAFF.

Activities, as prescribed in the DAFF application, that are likely to require permitting in this regard include:

- Cut, disturb, damage or destroy protected trees;
- Prune or de-limb individual protected trees; and
- Disturb protected trees for buildings or earth moving operations.

It was noted that the timber/wood from a number of the recorded protected species has great human utility. *Spirostachys africana* (Tamboti) timber for example, is highly sought after by furniture makers, while *Vachellia erioloba* (Camel Thorn) is a valuable source of fuel (firewood and charcoal). It is thus strongly recommended that wherever possible, the wood from cleared trees be supplied to local communities for fuel use and / or furniture manufacturing, etc., rather than being allowed to decompose in a debris heap.

### 10.3.9 Wetlands

The discussion below is based on a wetland delineation and assessment undertaken by GroundTruth (Pty) Ltd (GroundTruth, 2018) for the Grootegeluk Turfvlakte Expansion Project and Grootegeluk Coal Mine. The detailed report is included in APPENDIX O.

During the wetland assessment, GroundTruth (2018) identified 22 freshwater ecosystems in the project area that extends wider than the Turfvlakte project area. Of the 22 systems, 3 were classified as artificial systems that comprise of a watering hole, a borrow pit and the Voëltjie Dam (a licenced water storage facility). The remaining 19 systems where classified as natural wetland habitat. The artificial systems cover an area of approximately 2.13 ha while the remaining natural wetland systems covers approximately 1.64 ha.

Figure 75 illustrates the location of the natural and artificial wetland systems that were identified inside the Turfvlakte project area. The impact discussion in this section will only focus on the potential impact on these wetlands that were identified in the Turfvlakte project area.

The proposed Turfvlakte mining activities will result in the loss pans 10, 14, 15 and 18 and the watering hole (Figure 75) i.e. a loss of approximately 0.41 ha of intact wetland habitat (hectare equivalents). The impact will be of ***high (SP = 65)*** significance.

It is further likely that site clearing activities will result in disturbances to wetland habitat outside the direct development footprint through activities such as temporary stockpiles, construction camps, vehicle turning circles etc. extending beyond the development footprint.

This impact is expected to commence during construction but may also occur during operation and closure due to ongoing activities in and around the proposed Turfvlakte mining areas. By implementing an offset strategy as well as measures to minimise the impact on the unaffected wetlands, the impact can be reduced to one of ***moderate (SP = 55)*** significance. The offset strategy should be implemented in accordance with the Offset Study, conducted by GroundTruth (Pty) Ltd and included in APPENDIX O.

The following mitigation measures can reduce the impact on the wetland habitat outside the direct development footprint:

- Design of surface infrastructure areas should be optimised to minimise the size of the development footprint.

- All disturbance footprints must be separated from adjacent wetlands by a fence, either a security fence or five strand cattle fence. The purpose of the fence is to clearly demarcate sensitive areas and prevent accidental vehicle access to these areas.
- All construction staff should be educated on the sensitivity of wetland areas and should be made aware of all wetland areas in close proximity to the construction sites.
- Develop and implement a construction stormwater management plan prior to the commencement of site clearing activities.
- An alien vegetation management plan should be drawn up and implemented to limit the spread of alien vegetation into wetland habitat.
- All disturbed areas outside the direct development footprints should be rehabilitated and re-vegetated as soon as possible.

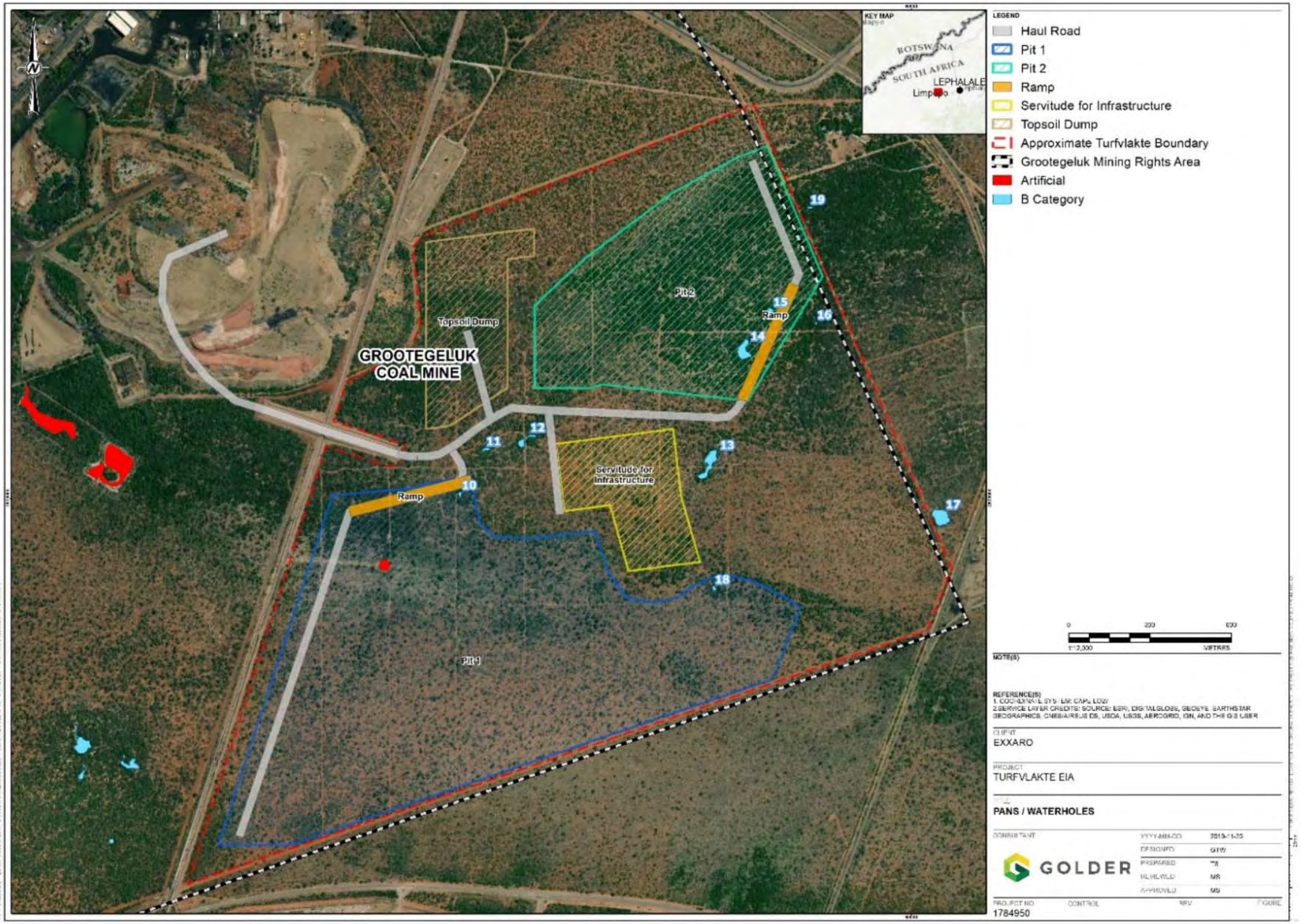



Figure 75: Pans and artificial waterhole located in the Grootegeluk Turfvlakte Expansion project area

### 10.3.10 Noise

The noise survey was carried out by dBAcoustics (dBAcoustics, 2019) and included in APPENDIX I.

#### *10.3.10.1 Construction*

Typical noise levels generated by various types of construction equipment are provided in Table 50. Conservative attenuation conditions, related to intervening ground conditions and screening, have been applied.

**Table 50: Typical noise levels generated by construction equipment**

| Equipment | Reduction in the noise level some distance from the source - dBA | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Cumulative distance from source in meters | 2m | 15m | 30m | 60m | 120m | 240m | 480m | 960m | 1920m |
| Dump truck | 91.0 | 62.5 | 56.5 | 50.4 | 44.4 | 38.4 | 32.4 | 26.4 | 20.3 |
| Backhoe | 85.0 | 56.5 | 50.5 | 44.4 | 38.4 | 32.4 | 26.4 | 20.4 | 14.3 |
| Drilling Equipment | 100.0 | 71.5 | 65.5 | 59.4 | 53.4 | 47.4 | 41.4 | 35.4 | 29.3 |
| Flatbed truck | 85.0 | 56.5 | 50.5 | 44.4 | 38.4 | 32.4 | 26.4 | 20.4 | 14.3 |
| Pickup truck | 70.0 | 41.5 | 35.5 | 29.4 | 23.4 | 17.4 | 11.4 | 5.4 | -0.7 |
| Tractor trailer | 85.0 | 56.5 | 50.5 | 44.4 | 38.4 | 32.4 | 26.4 | 20.4 | 14.3 |
| Crane | 85.0 | 56.5 | 50.5 | 44.4 | 38.4 | 32.4 | 26.4 | 20.4 | 14.3 |
| Pumps | 70.0 | 41.5 | 35.5 | 29.4 | 23.4 | 17.4 | 11.4 | 5.4 | -0.7 |
| Welding Machine | 72.0 | 43.5 | 37.5 | 31.4 | 25.4 | 19.4 | 13.4 | 7.4 | 1.3 |
| Generator | 90.0 | 61.5 | 55.5 | 49.4 | 43.4 | 37.4 | 31.4 | 25.4 | 19.3 |
| Compressor | 85.0 | 56.5 | 50.5 | 44.4 | 38.4 | 32.4 | 26.4 | 20.4 | 14.3 |
| Pile driver | 100.0 | 71.5 | 65.5 | 59.4 | 53.4 | 47.4 | 41.4 | 35.4 | 29.3 |
| Jackhammer | 90.0 | 61.5 | 55.5 | 49.4 | 43.4 | 37.4 | 31.4 | 25.4 | 19.3 |
| Rock drills | 100.0 | 71.5 | 65.5 | 59.4 | 53.4 | 47.4 | 41.4 | 35.4 | 29.3 |
| Pneumatic tools | 85.0 | 56.5 | 50.5 | 44.4 | 38.4 | 32.4 | 26.4 | 20.4 | 14.3 |
| **Cumulative noise levels from the construction activities of such work within a radius of 30m** | **105.5** | **76.9** | **70.9** | **64.9** | **58.9** | **52.9** | **46.8** | **40.8** | **34.8** |

The noise reduction calculated in Table 50 is for direct line of sight and medium ground conditions. Engineering control measures and topography can have an influence on how the noise level is perceived by the occupants of nearby noise sensitive areas.

The noise intrusion levels at the residential areas A to R, (in dBA) will be insignificant, during the construction phase of the individual open cast pits (Pit 1 and Pit 2) and is illustrated in Table 51 and Table 52 below.

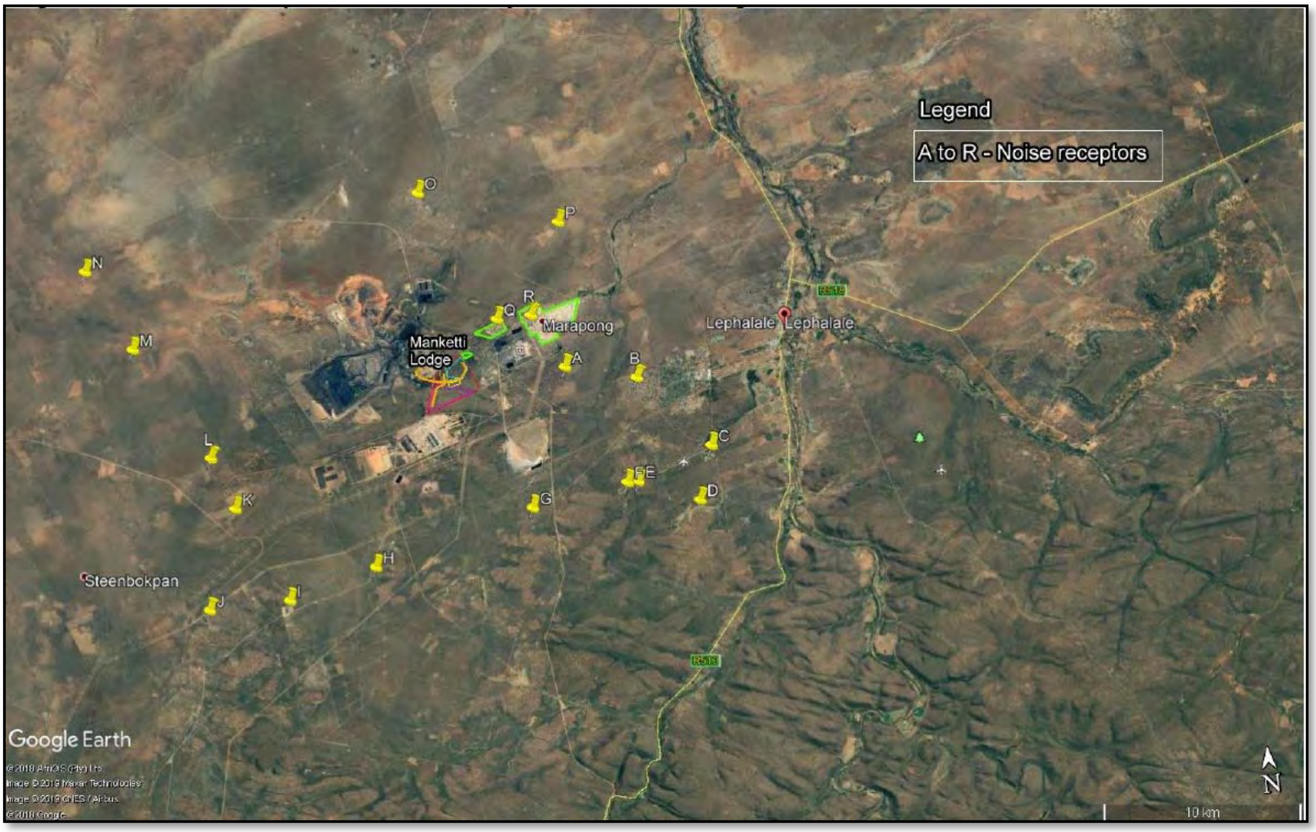



**Figure 76: Noise receptors in the vicinity of the Grootegeluk Turfvlakte Expansion project area (dBAcoustics, 2019)**

**Table 51: Noise intrusion levels in dBA during construction of Pit 1**

| Residential property | Site clearing and grubbing of footprint - dBA | Removal of topsoil | Construction of earth berm around the pit | Civil Construction (Service road) | Civil Construction | Building material and equipment | Cumulative Levels | Cumulative noise level - Daytime | Cumulative noise level - Night-time | Intrusion noise level - daytime | Intrusion noise level - night-time |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **A** | 10.7 | 5.7 | 7.7 | 7.7 | 7.7 | 0.7 | 15.4 | 36.9 | 34.7 | 0.0 | 0.1 |
| **B** | 6.3 | 1.3 | 3.3 | 3.3 | 3.3 | -3.7 | 11.0 | 36.9 | 34.6 | 0.0 | 0.0 |
| **C** | 2.8 | -2.2 | -0.2 | -0.2 | -0.2 | -7.2 | 7.4 | 36.9 | 34.6 | 0.0 | 0.0 |
| **D** | 2.4 | -2.6 | -0.6 | -0.6 | -0.6 | -7.6 | 7.1 | 36.9 | 34.6 | 0.0 | 0.0 |
| **E** | 5.3 | 0.3 | 2.3 | 2.3 | 2.3 | -4.7 | 10.0 | 36.9 | 34.6 | 0.0 | 0.0 |
| **F** | 5.0 | 0.0 | 2.0 | 2.0 | 2.0 | -5.0 | 9.7 | 36.9 | 34.6 | 0.0 | 0.0 |

| Residential property | Site clearing and grubbing of footprint - dBA | Removal of topsoil | Construction of earth berm around the pit | Civil Construction (Service road) | Civil Construction | Building material and equipment | Cumulative Levels | Cumulative noise level - Daytime | Cumulative noise level - Night-time | Intrusion noise level - daytime | Intrusion noise level - night-time |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **G** | 8.1 | 3.1 | 5.1 | 5.1 | 5.1 | -1.9 | 12.7 | 36.9 | 34.6 | 0.0 | 0.0 |
| **H** | 5.4 | 0.4 | 2.4 | 2.4 | 2.4 | -4.6 | 10.1 | 36.9 | 34.6 | 0.0 | 0.0 |
| **I** | 2.8 | -2.2 | -0.2 | -0.2 | -0.2 | -7.2 | 7.5 | 33.6 | 27.5 | 0.0 | 0.0 |
| **J** | 1.0 | -4.0 | -2.0 | -2.0 | -2.0 | -9.0 | 5.6 | 33.6 | 27.5 | 0.0 | 0.0 |
| **K** | 3.4 | -1.6 | 0.4 | 0.4 | 0.4 | -6.6 | 8.1 | 33.6 | 27.5 | 0.0 | 0.0 |
| **L** | 3.4 | -1.6 | 0.4 | 0.4 | 0.4 | -6.6 | 8.0 | 48.6 | 34.6 | 0.0 | 0.0 |
| **M** | 1.3 | -3.7 | -1.7 | -1.7 | -1.7 | -8.7 | 5.9 | 48.6 | 34.6 | 0.0 | 0.0 |
| **N** | -0.3 | -5.3 | -3.3 | -3.3 | -3.3 | -10.3 | 4.4 | 33.6 | 27.5 | 0.0 | 0.0 |
| **O** | 5.6 | 0.6 | 2.6 | 2.6 | 2.6 | -4.4 | 10.2 | 36.9 | 34.6 | 0.0 | 0.0 |
| **P** | 5.6 | 0.6 | 2.6 | 2.6 | 2.6 | -4.4 | 10.3 | 36.9 | 34.6 | 0.0 | 0.0 |
| **Q** | 17.5 | 12.5 | 14.5 | 14.5 | 14.5 | 7.5 | 22.1 | 43.2 | 48.1 | 0.0 | 0.0 |
| **R** | 12.9 | 7.9 | 9.9 | 9.9 | 9.9 | 2.9 | 17.5 | 50.2 | 51.2 | 0.0 | 0.0 |
| **Manketti Lodge** | 19.8 | 14.8 | 16.8 | 16.8 | 16.8 | 9.8 | 24.5 | 43.3 | 43.3 | 0.1 | 0.1 |

**Table 52: Noise intrusion levels in dBA during construction of Pit 2**

| Residential property | Site clearing and grubbing of footprint - dBA | Removal of topsoil | Construction of earth berm around the pit | Civil Construction (Service road) | Civil Construction | Building material and equipment deliveries | Cumulative Levels | Cumulative noise level - Daytime | Cumulative noise level - Night-time | Intrusion noise level - daytime | Intrusion noise level - night-time |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **A** | 11.5 | 6.5 | 8.5 | 8.5 | 8.5 | 1.5 | 16.2 | 36.9 | 34.7 | 0.0 | 0.1 |
| **B** | 7.0 | 2.0 | 4.0 | 4.0 | 4.0 | -3.0 | 11.7 | 36.9 | 34.6 | 0.0 | 0.0 |

| Residential property | Site clearing and grubbing of footprint - dBA | Removal of topsoil | Construction of earth berm around the pit | Civil Construction (Service road) | Civil Construction | Building material and equipment deliveries | Cumulative Levels | Cumulative noise level - Daytime | Cumulative noise level - Night-time | Intrusion noise level - daytime | Intrusion noise level - night-time |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **C** | 3.1 | -1.9 | 0.1 | 0.1 | 0.1 | -6.9 | 7.8 | 36.9 | 34.6 | 0.0 | 0.0 |
| **D** | 2.6 | -2.4 | -0.4 | -0.4 | -0.4 | -7.4 | 7.3 | 36.9 | 34.6 | 0.0 | 0.0 |
| **E** | 4.8 | -0.2 | 1.8 | 1.8 | 1.8 | -5.2 | 9.5 | 36.9 | 34.6 | 0.0 | 0.0 |
| **F** | 5.2 | 0.2 | 2.2 | 2.2 | 2.2 | -4.8 | 9.9 | 36.9 | 34.6 | 0.0 | 0.0 |
| **G** | 7.2 | 2.2 | 4.2 | 4.2 | 4.2 | -2.8 | 11.9 | 36.9 | 34.6 | 0.0 | 0.0 |
| **H** | 4.3 | -0.7 | 1.3 | 1.3 | 1.3 | -5.7 | 9.0 | 36.9 | 34.6 | 0.0 | 0.0 |
| **I** | 1.9 | -3.1 | -1.1 | -1.1 | -1.1 | -8.1 | 6.5 | 33.6 | 27.5 | 0.0 | 0.0 |
| **J** | 0.3 | -4.7 | -2.7 | -2.7 | -2.7 | -9.7 | 5.0 | 33.6 | 27.5 | 0.0 | 0.0 |
| **K** | 3.1 | -1.9 | 0.1 | 0.1 | 0.1 | -6.9 | 7.8 | 33.6 | 27.5 | 0.0 | 0.0 |
| **L** | 3.0 | -2.0 | 0.0 | 0.0 | 0.0 | -7.0 | 7.7 | 48.6 | 34.6 | 0.0 | 0.0 |
| **M** | 1.2 | -3.8 | -1.8 | -1.8 | -1.8 | -8.8 | 5.9 | 33.6 | 27.5 | 0.0 | 0.0 |
| **N** | -0.3 | -5.3 | -3.3 | -3.3 | -3.3 | -10.3 | 4.3 | 33.6 | 27.5 | 0.0 | 0.0 |
| **O** | 6.8 | 1.8 | 3.8 | 3.8 | 3.8 | -3.2 | 11.5 | 36.9 | 34.6 | 0.0 | 0.0 |
| **P** | 6.7 | 1.7 | 3.7 | 3.7 | 3.7 | -3.3 | 11.3 | 36.9 | 34.6 | 0.0 | 0.0 |
| **Q** | 19.6 | 14.6 | 16.6 | 16.6 | 16.6 | 9.6 | 24.2 | 43.3 | 48.1 | 0.1 | 0.0 |
| **R** | 13.8 | 8.8 | 10.8 | 10.8 | 10.8 | 3.8 | 18.5 | 50.2 | 51.2 | 0.0 | 0.0 |
| **Manketti Lodge** | 34.9 | 29.9 | 31.9 | 31.9 | 31.9 | 24.9 | 39.6 | 44.8 | 44.8 | 1.6 | 1.6 |

The potential impact of the construction activates is rated as being of ***moderate (SP=30)*** significance. The following mitigation measures are recommended to reduce the impact to one of ***low (SP=24)*** significance:

- The laydown area and other noisy fixed facilities should be located well away from noise sensitive areas adjacent to the proposed construction areas.
- All construction vehicles and equipment must be kept in good repair.
- Machinery with low noise levels which complies with the manufacturer's specifications must be used.

- Construction activities should be limited to daytime periods only.
- Noise monitoring to be conducted on a monthly basis until the shift in the prevailing ambient noise levels are determined, thereafter monitoring frequency may change to a quarterly basis.
- In general, construction activities should meet the noise standard requirements of the Occupational Health and Safety Act (Act No. 85 of 1993); and
- Construction staff working in areas where the 8 -hour ambient noise levels exceed 75dBA should wear hearing protection equipment.

### 10.3.10.2 Operation

The environmental noise impact during the operational phase at the identified noise receptors is detailed in Table 53. The noise intrusion levels will be insignificant at the different noise receptors A to R.

**Table 53: Noise intrusion levels in dBA during the operational phase**

| Residential property | Open cast mining activities - Pit 1 | Open cast mining activities - Pit 2 | Topsoil Activities | Hauling of coal | Maintenance activities | Emergency siren | Emergency generator | Cumulative Levels | Cumulative noise level - Daytime | Cumulative noise level - Night-time | Intrusion noise level - daytime | Intrusion noise level - night-time |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **A** | 7.7 | 8.5 | 6.9 | 8.0 | 10.6 | 17.8 | 15.1 | 21.1 | 37.0 | 34.8 | 0.1 | 0.2 |
| **B** | 3.3 | 4.0 | 2.9 | 3.4 | 6.2 | 12.6 | 11.2 | 16.5 | 36.9 | 34.7 | 0.0 | 0.1 |
| **C** | -0.2 | 0.1 | -0.5 | 0.1 | 2.9 | 8.8 | 7.8 | 13.1 | 36.9 | 34.6 | 0.0 | 0.0 |
| **D** | -0.6 | -0.4 | -0.8 | -0.2 | 2.7 | 8.2 | 7.3 | 12.6 | 36.9 | 34.6 | 0.0 | 0.0 |
| **E** | 2.3 | 1.8 | 1.3 | 2.1 | 4.9 | 10.5 | 9.6 | 14.8 | 36.9 | 34.6 | 0.0 | 0.0 |
| **F** | 2.0 | 2.2 | 1.7 | 2.4 | 5.3 | 10.8 | 10.0 | 15.2 | 36.9 | 34.6 | 0.0 | 0.0 |
| **G** | 5.1 | 4.2 | 3.8 | 4.9 | 7.6 | 12.8 | 12.3 | 17.3 | 36.9 | 34.7 | 0.0 | 0.1 |
| **H** | 2.4 | 1.3 | 1.8 | 2.3 | 5.1 | 9.2 | 9.9 | 14.6 | 36.9 | 34.6 | 0.0 | 0.0 |
| **I** | -0.2 | -1.1 | -0.7 | -0.5 | 2.4 | 6.7 | 7.5 | 12.2 | 33.6 | 27.6 | 0.0 | 0.1 |
| **J** | -2.0 | -2.7 | 0.2 | -2.1 | 0.8 | 5.1 | 5.9 | 10.8 | 33.6 | 27.6 | 0.0 | 0.1 |
| **K** | 0.4 | 0.1 | 0.2 | 0.2 | 3.1 | 7.3 | 8.3 | 12.9 | 33.6 | 27.6 | 0.0 | 0.1 |
| **L** | 0.4 | 0.0 | 0.3 | 0.2 | 3.1 | 7.3 | 8.2 | 12.8 | 48.6 | 34.6 | 0.0 | 0.0 |
| **M** | -1.7 | -1.8 | -1.6 | -1.8 | 1.1 | 5.5 | 6.3 | 11.1 | 33.6 | 27.6 | 0.0 | 0.1 |
| **N** | -3.3 | -3.3 | -3.0 | -3.2 | -0.4 | 4.2 | 4.8 | 9.8 | 33.6 | 27.6 | 0.0 | 0.1 |

| Residential property | Open cast mining activities - Pit 1 | Open cast mining activities - Pit 2 | Topsoil Activities | Hauling of coal | Maintenance activities | Emergency siren | Emergency generator | Cumulative Levels | Cumulative noise level - Daytime | Cumulative noise level - Night-time | Intrusion noise level - daytime | Intrusion noise level - night-time |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **O** | 2.6 | 3.8 | 3.5 | 3.1 | 5.9 | 11.6 | 11.3 | 16.2 | 36.9 | 34.7 | 0.0 | 0.1 |
| **P** | 2.6 | 3.7 | 3.3 | 3.2 | 6.0 | 12.4 | 11.0 | 16.4 | 36.9 | 34.7 | 0.0 | 0.1 |
| **Q** | 14.5 | 16.6 | 13.3 | 13.2 | 15.7 | 24.6 | 16.8 | 26.9 | 43.3 | 48.1 | 0.1 | 0.0 |
| **R** | 9.9 | 10.8 | 8.3 | 9.9 | 12.1 | 19.9 | 19.9 | 24.0 | 50.2 | 51.2 | 0.0 | 0.0 |
| **Manketti Lodge** | 16.8 | 31.9 | 19.4 | 20.3 | 22.2 | 30.3 | 30.2 | 36.1 | 44.0 | 44.0 | 0.8 | 0.8 |

The noise contours during the operational phase of the mine where Pit 1 will be operational is illustrated in Figure 77, when Pit 2 will be operational in Figure 78.

The potential environmental noise impact of the proposed opencast mining operations (excluding blasting) is assessed as being of ***moderate (SP = 52)*** significance, which can be managed to one of ***moderate (SP = 39)*** significance by implementing the following mitigation measures:

- All plant, equipment and vehicles should be kept in good repair.
- Where possible, very noisy activities should not take place at night.
- Noise monitoring to be done at the open cast mining footprint, noise sources within mining footprint and at the abutting residential areas on a monthly basis after which the frequency can change to a quarterly basis and eventually bi-anually, as per the current noise monitoring programme at Grootegeluk Coal Mine.
- Actively manage the proposed mining process at the Grootegeluk Turfvlakte Expansion Project and the noise management plan must be used to ensure compliance to the noise regulations and/or standards. The noise levels to be evaluated in terms of the baseline noise levels; and
- Noise monitoring will have to be carried out on a monthly basis during all phases of the project until the potential shift in the prevailing ambient noise levels are determined, after which the frequency of monitoring may be changed to a quarterly and later a bi-annual basis. The additional noise measuring points are illustrated in Figure 79 below.

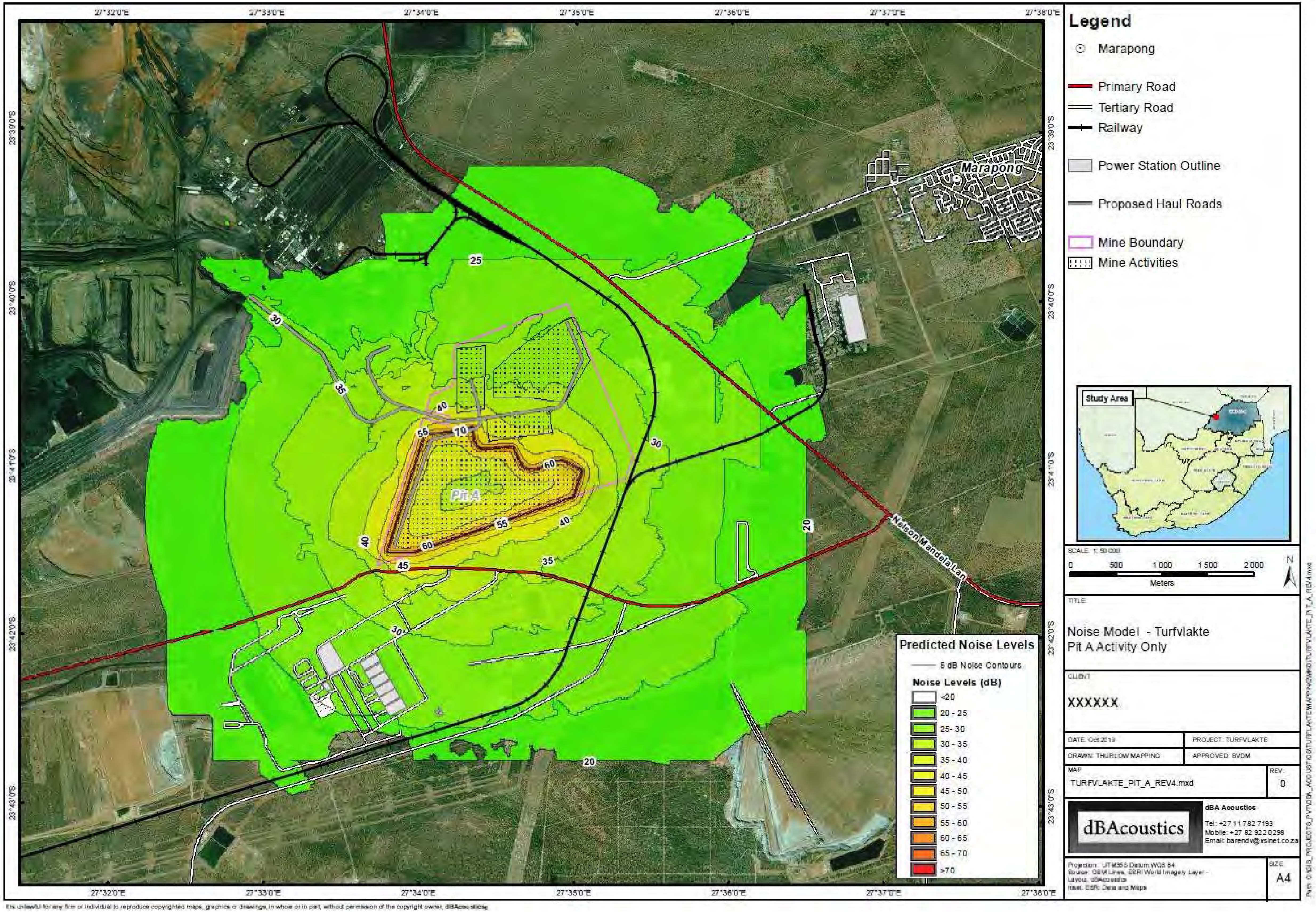



Figure 77: Noise contours during operations at Pit 1 and other infrastructure

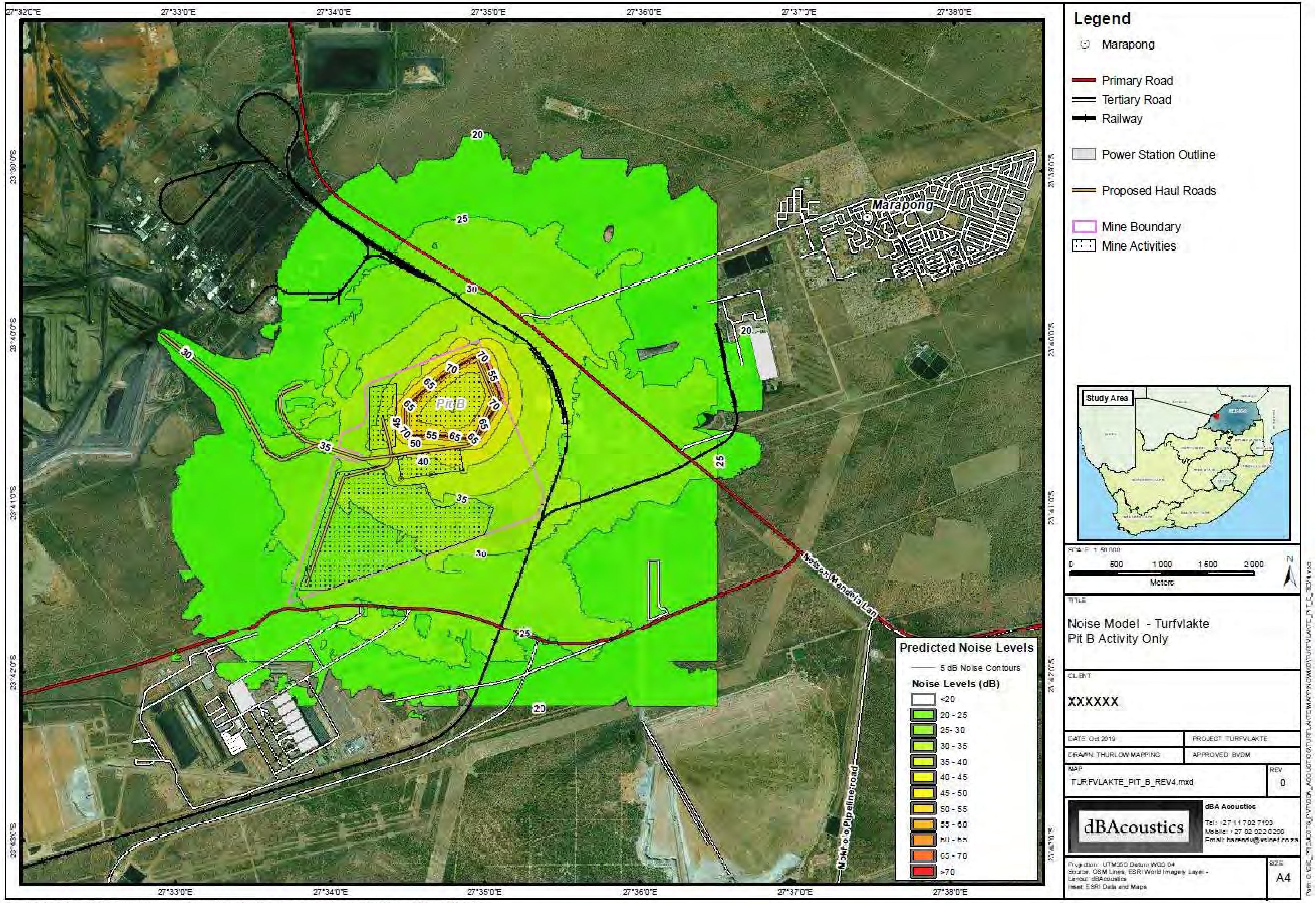



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**Figure 78: Noise contours during operations at Pit 2 and other infra-structure**

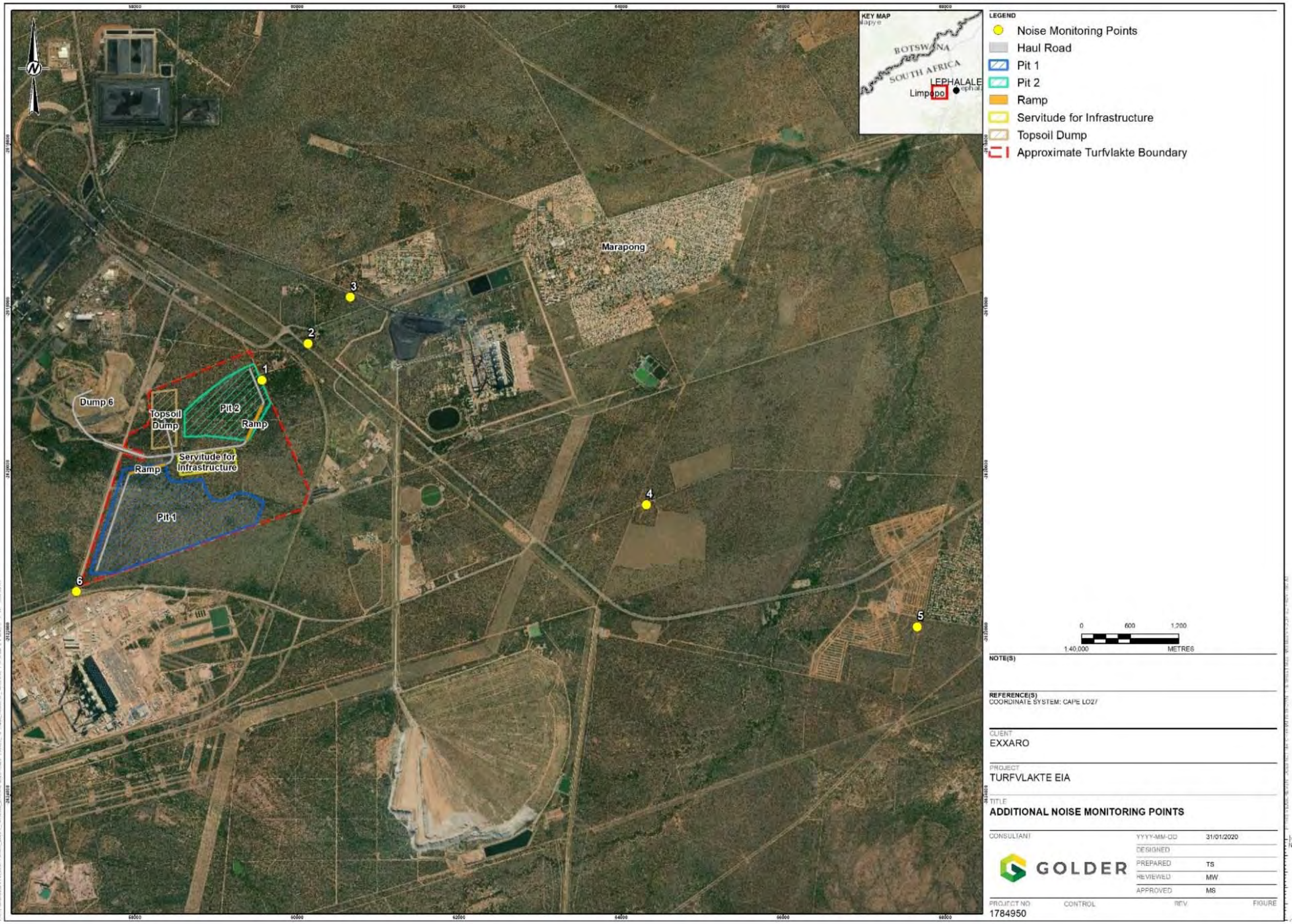



**Figure 79: Additional noise monitoring locations**

### 10.3.10.3 Decommissioning and Closure

The environmental noise impact of the decommissioning phase mining activities at the residential areas is detailed in Table 54. The noise intrusion levels will be insignificant at the different noise receptors A to R during the decommissioning phase of the Grootegeluk Turfvlakte Expansion Project.

**Table 54: Noise intrusion levels in dBA during the decommissioning phase**

| Residential | Demolition of all surface infrastructure | Rehabilitation of all disturbed areas | Cumulative Levels | Cumulative noise level - Daytime | Cumulative noise level - Night time | Intrusion noise level - daytime | Intrusion noise level - night time |
|---|---|---|---|---|---|---|---|
| **A** | 11.0 | 8.0 | 12.7 | 36.9 | 34.6 | 0.0 | 0.0 |
| **B** | 6.9 | 3.9 | 8.7 | 36.9 | 34.6 | 0.0 | 0.0 |
| **C** | 3.0 | 0.0 | 4.7 | 36.9 | 34.6 | 0.0 | 0.0 |
| **D** | 2.6 | -0.4 | 4.4 | 36.9 | 34.6 | 0.0 | 0.0 |
| **E** | 4.8 | 1.8 | 6.6 | 36.9 | 34.6 | 0.0 | 0.0 |
| **F** | 5.2 | 2.2 | 7.0 | 36.9 | 34.6 | 0.0 | 0.0 |
| **G** | 7.5 | 4.5 | 9.3 | 36.9 | 34.6 | 0.0 | 0.0 |
| **H** | 5.0 | 2.0 | 6.7 | 36.9 | 34.6 | 0.0 | 0.0 |
| **I** | 2.3 | -0.7 | 4.1 | 33.6 | 27.5 | 0.0 | 0.0 |
| **J** | 0.7 | -2.3 | 2.4 | 33.6 | 27.5 | 0.0 | 0.0 |
| **K** | 3.0 | 0.0 | 4.7 | 33.6 | 27.5 | 0.0 | 0.0 |
| **L** | 3.0 | 0.0 | 4.8 | 48.6 | 34.6 | 0.0 | 0.0 |
| **M** | 1.1 | -1.9 | 2.9 | 33.6 | 27.5 | 0.0 | 0.0 |
| **N** | -0.5 | -3.5 | 1.3 | 33.6 | 27.5 | 0.0 | 0.0 |
| **O** | 6.2 | 3.2 | 8.0 | 36.9 | 34.6 | 0.0 | 0.0 |
| **P** | 6.2 | 3.2 | 7.9 | 36.9 | 34.6 | 0.0 | 0.0 |
| **Q** | 16.1 | 13.1 | 17.8 | 43.2 | 48.1 | 0.0 | 0.0 |
| **R** | 12.4 | 9.4 | 14.1 | 50.2 | 51.2 | 0.0 | 0.0 |
| **Manketti Lodge** | 22.6 | 19.6 | 24.3 | 43.3 | 43.3 | 0.1 | 0.1 |

The activities associated with the decommissioning and closure phase of the opencast mining operations will generate similar, but probably lower, noise levels than those experienced during the construction phase. The duration will also be similar, except for post closure monitoring, which will continue for several years, but will not have any noise impacts.

The following mitigation measures will the implemented to reduce the assessed impact from one of ***moderate (SP = 30)***, to one of ***low (SP = 24)*** significance:

- Machinery with low noise levels which complies with the manufacturer's specifications to be used.
- Activities to take place during daytime period only.
- Vehicles to comply with manufacturers' specifications; and
- Noise monitoring to be carried out on a monthly basis until the potential shift in the prevailing ambient noise levels are determined, thereafter monitoring frequency may change to a quarterly basis.

### 10.3.11 Blasting and Vibration

A Blast Impact Assessment study was completed by Blast Management and Consulting (Pty) Ltd, in March 2018 (APPENDIX J).

#### *10.3.11.1 Construction*

The construction activities described in Section 10.2.1 will not require blasting, therefore there will be ***no (SP = 0)*** impact due to blasting.

#### *10.3.11.2 Operation*

Ground vibration, air blast, fly rock and fumes are some of the impacts that can be expected as a result from blasting operations (Blast Management & Consulting, 2018). In order to evaluate the possible influence from blasting operations with regards to ground vibration, air blast and fly rock, a planned blast design is required to determine possible influences.

During operations, blasting will be required for the overburden material. Available information indicate that coal will firstly be mechanically dug and ripped with drilling and blasting as a last option. This impact assessment concentrates on the drilling and blasting of the overburden. Coal requires significantly less explosives per unit than overburden.

The following mitigation measures will the implemented to reduce the assessed impact from one of ***high (SP = 80)***, to one of ***moderate (SP = 45)*** significance:

- Blasts design:
  - Blast design can be reviewed prior to first blast panned and done. Possible use of electronic initiation rather than conventional timing systems should be considered. This will allow for single blast hole firing - thus less charge mass per delay and less influence.
  - Test blasting should be done to confirm levels and ground vibration and air blast.
  - Detailed monitoring to be done during test blasting, and results used to help define blasting operations going forward.
- Stemming length:

- Stemming lengths provides for some control on fly rock. Recommended stemming length should range between 20 and 30 times the blast hole diameter. Increasing the stemming lengths to 30 and 34 times the blast hole diameter, will contribute to more acceptable air blast levels.

- Safe blasting distance and evacuation:
  - The calculated minimum safe distance is 305m. The final blast designs are not available, therefore the final safe distance to evacuate people and animals will still be decided upon. This distance may be greater than 305m, pending the final code of practice of the mine and responsible blaster's decision on safe distance. The use of minimum 500 m exclusion zone is rather recommended, and it will be required that evacuation be negotiated when blasting.
- Road Closure:
  - The district roads in the vicinity of the project area (D1675) is located 401m from Pit 1, thus road closure needs to be considered when blasting closer than 500m from the road. Smaller roads not necessarily reflected on all maps should also be considered for closures when blasting is done.
- Photographic inspections:
  - It is recommended that a photographic survey of all structures up to 1500m, from the centre of the proposed pit areas is completed.
  - Ground vibration monitoring to be done.
- Ground vibration and air blast levels:
  - The ground vibration and air blast levels limits recommended for blasting operations in this area are provided in Figure 77 and Figure 78.
- Blasting days and times of blasting:
  - A further consideration of blasting times is when weather conditions could influence the effects yielded by blasting operations. It is recommended not to blast too early in the morning when it is still cool or when there is a possibility of atmospheric inversion or too late in the afternoon in winter. Do not blast in fog. Do not blast in the dark. Refrain from blasting when wind is blowing strongly in the direction of an outside receptor. Do not blast with low overcast clouds. These 'do nots' stem from the influence that weather has on air blast. The energy of air blast cannot be increased but it is distributed differently and therefore is difficult to mitigate. It is recommended that a standard blasting time is fixed and blasting notice boards setup at various routes around the project area that will inform the community of blasting dates and times.
- Third party monitoring:
  - Third party consultation and monitoring should be considered for all ground vibration and air blast monitoring work. Monitoring could be done using permanent installed stations.
- Relocation:
  - A relocation program should be considered for all households within 305m of the proposed pit area

Most of the above aspects do not require specific locations of monitoring. Ground vibration and air blast monitoring requires identified locations for monitoring. Monitoring of ground vibration and air blast is done to ensure that the generated levels of ground vibration and air blast comply with recommendations. Proposed positions were selected to indicate the nearest points of interest at which levels of ground vibration and air blast should be within the accepted norms and standards as proposed in this report. The monitoring of ground vibration will also qualify the expected ground vibration and air blast levels and assist in mitigating these aspects properly. This will also contribute to proper relationships with the neighbours.

A minimum of seven monitoring positions were identified for Pit 1 and Pit 2 Some of these points may be applicable to more than one installation. Monitoring positions are indicated in Figure 80 and Table 55 lists the positions with coordinates. These points will need to be re-defined after the first blasts done and the monitoring programme defined.

**Table 55: Additional blast monitoring locations**

| Location number | Location Description | Latitude | Longitude |
|---|---|---|---|
| 6 | Railway line | 59965.28 | -2620795.47 |
| 79 | Buildings / Structures | 57422.05 | -2621705.43 |
| 82 | Bridge | 57836.83 | -2619761.73 |
| 84 | D1675 Road | 57595.00 | -2621480.66 |
| 101 | Building / Structure | 58141.47 | -2618979.14 |
| 112 | Manketti Lodge | 59746.58 | -2618652.80 |
| 142 | Buildings / Structures | 61862.18 | -2619759.82 |

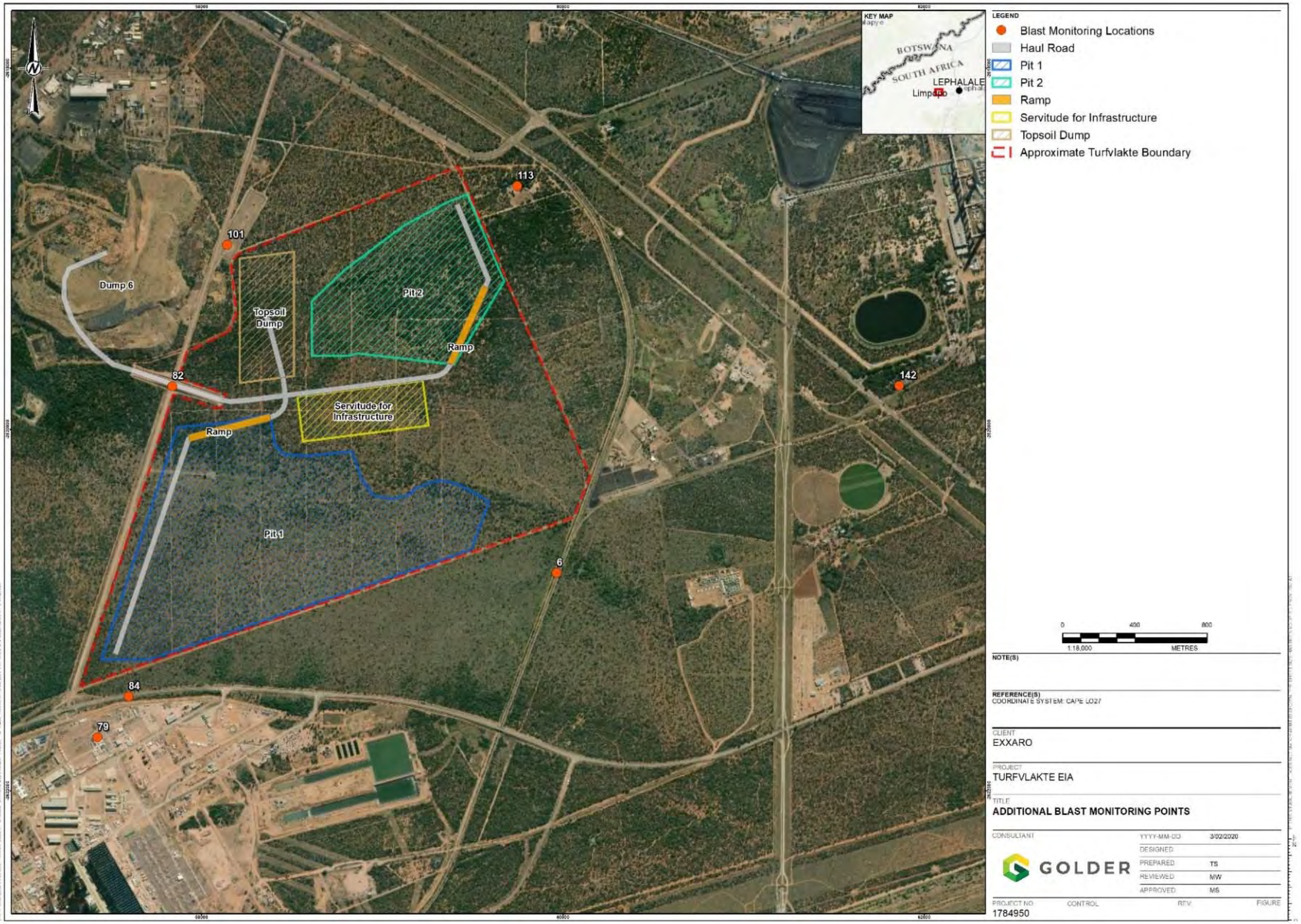



**Figure 80: Additional blast monitoring locations**

#### 10.3.11.3 *Decommissioning and Closure*

The activities described in Section 10.2.4 will not require blasting, i.e. there will be ***no (SP = 0)*** impact due to blasting.

### 10.3.12 Visual

Some of the activities on the Grootegeluk Turfvlakte Expansion project site will be visible to observers travelling on local roads and living in the nearby Marapong and Onverwacht residential areas. The assessment of visual impacts, as summarised below, is detailed in the Visual Impact Assessment report in APPENDIX K.

A typical visual impact assessment considers a radius of 10 km around the physical footprint of a development, because the humane eye cannot generally distinguish significant detail beyond this distance. Figure 81 illustrates the location of prominent receptors in the study area.  These include:

- Marapong village – the entire village is located within the study area (i.e. within the 10 km buffer around the project site); and
- Onverwacht residential area – the western edge of Onverwacht falls within the study area.

Other resident receptors include farmer owners, managers and workers that occupy the numerous rural homesteads that are scattered on farms throughout the study area.

Viewsheds were developed for the proposed project based on the indicated infrastructure locations and heights (Table 56). In this fashion, the level of theoretical visibility (LTV), based on the results of the Viewshed analysis, was then rated (Table 57).

**Table 56: Estimated heights of proposed site infrastructure**

| Facility Name | Height (m above ground) |
|---|---|
| Supporting infrastructure (e.g. offices, storage units) | 6 |
| Topsoil stockpiles | 40 |

**Table 57: Level of visibility rating**

| Level of theoretical visibility of project element | Visibility rating |
|---|---|
| Less than a quarter of the total project study area | Low |
| Between a quarter and half of the study area | Moderate |
| More than half of the study area | High |

Figure 82 shows the results of the Viewshed for the proposed surface laydown area (including the built infrastructure) and the proposed topsoil stockpile.

It is noted by Golder (2019d) that the Viewshed analyses do not factor in the screening effect of existing vegetation, and therefore represents a ‘worst-case” scenario. While the average height of the dense, closed Bushveld vegetation is relatively low ranging from 2 m to 5 m, its screening effect (especially in terms of lower structures less than two to three stories in height) over larger distances, is nevertheless notable.

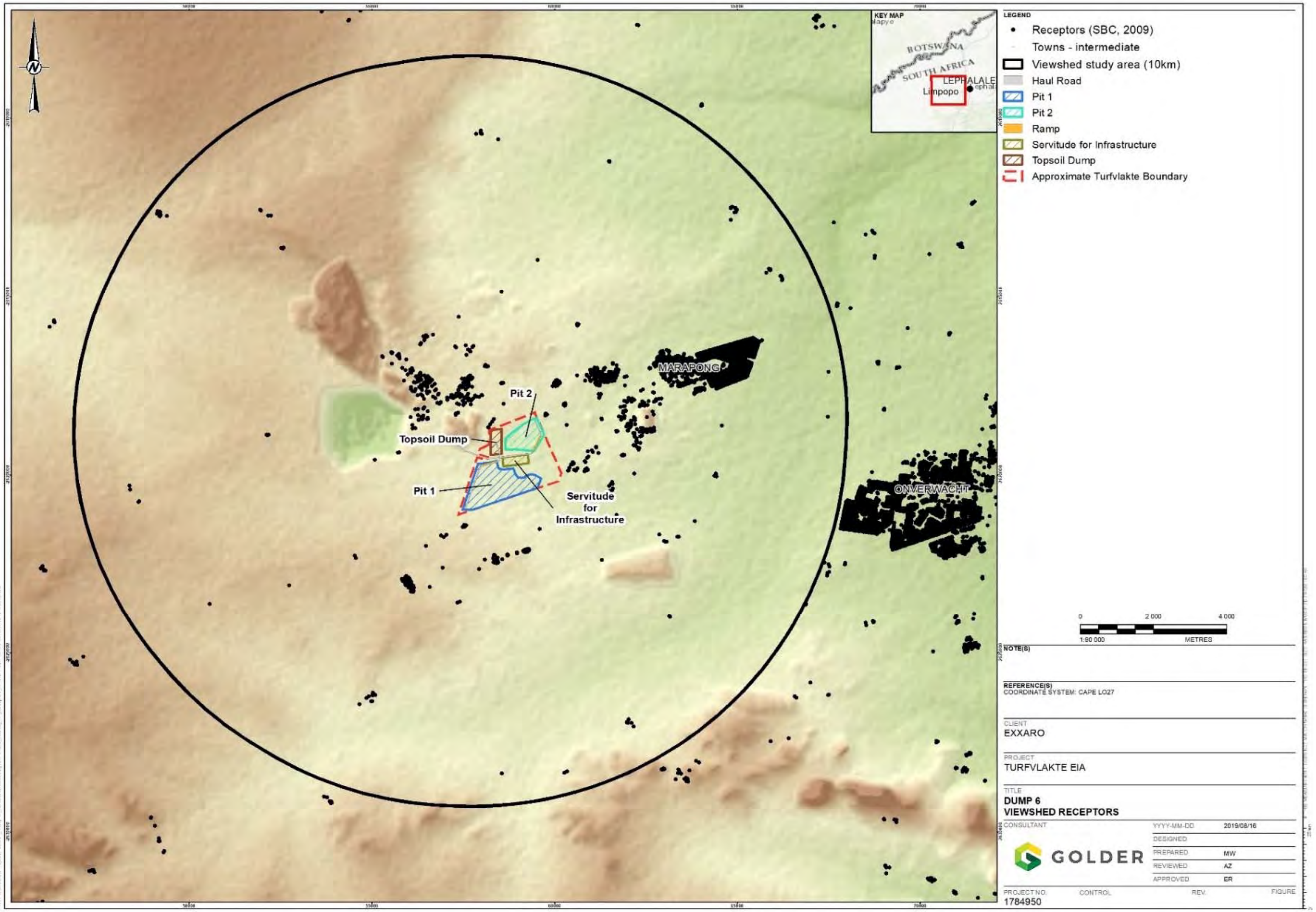



**Figure 81: Location of prominent receptors in the study area in relation to the proposed project infrastructure**

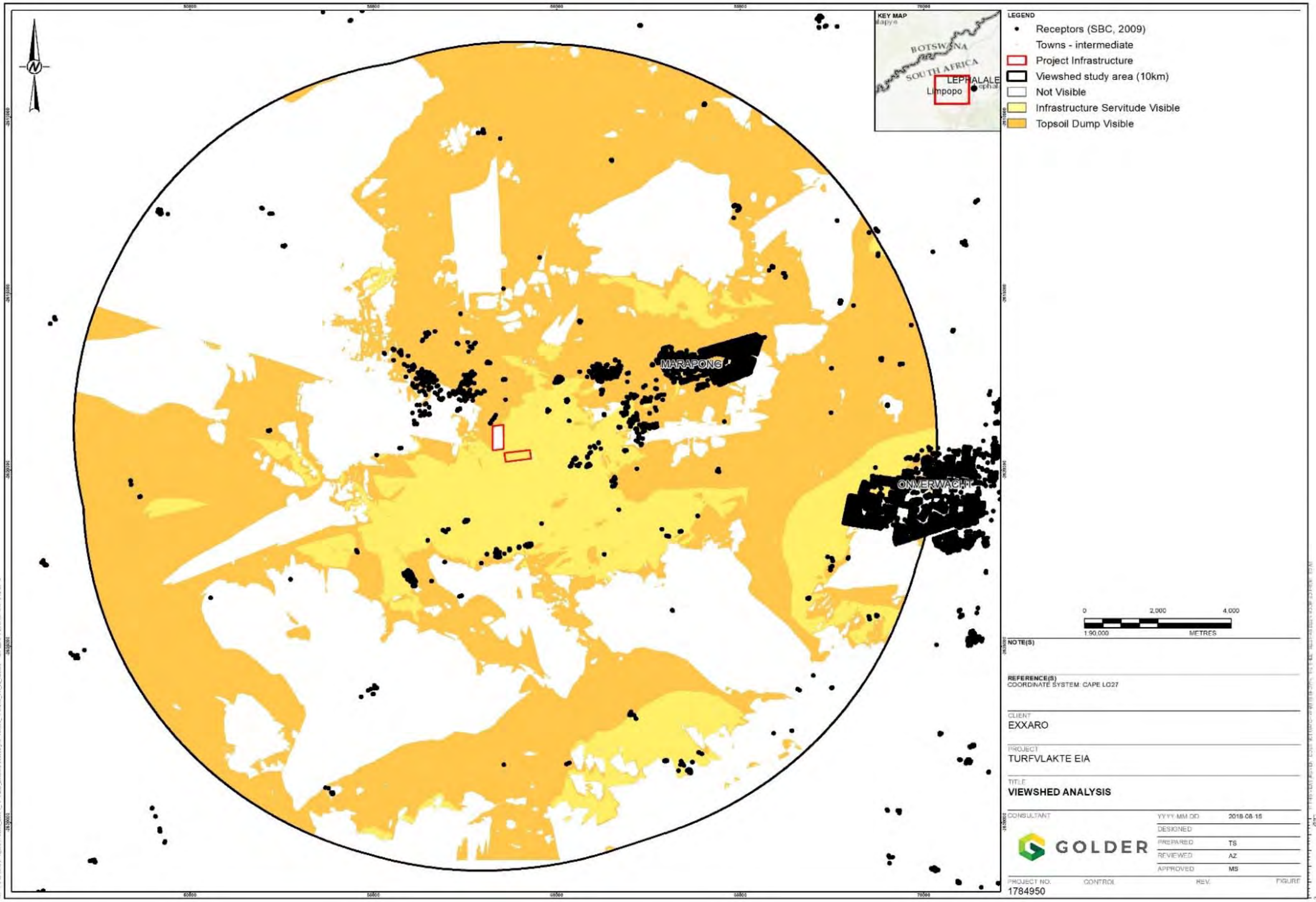



**Figure 82: Viewshed from the proposed topsoil stockpile and supporting infrastructure (within infrastructure servitude)**

#### 10.3.12.1 Construction

The potential day-time and night-time visual impacts during the construction phase are:

- Reduction in visual resource value due to presence of surface infrastructure.
- Reduction in visual resource value due to the open pits (Pit 1 and 2) and topsoil stockpiles.
- Formation of dust plumes as a result of construction activities, soil stripping and subsequent mining; and
- Light pollution at night.

Construction and operational mitigation possibilities are very limited for the proposed project, as a result of the scale and location of the mine, as well as the functional/operational requirements of the infrastructure and mining areas. Visual mitigation efforts should therefore be focussed on reducing the long-term post-closure impacts caused by the mine, through effective post-operational rehabilitation (Golder, 2019d).

The predicted visual impacts during the construction phase will be reduced from one of ***moderate (SP = 55***) significance to one of ***low (SP = 18)*** significance by implementing the following mitigation measures:

- Dust Control:
  - Water down haul roads and large bare areas as frequently as is required to minimise airborne dust.
  - Place a sufficiently deep layer of crushed rock or gravel at vehicle and machinery parking areas.
  - Apply chemical dust suppressants if deemed necessary.
  - Enforce a 40 km/h speed limit on-site for all vehicles.
  - Extend the Grootegeluk Coal Mine dust bucket fallout monitoring system to include the monitoring at the Grootegeluk Turfvlakte Expansion Project.
- General site management:
  - Maintain the construction site in a neat and orderly condition at all times.
  - Create designated areas for material storage, waste sorting and temporary storage, batching and other potentially intrusive activities.
  - Limit the physical extent of areas cleared for material laydown and vehicle parking as much as possible, and rehabilitate these area as soon as is feasible; and
  - Repair unsightly and ecologically detrimental erosion to steep or bare slopes as soon as possible, and re-vegetate these areas using a suitable mix of indigenous grass species.

#### 10.3.12.2 Operation

No additional activities, apart from those already identified in the construction phase of the proposed project, are expected.

The predicted impact will be reduced from one of ***moderate (SP = 55)*** significance to one of ***low (SP = 18)*** significance by implementing the following mitigation measures:

- Management of light pollution:
  - Utilise security lighting (if feasible) that is movement activated rather than permanently switched on, to prevent unnecessary constant illumination.

- Plan the lighting requirements of the facilities to ensure that lighting meets the need to keep the site secure and safe, without resulting in excessive illumination.
- Reduce the height and angle of illumination from which floodlights are fixed as much possible while still maintaining the required levels of illumination.
- Identify zones of high and low lighting requirements, focusing on only illuminating areas to the minimum extent possible to allow safe operations at night and for security surveillance.
- Avoid up-lighting of structures by rather directing lighting downwards and focussed on the area to be illuminated; and
- Fit all security lighting with ‘blinkers’ or specifically designed fixtures, to ensure light is directed downwards while preventing side spill. Light fixtures of this description are commonly available for a variety of uses and should be used to the greatest extent possible.

- Dust Control:
  - Water down haul roads and large bare areas as frequently as is required to minimise airborne dust.
  - Place a sufficiently deep layer of crushed rock or gravel at vehicle and machinery parking areas.
  - Apply chemical dust suppressants if deemed necessary.
  - Enforce a 40 km/h speed limit on-site for all vehicles.
  - Extend the Grootegeluk Coal Mine dust bucket fallout monitoring system to include the monitoring at the Grootegeluk Turfvlakte Expansion Project.
- Architectural measures:
  - To reduce the visual intrusion of the buildings, where practical roofing and cladding material should not be white or shiny (e.g. bare galvanised steel that causes glare);
  - Where practical, the construction and/or painting of perminant offices and other buildings in colours that are complementary to the surrounding landscape, such as olive green, light grey, grey green, blue grey, dark buff, rust, ochre variations of tan, will be considered; and
  - Utilise construction materials that have matt textures where possible.
- General site management:
  - Shape slopes and embankments to a maximum gradient of 1:4 and vegetate, to prevent erosion and improve their appearance.
  - Avoid using berms as visual screening devices, except in instances where vegetative screens are not feasible, as they are usually as intrusive as the elements that they are screening.
  - Shape and vegetate topsoil stockpiles to prevent erosion.
  - Retain existing trees wherever possible, as they already provide valuable screening.
  - Plant indigenous trees in all landscaped areas, as well as around plant infrastructure to break structural form and provide visual screens; and
  - Implement and maintain landscaping using indigenous plants and water-wise methods wherever visitors are expected, to improve the overall appearance of the operation.

#### *10.3.12.3 Decommissioning and Closure*

The potential day-time and night-time visual impacts during the decommissioning and closure phase are:

- Reinstatement of visual resource value due to dismantling of plant and mining infrastructure and subsequent rehabilitation of footprint areas.
- Permanent alteration of site topographical and visual character of due to presence of mined areas and material stockpiles; and
- Visible dust plumes during rehabilitation.

The predicted impact will be reduced from one of ***moderate (SP = 30)*** significance to one of ***low (SP = 18)*** significance by implementing the following mitigation measures:

- General site management:
  - Dismantle and remove all visible surface infrastructure during decommissioning.
  - Re-shape all footprint areas to be as natural in appearance as possible.
  - Fill and stabilise the pits using material from stockpiles/dumps, and contour/shape to ensure it is free draining.
  - Distribute topsoil over all disturbed footprints and actively revegetate (using grasses and if possible, trees) to establish a vigorous and self-sustaining vegetation cover.
  - The berms surrounding the remaining voids at both pits should also be revegetated.
  - Conduct on-going monitoring and maintenance of the rehabilitated areas to ensure that they establish successfully, and that erosion does not occur.
  - Continuously assess condition of vegetation cover of rehabilitated areas for adequate cover density and species composition. Due to the unpredictable nature of vegetation growth the effectiveness of the re-vegetation will only become apparent after several years. Where specimens die, grow poorly, or do not effect sufficient coverage, the cause of the problem should be established and the afflicted specimens replaced, or a more suitable alternative established, based on a case-to-case basis; and
  - Employ control measures to eradicate weedy and alien invader plant species as required.

### 10.3.13 Traffic

A manual traffic survey was undertaken at the key intersections within the study area to determine the impact expected from the proposed development at these intersections. The traffic impact assessment report is included in APPENDIX L.

At the time of the assessment, it was envisaged that 120 new job opportunities would become available as a result of the proposed project, but since then, it has been determined that existing Grootegeluk Coal Mine employees will be deployed during all phases of the proposed Grootegeluk Turfvlakte Expansion Project. The proposed mitigation measures, as described in the section below, will only be required in the event that the project requires external employees during the operational phase of the Grootegeluk Turfvlakte Expansion Project.

The export coal from the Grootgeluk Coal Mine beneficication plants, including the coal to be mined at the proposed Grootegeluk Turfvlakte Expansion Project, is transported to Richards Bay via railway.

The following key intersections (see Figure 83) were analysed:

- D2001 / Exxaro Warehouse Deliveries Intersection.
- D2001 / Grootegeluk Mine Access Intersection.
- D2001 / Matimba Power Station Access Intersection.
- D2001 / D1675 Intersection; and
- D1675 / D2649 Intersection.

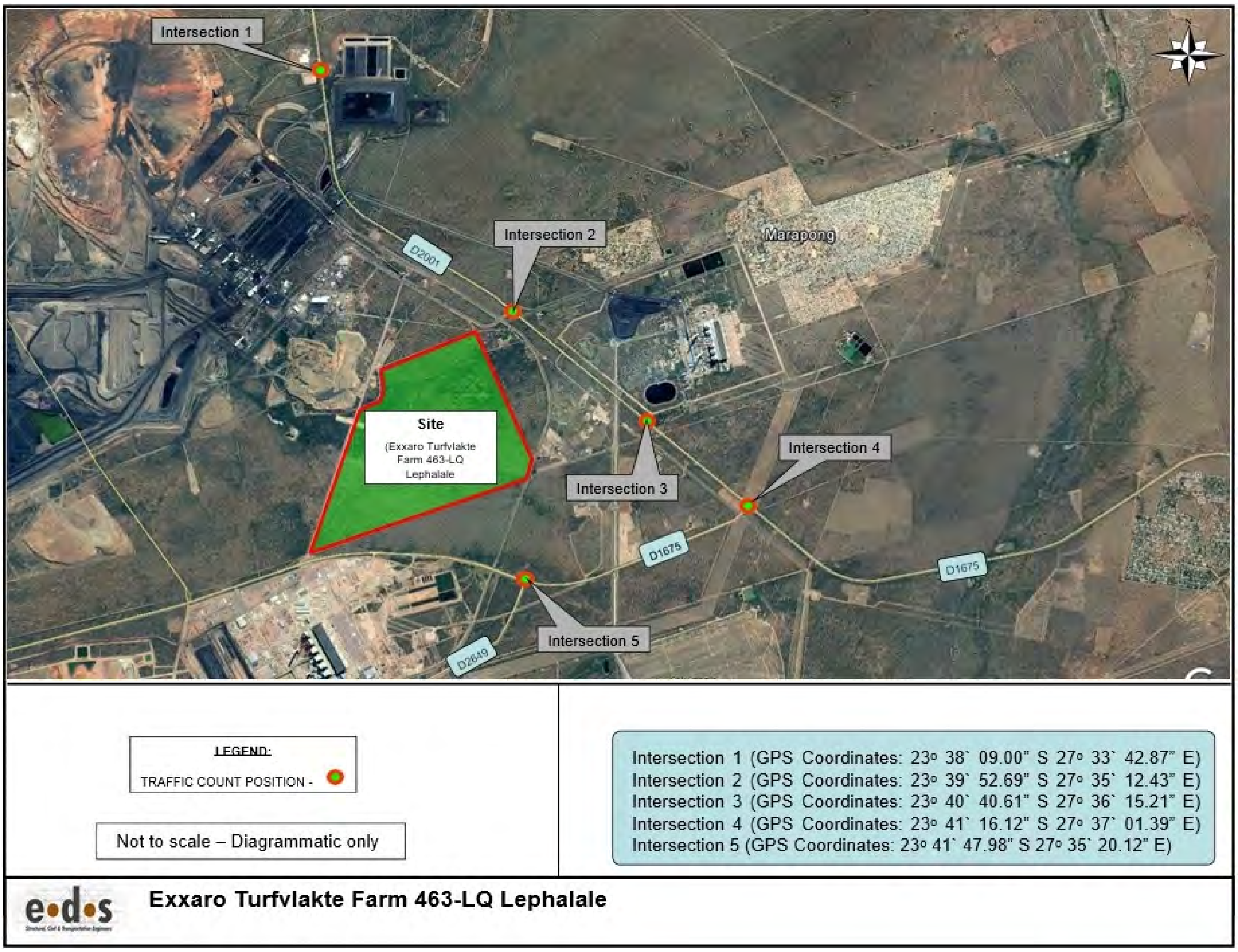



**Figure 83: Intersections considered**

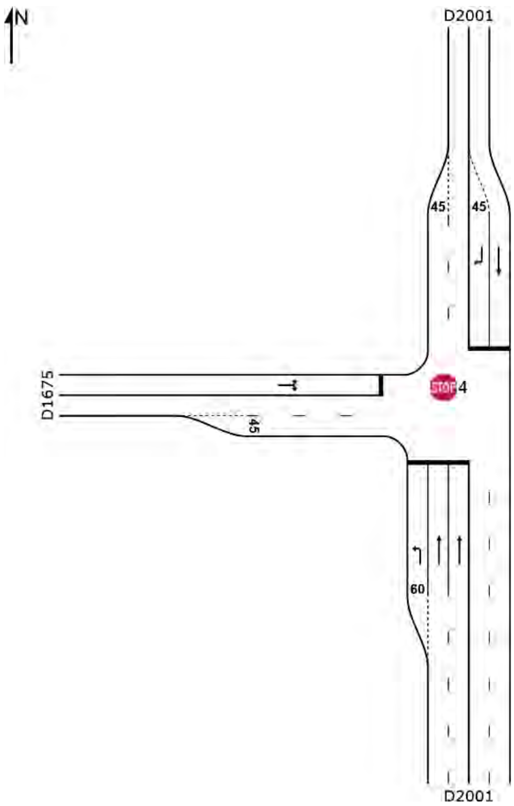
#### *10.3.13.1 Construction and Operation*

##### 10.3.13.1.1 Level of Service

The potential traffic impacts at each analysed intersection Figure 83 are briefly described below:

- **D2001 / Exxaro Warehouse Deliveries Intersection**: - This intersection currently operates at acceptable levels of service during the critical weekday peak periods and it has ample spare capacity to continue operating acceptably with the total future traffic demand. The proposed development would have **negligible** traffic impact at this intersection.
- **D2001 / Grootegeluk Mine Access Intersection**: - This intersection currently operates at acceptable levels of service during the critical weekday peak periods and it has ample spare capacity to continue operating acceptably with the total future traffic demand. The proposed development would have **negligible** traffic impact at this intersection.
- **D2001 / Matimba Power Station Access Intersection**: - This intersection currently operates at acceptable levels of service during the critical weekday peak periods and it has ample spare capacity to continue operating acceptably with the total future traffic demand. The proposed development would have negligible traffic impact at this intersection. The intersection will approach its capacity during the critical weekday morning (AM) peak period in the future with the total future traffic demand.
- **D2001 / D1675 Intersection**: - This intersection already operates at congested levels of service during both critical weekday peak periods. A TIA undertaken for the latent right development allowed for in this study (namely: Exxaro Thabametsi Coal Mine) has identified a need to upgrade this intersection as per the layout shown in Figure 84 of this study. But as mentioned, the TIA study was undertaken with the assumption that additional employees would need to be appointed, this however is not the case anymore. The proposed impact mitigation at the D2001/D1676 intersection is thus not required. If in future any additional employees be appointed at the proposed operations, then the intersection upgrade proposed below will need to be implemented.
- This latent intersection upgrade would suffice to accommodate the total future traffic demand and thus additional upgrades would not be required.
- **D1675 / D2649 Intersection**: - This intersection already operates at congested levels of service during the critical weekday peak periods. It is recommended that the Roads Agency Limpopo (RAL) consider upgrading of this intersection to a “butterfly” configuration, whereby traffic travelling along the D1675 towards D2001 flows freely past the intersection. Traffic on the D2649, entering D1675 and heading towards D2001 will have a dedicated, protected exit / receiving lane (unopposed traffic) which will then merge with the freely flowing traffic through the intersection. This type of intersection improves the capacity and safety of the right movements from the side of the road by allowing two stage gag acceptance by providing an acceleration lane in the middle of the road. A layout similar to the one described above has been constructed at the D2001 / Walter Sisulu Drive Intersection, where Onverwacht residential area is accessible to/from the D2001. The proposed development would have negligible traffic impact at this intersection.

Existing Intersection Geometry (Stop Control)




Proposed Intersection Geometry by Latent Rights (Signalised)

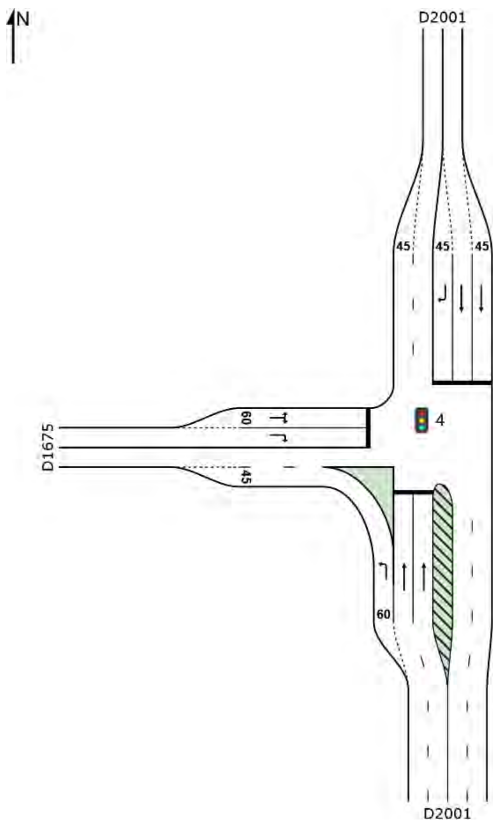
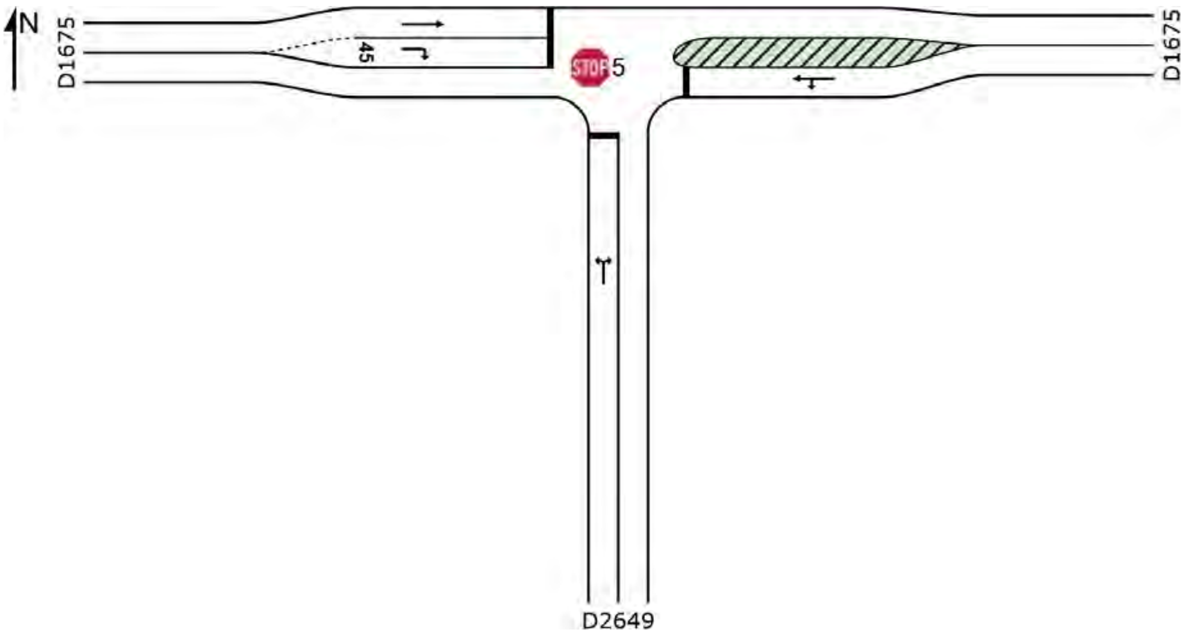



**Figure 84: Intersection D2001 / D1675 current and proposed Geometry**

Existing Intersection Geometry (Stop Control)




Proposed Intersection Geometry for Background Traffic Demand (Priority Control)

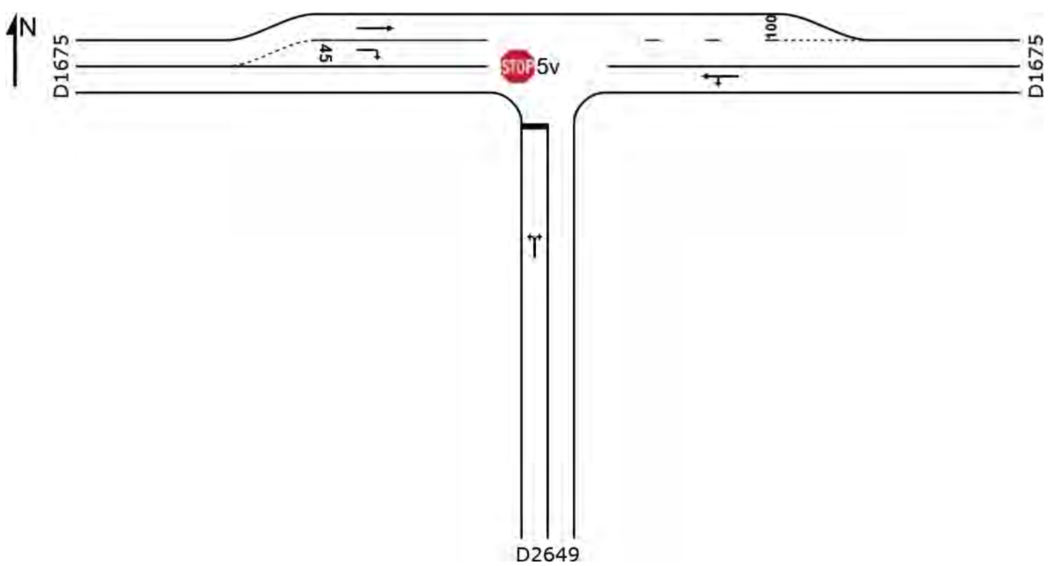



**Figure 85: Intersection D1675 / D1675 current and proposed Geometry**

Taking all known factors into account, the traffic impact during the construction and operational phases are assessed as being of ***low (SP = 27)* significance**.

The following measures are recommended to reduce the impact further:

- Use only reputable contractors.
- Require contractors to:
  - Keep their vehicles in good condition.

  - Use properly licensed and skilled drivers.
  - Monitor adherence to traffic regulations.
  - Take effective measures to avoid driver fatigue.
  - Monitor drivers for use of alcohol and other substances that could impair judgment and driving ability; and
  - Ensure that loads on trucks are properly secured during transport.
- As far as may be practicable, schedule the arrival and departure of heavy vehicles to avoid the morning and afternoon peak hours.
- Apply effective dust control measures as outlined in Section 10.3.9; and
- Record and respond to all complaints.

#### 10.3.13.2 Decommissioning and Closure

The closure and rehabilitation phase as described in Section 10.2.4 will have an impact of ***low (SP = 27)*** to ***no (SP = 0)*** significance on the local traffic resources and no mitigation measures are required.

### 10.3.14 Cultural and heritage

As noted in Section 7.13 and detailed in the Phase I HIA study for the proposed project area (APPENDIX Q), none of the types and ranges of heritage resources as outlined in Section 3 of the National Heritage Resources Act (No 25 of 1999) were identified during the study.

#### 10.3.14.1 Construction

The construction phase as described in Section 10.2.1 will have ***no (SP = 0)*** impacts however, it is always possible that an unknown grave or other buried cultural/archaeological items could be unearthed when excavations are being undertaken. In such an event, the following chance find procedure must be implemented to mitigate the potential impact:

- Cease all work in the immediate vicinity of the find.
- Demarcate the area with barrier tape or other highly visible means.
- Notify the South African Heritage Resources Authority (SAHRA) immediately.
- Commission an archaeologist accredited with the Association for Southern African Professional Archaeologists (ASAPA) to assess the find and determine appropriate mitigation measures. These may include obtaining the necessary authorisation from SAHRA to conduct the mitigation measures; and
- Prevent access to the find by unqualified persons until the assessment and mitigation processes have been completed.

#### 10.3.14.2 Operation

The earthmoving and opencast activities, associated with the operational phase, will have ***no (SP = 0)*** impact, however, it is always possible that an unknown grave or other buried cultural/archaeological items could be unearthed while topsoil and subsoil stripping and removal of overburden and coal are being undertaken. In such an event the chance find procedure described in Section 10.3.14.1 above must be implemented to mitigate the potential impact.

#### *10.3.14.3 Decommissioning and Closure*

The closure and rehabilitation phase as described in Section 10.2.4 will have ***no (SP = 0)*** impact on any identified cultural and heritage resources and no mitigation measures are required.

### 10.3.15 Palaeontology

As noted in Section 7.14, the Phase I PIA study (APPENDIX R) for the proposed project area, did not reveal the presence of any fossils.

#### *10.3.15.1 Construction*

The construction phase, as described in Section 10.2.1, will have no ***(SP = 0)*** impacts however, it is always possible that chance find fossils could be unearthed when excavations are being undertaken. In such an event the chance find procedure, as described in 10.3.14.1, must be implemented to mitigate the potential impact.

#### *10.3.15.2 Operation*

The earthmoving and opencast activities, associated with the operational phase, will have ***no (SP = 0)*** impact however, it is always possible that unknown fossils items could be unearthed while topsoil and subsoil stripping and removal of overburden and coal are being undertaken. In such an event the chance find procedure, described in 10.3.14.1, must be implemented to mitigate the potential impact.

#### *10.3.15.3 Decommissioning and Closure*

The closure and rehabilitation phase, as described in Section 10.2.4, will have ***no (SP = 0)*** impact on palaeontological resources and no mitigation measures are required.

### 10.3.16 Socio-economic

With the Grootegeluk Turfvlakte Expansion Project being an extension of the existing Grootegeluk Coal Mine, the socio- economic benefit to the local area will be centred around continued economic and employment benefits to the existing local and regional businesses and Grootegeluk Coal Mine employees. The Grootegeluk Turfvlakte Expansion Project will not necessarily open up new job opportunities but will rather sustain current employment into the future.

The assessment below is based on the socio-economic assessment attached as APPENDIX S.

#### *10.3.16.1 Construction*

The construction phase will result in both positive and negative impacts. Positive impacts are associated with sustaining current employment into the future, ***positive (SP = +24)***, and increased economic revenue, ***positive (SP = +23).*** Negative impacts include the possible health and safety risks associated with the construction activities, such as increased dust levels and increase traffic, the presence of heavy good vehicles and the associated deterioration of roads and possible road accidents, ***medium (SP = -48)***. Another negative impact is associated with the influx of people in search of jobs and business opportunities, ***medium (SP = -52)***.

These positive impacts can be enhanced to ***positive (SP = +32)*** and ***positive (SP = +48)*** respectively, by implementing the following mitigation measures:

- Employment opportunities:
  - A monitoring system should be put in place to ensure that Exxaro’s recruitment policy is adhered to.
  - Communities within the vicinity of the mine should be given special consideration in terms of the benefits arising from the project because they will be the most affected by the project. It is recommended that the following mitigation measures be implemented:

  - If not currently in place, a local skills database must be developed and updated regularly. The skills database should be used for recruitment purposes to minimise the probability of nepotism or corruption during the recruitment process.

- Increased economic revenue:
  - Exxaro shall develop and implement its housing model, which will be integrated within the local areas and aligned with the IDP of the region. The model will ensure that Grootegeluk Coal Mine employees are accommodated in their own formal accommodation located within the metropolitan frameworks of the region where the proposed operation will be based.
  - Exxaro shall give first preference to appropriate subcontractors/SMMEs located in the surrounding communities, followed by those located in the municipal area and lastly those situated elsewhere or outside the province.

The negative impacts can be mitigated to ***low (SP = -24)*** and ***low (SP = -27)*** respectively, by implementing the following mitigation measures:

- Population influx:
  - Additionally, relevant stakeholders should be engaged and consulted during the development of the detailed influx management plan.
  - Exxaro are to focus their efforts on the need for a local recruitment policy, workforce management, promotion of regional diversified growth strategies, implementation of health and safety education programmes and spatial planning, administration, and resource allocation.
  - Regarding any emerging recruitment opportunity, priority shall be given to locals, thus reducing the need for outsiders.
- Risk of community health and safety:
  - A community awareness campaign to be implemented in the surrounding communities to sensitise community members to traffic safety risks and health and communicable disease awareness.
  - Exxaro shall be implementing dust-and noise suppression measures in areas where vehicles will use unsealed roads. That must be accompanied by proper road markings and signs.
  - Exxaro will need to engage with communities using a dedicated community liaison officer and have in place an effective stakeholder engagement plan, inclusive of a grievance redress mechanism for communities to access which will be used by project-affected stakeholders to lodge complaints.
  - Exxaro's community health and safety plan shall be in place and updated regularly. Measures should be in place to ensure the health and safety of the neighbouring guesthouse patrons and staff.
  - Roads must be adequately maintained to prevent deterioration of road surfaces due to heavy vehicle traffic.
  - The time for blasting activities should be communicated to the surrounding landowners and the local population. – This will be done via signage on the road and by ensuring that blasting times are limited to a specified time of day, where possible.

#### 10.3.16.2 Operation

As with the construction phase, both positive and negative impacts will occur during the operational phase. Positive impacts associated with retention of current employment into the future, ***positive (SP = +24)***, skills transfer and development, ***positive (SP = +24),*** community development, ***positive (SP = +24),*** and regional economic development, ***positive (SP = +33),*** will continue to benefit the employees and local residence of Lephalale. These positive impacts can be enhanced to ***positive (SP = +32), (SP = +52)*** and ***(SP = +56)*** respectively by implementing the following measures during the operational phase:

- Skills transfer and development (as per Grootegeluk Coal Mine's SLP):
  - Comply with the requirements of the Skills Development Act, which includes the submission of a Workplace Skills Plan and an Annual Training Report as per the Sector Education and Training Authority's requirements.
  - Appoint a dedicated skills development facilitator within six months of the commencement of operations.
  - Submit a five-year plan for learnerships at once operations commence.
  - Provide employees with the opportunity to participate in mentoring relationships with an individual they feel could add value to their growth and development.
  - Implement a bursary scheme which aims to develop suitable students who once they have completed their studies are afforded professional career opportunities within our organisation.
- Community Development:
  - The community development aspects will be carried out as per Exxaro's SLP. During this process, Exxaro will engage stakeholders in the area to gauge whether they can align with any of their efforts to collaborate on some development initiatives planned for the communities. Additionally, the selection of project beneficiaries should be fair and directly affected parties should be given first preference.
- Regional economic development:
  - Exxaro shall pay royalties and tax to the government.
  - Exxaro shall adhere to their SLP commitments.

Health and safety risks, ***medium (SP = -48)*** will remain a negative impact during the operational phase but can be mitigated to ***low (SP = -24)*** by implementing the following measures:

- The mine shall be maintained during its lifetime in a manner that ensures a safe working environment for mine personnel.
- Ensure a safe environment for neighbouring communities.
- Adherence to rigorous operational health and safety programmes.
- Exxaro shall develop measures to comply with regional air quality studies recommendations.

### *10.3.16.3 Decommissioning and Closure*

The decommissioning and closure phase will result in negative impacts associated with loss of employment, ***high (SP = -75)***, reduced regional and economic development, ***high (SP = -70)***, and reduced community investment, ***high (SP = - 75).***

By implementing the following mitigation measures, these impacts can be reduced to ***high (SP = -65), medium (SP = -55)*** and ***high (SP = -65)*** *respectively.*

- Loss of employment:
  - Timely and adequate consultation with employees who are dependent on the mine for employment.
  - Assisting employees in seeking alternative employment at other power plants or related facilities.
  - Training and education of employees to equip them with skills that could benefit them in other industries. During the operational phase, members of the workforce will be encouraged to obtain skills or qualifications that are recognised by the National Qualifications Framework and are registered through the Mining Qualifications Authority. These qualifications include non-mining skills that will assist employees in areas other than mining.
  - Initiatives should be aligned with SLP commitments relating to downscaling and retrenchment.
- Reduced regional economic development:
  - Engage local and regional government concerning the decommissioning phase.
- Reduced community investment:
  - Exxaro shall develop exit strategies for all its community development initiatives.

### 10.3.17 Greenhouse Gas

A greenhouse gas (GHG) emissions assessment (APPENDIX V) was undertaken to assess the potential impact of the Grootegeluk Turfvlakte Expansion Project by:

- Identifying and quantifying significant sources of Scope 1 and Scope 2 emissions in the construction, operational and closure phases.
- Assess the impact of the impact of the Project's GHG emissions in terms of three benchmarks:
  - Contribution of the Project's GHG emissions to South Africa's annual GHG emissions.
  - Emissions intensity of the Project against emitters in the same sector.
  - Annual emissions of the Project against established thresholds.
- Provide high level recommendations for reducing the Project's GHG emissions

Golder (2020g) explains that the following three 'scopes' are used for the characterisation of direct and indirect emissision sources used for GHG emissions accounting and reporting.

The use of scopes not only improves transparency and consistency in reporting, but also ensures that organisations do not account for different emissions in the same scope (i.e. double counting). A brief description of the three scopes is provided below:

- **Scope 1: Direct GHG emissions:** Occur from sources that are owned or controlled by the organisation. This includes for example, emissions from combustion in boilers, furnaces, generators, and company-owned vehicles
- **Scope 2: Indirect GHG emissions:** Occur from the generation of purchased electricity or steam that is brought onto the organisation's property
- **Scope 3: Other indirect GHG emissions:** Occur from sources that are not owned or controlled by the organisation. This includes for example, purchased materials, transportation of materials, and the use of products sold to consumers

Figure 86 presents an overview of Scope 1, Scope 2, and Scope 3 emissions across the value chain of an organisation.

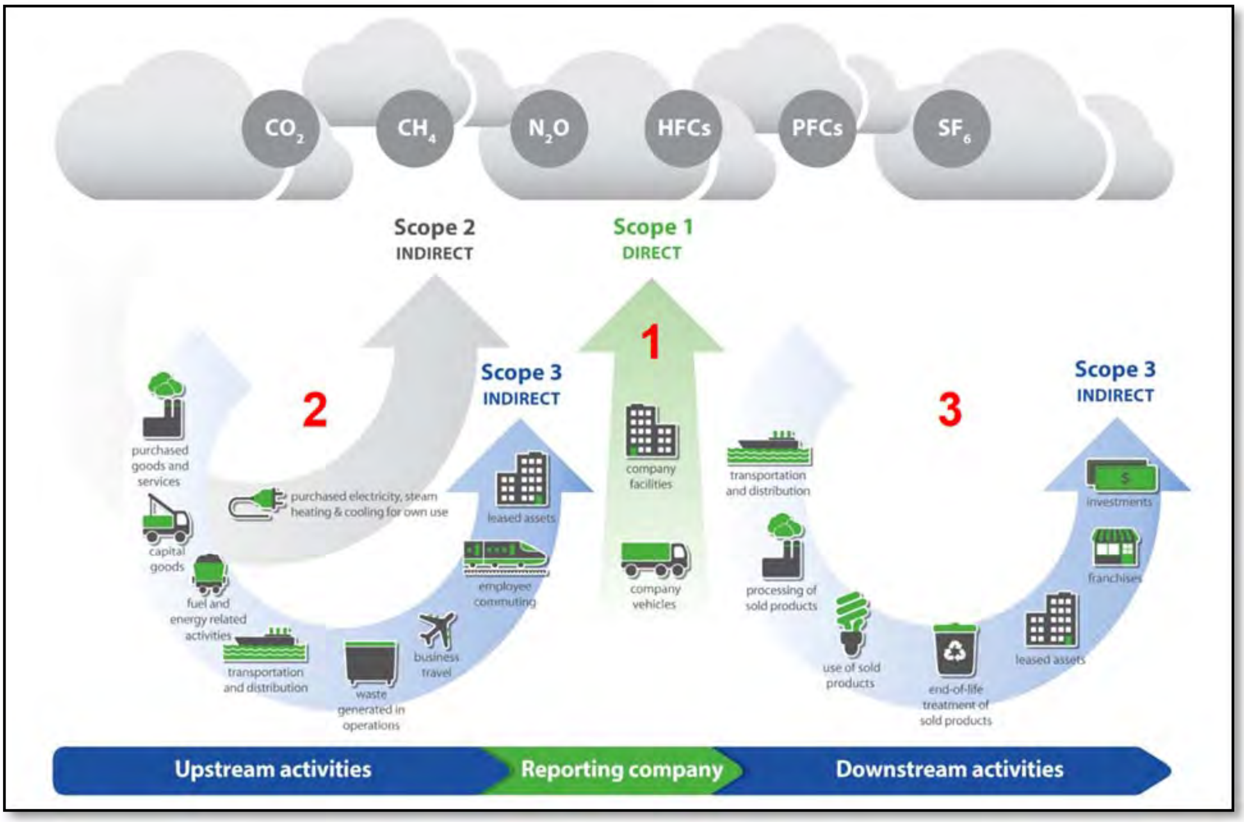



**Figure 86: Overview of Scope 1, Scope 2, and Scope 3 emissions across the value chain (WBCSD & WRI, 2004)**

In terms of the GHG Protocol, organisations are required to report on both Scope 1 and Scope 2 emissions.

Table 58 presents a summary of the sources of GHG emissions that were considered in this assessment, in each of the three project phases, namely construction, operation, and closure.

**Table 58: Summary of GHG emissions sources included in the assessment**

| Phase | Scope 1 | Scope 2 | LULUCF |
|---|---|---|---|
| Construction | Diesel fuel | - | Land use change |
| Operational | Diesel fuel | Purchased electricity | Land use change |
| | Lubricants | | |

| Phase | Scope 1 | Scope 2 | LULUCF |
|---|---|---|---|
| | Opencast coal mining (fugitive emissions) | | |
| Closure | Diesel fuel | - | - |

### 10.3.17.1 Reporting Period

The reporting period for the Grootegeluk Turfvlakte Expansion Project is as follows:

- Construction phase: 2022 (one year)
- Operational phase: 2023 to 2038 (16 years)
- Closure phase: 2039 (one year)

This assessment is the first GHG inventory for the Grootegeluk Turfvlakte Expansion Project, which can be used as a baseline against which to track and compare the GHG emissions of the Project over time.

### 10.3.17.2 Exclusions

Table 59 presents a summary of the sources of GHG emissions that have been excluded from this assessment, and the justification for their exclusion.

**Table 59: Excluded GHG emissions**

| Scope | Activity | Emissions Source | Comment |
|---|---|---|---|
| 1 | Petrol | Fleet vehicles | The GHG emissions from use of petrol in fleet vehicles has been excluded from this assessment as this is expected to be minimal (due to limited number of petrol vehicles, if any, that will be used onsite), and to have limited impact on the overall GHG emissions. |
| 1 | Fugitive emissions | Refrigeration and air-conditioning | The fugitive GHG emissions from refrigeration and air-conditioning has been excluded from this assessment as this is expected to be minimal (due to limited number of offices that will be onsite), and to have limited impact on the overall GHG emissions. |
| 3 | Solid waste disposal | Managed waste disposal site | The fugitive GHG emissions from disposal of solid waste to landfill has been excluded from this assessment as this is expected to be minimal (due to the limited number of staff that will be onsite), and to have limited impact on the overall GHG emissions. |
| 3 | Potable water | Potable water distribution | The GHG emissions from the distribution of potable water has been excluded from this assessment as this is expected to be minimal (due to the limited number of staff that will be onsite), and to have limited impact on the overall GHG emissions. |

| Scope | Activity | Emissions Source | Comment |
|---|---|---|---|
| 3 | Wastewater treatment and discharge | Sewage treatment plant | The fugitive GHG emissions from treatment and discharge of domestic/industrial wastewater has been excluded from this assessment as this is expected to be minimal (due to the limited number of staff that will be onsite), and to have limited impact on the overall GHG emissions. |
| 3 | Business travel | Public and private transport to site | The GHG emissions resulting from the travel of employees to and from site has been excluded from this assessment as this is expected to be minimal (due to the limited number of staff that will be onsite), and to have limited impact on the overall GHG emissions. |

### *10.3.17.3 Impact Assessment*

Due to the fact that the contribution of the Grootegeluk Turfvlakte Expansion Project to global GHG emissions will be relatively insignificant, and considering the extended period between the emission of GHGs and potential climate change impacts, the conventional approach to impact assessment may not be appropriate. As a result, GHG emissions assessments typically use an alternative approach to impact assessment based on benchmarks. In the context of this assessment, three benchmarks are considered (Golder, 2020g):

- Contribution of the Project’s GHG emissions to South Africa’s national GHG emissions
- Product unit intensity
- Pre-defined thresholds

These benchmarks have been used to assess the significance of the Grootegeluk Turfvlakte Expansion Project’s emissions.

#### 10.3.17.3.1 Contribution to South Africa’s National GHG Emissions

As discussed previously, South Africa’s gross GHG emissions was estimated to be 540 854 MtCO2e in 2015. The contribution of the Grootegeluk Turfvlakte Expansion Project to South Africa’s gross emissions was assessed under the following four scenarios:

- **Business-as-usual**: South Africa’s gross emissions continue to increase by an average of 1.54% per annum as reflected in period from 2000 to 2015.
- **Upper end**: With mitigation, South Africa limits its gross emissions to the upper end of the range committed to in the country’s INDC (i.e. 631 MtCO2e by 2030 (adjusted for AFOLU) and 445 MtCO2e (adjusted for AFOLU) by 2050).
- **Lower end**: With mitigation, South Africa limits its gross emissions to the lower end of the range committed to in the country’s INDC (i.e. 415 MtCO2e by 2030 (adjusted for AFOLU) and 229 MtCO2e (adjusted for AFOLU) by 2050).
- **Fare-share**: With mitigation, South Africa limits its gross emissions to what is considered to be its fair-share to global efforts to hold global warming to below 1.5°C (i.e. 360 MtCO2e by 2030 (adjusted for AFOLU) and 231 MtCO2e (adjusted for AFOLU) by 2050).

In the 'business-as-usual' scenario, the contribution of the Grootegeluk Turfvlakte Expansion Project to South Africa's gross emissions peaks at 0.0026% in 2023, decreasing thereafter. In the 'upper-end' scenario, the contribution of the Grootegeluk Turfvlakte Expansion Project to South Africa's gross emissions peaks at 0.0028% from 2036-2037. Similarly, the contribution of the Grootegeluk Turfvlakte Expansion Project to South Africa's gross emissions peaks at 0.0045% in the 'upper end' scenario and 0.0051% in the 'fare-share' scenario.

Given that the contribution of the Grootegeluk Turfvlakte Expansion Project to South Africa's gross emissions is estimated to be 0.0051% in the worst-case scenario, the impact of the Project's contribution is likely to be of ***low*** significance.

##### 10.3.17.3.2 Product Unit Intensity

Benchmarking potential GHG emissions resulting from the Grootegeluk Turfvlakte Expantion Project against emitters in the same sector can also be used to assess the significance of the Project's emissions. To allow for comparison, the average emissions intensity per product unit (i.e. CO2e per product unit) is typically used. Given that the product unit of the Grootegeluk Turfvlakte Expansion Project is tonnes of ROM coal, the emissions intensity per product unit is tCO2e/t.

On average, the product unity intensity of the Grootegeluk Turfvlakte Expansion Project is estimated to be 0.01 tCO2e/t.

On 19 June 2019, the Regulations on the Greenhouse Gas Emissions Intensity Benchmark Prescribed for the Purpose of Section 11 of Carbon Tax Act, 2019 were published under General Notice 691 in Government Gazette 43452 of 19 June 2020. These regulations specify the South African industry benchmark value for the opencast coal mining sector, which has been set as 0.014 $tCO_2e$/tonne ROM coal. Given that the emissions intensity of the Grootegeluk Turfvlakte Expansion Project is well below the South African industry benchmark value, the impact of the Project in terms of product unit intensity is likely to be of ***low*** significance.

##### 10.3.17.3.3 Pre-defined thresholds

The European Bank of Reconstruction and Development ("EBRD") developed thresholds which can be used for benchmarking the magnitude of annual emissions of a project (Table 60).

**Table 60: Benchmark thresholds for annual $CO_2e$ emissions (EBRD, 2010 as cited by** (Golder, 2020g)**)**

| GHG emissions ($tCO_2e/a$) | Qualitative rating |
|---|---|
| < 10,000 | Nominal/Negligible |
| 10,001 – 25,000 | Low |
| 25,001 – 100,000 | Medium-Low |
| 100,001 – 1,000,000 | Medium-High |
| > 1,000,000,001 | High |

The annual GHG emissions from the Grootegeluk Turfvlakte Expansion Project is estimated to be 14 553.9 $tCO_2e$. The Project falls within the 10 001 – 25 000 $tCO_2e$ threshold and the impact is therefore rated as ***low***.

### 10.3.18 Climate Change Assessment

A qualitative assessment was undertaken (APPENDIX X) to determine the potential impact of the projected changes in climate on the vulnerable components of the Grootegeluk Turfvlakte Expansion Project. The following components were considered in the assessment (Golder, 2020h):

- Open Pits
- Haul roads and ramps
- Topsoil dump
- Employees and contractors
- Beneficiation plants (at the Grootegeluk Coal Mine)
- Grootegluk Coal Mine Pit

#### 10.3.18.1 Construction

Given that construction is due to start in 2022, it is expected that the climatic conditions at the time will be very similar to the baseline climatic at the time of the assessment. The potential impacts of climate change during the construction phase have therefore not been considered in this assessment.

#### 10.3.18.2 Operation

##### 10.3.18.2.1 Open Pits

It is projected that there will be a decrease in annual average rainfall in the short-term (2020 to 2039) of between 3.8 mm to 34.9 mm. A decrease in annual average rainfall will reduce direct rainfall onto the open pits, surface runoff, and groundwater infiltration, thereby reducing pit dewatering requirements resulting in an impact of ***positive (SP = + 33)*** significance.

The following measures are recommended to ensure that the potential impact on the project remains positive:

- Limit the area in the immediate vicinity of the open pits that will be graded to drain towards the open pits.
- Construction of diversion channels and ditches to direct non-contact water away from the open pits.
- Use of pit floor sumps to pump excess pit water to Grootegeluk Coal Mine where it will be used for dust suppression and process water.

##### 10.3.18.2.2 Haul Roads and Ramps

Golder (2020g) projected that there will be a negligible increase in the number of extreme rainfall days in the short term 2020 to 2039) of between 0.05 days and 0.68 days. An increase in the number of extreme rainfall days can make access roads temporarily impassable, impacting negatively on the transport of overburden, interburden, and coal from the open pits to Grootegeluk Coal Mine.

Without mitigation, the significance of the impact on the project is likely to be of ***low (SP = - 7)*** significance. The significance of the impact would remain low ***(SP = - 7)*** with mitigation:

- Ensure that haul roads and ramps are maintained in good condition by attending to potholes, corrugations, and stormwater damage as soon as these develop.

##### 10.3.18.2.3 Topsoil Dump

As mentioned in the previous section, it is projected that there will be negligible increase in the number of extreme rainfall days in the short term. An increase in the number of extreme rainfall days can lead to increased erosion of the exposed topsoil dump, and sedimentation of the stormwater system and/or receiving environment.

Without mitigation, the significance of the impact on the project is likely to be low ***(SP = - 7)*** significance. By implementing the following mitigation measure the impact will be reduced to one of low ***(SP = - 5)*** significance:

- Construction of upslope diversion berms to divert stormwater runoff around the topsoil dump

- Construction of conduits to direct runoff from the topsoil dump to a stormwater outfall point

#### 10.3.18.2.4 Employees and Contractors

It is projected that there will be an increase in monthly average temperatures in the short term (2020 to 2039) of between 1.08°C and 1.25°C. It is also projected that there will be an increase in the number of hot days of between 19 days and 22 days. An increase in average monthly temperatures and number of hot days can increase the risk of employees and contractors suffering from heat stroke and dehydration, which can adversely affect their health and well-being.

Without mitigation, the significance of this impact on the project is likely to be of ***moderate (SP = - 48)*** significance. With the following mitigation, the significance of this impact is likely to be reduced to ***low (SP = - 24)*** significance

- Develop and implement an employee health awareness program to educate Exxaro's employees and contractors about the importance of drinking water and identifying the signs of early signs of heat stroke

Variations in climatic conditions, such as temperature, rainfall patterns, and humidity, can increase malaria transmission, which can adversely affect the health and well-being of employees and contractors.

Without mitigation, the significance of this impact on the project is likely to be of ***moderate (SP = - 48)*** significance. With mitigation, the significance of this impact is likely to be reduced to one of ***low (SP = - 24)*** significance:

- Monitor malaria incident reports.
- If local incidents are reported, implement fogging and spraying at the mine during the wet season (September to April).
- Develop and implement an employee health awareness program to educate Exxaro's employees and contractors about Malaria and preventative measures.

#### 10.3.18.2.5 Beneficiation Plants

It is projected that there will be a decrease in annual average rainfall in the short term of between 3.8 mm and 34.9 mm (<1% to 7.5% decrease). A decrease in average annual rainfall will reduce direct rainfall onto the open pits, surface runoff, and groundwater infiltration, thereby reducing the availability of pit water for the beneficiation plants at Grootegeluk Coal Mine.

Note that these beneficiation plants have been included in this assessment as the coal from the Grootegeluk Turfvlakte Expansion Project will be transported to the said plants for further beneficiation. The plants are therefore deemed to be a critical component of the Grootegeluk Turfvlakte Expansion Project's operations.

Without mitigation, the significance of the impact on the project is likely to be of ***moderate (SP = -36)*** By implementing the following mitigation measures, the significance of the impact is likely to be reduced to one of ***low (SP = - 28)***:

- Develop a water conservation/water demand management plan for the Grootegeluk Turfvlakte Expansion Project and incorporate it into the existing water conservation/water demand management plan for Grootegeluk Coal Mine for implementation.

#### 10.3.18.2.6 Grootegeluk Coal Mine Pit

In the short term, monthly average temperatures are projected to increase by between 0.97°C and 1.46°C, while the number of hot days is projected to increase by between 19 days and 22 days.

Marked increases in daily or seasonal temperatures will increase the rate of oxidation, thereby increasing exothermic reactions and the risk of spontaneous combustion of the coal discards in the backfill of the Grootegeluk Coal Mine Pit. The rate of exothermic reactions is directly related to the temperature, where each 10°C rise in temperature leads to an almost doubling of the oxidation process. Spontaneous combustion of the coal discards poses a risk to the safety of employees during the operational phase. The burning discards will also produce air pollutants which can negatively affect ambient air quality.

Note that the Grootegeluk Coal Mine Pit has been included in this assessment as the coal discard from the processing of ROM coal from the Grootegeluk Turfvlakte Expansion Project will be backfilled in the said pit. The Grootegeluk Coal Mine Pit is therefore deemed to be a critical component of the Grootegeluk Turfvlakte Expansion Project's operations.

Without mitigation, the significance of this impact on the project is likely to be of ***moderate (SP = - 39)*** significance. With mitigation, the significance of this impact is likely to be reduced to one of ***low (SP = - 26)*** significance:

- Where possible, cap each bench to minimise the exposed surface area for exothermic reactions and to prevent the ingress of oxygen and moisture
- Annual thermographic surveys of Dump 6 to identify 'hotspots' or potential spontaneous combustion areas.

### *10.3.18.3 Decommissioning and Closure*

#### 10.3.18.3.1 Rehabilitated Mining Areas

It is projected that there will be an increase in monthly average temperatures in the medium-term of between 1.4°C and 3.1°C, while the number of hot days is projected to increase by between 36 days and 59 days. It is also projected that there will be a decrease in annual average rainfall in the medium-term of between 46.5 mm and 72.1 mm (10% to 15.5% decrease).

A decrease in annual average rainfall, coupled with an increase in monthly average temperatures and evaporation rates, will reduce the water availability to the plants used in the rehabilitation of mining areas. This can impact negatively on the establishment of vegetation on these areas, and their stability in the long-term.

Without mitigation, the significance of the impact on the project is likely to be of moderate ***(SP = - 33) significance***. By implementing the following mitigation, the significance of the impact is likely to be reduced to one of low ***(SP = - 22)*** significance:

- Post-closure monitoring of the re-vegetated areas on an annual basis. If required, apply new topsoil, fertilise, reseed/replant, and water areas where plants have been washed away or struggling to become established.

## 11.0 ASSESSMENT OF EACH IDENTIFIED POTENTIAL ENVIRONMENTAL IMPACT AND RISK

Table 61 below summarises the potential impacts of various environmental aspects applicable through the construction, operation and decommissioning phases of the Grootegeluk Turfvlakte Expansion Project. Responsibilities for implementing the mitigation measures are identified and the frequencies with which the results of the various measures are to be monitored are stated in further sections of this report.

**Table 61: Assessment of each identified potentially significant impact and risk**

| **ACTIVITY**<br>**Whether listed or not listed**<br>*(e.g. Excavations, blasting, stockpiles, discard dumps or dams, Loading, hauling and transport, Water supply dams and boreholes, accommodation, offices, ablution, stores, workshops, processing plant, storm water control, berms, roads, pipelines, power lines, conveyors, etc.)* | **POTENTIAL IMPACT**<br>*(e.g. dust, noise, drainage surface disturbance, fly rock, surface water contamination, groundwater contamination, air pollution etc.)* | **ASPECTS AFFECTED** | **PHASE**<br>**In which impact is anticipated**<br>*(e.g. Construction, commissioning, operational Decommissioning, closure, post-closure)* | **SIGNIFICANCE**<br>**(If not mitigated)** | **MITIGATION TYPE**<br>**Modify, remedy, control or stop**<br>*(e.g. Modify through alternative method; Control through noise control; Control through management and monitoring; Remedy through rehabilitation* | **SIGNIFICANCE**<br>**(If mitigated)** |
|---|---|---|---|---|---|---|
| **Geology** | | | | | | |
| Construction of Turfvlakte Infrastructure | Disturbance of near surface geology | Geology | Construction Phase | Low | None | Low |
| Mining of Turfvlakte Open Pits | Permanent disturbance of the geology at the pit areas | Geology | Operation Phase | High | None | High |
| Decommissioning of the Turfvlakte infrastructure, site closure and rehabilitation | It is not expected that additional impacts on the geology of the project area would occur during the decommissioning and closure phase. | Geology | Decommissioning and Closure Phase | None | N/A | None |
| **Air Quality** | | | | | | |
| Construction of the Turfvlakte Infrastructure | Dust and fine particulates affecting ambient air quality | Air Quality | Construction Phase | Moderate | Minimise and control through impact management and monitoring. | Low |
| Mining of Grootegeluk, Thabametsi and Turfvlakte Pits | Dust and fine particulates affecting ambient air quality | Air Quality | Operation Phase | High | Minimise and control through impact management and monitoring. | Moderate |
| Processing ore associated with the mining of the Grootegeluk, Thabametsi and Turfvlakte Pits | Dust and fine particulates affecting ambient air quality | Air Quality | Operation Phase | High | Minimise and control through impact management and monitoring. | Moderate |
| Rehabilitation of Dump 4 and 5 and placement of overburden on Dump 6. | Dust and fine particulates affecting ambient air quality | Air Quality | Operation Phase | High | Minimise and control through impact management and monitoring. | Moderate |
| Decommissioning of the Turfvlakte infrastructure, site closure and rehabilitation | Dust and fine particulates affecting ambient air quality | Air Quality | Decommissioning and Closure Phase | Moderate | Minimise and control through impact management and monitoring. | Low |
| **Topography** | | | | | | |
| Construction of Turfvlakte Infrastructure | Altering of the topography in the project area | Topography | Construction Phase | Moderate | None | Moderate |

| **ACTIVITY**<br>**Whether listed or not listed**<br>*(e.g. Excavations, blasting, stockpiles, discard dumps or dams, Loading, hauling and transport, Water supply dams and boreholes, accommodation, offices, ablution, stores, workshops, processing plant, storm water control, berms, roads, pipelines, power lines, conveyors, etc.)* | **POTENTIAL IMPACT**<br>*(e.g. dust, noise, drainage surface disturbance, fly rock, surface water contamination, groundwater contamination, air pollution etc.)* | **ASPECTS AFFECTED** | **PHASE**<br>**In which impact is anticipated**<br>*(e.g. Construction, commissioning, operational Decommissioning, closure, post-closure)* | **SIGNIFICANCE (If not mitigated)** | **MITIGATION TYPE**<br>**Modify, remedy, control or stop**<br>*(e.g. Modify through alternative method; Control through noise control; Control through management and monitoring; Remedy through rehabilitation* | **SIGNIFICANCE (If mitigated)** |
|---|---|---|---|---|---|---|
| Mining of Turfvlakte Open Pits | Altering of the topography at the pit areas | Topography | Operational Phase | High | Minimise and control through impact management and monitoring. | High |
| Decommissioning of the Turfvlakte infrastructure, site closure and rehabilitation | Altering of the topography at the pit areas | Topography | Decommissioning and Closure Phase | High | Remedy through rehabilitation. | High |
| **Heritage Resources** | | | | | | |
| Site clearance and pit excavation | No impacts expected, but chance finds with potentially high impacts could occur | Heritage Resources | Construction phase | High | Minimise and control through monitoring. | Low |
| Site clearance and pit excavation | No impacts expected, but chance finds with potentially high impacts could occur | Heritage Resources | Operational phase | High | Minimise and control through monitoring. | Low |
| Decommissioning of the Turfvlakte infrastructure, site closure and rehabilitation | Closure and rehabilitation activities cannot affect any sites of archaeological or cultural significance | Heritage Resources | Decommissioning and closure phase | None | N/A | None |
| **Palaeontological Resources** | | | | | | |
| Site clearance and pit excavation | No impacts expected, but chance finds with potentially high impacts could occur | Palaeontological Resources | Construction phase | High | Minimise and control through monitoring. | Low |
| Open cast mining activities | No impacts expected, but chance finds with potentially high impacts could occur | Palaeontological Resources | Operational phase | High | Minimise and control through monitoring. | Low |
| Decommissioning of the Turfvlakte infrastructure, site closure and rehabilitation | Closure and rehabilitation activities cannot affect any sites of palaeontological significance | Palaeontological Resources | Decommissioning and closure phase | None | N/A | None |
| **Noise** | | | | | | |
| Site clearance and grubbing of footprint | Noise increase at the boundary of the mine footprint and at the abutting residential areas | Noise | Construction phase | Moderate | Minimise and control through impact management and monitoring. | Low |
| Civil construction and construction activities at the footprint | Noise increase at the boundary of the mine footprint and at the abutting residential areas | Noise | Construction phase | Moderate | Minimise and control through impact management and monitoring. | Low |
| Construction of earth berm around the pit | Noise increase at the boundary of the mine footprint and at the abutting residential areas | Noise | Construction phase | Moderate | Minimise and control through impact management and monitoring. | Low |

| **ACTIVITY**<br>**Whether listed or not listed**<br>*(e.g. Excavations, blasting, stockpiles, discard dumps or dams, Loading, hauling and transport, Water supply dams and boreholes, accommodation, offices, ablution, stores, workshops, processing plant, storm water control, berms, roads, pipelines, power lines, conveyors, etc.)* | **POTENTIAL IMPACT**<br>*(e.g. dust, noise, drainage surface disturbance, fly rock, surface water contamination, groundwater contamination, air pollution etc.)* | **ASPECTS AFFECTED** | **PHASE**<br>**In which impact is anticipated**<br>*(e.g. Construction, commissioning, operational Decommissioning, closure, post-closure)* | **SIGNIFICANCE (If not mitigated)** | **MITIGATION TYPE**<br>**Modify, remedy, control or stop**<br>*(e.g. Modify through alternative method; Control through noise control; Control through management and monitoring; Remedy through rehabilitation* | **SIGNIFICANCE (If mitigated)** |
|---|---|---|---|---|---|---|
| Construction of the haul road | Noise increase at the boundary of the mine footprint and at the abutting residential areas | Noise | Construction phase | Moderate | Minimise and control through impact management and monitoring. | Low |
| Building material and equipment deliveries at the site | Noise increase at the boundary of the mine footprint and at the abutting residential areas | Noise | Construction phase | Moderate | Minimise and control through impact management and monitoring. | Low |
| Construction vehicles | Increased traffic noise | Noise | Construction phase | Low | Minimise and control through impact management and monitoring. | Low |
| Open cast mining activities at the rim of the open cast pit 1 | Noise increase at the boundary of the mine footprint and at the abutting residential areas | Noise | Operational phase | Moderate | Minimise and control through impact management and monitoring. | Moderate |
| Open cast mining activities at the rim of the open cast pit 2 | Noise increase at the boundary of the mine footprint and at the abutting residential areas | Noise | Operational phase | Moderate | Minimise and control through impact management and monitoring. | Moderate |
| Hauling of coal | Noise increase at the boundary of the mine footprint and at the abutting residential areas | Noise | Operational phase | Moderate | Minimise and control through impact management and monitoring. | Moderate |
| Maintenance activities | Noise increase at the boundary of the mine footprint and at the abutting residential areas | Noise | Operational phase | Moderate | Minimise and control through impact management and monitoring. | Low |
| Emergency siren | Noise increase at the boundary of the mine footprint and at the abutting residential areas | Noise | Operational phase | Moderate | Minimise and control through impact management and monitoring. | Moderate |
| Emergency generator | Noise increase at the boundary of the mine footprint and at the abutting residential areas | Noise | Operational phase | Moderate | Minimise and control through impact management and monitoring. | Moderate |
| Decommissioning of the Turfvlakte infrastructure, site closure and rehabilitation | Noise increase at the boundary of the mine footprint and at the abutting residential areas | Noise | Decommissioning and Closure phase | Moderate | Minimise and control through impact management and monitoring. | Low |
| **Blasting and Vibration** | | | | | | |
| Site clearance and pit excavation | No impacts expected, as no blasting will be required | Blasting | Construction phase | None | N/A | None |

| **ACTIVITY**<br>**Whether listed or not listed**<br>*(e.g. Excavations, blasting, stockpiles, discard dumps or dams, Loading, hauling and transport, Water supply dams and boreholes, accommodation, offices, ablution, stores, workshops, processing plant, storm water control, berms, roads, pipelines, power lines, conveyors, etc.)* | **POTENTIAL IMPACT**<br>*(e.g. dust, noise, drainage surface disturbance, fly rock, surface water contamination, groundwater contamination, air pollution etc.)* | **ASPECTS AFFECTED** | **PHASE**<br>**In which impact is anticipated**<br>*(e.g. Construction, commissioning, operational Decommissioning, closure, post-closure)* | **SIGNIFICANCE (If not mitigated)** | **MITIGATION TYPE**<br>**Modify, remedy, control or stop**<br>*(e.g. Modify through alternative method; Control through noise control; Control through management and monitoring; Remedy through rehabilitation* | **SIGNIFICANCE (If mitigated)** |
|---|---|---|---|---|---|---|
| Blasting | Ground vibration Impact on houses and structures | Vibration | Operational phase | High | Minimise and control through impact management and monitoring. | Low |
| Blasting | Ground vibration Impact on industrial surface infrastructure | Vibration | Operational phase | Moderate | Minimise and control through impact management and monitoring. | Low |
| Blasting | Ground vibration Impact on roads and road structures | Blasting | Operational phase | High | Minimise and control through impact management and monitoring. | Low |
| Blasting | Air blast impact on houses and structures | Blasting | Operational phase | Moderate | Minimise and control through impact management and monitoring. | Low |
| Blasting | Air blast impact on industrial surface infrastructure | Vibration | Operational phase | Moderate | Minimise and control through impact management and monitoring. | Low |
| Blasting | Air blast impact on roads and road structures | Vibration | Operational phase | None (unlikely) | Minimise and control through management and monitoring. | None (unlikely) |
| Blasting | Fly rock impact on houses and structures | Blasting | Operational phase | None (unlikely) | Minimise and control through management and monitoring. | None (unlikely) |
| Blasting | Fly rock impact on industrial surface infrastructure | Blasting | Operational phase | High | Minimise and control through management and monitoring. | Low |
| Blasting | Fly rock impact on roads and road structures | Vibration | Operational phase | High | Minimise and control through management and monitoring. | Low |
| Decommissioning of the Turfvlakte infrastructure, site closure and rehabilitation | No impacts expected, as no blasting will be required | Blasting | Decommissioning and Closure phase | None | N/A | None |
| **Visual** | | | | | | |
| Site clearance and pit excavation | Reduction in visual resource value due to presence of the open pits and associated mining infrastructure. | Visual | Construction phase | Moderate | Minimise and control through impact management and monitoring. | Moderate |

| ACTIVITY<br>Whether listed or not listed<br>*(e.g. Excavations, blasting, stockpiles, discard dumps or dams, Loading, hauling and transport, Water supply dams and boreholes, accommodation, offices, ablution, stores, workshops, processing plant, storm water control, berms, roads, pipelines, power lines, conveyors, etc.)* | POTENTIAL IMPACT<br>*(e.g. dust, noise, drainage surface disturbance, fly rock, surface water contamination, groundwater contamination, air pollution etc.)* | ASPECTS AFFECTED | PHASE<br>In which impact is anticipated<br>*(e.g. Construction, commissioning, operational Decommissioning, closure, post-closure)* | SIGNIFICANCE<br>(If not mitigated) | MITIGATION TYPE<br>Modify, remedy, control or stop<br>*(e.g. Modify through alternative method; Control through noise control; Control through management and monitoring; Remedy through rehabilitation* | SIGNIFICANCE<br>(If mitigated) |
|---|---|---|---|---|---|---|
| Site clearance and pit excavation | Formation of dust plumes as a result of construction activities, soil stripping and subsequent mining. | Visual | Construction phase | Moderate | Minimise and control through impact management and monitoring. | Low |
| Site clearance and pit excavation | Light pollution at night. | Visual | Construction phase | Moderate | Minimise and control through impact management and monitoring. | Low |
| Opencast mining activities | Reduction in visual resource value due to presence of the new plant and other mining infrastructure. | Visual | Operational phase | Moderate | Minimise and control through impact management and monitoring. | Moderate |
| Opencast mining activities | Reduction in visual resource value due to the open pits and material stockpiles/ dumps (e.g. discard/ dumps, topsoil stockpile, product stockpiles). | Visual | Operational phase | Moderate | Minimise and control through impact management and monitoring. | Moderate |
| Opencast mining activities | Formation of dust plumes as a result of construction activities, soil stripping and subsequent mining. | Visual | Operational phase | Moderate | Minimise and control through impact management and monitoring. | Low |
| Decommissioning of the Turfvlakte infrastructure, site closure and rehabilitation | Reinstatement of visual resource value due to dismantling of mining infrastructure and subsequent rehabilitation of footprint areas. | Visual | Decommissioning and Closure phase | Low | Remedy through rehabilitation. | None |
| Decommissioning of the Turfvlakte infrastructure, site closure and rehabilitation | Permanent alteration of site topographical and visual character of due to presence of mined areas and material stockpiles/dumps. | Visual | Decommissioning and Closure phase | Low | Remedy through rehabilitation. | None |
| Decommissioning of the Turfvlakte infrastructure, site closure and rehabilitation | Visible dust plumes during rehabilitation. | Visual | Decommissioning and Closure phase | Moderate | Minimise and control through impact management and monitoring. | Low |
| **Terrestrial Ecology** | | | | | | |
| Vegetation clearing and earth works | Habitat loss and degradation | Terrestrial Ecology | Construction phase | High | Minimise through impact management and rehabilitation. | High |
| Vegetation clearing and earth works | Habitat fragmentation | Terrestrial Ecology | Construction phase | High | Minimise through impact management and rehabilitation. | Moderate |

| **ACTIVITY**<br>**Whether listed or not listed**<br>*(e.g. Excavations, blasting, stockpiles, discard dumps or dams, Loading, hauling and transport, Water supply dams and boreholes, accommodation, offices, ablution, stores, workshops, processing plant, storm water control, berms, roads, pipelines, power lines, conveyors, etc.)* | **POTENTIAL IMPACT**<br>*(e.g. dust, noise, drainage surface disturbance, fly rock, surface water contamination, groundwater contamination, air pollution etc.)* | **ASPECTS AFFECTED** | **PHASE**<br>**In which impact is anticipated**<br>*(e.g. Construction, commissioning, operational Decommissioning, closure, post-closure)* | **SIGNIFICANCE (If not mitigated)** | **MITIGATION TYPE**<br>**Modify, remedy, control or stop**<br>*(e.g. Modify through alternative method; Control through noise control; Control through management and monitoring; Remedy through rehabilitation* | **SIGNIFICANCE (If mitigated)** |
|---|---|---|---|---|---|---|
| Vegetation clearing and earth works | Establishment and spread of alien invasive species | Terrestrial Ecology | Construction phase | Moderate | Minimise and control through impact management and monitoring. | Low |
| Vegetation clearing and earth works | Mortality and disturbance of fauna, incl. fauna of conservation importance | Terrestrial Ecology | Construction phase | Moderate | Minimise and control through impact management and monitoring. | Low |
| Vegetation clearing and earth works | Loss and disturbance of fauna of conservation importance | Terrestrial Ecology | Construction phase | High | Avoid, where possible | Moderate |
| Vegetation clearing and earth works | Loss and disturbance of flora of conservation importance | Terrestrial Ecology | Construction phase | High | Minimise through impact management and rehabilitation. | Moderate |
| Opencast mining activities | Establishment and spread of alien invasive species | Terrestrial Ecology | Operational phase | Moderate | Minimise and control through impact management and monitoring. | Low |
| Opencast mining activities | Mortality and disturbance of fauna, incl. fauna of conservation importance | Terrestrial Ecology | Operational phase | Moderate | Minimise and control through impact management and monitoring. | Low |
| Decommissioning of the Turfvlakte infrastructure, site closure and rehabilitation | Establishment and spread of alien invasive species | Terrestrial Ecology | Decommissioning and closure phase | Moderate | Minimise and control through impact management and monitoring. | Low |
| **Soils, Land Use and Land Capability** | | | | | | |
| Vegetation clearance as project infrastructure are constructed | Disturbance of soil, resulting in increased decomposition of soil organic matter from topsoil. | Soil degradation | Construction phase | High | Minimise and control through impact management and monitoring. | Moderate |
| Soil stripping and stockpiling | ■ Loss of soils through erosion, particularly for topsoil stockpiles with unvegetated steep slopes<br>■ Homogenization of soil profiles, i.e. Loss of characteristic horizons.<br>■ Loss and/or reduction in soil biodiversity in stockpiled soil.<br>■ Loss of soil nutrients, particularly for unvegetated topsoil stockpiles. | Soil degradation | Construction phase | High | Minimise and control through impact management and monitoring. | Moderate |

| **ACTIVITY**<br>**Whether listed or not listed**<br>*(e.g. Excavations, blasting, stockpiles, discard dumps or dams, Loading, hauling and transport, Water supply dams and boreholes, accommodation, offices, ablution, stores, workshops, processing plant, storm water control, berms, roads, pipelines, power lines, conveyors, etc.)* | **POTENTIAL IMPACT**<br>*(e.g. dust, noise, drainage surface disturbance, fly rock, surface water contamination, groundwater contamination, air pollution etc.)* | **ASPECTS AFFECTED** | **PHASE**<br>**In which impact is anticipated**<br>*(e.g. Construction, commissioning, operational Decommissioning, closure, post-closure)* | **SIGNIFICANCE**<br>**(If not mitigated)** | **MITIGATION TYPE**<br>**Modify, remedy, control or stop**<br>*(e.g. Modify through alternative method; Control through noise control; Control through management and monitoring; Remedy through rehabilitation* | **SIGNIFICANCE**<br>**(If mitigated)** |
|---|---|---|---|---|---|---|
| | ■ Loss of soil organic matter due to increased aeration (caused by soil disturbance) and subsequent organic matter decomposition.<br>■ Modification of existing landscape and hydrological regimes. | | | | | |
| Construction of access roads, haul roads, stockpile area, laydown areas and substation | ■ Burial of soil / covering of soils by camp accommodation facility, haul roads, mine waste facilities and processing plant.<br>■ Soil compaction in areas where active heavy machinery will be mobilised for the development of the accommodation facility, mine infrastructure and associated utilities.<br>■ Increased run-off (and erosion) in compacted areas and modification of natural infiltration.<br>■ Soil contamination from hydrocarbon and chemical spills including sterilisation by cement pollutants. | Soil availability<br>Soil quality | Construction phase | High | Minimise and control through impact management and monitoring. | Moderate |
| Transportation and use of equipment - potential spills of chemicals (e.g., hydrocarbon). Soil contamination on adjacent land potentially occurring due to inappropriate waste disposal and potential oil and diesel leakages from vehicles and machinery | ■ Contamination of soils by hydrocarbon pollutants.<br>■ Increased soil compaction and run-off at equipment and machinery laydown areas. | Soil contamination<br>Soil compaction | Construction phase | Moderate | Minimise and control through impact management and monitoring. | Low |
| Open pit development, drilling and blasting | ■ Loss/ Change of current land use.<br>■ Soil disturbance due to excavation activities at pit location as well as in surrounding soils.<br>■ Modification of natural soil hydrological regime.<br>■ Loss of potentially arable land. (Potential effects on soil and land use with the | Land use<br>Soil quality | Operational phase | High | Implement mitigation measures indicated for blasiting.<br>Control through continuous monitoring | High |

| ACTIVITY<br>**Whether listed or not listed**<br>*(e.g. Excavations, blasting, stockpiles, discard dumps or dams, Loading, hauling and transport, Water supply dams and boreholes, accommodation, offices, ablution, stores, workshops, processing plant, storm water control, berms, roads, pipelines, power lines, conveyors, etc.)* | POTENTIAL IMPACT<br>*(e.g. dust, noise, drainage surface disturbance, fly rock, surface water contamination, groundwater contamination, air pollution etc.)* | ASPECTS AFFECTED | PHASE<br>**In which impact is anticipated**<br>*(e.g. Construction, commissioning, operational Decommissioning, closure, post-closure)* | SIGNIFICANCE<br>(If not mitigated) | MITIGATION TYPE<br>**Modify, remedy, control or stop**<br>*(e.g. Modify through alternative method; Control through noise control; Control through management and monitoring; Remedy through rehabilitation* | SIGNIFICANCE<br>(If mitigated) |
|---|---|---|---|---|---|---|
| | development of the open pit may be similar to what is anticipated for construction phase) | | | | | |
| Hauling of coal and waste rock for storage in their respective storage facilities. | ■ Soil contamination from hydrocarbon spills from vehicles; and<br>■ Soil contamination from spillage/poor handling of product and waste rock outside the designated areas. | Soil quality | Operational phase | High | Reduce through eliminating contaminant source | Low |
| Spills of chemicals (e.g., hydrocarbon).<br><br>Soil contamination on adjacent land potentially occurring due to inappropriate waste disposal and potential oil and diesel leakages from vehicles and machinery | Contamination of soils by hydrocarbon pollutants | Soil contamination | Operational phase | Moderate | Minimise and control through impact management and monitoring. | Low |
| Removal of redundant infrastructure | ■ Spillage of chemical solutions during the dismantling of plant equipment, pipelines or pumps which were in contact with chemicals solution may contaminate the soils;<br>■ Spillage of diesel, oils and greases from the dismantled plant equipment, resulting in hydrocarbon contamination of exposed soils. | Soil contamination | Decommissioning & Closure Phase | Moderate | Control through minimizing occurrence of contaminant source | Low |
| Backfilling of Turfvlakte Pits | Spilling of backfill material during haulage outside the designated areas. | Soil quality (contamination) | Decommissioning & Closure Phase | Moderate | Control through minimizing occurrence of contaminant source | Low |
| Grading of project site to ensure long-term drainage conditions on site | ■ Soil compaction in areas where active heavy machinery will be mobilised for the shaping of the final landform; and<br>■ Loss of soil organic matter due to increased aeration (caused by soil disturbance) and subsequent organic matter decomposition. | Soil compaction<br><br>Soil erosion<br><br>Soil quality | Decommissioning & Closure Phase | High | Minimise and control through impact management and monitoring. | Moderate |
| Soil placement and revegetation of project site | ■ Soil handling to convey soil from topsoil stockpile to project site for surface | Land use | Decommissioning & Closure | High | Minimise and control through impact management and monitoring. | Moderate |

| ACTIVITY<br>Whether listed or not listed<br>*(e.g. Excavations, blasting, stockpiles, discard dumps or dams, Loading, hauling and transport, Water supply dams and boreholes, accommodation, offices, ablution, stores, workshops, processing plant, storm water control, berms, roads, pipelines, power lines, conveyors, etc.)* | POTENTIAL IMPACT<br>*(e.g. dust, noise, drainage surface disturbance, fly rock, surface water contamination, groundwater contamination, air pollution etc.)* | ASPECTS AFFECTED | PHASE<br>In which impact is anticipated<br>*(e.g. Construction, commissioning, operational Decommissioning, closure, post-closure)* | SIGNIFICANCE<br>(If not mitigated) | MITIGATION TYPE<br>Modify, remedy, control or stop<br>*(e.g. Modify through alternative method; Control through noise control; Control through management and monitoring; Remedy through rehabilitation* | SIGNIFICANCE<br>(If mitigated) |
|---|---|---|---|---|---|---|
| | rehabilitation activities, may result in degradation of soil quality due to soil disturbance.<br>■ Contamination of soil by handling of soil with contaminated earth moving machinery (machinery previously used for handling mine waste such as waste rock or tailings material). Insufficient soil volumes to meet end land use soil requirements. | Soil quality<br>Soil quantity | | | | |
| **Groundwater** | | | | | | |
| Footprint Clearance / Construction | Clearing topsoil for footprint areas can increase infiltration rates of water to the groundwater system and increase aquifer vulnerability | Groundwater contamination | Construction | Low | Minimise and control through impact management and monitoring. | Low |
| Waste / hydrocarbon Handling | Handling of waste and transport of building material can cause various types of spills (hydrocarbons) which can infiltrate and contaminate the groundwater system. | Soil contamination | Construction | Low | Minimise and control through impact management and monitoring.<br>Remedy through rehabilitation. | Low |
| Open pit mining | Open pit mining will result in groundwater inflows into the workings which need to be pumped out for mine safety and the resultant dewatering (water level decrease) of the groundwater system in the immediate vicinity of the workings. | Groundwater quantity | Operational | Moderate | Minimise and control through impact management and monitoring. | Low |
| Open pit mining | Exposure of geological strata in the open pit areas will result in a deterioration in quality of groundwater flowing into the open pit and the pit water, due to the ARD formation in some strata, and the leaching of various major and trace elements from all strata. | Groundwater contamination | Operational | Moderate | Minimise and control through impact management and monitoring.<br>Remedy through rehabilitation. | Low |
| Mineral residue handling and disposal at Dump 6 | Dumping of overburden material will result in the contaminated seepage with ARD formation in some strata, and the leaching of various major and trace elements from all strata. | Groundwater contamination | Operational | Moderate | Minimise and control through impact management and monitoring. | Low |

| ACTIVITY<br>Whether listed or not listed<br>*(e.g. Excavations, blasting, stockpiles, discard dumps or dams, Loading, hauling and transport, Water supply dams and boreholes, accommodation, offices, ablution, stores, workshops, processing plant, storm water control, berms, roads, pipelines, power lines, conveyors, etc.)* | POTENTIAL IMPACT<br>*(e.g. dust, noise, drainage surface disturbance, fly rock, surface water contamination, groundwater contamination, air pollution etc.)* | ASPECTS AFFECTED | PHASE<br>In which impact is anticipated<br>*(e.g. Construction, commissioning, operational Decommissioning, closure, post-closure)* | SIGNIFICANCE<br>(If not mitigated) | MITIGATION TYPE<br>Modify, remedy, control or stop<br>*(e.g. Modify through alternative method; Control through noise control; Control through management and monitoring; Remedy through rehabilitation* | SIGNIFICANCE<br>(If mitigated) |
|---|---|---|---|---|---|---|
| Partially backfilled open pit with final void | Exposure of geological strata and backfill material will result in the contamination of the pit water with ARD and other material leached from the backfill. | Groundwater quantity | Post Closure | Moderate | Minimise and control through impact management and monitoring. | Low |
| **Socio-economic** | | | | | | |
| Construction of the Turfvlakte Infrastructure | Sustain current employment into the future | Socio-economic | Construction | Positive | Control through monitoring. | Positive |
| Construction of the Turfvlakte Infrastructure | Increased economic revenue | Socio-economic | Construction | Positive | Control through monitoring. | Positive |
| Construction of the Turfvlakte Infrastructure | Health and Safety Risk | Socio-economic | Construction | Moderate | Minimise and control through impact management and monitoring. | Low |
| Construction of the Turfvlakte Infrastructure | Population Influx | Socio-economic | Construction | Moderate | Minimise and control through impact management and monitoring. | Low |
| Open pit mining operations | Skills transfer and development | Socio-economic | Operational | Positive | Control through monitoring. | Positive |
| Open pit mining operations | Community Development | Socio-economic | Operational | Positive | Control through monitoring. | Positive |
| Open pit mining operations | Regional and economic development | Socio-economic | Operational | Positive | Control through monitoring. | Positive |
| Open pit mining operations | Sustain current employment into the future | Socio-economic | Operational | Positive | Control through monitoring. | Positive |
| Open pit mining operations | Health and Safety Risk | Socio-economic | Operational Phase | Moderate | Minimise and control through impact management and monitoring. | Low |
| Decommissioning of the Turfvlakte infrastructure, site closure and rehabilitation | Loss of employment | Socio-economic | Decommissioning & Closure | High | Minimise and control through impact management and monitoring. | High |
| Decommissioning of the Turfvlakte infrastructure, site closure and rehabilitation | Reduced regional economic development | Socio-economic | Decommissioning & Closure | High | Minimise and control through impact management and monitoring. | Moderate |

| ACTIVITY<br>Whether listed or not listed<br>*(e.g. Excavations, blasting, stockpiles, discard dumps or dams, Loading, hauling and transport, Water supply dams and boreholes, accommodation, offices, ablution, stores, workshops, processing plant, storm water control, berms, roads, pipelines, power lines, conveyors, etc.)* | POTENTIAL IMPACT<br>*(e.g. dust, noise, drainage surface disturbance, fly rock, surface water contamination, groundwater contamination, air pollution etc.)* | ASPECTS AFFECTED | PHASE<br>In which impact is anticipated<br>*(e.g. Construction, commissioning, operational Decommissioning, closure, post-closure)* | SIGNIFICANCE (If not mitigated) | MITIGATION TYPE<br>Modify, remedy, control or stop<br>*(e.g. Modify through alternative method; Control through noise control; Control through management and monitoring; Remedy through rehabilitation* | SIGNIFICANCE (If mitigated) |
|---|---|---|---|---|---|---|
| Decommissioning of the Turfvlakte infrastructure, site closure and rehabilitation | Reduced community investment | Socio-economic | Decommissioning & Closure | High | Minimise and control through impact management and monitoring. | High |
| **Surface Water** | | | | | | |
| Construction of the Turfvlakte Infrastructure – Site clearing | Contaminated run-off from the site; specifically, sediment and hydrocarbons from the machinery used. | Surface water and receiving environment contamination | Construction Phase | Moderate | Minimise and control through impact management and monitoring. | Low |
| Construction of the Turfvlakte Infrastructure – Laydown areas for construction contractors | Contaminated run-off from the site; specifically, sediment and hydrocarbons from the machinery used. | Surface water and receiving environment contamination | Construction Phase | Moderate | Minimise and control through impact management and monitoring. | Low |
| Open pit mining operations | Area from which natural run-off to water resources can be expected will be reduced by an additional 2.4% of that already reduced by the Grootegeluk Mine | Surface water resources | Operational Phase | Low | Minimise and control through management and monitoring. | Low |
| Contractor laydown area (Haul truck area) | Contaminated run-off from laydown areas can be expected due to spillages, e.g. hydrocarbons | Surface water and receiving environment contamination | Operational Phase | Moderate | Minimise and control through impact management and monitoring. | Low |
| Haul Roads | Surface water may be impacted by coal fines at the loading points and hydrocarbons from equipment, and sediments from potential erosion impacts by storm water from the erosion around the roads. | Surface water and receiving environment contamination | Operational Phase | Moderate | Minimise and control through impact management and monitoring. | Low |
| Pits | Development of the pits my require dewatering to ensure that mining can continue and will need to be discharged/ disposed. | Groundwater levels and surface water environment if disposed of to the surface water resource | Operational Phase | Low | Minimise and control through impact management and monitoring. | Low |
| Pits | Storm water entering the pits will need to be pumped. | Opencast void | Operational Phase | Low | Minimise and control through impact management and monitoring. | Low |
| Pits | Storm water entering the remaining opencast void of Pit 1 may fill the void and decant into surrounding environment | Surface water and environment | Decommissioning and Closure | Moderate | Minimise and control through impact management and monitoring. | Low |

| **ACTIVITY**<br>**Whether listed or not listed**<br>*(e.g. Excavations, blasting, stockpiles, discard dumps or dams, Loading, hauling and transport, Water supply dams and boreholes, accommodation, offices, ablution, stores, workshops, processing plant, storm water control, berms, roads, pipelines, power lines, conveyors, etc.)* | **POTENTIAL IMPACT**<br>*(e.g. dust, noise, drainage surface disturbance, fly rock, surface water contamination, groundwater contamination, air pollution etc.)* | **ASPECTS AFFECTED** | **PHASE**<br>**In which impact is anticipated**<br>*(e.g. Construction, commissioning, operational Decommissioning, closure, post-closure)* | **SIGNIFICANCE (If not mitigated)** | **MITIGATION TYPE**<br>**Modify, remedy, control or stop**<br>*(e.g. Modify through alternative method; Control through noise control; Control through management and monitoring; Remedy through rehabilitation* | **SIGNIFICANCE (If mitigated)** |
|---|---|---|---|---|---|---|
| Open pit mining operations | Area from which natural run-off to water resources can be expected will be reduced by an additional 2.4% of that already reduced by the Grootegeluk Mine | Surface water resources | Decommissioning and Closure | Low | Minimise and control through impact management, rehabilitation and monitoring. | Low |
| **Wetlands** | | | | | | |
| Construction of the Turfvlakte Infrastructure | Impact on / Loss of pans | Wetlands | Construction Phase | High | Minimise and control through impact management and monitoring. | Moderate |
| Open cast mining activities | Impact on / Loss of pans | Wetlands | Operational Phase | High | Minimise and control through impact management and monitoring. | Moderate |
| Decommissioning of the Turfvlakte infrastructure, site closure and rehabilitation | Impact on / Loss of pans | Wetlands | Decommissioning and Closure Phase | High | Minimise and control through impact management and monitoring. | Moderate |
| **Traffic** | | | | | | |
| Construction of the Turfvlakte Infrastructure | Increased traffic on existing roads. | Traffic | Construction Phase | Low | Minimise and control through impact management and monitoring. | Low |
| Open cast mining activities | Increased traffic on existing roads. | Traffic | Operational Phase | Low | Minimise and control through impact management and monitoring. | Low |
| Decommissioning of the Turfvlakte infrastructure, site closure and rehabilitation | Increased traffic on existing roads. | Traffic | Decommissioning and Closure Phase | Low | Minimise and control through impact management and monitoring. | Low |

## 12.0 IMPACT MANAGEMENT OUTCOMES

Table 62 provides a description of impact management outcomes, identifying the standard of impact management required for the environmental aspects.

**Table 62: Description of impact management outcomes**

| **ACTIVITY** ***Whether listed or not listed.*** *(E.g. Excavations, blasting, stockpiles, discard dumps or dams, loading, hauling and transport, Water supply dams and boreholes, accommodation, offices, ablution, stores, workshops, processing plant, storm water control, berms, roads, pipelines, power lines, conveyors etc.).* | **POTENTIAL IMPACT** *(e.g. dust, noise, drainage (surface) disturbance, fly rock, surface water contamination, groundwater contamination, air pollution etc.)* | **ASPECTS AFFECTED** | **PHASE** ***In which impact is anticipated*** *(e.g. Construction, commissioning, operational Decommissioning, closure, post- closure)* | **MITIGATION TYPE** *(modify, remedy, control, or stop) through (e.g. noise control measures, storm- water control, dust control, rehabilitation, design measures, blasting controls, avoidance, relocation, alternative activity etc.) E.g. Modify through alternative method. Control through noise control through management and monitoring Remedy through rehabilitation.* | **STANDARD TO BE ACHIEVED** *(Impact avoided, noise levels, dust levels, rehabilitation standards, end use objectives) etc.* |
|---|---|---|---|---|---|
| **Geology** | | | | | |
| Construction of Turfvlakte Infrastructure | Disturbance of near surface geology | Geology | Construction Phase | None | N/A |
| Mining of Turfvlakte Open Pits | Permanent disturbance of the geology at the pit areas | Geology | Operation Phase | None | N/A |
| Decommissioning of the Turfvlakte infrastructure, site closure and rehabilitation | It is not expected that additional impacts on the geology of the project area would occur during the decommissioning and closure phase. | Geology | Decommissioning and Closure Phase | N/A | N/A |
| **Air Quality** | | | | | |
| Construction of the Turfvlakte Infrastructure | Dust and fine particulates affecting ambient air quality | Air Quality | Construction phase | Minimise and control through impact management and monitoring. | Compliance with NAAQA at the mine boundary. |
| Mining of Grootegeluk, Thabametsi and Turfvlakte Pits | Dust and fine particulates affecting ambient air quality | Air Quality | Operational phase | Minimise and control through impact management and monitoring. | Compliance with NAAQA at the mine boundary. |
| Processing ore associated with the mining of the Grootegeluk, Thabametsi and Turfvlakte Pits | Dust and fine particulates affecting ambient air quality | Air Quality | Operational phase | Minimise and control through impact management and monitoring. | Compliance with NAAQA at the mine boundary. |
| Rehabilitation of Dump 4 and 5 and placement of overburden on Dump 6. | Dust and fine particulates affecting ambient air quality | Air Quality | Operational phase | Minimise and control through impact management and monitoring. | Compliance with NAAQA at the mine boundary. |
| Decommissioning of the Turfvlakte Infrastructure | Dust and fine particulates affecting ambient air quality | Air Quality | Decommissioning and closure phase | Minimise and control through impact management and monitoring. | Compliance with NAAQA at the mine boundary. |
| **Topography** | | | | | |
| Construction of Turfvlakte Infrastructure | Altering of the topography in the project area | Topography | Construction Phase | None | N/A |

| **ACTIVITY**<br>***Whether listed or not listed.***<br>*(E.g. Excavations, blasting, stockpiles, discard dumps or dams, loading, hauling and transport, Water supply dams and boreholes, accommodation, offices, ablution, stores, workshops, processing plant, storm water control, berms, roads, pipelines, power lines, conveyors etc.).* | **POTENTIAL IMPACT**<br>*(e.g. dust, noise, drainage (surface) disturbance, fly rock, surface water contamination, groundwater contamination, air pollution etc.)* | **ASPECTS AFFECTED** | **PHASE**<br>***In which impact is anticipated***<br>*(e.g. Construction, commissioning, operational Decommissioning, closure, post- closure)* | **MITIGATION TYPE**<br>*(modify, remedy, control, or stop) through (e.g. noise control measures, storm- water control, dust control, rehabilitation, design measures, blasting controls, avoidance, relocation, alternative activity etc.) E.g. Modify through alternative method. Control through noise control through management and monitoring Remedy through rehabilitation.* | **STANDARD TO BE ACHIEVED**<br>*(Impact avoided, noise levels, dust levels, rehabilitation standards, end use objectives) etc.* |
|---|---|---|---|---|---|
| Mining of Turfvlakte Open Pits | Altering of the topography at the pit areas | Topography | Operational Phase | Minimise and control through impact management and monitoring. | N/A |
| Decommissioning of the Turfvlakte infrastructure, site closure and rehabilitation | Altering of the topography at the pit areas | Topography | Decommissioning and Closure Phase | Remedy through rehabilitation. | Rehabilitate to topography similar to pre-construction. |
| **Heritage Resources** | | | | | |
| Site clearance and pit excavation | No impacts expected, but chance finds with potentially high impacts could occur | Heritage Resources | Construction phase | Minimise and control through monitoring. | Impact avoided, where not possible, chance find procedure to be implemented. |
| Open cast mining activities | No impacts expected, but chance finds with potentially high impacts could occur | Heritage Resources | Operational phase | Minimise and control through monitoring. | Impact avoided, where not possible, chance find procedure to be implemented |
| Site rehabilitation and closure | Closure and rehabilitation activities cannot affect any sites of archaeological or cultural significance | Heritage Resources | Decommissioning and closure phase | N/A | Impact avoided, where not possible, chance find procedure to be implemented |
| **Palaeontological Resources** | | | | | |
| Site clearance and pit excavation | No impacts expected, but chance finds with potentially high impacts could occur | Palaeontological Resources | Construction phase | Minimise and control through monitoring. | Impact avoided, where not possible, chance find procedure to be implemented |
| Open cast mining activities | No impacts expected, but chance finds with potentially high impacts could occur | Palaeontological Resources | Operational phase | Minimise and control through monitoring. | Impact avoided, where not possible, chance find procedure to be implemented |
| Site rehabilitation and closure | Closure and rehabilitation activities cannot affect any sites of palaeontological significance | Palaeontological Resources | Decommissioning and closure phase | N/A | Impact avoided, where not possible, chance find procedure to be implemented |
| **Noise** | | | | | |
| Site clearance and grubbing of footprint | Noise increase at the boundary of the mine footprint and at the abutting residential areas | Noise | Construction phase | Minimise and control through impact management and monitoring. | Compliance with SANS 10103:2008 – Noise level guidelines |
| Civil construction and construction activities at the footprint | Noise increase at the boundary of the mine footprint and at the abutting residential areas | Noise | Construction phase | Minimise and control through impact management and monitoring. | Compliance with SANS 10103:2008 – Noise level guidelines |
| Construction of earth berm around the pit | Noise increase at the boundary of the mine footprint and at the abutting residential areas | Noise | Construction phase | Minimise and control through impact management and monitoring. | Compliance with SANS 10103:2008 – Noise level guidelines |

| **ACTIVITY**<br>***Whether listed or not listed.***<br>*(E.g. Excavations, blasting, stockpiles, discard dumps or dams, loading, hauling and transport, Water supply dams and boreholes, accommodation, offices, ablution, stores, workshops, processing plant, storm water control, berms, roads, pipelines, power lines, conveyors etc.).* | **POTENTIAL IMPACT**<br>*(e.g. dust, noise, drainage (surface) disturbance, fly rock, surface water contamination, groundwater contamination, air pollution etc.)* | **ASPECTS AFFECTED** | **PHASE**<br>***In which impact is anticipated***<br>*(e.g. Construction, commissioning, operational Decommissioning, closure, post- closure)* | **MITIGATION TYPE**<br>*(modify, remedy, control, or stop) through (e.g. noise control measures, storm- water control, dust control, rehabilitation, design measures, blasting controls, avoidance, relocation, alternative activity etc.) E.g. Modify through alternative method. Control through noise control through management and monitoring Remedy through rehabilitation.* | **STANDARD TO BE ACHIEVED**<br>*(Impact avoided, noise levels, dust levels, rehabilitation standards, end use objectives) etc.* |
|---|---|---|---|---|---|
| Construction of the haul road | Noise increase at the boundary of the mine footprint and at the abutting residential areas | Noise | Construction phase | Minimise and control through impact management and monitoring. | Compliance with SANS 10103:2008 – Noise level guidelines |
| Building material and equipment deliveries at the site | Noise increase at the boundary of the mine footprint and at the abutting residential areas | Noise | Construction phase | Minimise and control through impact management and monitoring. | Compliance with SANS 10103:2008 – Noise level guidelines |
| Construction vehicles | Increased traffic noise | Noise | Construction phase | Minimise and control through impact management and monitoring. | Compliance with SANS 10103:2008 – Noise level guidelines |
| Open cast mining activities at the rim of the open cast pit 1 | Noise increase at the boundary of the mine footprint and at the abutting residential areas | Noise | Operational phase | Minimise and control through impact management and monitoring. | Compliance with SANS 10103:2008 – Noise level guidelines |
| Open cast mining activities at the rim of the open cast pit 2 | Noise increase at the boundary of the mine footprint and at the abutting residential areas | Noise | Operational phase | Minimise and control through impact management and monitoring. | Compliance with SANS 10103:2008 – Noise level guidelines |
| Hauling of coal | Noise increase at the boundary of the mine footprint and at the abutting residential areas | Noise | Operational phase | Minimise and control through impact management and monitoring. | Compliance with SANS 10103:2008 – Noise level guidelines |
| Maintenance activities | Noise increase at the boundary of the mine footprint and at the abutting residential areas | Noise | Operational phase | Minimise and control through impact management and monitoring. | Compliance with SANS 10103:2008 – Noise level guidelines |
| Emergency siren | Noise increase at the boundary of the mine footprint and at the abutting residential areas | Noise | Operational phase | Minimise and control through impact management and monitoring. | Compliance with SANS 10103:2008 – Noise level guidelines |
| Emergency generator | Noise increase at the boundary of the mine footprint and at the abutting residential areas | Noise | Operational phase | Minimise and control through impact management and monitoring. | Compliance with SANS 10103:2008 – Noise level guidelines |
| Demolition of all infrastructure | Noise increase at the boundary of the mine footprint and at the abutting residential areas | Noise | Decommissioning and Closure phase | Minimise and control through impact management and monitoring. | Compliance with SANS 10103:2008 – Noise level guidelines |

| ACTIVITY<br>***Whether listed or not listed.***<br>*(E.g. Excavations, blasting, stockpiles, discard dumps or dams, loading, hauling and transport, Water supply dams and boreholes, accommodation, offices, ablution, stores, workshops, processing plant, storm water control, berms, roads, pipelines, power lines, conveyors etc.).* | POTENTIAL IMPACT<br>*(e.g. dust, noise, drainage (surface) disturbance, fly rock, surface water contamination, groundwater contamination, air pollution etc.)* | ASPECTS AFFECTED | PHASE<br>***In which impact is anticipated***<br>*(e.g. Construction, commissioning, operational Decommissioning, closure, post- closure)* | MITIGATION TYPE<br>*(modify, remedy, control, or stop) through (e.g. noise control measures, storm- water control, dust control, rehabilitation, design measures, blasting controls, avoidance, relocation, alternative activity etc.) E.g. Modify through alternative method. Control through noise control through management and monitoring Remedy through rehabilitation.* | STANDARD TO BE ACHIEVED<br>*(Impact avoided, noise levels, dust levels, rehabilitation standards, end use objectives) etc.* |
|---|---|---|---|---|---|
| Revegetation of rehabilitated areas | Noise increase at the boundary of the mine footprint and at the abutting residential areas | Noise | Decommissioning and Closure phase | Minimise and control through impact management and monitoring. | Compliance with SANS 10103:2008 – Noise level guidelines |
| **Blasting and Vibration** | | | | | |
| Site clearance and pit excavation | No blasting to be undertaken during the Construction phase of the project | Blasting | Construction phase | N/A | N/A |
| Blasting | Ground vibration Impact on houses and structures | Vibration | Operational phase | Minimise and control through impact management and monitoring. | Minimise impacts associated with ground vibration. |
| Blasting | Ground vibration Impact on industrial surface infrastructure | Vibration | Operational phase | Minimise and control through impact management and monitoring. | Minimise impacts associated with ground vibration. |
| Blasting | Ground vibration Impact on roads and road structures | Blasting | Operational phase | Minimise and control through impact management and monitoring. | Minimise impacts associated with ground vibration. |
| Blasting | Air blast impact on houses and structures | Blasting | Operational phase | Minimise and control through impact management and monitoring. | Minimise impacts associated with air blast. |
| Blasting | Air blast impact on industrial surface infrastructure | Vibration | Operational phase | Minimise and control through impact management and monitoring. | Minimise impacts associated with air blast. |
| Blasting | Air blast impact on roads and road structures | Vibration | Operational phase | Minimise and control through management and monitoring. | Minimise impacts associated with air blast. |
| Blasting | Fly rock impact on houses and structures | Blasting | Operational phase | Minimise and control through management and monitoring. | Minimise impacts associated with fly rock. |
| Blasting | Fly rock impact on industrial surface infrastructure | Blasting | Operational phase | Minimise and control through management and monitoring. | Minimise impacts associated with fly rock. |

| **ACTIVITY** *Whether listed or not listed.* *(E.g. Excavations, blasting, stockpiles, discard dumps or dams, loading, hauling and transport, Water supply dams and boreholes, accommodation, offices, ablution, stores, workshops, processing plant, storm water control, berms, roads, pipelines, power lines, conveyors etc.).* | **POTENTIAL IMPACT** *(e.g. dust, noise, drainage (surface) disturbance, fly rock, surface water contamination, groundwater contamination, air pollution etc.)* | **ASPECTS AFFECTED** | **PHASE** *In which impact is anticipated* *(e.g. Construction, commissioning, operational Decommissioning, closure, post- closure)* | **MITIGATION TYPE** *(modify, remedy, control, or stop) through (e.g. noise control measures, storm- water control, dust control, rehabilitation, design measures, blasting controls, avoidance, relocation, alternative activity etc.) E.g. Modify through alternative method. Control through noise control through management and monitoring Remedy through rehabilitation.* | **STANDARD TO BE ACHIEVED** *(Impact avoided, noise levels, dust levels, rehabilitation standards, end use objectives) etc.* |
|---|---|---|---|---|---|
| Blasting | Fly rock impact on roads and road structures | Vibration | Operational phase | Minimise and control through management and monitoring. | Minimise impacts associated with fly rock. |
| Site clearance and pit excavation | No blasting to be undertaken during the Decommissioning and Closure phase of the project | Blasting | Decommissioning and Closure phase | N/A | N/A |
| **Visual** | | | | | |
| Site clearance and pit excavation | Reduction in visual resource value due to presence of the open pits and associated mining infrastructure. | Visual | Construction phase | Minimise and control through impact management and monitoring. | Reduced visual intrusion and no complaints from receptors |
| Site clearance and pit excavation | Formation of dust plumes as a result of construction activities, soil stripping and subsequent mining. | Visual | Construction phase | Minimise and control through impact management and monitoring. | Reduced visual intrusion and no complaints from receptors |
| Site clearance and pit excavation | Light pollution at night. | Visual | Construction phase | Minimise and control through impact management and monitoring. | Reduced visual intrusion and no complaints from receptors |
| Opencast mining activities | Reduction in visual resource value due to presence of the new plant and other mining infrastructure. | Visual | Operational phase | Minimise and control through impact management and monitoring. | Reduced visual intrusion and no complaints from receptors |
| Opencast mining activities | Reduction in visual resource value due to the open pits and material stockpiles/ dumps (e.g. discard/ dumps, topsoil stockpile, product stockpiles). | Visual | Operational phase | Minimise and control through impact management and monitoring. | Reduced visual intrusion and no complaints from receptors |
| Opencast mining activities | Formation of dust plumes as a result of construction activities, soil stripping and subsequent mining. | Visual | Operational phase | Minimise and control through impact management and monitoring. | Reduced visual intrusion and no complaints from receptors |
| Opencast mining activities | Light pollution at night. | Visual | Operational phase | Remedy through rehabilitation. | Reduced visual intrusion and no complaints from receptors |
| Site rehabilitation and closure | Reinstatement of visual resource value due to dismantling of mining infrastructure and subsequent rehabilitation of footprint areas. | Visual | Decommissioning and Closure phase | Remedy through rehabilitation. | Reduced visual intrusion and no complaints from receptors |

| **ACTIVITY** ***Whether listed or not listed.*** *(E.g. Excavations, blasting, stockpiles, discard dumps or dams, loading, hauling and transport, Water supply dams and boreholes, accommodation, offices, ablution, stores, workshops, processing plant, storm water control, berms, roads, pipelines, power lines, conveyors etc.).* | **POTENTIAL IMPACT** *(e.g. dust, noise, drainage (surface) disturbance, fly rock, surface water contamination, groundwater contamination, air pollution etc.)* | **ASPECTS AFFECTED** | **PHASE** ***In which impact is anticipated*** *(e.g. Construction, commissioning, operational Decommissioning, closure, post- closure)* | **MITIGATION TYPE** *(modify, remedy, control, or stop) through (e.g. noise control measures, storm- water control, dust control, rehabilitation, design measures, blasting controls, avoidance, relocation, alternative activity etc.) E.g. Modify through alternative method. Control through noise control through management and monitoring Remedy through rehabilitation.* | **STANDARD TO BE ACHIEVED** *(Impact avoided, noise levels, dust levels, rehabilitation standards, end use objectives) etc.* |
|---|---|---|---|---|---|
| Site rehabilitation and closure | Permanent alteration of site topographical and visual character of due to presence of mined areas and material stockpiles/dumps. | Visual | Decommissioning and Closure phase | Minimise and control through impact management and monitoring. | Reduced visual intrusion and no complaints from receptors |
| Site rehabilitation and closure | Visible dust plumes during rehabilitation. | Visual | Decommissioning and Closure phase | Minimise and control through impact management and monitoring. | Reduced visual intrusion and no complaints from receptors |
| **Terrestrial Ecology** | | | | | |
| Vegetation clearing and earth works | Habitat loss and degradation | Terrestrial Ecology | Construction phase | Minimise through impact management and rehabilitation. | Impact avoided / mitigated |
| Vegetation clearing and earth works | Habitat fragmentation | Terrestrial Ecology | Construction phase | Minimise through impact management and rehabilitation. | Impact mitigated avoided / mitigated |
| Vegetation clearing and earth works | Establishment and spread of alien invasive species | Terrestrial Ecology | Construction phase | Minimise and control through impact management and monitoring. | Impact avoided / mitigated |
| Vegetation clearing and earth works | Mortality and disturbance of fauna, incl. fauna of conservation importance | Terrestrial Ecology | Construction phase | Minimise and control through impact management and monitoring. | Impact avoided / mitigated |
| Vegetation clearing and earth works | Loss and disturbance of fauna of conservation importance | Terrestrial Ecology | Construction phase | Minimise through impact management and rehabilitation. | Impact avoided / mitigated |
| Vegetation clearing and earth works | Loss and disturbance of flora of conservation importance | Terrestrial Ecology | Construction phase | Minimise through impact management and rehabilitation. | Impact avoided / mitigated |
| Opencast mining activities | Establishment and spread of alien invasive species | Terrestrial Ecology | Operational phase | Minimise and control through impact management and monitoring. | Impact mitigated |
| Opencast mining activities | Mortality and disturbance of fauna, incl. fauna of conservation importance | Terrestrial Ecology | Operational phase | Minimise and control through impact management and monitoring. | Impact avoided / mitigated |

| **ACTIVITY**<br>***Whether listed or not listed.***<br>*(E.g. Excavations, blasting, stockpiles, discard dumps or dams, loading, hauling and transport, Water supply dams and boreholes, accommodation, offices, ablution, stores, workshops, processing plant, storm water control, berms, roads, pipelines, power lines, conveyors etc.).* | **POTENTIAL IMPACT**<br>*(e.g. dust, noise, drainage (surface) disturbance, fly rock, surface water contamination, groundwater contamination, air pollution etc.)* | **ASPECTS AFFECTED** | **PHASE**<br>***In which impact is anticipated***<br>*(e.g. Construction, commissioning, operational Decommissioning, closure, post- closure)* | **MITIGATION TYPE**<br>*(modify, remedy, control, or stop) through (e.g. noise control measures, storm- water control, dust control, rehabilitation, design measures, blasting controls, avoidance, relocation, alternative activity etc.) E.g. Modify through alternative method. Control through noise control through management and monitoring Remedy through rehabilitation.* | **STANDARD TO BE ACHIEVED**<br>*(Impact avoided, noise levels, dust levels, rehabilitation standards, end use objectives) etc.* |
|---|---|---|---|---|---|
| | | | | | |
| Site rehabilitation and closure | Establishment and spread of alien invasive species | Terrestrial Ecology | Decommissioning and closure phase | Minimise and control through impact management and monitoring. | Impact mitigated |
| **Soils, Land Use and Land Capability** | | | | | |
| Vegetation clearance as project infrastructure are constructed | Disturbance of soil, resulting in increased decomposition of soil organic matter from topsoil. | Soil degradation | Construction phase | Minimise and control through impact management and monitoring. | As per Exxaro Land Clearance Procedure<br><br>Soils Stripping and Handling Recommendations |
| Soil stripping and stockpiling | ■ Loss of soils through erosion, particularly for topsoil stockpiles with unvegetated steep slopes<br>■ Homogenization of soil profiles, i.e. Loss of characteristic horizons.<br>■ Loss and/or reduction in soil biodiversity in stockpiled soil.<br>■ Loss of soil nutrients, particularly for unvegetated topsoil stockpiles.<br>■ Loss of soil organic matter due to increased aeration (caused by soil disturbance) and subsequent organic matter decomposition.<br>Modification of existing landscape and hydrological regimes. | Soil degradation | Construction phase | Minimise and control through impact management and monitoring. | Stockpile height not exceeding 3 m, where practically possible.<br><br>Re-use stockpiled soil within as short a period as possible (within 3-5 years) |
| Construction of access roads, haul roads, stockpile area, laydown areas and substation | ■ Burial of soil / covering of soils by camp accommodation facility, haul roads, mine waste facilities and processing plant.<br>■ Soil compaction in areas where active heavy machinery will be mobilised for the development of the accommodation facility, mine infrastructure and associated utilities.<br>■ Increased run-off (and erosion) in compacted areas and modification of natural infiltration.<br>Soil contamination from hydrocarbon and chemical spills including sterilisation by cement pollutants. | Soil availability<br><br>Soil quality | Construction phase | Minimise and control through impact management and monitoring. | Contaminant levels below SSV2 (GNR. 331.<br><br>Norms and Standards for Remediation of Contaminated Land & Soil Quality) |

| **ACTIVITY**<br>***Whether listed or not listed.***<br>*(E.g. Excavations, blasting, stockpiles, discard dumps or dams, loading, hauling and transport, Water supply dams and boreholes, accommodation, offices, ablution, stores, workshops, processing plant, storm water control, berms, roads, pipelines, power lines, conveyors etc.).* | **POTENTIAL IMPACT**<br>*(e.g. dust, noise, drainage (surface) disturbance, fly rock, surface water contamination, groundwater contamination, air pollution etc.)* | **ASPECTS AFFECTED** | **PHASE**<br>***In which impact is anticipated***<br>*(e.g. Construction, commissioning, operational Decommissioning, closure, post- closure)* | **MITIGATION TYPE**<br>*(modify, remedy, control, or stop) through (e.g. noise control measures, storm- water control, dust control, rehabilitation, design measures, blasting controls, avoidance, relocation, alternative activity etc.) E.g. Modify through alternative method. Control through noise control through management and monitoring Remedy through rehabilitation.* | **STANDARD TO BE ACHIEVED**<br>*(Impact avoided, noise levels, dust levels, rehabilitation standards, end use objectives) etc.* |
|---|---|---|---|---|---|
| Transportation and use of equipment - potential spills of chemicals (e.g., hydrocarbon). Soil contamination on adjacent land potentially occurring due to inappropriate waste disposal and potential oil and diesel leakages from vehicles and machinery | ■ Contamination of soils by hydrocarbon pollutants.<br>Increased soil compaction and run-off at equipment and machinery laydown areas. | Soil contamination<br>Soil compaction | Construction phase | Minimise and control through impact management and monitoring. | Contaminant levels below SSV2 (GNR. 331.<br>Norms and Standards for Remediation of Contaminated Land & Soil Quality) |
| Open pit development, drilling and blasting | ■ Loss/ Change of current land use.<br>■ Soil disturbance due to excavation activities at pit location as well as in surrounding soils.<br>■ Modification of natural soil hydrological regime.<br>Loss of potentially arable land. (Potential effects on soil and land use with the development of the open pit may be similar to what is anticipated for construction phase) | Land use<br>Soil quality | Operational phase | None | Impact avoided / mitigated |
| Hauling of coal and waste rock for storage in their respective storage facilities. | ■ Soil contamination from hydrocarbon spills from vehicles; and<br>■ Soil contamination from spillage/poor handling of product and waste rock outside the designated areas. | Soil quality | Operational phase | Reduce through eliminating contaminant source | Impact avoided |
| Spills of chemicals (e.g., hydrocarbon).<br>Soil contamination on adjacent land potentially occurring due to inappropriate waste disposal and potential oil and diesel leakages from vehicles and machinery | Contamination of soils by hydrocarbon pollutants | Soil contamination | Operational phase | Minimise and control through impact management and monitoring. | Rehabilitation standards/objectives |
| Removal of redundant infrastructure | ■ Spillage of chemical solutions during the dismantling of plant equipment, pipelines or pumps which were in contact with chemicals solution may contaminate the soils.<br>Spillage of diesel, oils and greases from the dismantled plant equipment, resulting in hydrocarbon contamination of exposed soils. | Soil contamination | Decommissioning & Closure Phase | Control through minimizing occurrence of contaminant source | Rehabilitation standards/objectives<br>GN 331 |

| **ACTIVITY**<br>***Whether listed or not listed.***<br>*(E.g. Excavations, blasting, stockpiles, discard dumps or dams, loading, hauling and transport, Water supply dams and boreholes, accommodation, offices, ablution, stores, workshops, processing plant, storm water control, berms, roads, pipelines, power lines, conveyors etc.).* | **POTENTIAL IMPACT**<br>*(e.g. dust, noise, drainage (surface) disturbance, fly rock, surface water contamination, groundwater contamination, air pollution etc.)* | **ASPECTS AFFECTED** | **PHASE**<br>***In which impact is anticipated***<br>*(e.g. Construction, commissioning, operational Decommissioning, closure, post- closure)* | **MITIGATION TYPE**<br>*(modify, remedy, control, or stop) through (e.g. noise control measures, storm- water control, dust control, rehabilitation, design measures, blasting controls, avoidance, relocation, alternative activity etc.) E.g. Modify through alternative method. Control through noise control through management and monitoring Remedy through rehabilitation.* | **STANDARD TO BE ACHIEVED**<br>*(Impact avoided, noise levels, dust levels, rehabilitation standards, end use objectives) etc.* |
|---|---|---|---|---|---|
| Backfilling of Turfvlakte Pits | Spilling of backfill material during haulage outside the designated areas. | Soil quality (contamination) | Decommissioning & Closure Phase | Control through minimizing occurrence of contaminant source | Rehabilitation standards/objectives<br><br>GN 331 |
| Grading of project site to ensure long-term drainage conditions on site | ■ Soil compaction in areas where active heavy machinery will be mobilised for the shaping of the final landform; and<br>Loss of soil organic matter due to increased aeration (caused by soil disturbance) and subsequent organic matter decomposition. | Soil compaction<br><br>Soil erosion<br><br>Soil quality | Decommissioning & Closure Phase | Minimise and control through impact management and monitoring. | Rehabilitation standards/objectives |
| Soil placement and revegetation of project site | ■ Soil handling to convey soil from topsoil stockpile to project site for surface rehabilitation activities, may result in degradation of soil quality due to soil disturbance.<br>Contamination of soil by handling of soil with contaminated earth moving machinery (machinery previously used for handling mine waste such as waste rock or tailings material). Insufficient soil volumes to meet end land use soil requirements. | Land use<br><br>Soil quality<br><br>Soil quantity | Decommissioning & Closure Phase | Minimise and control through impact management and monitoring. | Rehabilitation standards/objectives |
| **Groundwater** | | | | | |
| Footprint Clearance / Construction | Clearing topsoil for footprint areas can increase infiltration rates of water to the groundwater system and increase aquifer vulnerability | Groundwater contamination | Construction Phase | Minimise and control through impact management and monitoring. | WUL groundwater water quality guidelines |
| Waste / hydrocarbon Handling | Handling of waste and transport of building material can cause various types of spills (hydrocarbons) which can infiltrate and contaminate the groundwater system. | Soil contamination | Construction Phase | Minimise and control through impact management and monitoring.<br><br>Remedy through rehabilitation. | Impact avoided |
| Open pit mining | Open pit mining will result in groundwater inflows into the workings which need to be pumped out for mine safety and the resultant dewatering (water level decrease) of the groundwater system in the immediate vicinity of the workings. | Groundwater quantity | Operational | Minimise and control through impact management and monitoring. | Impact avoided |
| Open pit mining | Exposure of geological strata in the open pit areas will result in a deterioration in quality of groundwater flowing into the open pit and the pit water, due to the ARD formation in some strata, and the leaching of various major and trace elements from all strata. | Groundwater contamination | Operational | Minimise and control through impact management and monitoring.<br><br>Remedy through rehabilitation. | WUL groundwater water quality guidelines |

| **ACTIVITY**<br>***Whether listed or not listed.***<br>*(E.g. Excavations, blasting, stockpiles, discard dumps or dams, loading, hauling and transport, Water supply dams and boreholes, accommodation, offices, ablution, stores, workshops, processing plant, storm water control, berms, roads, pipelines, power lines, conveyors etc.).* | **POTENTIAL IMPACT**<br>*(e.g. dust, noise, drainage (surface) disturbance, fly rock, surface water contamination, groundwater contamination, air pollution etc.)* | **ASPECTS AFFECTED** | **PHASE**<br>***In which impact is anticipated***<br>*(e.g. Construction, commissioning, operational Decommissioning, closure, post- closure)* | **MITIGATION TYPE**<br>*(modify, remedy, control, or stop) through (e.g. noise control measures, storm- water control, dust control, rehabilitation, design measures, blasting controls, avoidance, relocation, alternative activity etc.) E.g. Modify through alternative method. Control through noise control through management and monitoring Remedy through rehabilitation.* | **STANDARD TO BE ACHIEVED**<br>*(Impact avoided, noise levels, dust levels, rehabilitation standards, end use objectives) etc.* |
|---|---|---|---|---|---|
| Mineral residue handling and disposal at Dump 6 | Dumping of overburden material will result in the contaminated seepage with ARD formation in some strata, and the leaching of various major and trace elements from all strata. | Groundwater contamination | Operational | Minimise and control through impact management and monitoring. | WUL groundwater water quality guidelines |
| Partially backfilled open pit with final void | Exposure of geological strata and backfill material will result in the contamination of the pit water with ARD and other material leached from the backfill. | Groundwater quantity | Post Closure | Minimise and control through impact management and monitoring. | Impact avoided |
| **Surface Water** | | | | | |
| Construction of the Turfvlakte Infrastructure – Site clearing | Contaminated run-off from the site; specifically, sediment and hydrocarbons from the machinery used. | Surface water and receiving environment contamination | Construction Phase | Minimise and control through impact management and monitoring. | Impact avoided |
| Construction of the Turfvlakte Infrastructure – Laydown areas for construction contractors | Contaminated run-off from the site; specifically, sediment and hydrocarbons from the machinery used. | Surface water and receiving environment contamination | Construction Phase | Minimise and control through impact management and monitoring. | Impact avoided |
| Open pit mining operations | Area from which natural run-off to water resources can be expected will be reduced by an additional 2.4% of that already reduced by the Grootegeluk Mine | Surface water resources | Operational Phase | Minimise and control through management and monitoring. | Regulation GN 704 for storm water management at mines |
| Contractor laydown area (Haul truck area) | Contaminated run-off from laydown areas can be expected due to spillages, e.g. hydrocarbons | Surface water and receiving environment contamination | Operational Phase | Minimise and control through impact management and monitoring. | Regulation GN 704 for storm water management at mines |
| Haul Roads | Surface water may be impacted by coal fines at the loading points and hydrocarbons from equipment, and sediments from potential erosion impacts by storm water from the erosion around the roads. | Surface water and receiving environment contamination | Operational Phase | Minimise and control through impact management and monitoring. | Impact avoided |
| Pits | Development of the pits my require dewatering to ensure that mining can continue and will need to be discharged/ disposed. | Groundwater levels and surface water environment if disposed of to the surface water resource | Operational Phase | Minimise and control through impact management and monitoring. | Impact managed |
| Pits | Storm water entering the pits will need to be pumped. | Opencast void | Operational Phase | Minimise and control through impact management and monitoring. | Impact managed |

| **ACTIVITY** ***Whether listed or not listed.*** *(E.g. Excavations, blasting, stockpiles, discard dumps or dams, loading, hauling and transport, Water supply dams and boreholes, accommodation, offices, ablution, stores, workshops, processing plant, storm water control, berms, roads, pipelines, power lines, conveyors etc.).* | **POTENTIAL IMPACT** *(e.g. dust, noise, drainage (surface) disturbance, fly rock, surface water contamination, groundwater contamination, air pollution etc.)* | **ASPECTS AFFECTED** | **PHASE** ***In which impact is anticipated*** *(e.g. Construction, commissioning, operational Decommissioning, closure, post- closure)* | **MITIGATION TYPE** *(modify, remedy, control, or stop) through (e.g. noise control measures, storm- water control, dust control, rehabilitation, design measures, blasting controls, avoidance, relocation, alternative activity etc.) E.g. Modify through alternative method. Control through noise control through management and monitoring Remedy through rehabilitation.* | **STANDARD TO BE ACHIEVED** *(Impact avoided, noise levels, dust levels, rehabilitation standards, end use objectives) etc.* |
|---|---|---|---|---|---|
| Pits | Storm water entering the remaining opencast void of Pit 1 may fill the void and decant into surrounding environment | Surface water and environment | Decommissioning and Closure | Minimise and control through impact management and monitoring. | Impact avoided |
| Open pit mining operations | Area from which natural run-off to water resources can be expected will be reduced by an additional 2.4% of that already reduced by the Grootegeluk Mine | Surface water resources | Decommissioning and Closure | Minimise and control through impact management, rehabilitation and monitoring. | Regulation GN 704 for storm water management at mines |
| **Socio-economic** | | | | | |
| Construction of the Turfvlakte Infrastructure | Sustain current employment into the future | Socio-economic | Construction | Control through monitoring. | N/A |
| Construction of the Turfvlakte Infrastructure | Increased economic revenue | Socio-economic | Construction | Control through monitoring. | N/A |
| Construction of the Turfvlakte Infrastructure | Health and Safety Risk | Socio-economic | Construction | Minimise and control through impact management and monitoring. | Impact avoided |
| Construction of the Turfvlakte Infrastructure | Population Influx | Socio-economic | Construction | Minimise and control through impact management and monitoring. | Impact avoided |
| Open pit mining operations | Skills transfer and development | Socio-economic | Operational | Control through monitoring. | N/A |
| Open pit mining operations | Community Development | Socio-economic | Operational | Control through monitoring. | N/A |
| Open pit mining operations | Regional and economic development | Socio-economic | Operational | Control through monitoring. | N/A |
| Open pit mining operations | Sustain current employment into the future | Socio-economic | Operational | Control through monitoring. | N/A |
| Open pit mining operations | Health and Safety Risk | Socio-economic | Operational | Minimise and control through impact management and monitoring. | Impact avoided |

| **ACTIVITY**<br>***Whether listed or not listed.***<br>*(E.g. Excavations, blasting, stockpiles, discard dumps or dams, loading, hauling and transport, Water supply dams and boreholes, accommodation, offices, ablution, stores, workshops, processing plant, storm water control, berms, roads, pipelines, power lines, conveyors etc.).* | **POTENTIAL IMPACT**<br>*(e.g. dust, noise, drainage (surface) disturbance, fly rock, surface water contamination, groundwater contamination, air pollution etc.)* | **ASPECTS AFFECTED** | **PHASE**<br>***In which impact is anticipated***<br>*(e.g. Construction, commissioning, operational Decommissioning, closure, post- closure)* | **MITIGATION TYPE**<br>*(modify, remedy, control, or stop) through (e.g. noise control measures, storm- water control, dust control, rehabilitation, design measures, blasting controls, avoidance, relocation, alternative activity etc.) E.g. Modify through alternative method. Control through noise control through management and monitoring Remedy through rehabilitation.* | **STANDARD TO BE ACHIEVED**<br>*(Impact avoided, noise levels, dust levels, rehabilitation standards, end use objectives) etc.* |
|---|---|---|---|---|---|
| Decommissioning and removal of the Turfvlakte infrastructure | Loss of employment | Socio-economic | Decommissioning & Closure | Minimise and control through impact management and monitoring. | Impact managed |
| Decommissioning and removal of the Turfvlakte infrastructure | Reduced regional economic development | Socio-economic | Decommissioning & Closure | Minimise and control through impact management and monitoring. | Impact managed |
| Decommissioning and removal of the Turfvlakte infrastructure | Reduced community investment | Socio-economic | Decommissioning & Closure | Minimise and control through impact management and monitoring. | Impact managed |
| **Wetlands** | | | | | |
| Construction of the Turfvlakte Infrastructure | Impact on / Loss of pans | Wetlands | Construction Phase | Avoid<br><br>Minimise and control through impact management and monitoring. | Requirements of Offset Study |
| Open cast mining activities | Impact on / Loss of pans | Wetlands | Operational Phase | Avoid<br><br>Minimise and control through impact management and monitoring. | Requirements of Offset Study |
| Decommissioning of the Turfvlakte infrastructure, site closure and rehabilitation | Impact on / Loss of pans | Wetlands | Decommissioning and Closure Phase | Avoid<br><br>Minimise and control through impact management and monitoring. | Requirements of Offset Study |
| **Traffic** | | | | | |
| Construction of the Turfvlakte Infrastructure | Increased traffic on existing roads. | Traffic | Construction Phase | Minimise and control through impact management and monitoring. | No complaints from public |

| **ACTIVITY**<br>***Whether listed or not listed.***<br>*(E.g. Excavations, blasting, stockpiles, discard dumps or dams, loading, hauling and transport, Water supply dams and boreholes, accommodation, offices, ablution, stores, workshops, processing plant, storm water control, berms, roads, pipelines, power lines, conveyors etc.).* | **POTENTIAL IMPACT**<br>*(e.g. dust, noise, drainage (surface) disturbance, fly rock, surface water contamination, groundwater contamination, air pollution etc.)* | **ASPECTS AFFECTED** | **PHASE**<br>***In which impact is anticipated***<br>*(e.g. Construction, commissioning, operational Decommissioning, closure, post- closure)* | **MITIGATION TYPE**<br>*(modify, remedy, control, or stop) through (e.g. noise control measures, storm- water control, dust control, rehabilitation, design measures, blasting controls, avoidance, relocation, alternative activity etc.) E.g. Modify through alternative method. Control through noise control through management and monitoring Remedy through rehabilitation.* | **STANDARD TO BE ACHIEVED**<br>*(Impact avoided, noise levels, dust levels, rehabilitation standards, end use objectives) etc.* |
|---|---|---|---|---|---|
| Open cast mining activities | Increased traffic on existing roads. | Traffic | Operational Phase | Minimise and control through impact management and monitoring. | No complaints from public |
| Decommissioning of the Turfvlakte infrastructure, site closure and rehabilitation | Increased traffic on existing roads. | Traffic | Decommissioning and Closure Phase | Minimise and control through impact management and monitoring. | No complaints from public |

## 13.0 IMPACT MANAGEMENT ACTIONS

Table 63 provided a description of the impact management actions, identifying the manner in which the impact management objectives and outcomes will be achieved.

**Table 63: Impact management actions**

| **ACTIVITY** *whether listed or not listed. (E.g. Excavations, blasting, stockpiles, discard dumps or dams, loading, hauling and transport, Water supply dams and boreholes, accommodation, offices, ablution, stores, workshops, processing plant, storm water control, berms, roads, pipelines, power lines, conveyors, etc.).* | **POTENTIAL IMPACT** *(e.g. dust, noise, drainage surface disturbance, fly rock, surface water contamination, groundwater contamination, air pollution etc.)* | **MITIGATION TYPE** *(modify, remedy, control, or stop) through* *(e.g. noise control measures, storm- water control, dust control, rehabilitation, design measures, blasting controls, avoidance, relocation, alternative activity etc.) E.g. Modify through alternative method. Control through noise control through management and monitoring Remedy through rehabilitation.* | **TIME PERIOD FOR IMPLEMENTATION** *Describe the time period when the measures in the environmental management programme must be implemented Measures must be implemented when required. With regard to Rehabilitation specifically this must take place at the earliest opportunity. With regard to Rehabilitation, therefore state either upon cessation of the individual activity or upon the cessation of mining, bulk sampling or alluvial diamond prospecting as the case may be.* | **COMPLIANCE WITH STANDARDS** *(A description of how each of the recommendations in 2.11.6 read with 2.12 and 2.15.2 herein will comply with any prescribed environmental management standards or practices that have been identified by Competent Authorities)* |
|---|---|---|---|---|
| **CONSTRUCTION PHASE** | | | | |
| **Geology** | | | | |
| Construction of Turfvlakte Infrastructure | Disturbance of near surface geology | None | N/A | N/A |
| **Air Quality** | | | | |
| Construction of the Turfvlakte Infrastructure | Dust and fine particulates affecting ambient air quality | Minimise and control through impact management and monitoring. | Duration of construction activities | Implementing dust control measures at significant emission sources, the cumulative ambient particulate load will be reduced. |
| **Topography** | | | | |
| Construction of Turfvlakte Infrastructure | Altering of the topography in the project area | None | N/A | N/A |
| **Heritage Resources** | | | | |
| Construction of Turfvlakte Infrastructure | No impacts expected, but chance finds with potentially high impacts could occur | Minimise and control through monitoring. | Duration of construction activities. | By monitoring construction activities and implementing the chance find procedure, damage to heritage resources can be avoided. |
| **Palaeontological Resources** | | | | |
| Construction of Turfvlakte Infrastructure | No impacts expected, but chance finds with potentially high impacts could occur | Minimise and control through management and monitoring. | Duration of construction activities. | By monitoring construction activities and implementing the chance find procedure, damage to palaeontological resources can be avoided. |
| **Noise** | | | | |
| Site clearance and grubbing of footprint | Noise increase at the boundary of the mine footprint and at the abutting residential areas | Minimise and control through impact management and monitoring. | At commencement of noisy construction activities. | |

| **ACTIVITY** *whether listed or not listed. (E.g. Excavations, blasting, stockpiles, discard dumps or dams, loading, hauling and transport, Water supply dams and boreholes, accommodation, offices, ablution, stores, workshops, processing plant, storm water control, berms, roads, pipelines, power lines, conveyors, etc.).* | **POTENTIAL IMPACT** *(e.g. dust, noise, drainage surface disturbance, fly rock, surface water contamination, groundwater contamination, air pollution etc.)* | **MITIGATION TYPE** *(modify, remedy, control, or stop) through* *(e.g. noise control measures, storm- water control, dust control, rehabilitation, design measures, blasting controls, avoidance, relocation, alternative activity etc.) E.g. Modify through alternative method. Control through noise control through management and monitoring Remedy through rehabilitation.* | **TIME PERIOD FOR IMPLEMENTATION** *Describe the time period when the measures in the environmental management programme must be implemented Measures must be implemented when required. With regard to Rehabilitation specifically this must take place at the earliest opportunity. With regard to Rehabilitation, therefore state either upon cessation of the individual activity or upon the cessation of mining, bulk sampling or alluvial diamond prospecting as the case may be.* | **COMPLIANCE WITH STANDARDS** *(A description of how each of the recommendations in 2.11.6 read with 2.12 and 2.15.2 herein will comply with any prescribed environmental management standards or practices that have been identified by Competent Authorities)* |
|---|---|---|---|---|
| Civil construction and construction activities at the footprint | Noise increase at the boundary of the mine footprint and at the abutting residential areas | Minimise and control through impact management and monitoring. | Monthly Noise monitoring until potential shift in prevailing ambient noise levels are determined, thereafter Quarterly noise monitoring required. | Implementing noise control measures at source can reduce the cumulative environmental noise levels. |
| Construction of earth berm around the pit | Noise increase at the boundary of the mine footprint and at the abutting residential areas | Minimise and control through impact management and monitoring. | | |
| Construction of the haul road | Noise increase at the boundary of the mine footprint and at the abutting residential areas | Minimise and control through impact management and monitoring. | | |
| Building material and equipment deliveries at the site | Noise increase at the boundary of the mine footprint and at the abutting residential areas | Minimise and control through impact management and monitoring. | | |
| Construction vehicles | Increased traffic noise | Minimise and control through impact management and monitoring. | | |
| **Blasting and Vibration** | | | | |
| Site clearance and grubbing of footprint | No impacts expected, as no blasting will be required | N/A | N/A | N/A |
| **Visual** | | | | |
| Site clearance and pit excavation | Reduction in visual resource value due to presence of the open pits and associated mining infrastructure. | Minimise and control through impact management and monitoring. | For duration of construction activities | Implementing the proposed mitigation measures will reduce the cumulative visual impact |
| Site clearance and pit excavation | Formation of dust plumes as a result of construction activities, soil stripping and subsequent mining. | Minimise and control through impact management and monitoring. | For duration of construction activities | Implementing the proposed mitigation measures will reduce the cumulative visual impact |
| Site clearance and pit excavation | Light pollution at night. | Minimise and control through impact management and monitoring. | For duration of construction activities | Implementing the proposed mitigation measures will reduce the cumulative visual impact |
| **Terrestrial Ecology** | | | | |
| Vegetation clearing and earth works | Habitat loss and degradation | Minimise through impact management and rehabilitation. | For duration of construction activities | Implementing the proposed mitigation measures will reduce the impact on terrestrial ecology |
| Vegetation clearing and earth works | Habitat fragmentation | Minimise through impact management and rehabilitation. | For duration of construction activities | Implementing the proposed mitigation measures will reduce the impact on terrestrial ecology |

| **ACTIVITY** *whether listed or not listed. (E.g. Excavations, blasting, stockpiles, discard dumps or dams, loading, hauling and transport, Water supply dams and boreholes, accommodation, offices, ablution, stores, workshops, processing plant, storm water control, berms, roads, pipelines, power lines, conveyors, etc.).* | **POTENTIAL IMPACT** *(e.g. dust, noise, drainage surface disturbance, fly rock, surface water contamination, groundwater contamination, air pollution etc.)* | **MITIGATION TYPE** *(modify, remedy, control, or stop) through* *(e.g. noise control measures, storm- water control, dust control, rehabilitation, design measures, blasting controls, avoidance, relocation, alternative activity etc.) E.g. Modify through alternative method. Control through noise control through management and monitoring Remedy through rehabilitation.* | **TIME PERIOD FOR IMPLEMENTATION** *Describe the time period when the measures in the environmental management programme must be implemented Measures must be implemented when required. With regard to Rehabilitation specifically this must take place at the earliest opportunity. With regard to Rehabilitation, therefore state either upon cessation of the individual activity or upon the cessation of mining, bulk sampling or alluvial diamond prospecting as the case may be.* | **COMPLIANCE WITH STANDARDS** *(A description of how each of the recommendations in 2.11.6 read with 2.12 and 2.15.2 herein will comply with any prescribed environmental management standards or practices that have been identified by Competent Authorities)* |
|---|---|---|---|---|
| Vegetation clearing and earth works | Establishment and spread of alien invasive species | Minimise and control through impact management and monitoring. | For duration of construction activities | Implementing the proposed mitigation measures will reduce the impact on terrestrial ecology |
| Vegetation clearing and earth works | Mortality and disturbance of fauna, incl. fauna of conservation importance | Minimise and control through impact management and monitoring. | For duration of construction activities | Implementing the proposed mitigation measures will reduce the impact on terrestrial ecology |
| Vegetation clearing and earth works | Loss and disturbance of fauna of conservation importance | Avoid | For duration of construction activities | Implementing the proposed mitigation measures will reduce the impact on terrestrial ecology |
| Vegetation clearing and earth works | Loss and disturbance of flora of conservation importance | Minimise through impact management and rehabilitation. | For duration of construction activities | Implementing the proposed mitigation measures will reduce the impact on terrestrial ecology |
| **Soils, Land Use and Land Capability** | | | | |
| Vegetation clearance as project infrastructure are constructed | Disturbance of soil, resulting in increased decomposition of soil organic matter from topsoil. | Minimise and control through impact management and monitoring. | Construction phase | Conduct soils stripping and handling in accordance with the Exxaro land Clearance Procedure to reduce the impact on soils in the immediate area. |
| Soil stripping and stockpiling | ■ Loss of soils through erosion, particularly for topsoil stockpiles with unvegetated steep slopes<br>■ Homogenization of soil profiles, i.e. Loss of characteristic horizons.<br>■ Loss and/or reduction in soil biodiversity in stockpiled soil.<br>■ Loss of soil nutrients, particularly for unvegetated topsoil stockpiles.<br>■ Loss of soil organic matter due to increased aeration (caused by soil disturbance) and subsequent organic matter decomposition.<br>■ Modification of existing landscape and hydrological regimes. | Minimise and control through impact management and monitoring. | Construction phase | Limiting stockpile heights and re-use of stockpiled soils will reduce the impact on soils in the immediate area. |

| **ACTIVITY** *whether listed or not listed. (E.g. Excavations, blasting, stockpiles, discard dumps or dams, loading, hauling and transport, Water supply dams and boreholes, accommodation, offices, ablution, stores, workshops, processing plant, storm water control, berms, roads, pipelines, power lines, conveyors, etc.).* | **POTENTIAL IMPACT** *(e.g. dust, noise, drainage surface disturbance, fly rock, surface water contamination, groundwater contamination, air pollution etc.)* | **MITIGATION TYPE** *(modify, remedy, control, or stop) through* *(e.g. noise control measures, storm- water control, dust control, rehabilitation, design measures, blasting controls, avoidance, relocation, alternative activity etc.) E.g. Modify through alternative method. Control through noise control through management and monitoring Remedy through rehabilitation.* | **TIME PERIOD FOR IMPLEMENTATION** *Describe the time period when the measures in the environmental management programme must be implemented Measures must be implemented when required. With regard to Rehabilitation specifically this must take place at the earliest opportunity. With regard to Rehabilitation, therefore state either upon cessation of the individual activity or upon the cessation of mining, bulk sampling or alluvial diamond prospecting as the case may be.* | **COMPLIANCE WITH STANDARDS** *(A description of how each of the recommendations in 2.11.6 read with 2.12 and 2.15.2 herein will comply with any prescribed environmental management standards or practices that have been identified by Competent Authorities)* |
|---|---|---|---|---|
| Construction of access roads, haul roads, stockpile area, laydown areas and substation | ■ Burial of soil / covering of soils by camp accommodation facility, haul roads, mine waste facilities and processing plant.<br>■ Soil compaction in areas where active heavy machinery will be mobilised for the development of the accommodation facility, mine infrastructure and associated utilities.<br>■ Increased run-off (and erosion) in compacted areas and modification of natural infiltration.<br>■ Soil contamination from hydrocarbon and chemical spills including sterilisation by cement pollutants. | Minimise and control through impact management and monitoring. | Construction phase | Implementing the requirements of GNR. 331. Norms and Standards for Remediation of Contaminated Land & Soil Quality will reduce the impact on soils in the immediate area. |
| Transportation and use of equipment - potential spills of chemicals (e.g., hydrocarbon). Soil contamination on adjacent land potentially occurring due to inappropriate waste disposal and potential oil and diesel leakages from vehicles and machinery | Contamination of soils by hydrocarbon pollutants. Increased soil compaction and run-off at equipment and machinery laydown areas. | Minimise and control through impact management and monitoring. | Construction phase | Limiting stockpile heights and re-use of stockpiled soils will reduce the impact on soils in the immediate area.<br>Implementing the requirements of GNR. 331. Norms and Standards for Remediation of Contaminated Land & Soil Quality will reduce the impact on soils in the immediate area. |
| **Groundwater** | | | | |
| Footprint Clearance / Construction | Clearing topsoil for footprint areas can increase infiltration rates of water to the groundwater system and increase aquifer vulnerability | Minimise and control through impact management and monitoring. | Construction phase | Implement the proposed mitigation measures to ensure compliance to the WUL groundwater quality guidelines |
| Waste / hydrocarbon Handling | Handling of waste and transport of building material can cause various types of spills (hydrocarbons) which can infiltrate and contaminate the groundwater system. | Minimise and control through impact management and monitoring.<br>Remedy through rehabilitation. | Construction phase | Implement the proposed mitigation measures to ensure compliance to the WUL groundwater quality guidelines |
| **Surface Water** | | | | |

| **ACTIVITY** *whether listed or not listed. (E.g. Excavations, blasting, stockpiles, discard dumps or dams, loading, hauling and transport, Water supply dams and boreholes, accommodation, offices, ablution, stores, workshops, processing plant, storm water control, berms, roads, pipelines, power lines, conveyors, etc.).* | **POTENTIAL IMPACT** *(e.g. dust, noise, drainage surface disturbance, fly rock, surface water contamination, groundwater contamination, air pollution etc.)* | **MITIGATION TYPE** *(modify, remedy, control, or stop) through* *(e.g. noise control measures, storm- water control, dust control, rehabilitation, design measures, blasting controls, avoidance, relocation, alternative activity etc.) E.g. Modify through alternative method. Control through noise control through management and monitoring Remedy through rehabilitation.* | **TIME PERIOD FOR IMPLEMENTATION** *Describe the time period when the measures in the environmental management programme must be implemented Measures must be implemented when required. With regard to Rehabilitation specifically this must take place at the earliest opportunity. With regard to Rehabilitation, therefore state either upon cessation of the individual activity or upon the cessation of mining, bulk sampling or alluvial diamond prospecting as the case may be.* | **COMPLIANCE WITH STANDARDS** *(A description of how each of the recommendations in 2.11.6 read with 2.12 and 2.15.2 herein will comply with any prescribed environmental management standards or practices that have been identified by Competent Authorities)* |
|---|---|---|---|---|
| Construction of the Turfvlakte Infrastructure – Site clearing | Contaminated run-off from the site; specifically, sediment and hydrocarbons from the machinery used. | Minimise and control through impact management and monitoring. | Construction Phase | Compliance with GN704<br><br>Implement the proposed mitigation measures to ensure compliance to the WUL conditions. |
| Construction of the Turfvlakte Infrastructure – Laydown areas for construction contractors | Contaminated run-off from the site; specifically, sediment and hydrocarbons from the machinery used. | Minimise and control through impact management and monitoring. | Construction Phase | Compliance with GN704<br><br>Implement the proposed mitigation measures to ensure compliance to the WUL conditions. |
| **Socio-economic** | | | | |
| Construction of the Turfvlakte Infrastructure | Sustain current employment into the future | Control through monitoring. | Construction phase | N/A |
| Construction of the Turfvlakte Infrastructure | Increased economic revenue | Control through monitoring. | Construction phase | N/A |
| Construction of the Turfvlakte Infrastructure | Health and Safety Risk | Minimise and control through impact management and monitoring. | Construction phase | Implement the proposed mitigation measures to reduce the health and safety risks. |
| Construction of the Turfvlakte Infrastructure | Population Influx | Minimise and control through impact management and monitoring. | Construction phase | Implement the proposed mitigation measures to reduce the potential risk associated with population influx. |
| **Wetlands** | | | | |
| Construction of the Turfvlakte Infrastructure | Impact on / Loss of pans | Avoid<br><br>Minimise and control through impact management and monitoring. | Construction phase | Implement requirements of Offset Study to mitigation impacts. |
| **Traffic** | | | | |
| Construction of the Turfvlakte Infrastructure | Increased traffic on existing roads. | Minimise and control through impact management and monitoring. | Construction phase | Implement the proposed mitigation measures to ensure traffic impacts are avoided. |
| **OPERATIONAL PHASE** | | | | |
| **Geology** | | | | |
| Mining of Turfvlakte Open Pits | Permanent disturbance of the geology at the pit areas | None | Daily, for the duration of the operational phase activities. | N/A |

| **ACTIVITY** *whether listed or not listed. (E.g. Excavations, blasting, stockpiles, discard dumps or dams, loading, hauling and transport, Water supply dams and boreholes, accommodation, offices, ablution, stores, workshops, processing plant, storm water control, berms, roads, pipelines, power lines, conveyors, etc.).* | **POTENTIAL IMPACT** *(e.g. dust, noise, drainage surface disturbance, fly rock, surface water contamination, groundwater contamination, air pollution etc.)* | **MITIGATION TYPE** *(modify, remedy, control, or stop) through* *(e.g. noise control measures, storm- water control, dust control, rehabilitation, design measures, blasting controls, avoidance, relocation, alternative activity etc.) E.g. Modify through alternative method. Control through noise control through management and monitoring Remedy through rehabilitation.* | **TIME PERIOD FOR IMPLEMENTATION** *Describe the time period when the measures in the environmental management programme must be implemented Measures must be implemented when required. With regard to Rehabilitation specifically this must take place at the earliest opportunity. With regard to Rehabilitation, therefore state either upon cessation of the individual activity or upon the cessation of mining, bulk sampling or alluvial diamond prospecting as the case may be.* | **COMPLIANCE WITH STANDARDS** *(A description of how each of the recommendations in 2.11.6 read with 2.12 and 2.15.2 herein will comply with any prescribed environmental management standards or practices that have been identified by Competent Authorities)* |
|---|---|---|---|---|
| **Air Quality** | | | | |
| Mining of Grootegeluk, Thabametsi and Turfvlakte Pits | Dust and fine particulates affecting ambient air quality | Minimise and control through impact management and monitoring. | Daily, for the duration of the operational phase activities. | Implementing dust control measures at significant emission sources, the cumulative ambient particulate load will be reduced. |
| Processing ore associated with the mining of the Grootegeluk, Thabametsi and Turfvlakte Pits | Dust and fine particulates affecting ambient air quality | Minimise and control through impact management and monitoring. | Daily, for the duration of the operational phase activities. | Implementing dust control measures at significant emission sources, the cumulative ambient particulate load will be reduced. |
| Rehabilitation of Dump 4 and 5 and placement of overburden on Dump 6. | Dust and fine particulates affecting ambient air quality | Minimise and control through impact management and monitoring. | Daily, for the duration of the operational phase activities. | Implementing dust control measures at significant emission sources, the cumulative ambient particulate load will be reduced. |
| **Topography** | | | | |
| Mining of Turfvlakte Open Pits | Altering of the topography at the pit areas. | Minimise and control through impact management and monitoring. | Daily, for the duration of the operational phase activities. | N/A |
| **Heritage Resources** | | | | |
| Open cast mining activities | No impacts expected, but chance finds with potentially high impacts could occur | Minimise and control through monitoring. | Daily, for the duration of the operational phase activities. | By monitoring construction activities and implementing the chance find procedure, damage to heritage resources can be avoided. |
| **Palaeontological Resources** | | | | |
| Open cast mining activities | No impacts expected, but chance finds with potentially high impacts could occur | Minimise and control through monitoring. | Daily, for the duration of the operational phase activities. | By monitoring construction activities and implementing the chance find procedure, damage to palaeontological resources can be avoided. |
| **Noise** | | | | |
| Open cast mining activities at the rim of the open cast pit 1 | Noise increase at the boundary of the mine footprint and at the abutting residential areas | Minimise and control through impact management and monitoring. | At commencement of noisy operational activities.<br>Monthly Noise monitoring until potential shift in prevailing ambient noise levels are determined, thereafter Quarterly noise monitoring required. | Implementing noise control measures at source can reduce the cumulative environmental noise levels. |
| Open cast mining activities at the rim of the open cast pit 2 | Noise increase at the boundary of the mine footprint and at the abutting residential areas | Minimise and control through impact management and monitoring. | | |
| Hauling of coal | Noise increase at the boundary of the mine footprint and at the abutting residential areas | Minimise and control through impact management and monitoring. | | |

| **ACTIVITY** *whether listed or not listed. (E.g. Excavations, blasting, stockpiles, discard dumps or dams, loading, hauling and transport, Water supply dams and boreholes, accommodation, offices, ablution, stores, workshops, processing plant, storm water control, berms, roads, pipelines, power lines, conveyors, etc.).* | **POTENTIAL IMPACT** *(e.g. dust, noise, drainage surface disturbance, fly rock, surface water contamination, groundwater contamination, air pollution etc.)* | **MITIGATION TYPE** *(modify, remedy, control, or stop) through* *(e.g. noise control measures, storm- water control, dust control, rehabilitation, design measures, blasting controls, avoidance, relocation, alternative activity etc.) E.g. Modify through alternative method. Control through noise control through management and monitoring Remedy through rehabilitation.* | **TIME PERIOD FOR IMPLEMENTATION** *Describe the time period when the measures in the environmental management programme must be implemented Measures must be implemented when required. With regard to Rehabilitation specifically this must take place at the earliest opportunity. With regard to Rehabilitation, therefore state either upon cessation of the individual activity or upon the cessation of mining, bulk sampling or alluvial diamond prospecting as the case may be.* | **COMPLIANCE WITH STANDARDS** *(A description of how each of the recommendations in 2.11.6 read with 2.12 and 2.15.2 herein will comply with any prescribed environmental management standards or practices that have been identified by Competent Authorities)* |
|---|---|---|---|---|
| Maintenance activities | Noise increase at the boundary of the mine footprint and at the abutting residential areas | Minimise and control through impact management and monitoring. | | |
| Emergency siren | Noise increase at the boundary of the mine footprint and at the abutting residential areas | Minimise and control through impact management and monitoring. | | |
| Emergency generator | Noise increase at the boundary of the mine footprint and at the abutting residential areas | Minimise and control through impact management and monitoring. | | |
| **Blasting and Vibration** | | | | |
| Blasting | Ground vibration Impact on houses and structures | Minimise and control through impact management and monitoring. | Continuous during operational phase | National Environmental Management Act No. 107 of 1998; Mine Health and Safety Act No. 29 of 1996; Mineral and Petroleum Resources Development Act No. 28 of 2002; and the Explosives Act No. 15 of 2003. Guidelines and safe blasting criteria applied as per internationally accepted standards, and specifically the United States Bureau of Mines (USBM) criteria for safe blasting for ground vibration and the recommendations on air blast. |
| Blasting | Ground vibration Impact on industrial surface infrastructure | Minimise and control through impact management and monitoring. | Continuous during operational phase | |
| Blasting | Air blast impact on houses and structures | Minimise and control through impact management and monitoring. | Continuous during operational phase | |
| Blasting | Air blast impact on industrial surface infrastructure | Minimise and control through impact management and monitoring. | Continuous during operational phase | |
| Blasting | Air blast impact on roads and road structures | Minimise and control through impact management and monitoring. | Continuous during operational phase | |
| Blasting | Fly rock impact on houses and structures | Minimise and control through impact management and monitoring. | Continuous during operational phase | |
| Blasting | Fly rock impact on industrial surface infrastructure | Minimise and control through impact management and monitoring. | Continuous during operational phase | |
| Blasting | Fly rock impact on roads and road structures | Minimise and control through impact management and monitoring. | Continuous during operational phase | |
| **Visual** | | | | |
| Opencast mining activities | Reduction in visual resource value due to presence of the open pits and associated mining infrastructure. | Minimise and control through impact management and monitoring. | Continuous during operational phase | Implementing the proposed mitigation measures will reduce the cumulative visual impact |
| Opencast mining activities | Formation of dust plumes as a result of construction activities, soil stripping and subsequent mining. | Minimise and control through impact management and monitoring. | Continuous during operational phase | Implementing the proposed mitigation measures will reduce the cumulative visual impact |

| **ACTIVITY** *whether listed or not listed. (E.g. Excavations, blasting, stockpiles, discard dumps or dams, loading, hauling and transport, Water supply dams and boreholes, accommodation, offices, ablution, stores, workshops, processing plant, storm water control, berms, roads, pipelines, power lines, conveyors, etc.).* | **POTENTIAL IMPACT** *(e.g. dust, noise, drainage surface disturbance, fly rock, surface water contamination, groundwater contamination, air pollution etc.)* | **MITIGATION TYPE** *(modify, remedy, control, or stop) through* *(e.g. noise control measures, storm- water control, dust control, rehabilitation, design measures, blasting controls, avoidance, relocation, alternative activity etc.) E.g. Modify through alternative method. Control through noise control through management and monitoring Remedy through rehabilitation.* | **TIME PERIOD FOR IMPLEMENTATION** *Describe the time period when the measures in the environmental management programme must be implemented Measures must be implemented when required. With regard to Rehabilitation specifically this must take place at the earliest opportunity. With regard to Rehabilitation, therefore state either upon cessation of the individual activity or upon the cessation of mining, bulk sampling or alluvial diamond prospecting as the case may be.* | **COMPLIANCE WITH STANDARDS** *(A description of how each of the recommendations in 2.11.6 read with 2.12 and 2.15.2 herein will comply with any prescribed environmental management standards or practices that have been identified by Competent Authorities)* |
|---|---|---|---|---|
| Opencast mining activities | Light pollution at night. | Minimise and control through impact management and monitoring. | Continuous during operational phase | Implementing the proposed mitigation measures will reduce the cumulative visual impact |
| **Terrestrial Ecology** | | | | |
| Opencast mining activities | Establishment and spread of alien invasive species | Minimise and control through impact management and monitoring. | Continuous during operational phase | Implementing the proposed mitigation measures will reduce the impact on terrestrial ecology |
| Opencast mining activities | Mortality and disturbance of fauna, incl. fauna of conservation importance | Minimise and control through impact management and monitoring. | Continuous during operational phase | Implementing the proposed mitigation measures will reduce the impact on terrestrial ecology |
| **Soils, Land Use and Land Capability** | | | | |
| Open pit development, drilling and blasting | ■ Loss/ Change of current land use.<br>■ Soil disturbance due to excavation activities at pit location as well as in surrounding soils.<br>■ Modification of natural soil hydrological regime.<br>■ Loss of potentially arable land. (Potential effects on soil and land use with the development of the open pit may be similar to what is anticipated for construction phase) | None | Continues during operational phase | N/A |
| Hauling of coal and waste rock for storage in their respective storage facilities | ■ Soil contamination from hydrocarbon spills from vehicles; and<br>■ Soil contamination from spillage/poor handling of product and waste rock outside the designated areas. | Reduce through eliminating contaminant source | Continuous during operational phase | Implementing the proposed mitigation measures to reduce the impact on soils, land use and land capability. |
| Spills of chemicals (e.g., hydrocarbon) .Soil contamination on adjacent land potentially occurring due to inappropriate waste disposal and potential oil and diesel leakages from vehicles and machinery | Contamination of soils by hydrocarbon pollutants | Minimise and control through impact management and monitoring. | Continuous during operational phase | Compliance to rehabilitation standards/objectives |

| **ACTIVITY** *whether listed or not listed. (E.g. Excavations, blasting, stockpiles, discard dumps or dams, loading, hauling and transport, Water supply dams and boreholes, accommodation, offices, ablution, stores, workshops, processing plant, storm water control, berms, roads, pipelines, power lines, conveyors, etc.).* | **POTENTIAL IMPACT** *(e.g. dust, noise, drainage surface disturbance, fly rock, surface water contamination, groundwater contamination, air pollution etc.)* | **MITIGATION TYPE** *(modify, remedy, control, or stop) through* *(e.g. noise control measures, storm- water control, dust control, rehabilitation, design measures, blasting controls, avoidance, relocation, alternative activity etc.) E.g. Modify through alternative method. Control through noise control through management and monitoring Remedy through rehabilitation.* | **TIME PERIOD FOR IMPLEMENTATION** *Describe the time period when the measures in the environmental management programme must be implemented Measures must be implemented when required. With regard to Rehabilitation specifically this must take place at the earliest opportunity. With regard to Rehabilitation, therefore state either upon cessation of the individual activity or upon the cessation of mining, bulk sampling or alluvial diamond prospecting as the case may be.* | **COMPLIANCE WITH STANDARDS** *(A description of how each of the recommendations in 2.11.6 read with 2.12 and 2.15.2 herein will comply with any prescribed environmental management standards or practices that have been identified by Competent Authorities)* |
|---|---|---|---|---|
| **Groundwater** | | | | |
| Open pit mining | Open pit mining will result in groundwater inflows into the workings which need to be pumped out for mine safety and the resultant dewatering (water level decrease) of the groundwater system in the immediate vicinity of the workings. | Minimise and control through impact management and monitoring. | Continuous during operational phase | Implementing the proposed mitigation measures to reduce the impact on groundwater. |
| Open pit mining | Exposure of geological strata in the open pit areas will result in a deterioration in quality of groundwater flowing into the open pit and the pit water, due to the ARD formation in some strata, and the leaching of various major and trace elements from all strata. | Minimise and control through impact management and monitoring. | Continuous during operational phase | Implement the proposed mitigation measures to ensure compliance to the WUL groundwater quality guidelines. |
| Mineral residue handling and disposal at Dump 6 | Dumping of overburden material will result in the contaminated seepage with ARD formation in some strata, and the leaching of various major and trace elements from all strata. | Minimise and control through impact management and monitoring. | Continuous during operational phase | Implementing the proposed mitigation measures to reduce the impact on groundwater. |
| **Surface Water** | | | | |
| Open pit mining operations | Area from which natural run-off to water resources can be expected will be reduced by an additional 2.4% of that already reduced by the Grootegeluk Mine | Minimise and control through impact management and monitoring. | Operational Phase | Compliance with GN704<br><br>Implement the proposed mitigation measures to ensure compliance to the WUL conditions. |
| Contractor laydown area (Haul truck area) | Contaminated run-off from laydown areas can be expected due to spillages, e.g. hydrocarbons | Minimise and control through impact management and monitoring. | Operational Phase | Compliance with GN704<br><br>Implement the proposed mitigation measures to ensure compliance to the WUL conditions. |
| Haul Roads | Surface water may be impacted by coal fines at the loading points and hydrocarbons from equipment, and sediments from potential erosion impacts by storm water from the erosion around the roads. | Minimise and control through impact management and monitoring. | Operational Phase | Compliance with GN704<br><br>Implement the proposed mitigation measures to ensure compliance to the WUL conditions. |
| Pits | Development of the pits my require dewatering to ensure that mining can | Minimise and control through impact management and monitoring. | Operational Phase | Compliance with GN704 |

| **ACTIVITY** *whether listed or not listed. (E.g. Excavations, blasting, stockpiles, discard dumps or dams, loading, hauling and transport, Water supply dams and boreholes, accommodation, offices, ablution, stores, workshops, processing plant, storm water control, berms, roads, pipelines, power lines, conveyors, etc.).* | **POTENTIAL IMPACT** *(e.g. dust, noise, drainage surface disturbance, fly rock, surface water contamination, groundwater contamination, air pollution etc.)* | **MITIGATION TYPE** *(modify, remedy, control, or stop) through* *(e.g. noise control measures, storm- water control, dust control, rehabilitation, design measures, blasting controls, avoidance, relocation, alternative activity etc.) E.g. Modify through alternative method. Control through noise control through management and monitoring Remedy through rehabilitation.* | **TIME PERIOD FOR IMPLEMENTATION** *Describe the time period when the measures in the environmental management programme must be implemented Measures must be implemented when required. With regard to Rehabilitation specifically this must take place at the earliest opportunity. With regard to Rehabilitation, therefore state either upon cessation of the individual activity or upon the cessation of mining, bulk sampling or alluvial diamond prospecting as the case may be.* | **COMPLIANCE WITH STANDARDS** *(A description of how each of the recommendations in 2.11.6 read with 2.12 and 2.15.2 herein will comply with any prescribed environmental management standards or practices that have been identified by Competent Authorities)* |
|---|---|---|---|---|
| | continue and will need to be discharged/ disposed. | | | Implement the proposed mitigation measures to ensure compliance to the WUL conditions. |
| Pits | Storm water entering the pits will need to be pumped. | Minimise and control through impact management and monitoring. | Operational Phase | Compliance with GN704<br><br>Implement the proposed mitigation measures to ensure compliance to the WUL conditions. |
| **Socio-economic** | | | | |
| Open pit mining operations | Skills transfer and development | Control through monitoring. | Operational Phase | Implement the proposed mitigation measures to reduce the health and safety risks. |
| Open pit mining operations | Community Development | Control through monitoring. | Operational Phase | Implement the proposed mitigation measures to reduce the health and safety risks. |
| Open pit mining operations | Regional and economic development | Control through monitoring. | Operational Phase | Implement the proposed mitigation measures to reduce the health and safety risks. |
| Open pit mining operations | Sustain current employment into the future | Control through monitoring. | Operational Phase | Implement the proposed mitigation measures to reduce the health and safety risks. |
| **Wetlands** | | | | |
| Open cast mining activities | Impact on / Loss of pans | Avoid<br><br>Minimise and control through impact management and monitoring. | Operational Phase | Implement requirements of Offset Study to mitigation impacts. |
| **Traffic** | | | | |
| Open cast mining activities | Increased traffic on existing roads. | Minimise and control through impact management and monitoring. | Operational Phase | Implement the proposed mitigation measures to ensure traffic impacts are avoided. |
| **DECOMMISSIONING PHASE** | | | | |
| **Geology** | | | | |
| Decommissioning of the Turfvlakte infrastructure, site closure and rehabilitation | It is not expected that additional impacts on the geology of the project area would occur | N/A | Decommissioning and Closure phase | N/A |

| **ACTIVITY** *whether listed or not listed. (E.g. Excavations, blasting, stockpiles, discard dumps or dams, loading, hauling and transport, Water supply dams and boreholes, accommodation, offices, ablution, stores, workshops, processing plant, storm water control, berms, roads, pipelines, power lines, conveyors, etc.).* | **POTENTIAL IMPACT** *(e.g. dust, noise, drainage surface disturbance, fly rock, surface water contamination, groundwater contamination, air pollution etc.)* | **MITIGATION TYPE** *(modify, remedy, control, or stop) through* *(e.g. noise control measures, storm- water control, dust control, rehabilitation, design measures, blasting controls, avoidance, relocation, alternative activity etc.) E.g. Modify through alternative method. Control through noise control through management and monitoring Remedy through rehabilitation.* | **TIME PERIOD FOR IMPLEMENTATION** *Describe the time period when the measures in the environmental management programme must be implemented Measures must be implemented when required. With regard to Rehabilitation specifically this must take place at the earliest opportunity. With regard to Rehabilitation, therefore state either upon cessation of the individual activity or upon the cessation of mining, bulk sampling or alluvial diamond prospecting as the case may be.* | **COMPLIANCE WITH STANDARDS** *(A description of how each of the recommendations in 2.11.6 read with 2.12 and 2.15.2 herein will comply with any prescribed environmental management standards or practices that have been identified by Competent Authorities)* |
|---|---|---|---|---|
| | during the decommissioning and closure phase. | | | |
| **Air Quality** | | | | |
| Decommissioning of the Turfvlakte Infrastructure | Dust and fine particulates affecting ambient air quality | Minimise and control through management and monitoring. | For duration of decommissioning and closure activities. | Implementing dust control measures at significant emission sources, the cumulative ambient particulate load will be reduced. |
| **Topography** | | | | |
| Decommissioning of the Turfvlakte infrastructure, site closure and rehabilitation | Altering of the topography at the pit areas | Remedy through rehabilitation. | For duration of decommissioning and closure activities. | Rehabilitated topography similar to pre-construction. |
| **Heritage Resources** | | | | |
| Site rehabilitation and closure | It is not expected that closure and rehabilitation activities will affect any sites of archaeological or cultural significance | N/A | N/A | N/A |
| **Palaeontological Resources** | | | | |
| Site rehabilitation and closure | It is not expected that closure and rehabilitation activities will affect any sites of palaeontological significance | N/A | N/A | N/A |
| **Noise** | | | | |
| Demolition of all infrastructure | Noise increase at the boundary of the mine footprint and at the abutting residential areas | Minimise and control through impact management and monitoring. | At commencement of noisy decommissioning activities.<br>Monthly Noise monitoring until potential shift in prevailing ambient noise levels are determined, thereafter Quarterly noise monitoring required. | Implementing noise control measures at source can reduce the cumulative environmental noise levels. |
| Revegetation of rehabilitated areas | Noise increase at the boundary of the mine footprint and at the abutting residential areas | Minimise and control through impact management and monitoring. | | Implementing noise control measures at source can reduce the cumulative environmental noise levels. |
| **Blasting and Vibration** | | | | |
| Site rehabilitation and closure | No impacts expected, as no blasting will be required | N/A | N/A | N/A |
| **Visual** | | | | |

| **ACTIVITY**<br>*whether listed or not listed. (E.g. Excavations, blasting, stockpiles, discard dumps or dams, loading, hauling and transport, Water supply dams and boreholes, accommodation, offices, ablution, stores, workshops, processing plant, storm water control, berms, roads, pipelines, power lines, conveyors, etc.).* | **POTENTIAL IMPACT**<br>*(e.g. dust, noise, drainage surface disturbance, fly rock, surface water contamination, groundwater contamination, air pollution etc.)* | **MITIGATION TYPE**<br>*(modify, remedy, control, or stop) through*<br>*(e.g. noise control measures, storm- water control, dust control, rehabilitation, design measures, blasting controls, avoidance, relocation, alternative activity etc.) E.g. Modify through alternative method. Control through noise control through management and monitoring Remedy through rehabilitation.* | **TIME PERIOD FOR IMPLEMENTATION**<br>*Describe the time period when the measures in the environmental management programme must be implemented Measures must be implemented when required. With regard to Rehabilitation specifically this must take place at the earliest opportunity. With regard to Rehabilitation, therefore state either upon cessation of the individual activity or upon the cessation of mining, bulk sampling or alluvial diamond prospecting as the case may be.* | **COMPLIANCE WITH STANDARDS**<br>*(A description of how each of the recommendations in 2.11.6 read with 2.12 and 2.15.2 herein will comply with any prescribed environmental management standards or practices that have been identified by Competent Authorities)* |
|---|---|---|---|---|
| Site rehabilitation and closure | Reinstatement of visual resource value due to dismantling of mining infrastructure and subsequent rehabilitation of footprint areas. | Remedy through rehabilitation. | At commencement of decommissioning activities. | Implementing the proposed mitigation measures will reduce the cumulative visual impact. |
| Site rehabilitation and closure | Permanent alteration of site topographical and visual character of due to presence of mined areas and material stockpiles/dumps. | Minimise and control through impact management and monitoring. | At commencement of decommissioning activities. | Implementing the proposed mitigation measures will reduce the cumulative visual impact |
| Site rehabilitation and closure | Visible dust plumes during rehabilitation. | Minimise and control through impact management and monitoring. | At commencement of decommissioning activities. | Implementing the proposed mitigation measures will reduce the cumulative visual impact |
| **Terrestrial Ecology** | | | | |
| Site rehabilitation and closure | Establishment and spread of alien invasive species | Minimise and control through impact management and monitoring. | Continuous through decommissioning and closure phase | Implementing the proposed mitigation measures will reduce the impact on terrestrial ecology. |
| **Soils, Land Use and Land Capability** | | | | |
| Removal of redundant infrastructure | ■ Spillage of chemical solutions during the dismantling of plant equipment, pipelines or pumps which were in contact with chemicals solution may contaminate the soils;<br>■ Spillage of diesel, oils and greases from the dismantled plant equipment, resulting in hydrocarbon contamination of exposed soils. | Control through minimizing occurrence of contaminant source | Decommissioning and closure phase | Implementation of Rehabilitation standards/objectives and requirements of GNR. 331. Norms and Standards for Remediation of Contaminated Land & Soil Quality will reduce the impact on soils in the immediate area. |
| Backfilling of Turfvlakte Pits | Spilling of backfill material during haulage outside the designated areas. | Control through minimizing occurrence of contaminant source | Decommissioning and closure phase | Implementation of Rehabilitation standards/objectives and requirements of GNR. 331. Norms and Standards for Remediation of Contaminated Land & Soil Quality will reduce the impact on soils in the immediate area. |
| Grading of project site to ensure long-term drainage conditions on site | ■ Soil compaction in areas where active heavy machinery will be mobilised for the shaping of the final landform; | Minimise and control through impact management and monitoring. | Decommissioning and closure phase | Implementation of Rehabilitation standards/objectives will reduce the impact on soils in the immediate area. |

| **ACTIVITY** *whether listed or not listed. (E.g. Excavations, blasting, stockpiles, discard dumps or dams, loading, hauling and transport, Water supply dams and boreholes, accommodation, offices, ablution, stores, workshops, processing plant, storm water control, berms, roads, pipelines, power lines, conveyors, etc.).* | **POTENTIAL IMPACT** *(e.g. dust, noise, drainage surface disturbance, fly rock, surface water contamination, groundwater contamination, air pollution etc.)* | **MITIGATION TYPE** *(modify, remedy, control, or stop) through* *(e.g. noise control measures, storm- water control, dust control, rehabilitation, design measures, blasting controls, avoidance, relocation, alternative activity etc.) E.g. Modify through alternative method. Control through noise control through management and monitoring Remedy through rehabilitation.* | **TIME PERIOD FOR IMPLEMENTATION** *Describe the time period when the measures in the environmental management programme must be implemented Measures must be implemented when required. With regard to Rehabilitation specifically this must take place at the earliest opportunity. With regard to Rehabilitation, therefore state either upon cessation of the individual activity or upon the cessation of mining, bulk sampling or alluvial diamond prospecting as the case may be.* | **COMPLIANCE WITH STANDARDS** *(A description of how each of the recommendations in 2.11.6 read with 2.12 and 2.15.2 herein will comply with any prescribed environmental management standards or practices that have been identified by Competent Authorities)* |
|---|---|---|---|---|
| | ▪ Loss of soil organic matter due to increased aeration (caused by soil disturbance) and subsequent organic matter decomposition. | | | |
| Soil placement and revegetation of project site | ▪ Soil handling to convey soil from topsoil stockpile to project site for surface rehabilitation activities, may result in degradation of soil quality due to soil disturbance.<br>▪ Contamination of soil by handling of soil with contaminated earth moving machinery (machinery previously used for handling mine waste such as waste rock or tailings material). Insufficient soil volumes to meet end land use soil requirements. | Minimise and control through impact management and monitoring. | Decommissioning and closure phase | Implementation of Rehabilitation standards/objectives will reduce the impact on soils in the immediate area. |
| **Groundwater** | | | | |
| Partially backfilled open pit with final void | Exposure of geological strata and backfill material will result in the contamination of the pit water with ARD and other material leached from the backfill. | Minimise and control through impact management and monitoring. | Post Closure | Implement the proposed mitigation measures to ensure compliance to the WUL conditions. |
| **Surface Water** | | | | |
| Pits | Storm water entering the remaining opencast void of Pit 1 may fill the void and decant into surrounding environment | Minimise and control through impact management and monitoring. | Decommissioning and Closure | Compliance with GN704<br><br>Implement the proposed mitigation measures to ensure compliance to the WUL conditions. |
| Open pit mining operations | Area from which natural run-off to water resources can be expected will be reduced by an additional 2.4% of that already reduced by the Grootegeluk Mine | Minimise and control through impact management, rehabilitation and monitoring. | Decommissioning and Closure | Compliance with GN704<br><br>Implement the proposed mitigation measures to ensure compliance to the WUL conditions. |
| **Socio-economic** | | | | |

| **ACTIVITY** *whether listed or not listed. (E.g. Excavations, blasting, stockpiles, discard dumps or dams, loading, hauling and transport, Water supply dams and boreholes, accommodation, offices, ablution, stores, workshops, processing plant, storm water control, berms, roads, pipelines, power lines, conveyors, etc.).* | **POTENTIAL IMPACT** *(e.g. dust, noise, drainage surface disturbance, fly rock, surface water contamination, groundwater contamination, air pollution etc.)* | **MITIGATION TYPE** *(modify, remedy, control, or stop) through* *(e.g. noise control measures, storm- water control, dust control, rehabilitation, design measures, blasting controls, avoidance, relocation, alternative activity etc.) E.g. Modify through alternative method. Control through noise control through management and monitoring Remedy through rehabilitation.* | **TIME PERIOD FOR IMPLEMENTATION** *Describe the time period when the measures in the environmental management programme must be implemented Measures must be implemented when required. With regard to Rehabilitation specifically this must take place at the earliest opportunity. With regard to Rehabilitation, therefore state either upon cessation of the individual activity or upon the cessation of mining, bulk sampling or alluvial diamond prospecting as the case may be.* | **COMPLIANCE WITH STANDARDS** *(A description of how each of the recommendations in 2.11.6 read with 2.12 and 2.15.2 herein will comply with any prescribed environmental management standards or practices that have been identified by Competent Authorities)* |
|---|---|---|---|---|
| Decommissioning of the Turfvlakte Infrastructure | Loss of employment | Minimise and control through impact management and monitoring. | Decommissioning and closure phase | Implement the proposed mitigation measures to reduce the impacts as a result of loss of employment. |
| Decommissioning of the Turfvlakte Infrastructure | Reduced regional economic development | Minimise and control through impact management and monitoring. | Decommissioning and closure phase | N/A |
| Decommissioning of the Turfvlakte Infrastructure | Reduced community investment | Minimise and control through impact management and monitoring. | Decommissioning and closure phase | Implement the proposed mitigation measures to reduce the impacts as a result of loss of employment. |
| **Wetlands** | | | | |
| Decommissioning of the Turfvlakte infrastructure, site closure and rehabilitation | Impact on / Loss of pans | Avoid<br><br>Minimise and control through impact management and monitoring. | Decommissioning and closure phase | Implement requirements of Offset Study to mitigation impacts. |
| **Traffic** | | | | |
| Decommissioning of the Turfvlakte infrastructure, site closure and rehabilitation | Increased traffic on existing roads. | Minimise and control through impact management and monitoring. | Decommissioning and closure phase | Implement the proposed mitigation measures to ensure traffic impacts are avoided. |

# 14.0 CLOSURE PLANNING AND FINANCIAL PROVISION

## 14.1 Closure Planning

### 14.1.1 Environmental Risk Assessment

A screening level Environmental Risk Assessment (ERA) was undertaken as part of the closure planning for the Grootegeluk Turfvlakte Expansion Project. The aim of the ERA is to inform the likely closure measures to ensure a meaningful and sustainable post closure situation (Golder, 2020b). The ERA process and identified key environmental risks and mitigation measures are detailed in the *Turfvlakte Final Decommissioning, Rehabilitation and Mine Closure Plan, Environmental Risk Assessment and Annual Rehabilitation Plan in terms of GN R. 1147* ( APPENDIX W).

## 14.2 Closure Vision

The closure vision for the proposed Grootegeluk Turfvlakte Expansion Project is (Golder, 2020b):

*"To establish a safe, stable and non-polluting landscape that is sustainable over the long term while supporting and integrating with the desired game-farming end land use."*

## 14.3 Environmental Objectives in Relation to Closure

The above overall closure vision is underpinned by the more specific closure objectives listed below:

- **Physical stability:** To remove and/or stabilise surface infrastructure that is present on the mine to facilitate the implementation of the planned final land use.
- **Environmental quality:** To ensure that local environmental quality is not adversely affected by possible physical effects and chemical contamination arising from the mine site, as well as to sustain catchment yield as far as possible after closure.
- **Health and safety:** To limit the possible health and safety threats to humans and animals using the rehabilitated mine site as it becomes available.
- **Land capability / land use:** To re-instate suitable land capabilities over the various portions of the mine site to facilitate the progressive implementation of the planned final land use.
- **Aesthetic quality:** To leave behind a rehabilitated mine site that, in general, is not only neat and tidy, giving an acceptable overall aesthetic appearance, but which in terms of this attribute is also aligned to the planned final land use.
- **Biodiversity:** To encourage, where appropriate, the re-establishment of indigenous vegetation on the rehabilitated mine sites such that the terrestrial biodiversity is largely re-instated over time.
- **Social:** To ensure that the transfer of any infrastructure to third parties, if applicable, contributes to the long-term socio-economic benefit of the local communities, and that these benefits are lasting and sustainable.

## 14.4 Next Land Use Planning

With the Grootegeluk Turfvlakte Expansion project area being relatively undisturbed with no formal land uses occurring at present, other than forming part of the Manketti game reserve that surrounds much of Grootegeluk Coal Mine, the targeted next land use, post mining and rehabilitation, will be mainly wilderness supporting the Manketti game reserve and surrounding game farming activities.

## 14.5 Quantum of financial provision

Key aspects and assumptions considered in the determination of closure costs are detailed in APPENDIX W and set out below. The summary of the scheduled closure costs as at August 2019 are included in Table 64. Detailed costing sheets are provided in APPENDIX W.

### 14.5.1 General

The following overarching and contextual assumptions have been applied to inform the process of determining the Grootegeluk Turfvlakte Expansion Project closure costs (Golder, 2020b):

- The computed closure costs are in terms of scheduled closure, as the project is still in the permitting/approval stage and hence no disturbance on site has taken place yet.
- The full closure of the mining activities at the Grootegeluk Turfvlakte Expansion Project would likely comprise a number of cost components, some of which are not directly related to the physical closure and site rehabilitation process. This report therefore only addresses the decommissioning and rehabilitation costs, equating to an outside (third-party) contractor establishing on-site and conducting the rehabilitation-related work. Other components such as workforce matters, separation packages, re-training/re-skilling, etc. are outside the scope of this report.
- Dedicated contractors would be commissioned to conduct the demolition and rehabilitation work at the mining activities at the Grootegeluk Turfvlakte Expansion Project site. This would inter alia require establishment costs for the contractors and hence, the allowance for preliminary and general (P&Gs) matters and contingencies in the cost calculation. Current experience indicates that generally higher allowances for these aspects are needed than has previously been the norm, due to increasingly stringent health and safety requirements and costs associated with labour sourcing and supply chain requirements, amongst others. Furthermore, the level of variability of the computed closure is still expected to be high given the conceptual nature of the project at this point. Accordingly, the allowance made for Ps&Gs was determined as 25% of the total “routine” demolition and rehabilitation costs (sub-total 1 of the closure costs). In addition, the contingencies allowance for addressing unexpected matters during closure implementation has been determined as 15% of sub-total 1.
- Allowance has also been made for third-party contractors and consultants to conduct post closure care and maintenance work, as well as monitoring of the rehabilitated areas to ensure that the required revegetation trajectories and site relinquishment criteria are achieved.
- In accordance with the DMRE guideline and international good practice, no cost off-sets due to possible salvage values were considered and gross rehabilitation costs are reported.
- Costs are reflected exclusive of VAT.
- The costs are presented in present day costs (with no discounting) with longer running costs items, for example the ongoing abstraction of contaminated groundwater, performance monitoring and care and maintenance, etc. reflected as cumulative amounts.

### 14.5.2 Decommissioning and site rehabilitation

The following specific assumptions were made regarding the decommissioning and demolition of the surface infrastructure and subsequent rehabilitation of the mining-related disturbances (Golder, 2020b):

- At scheduled closure, the Turfvlakte site would be rehabilitated to a wilderness state, with the only notable exception being the open pit final voids that will remain after closure.

- All existing access roads will be maintained after closure for rehabilitation monitoring and maintenance purposes, and to support the next land use.
- All new gravel and dirt roads, haul roads and any potential tar/asphalt and paved surfaces created as part of the project and that will not be needed to support the next land use will be rehabilitated at closure
- Crushed concrete will be transported to the Grootegeluk Dump 6 existing general waste site or alternatively to the nearest Turfvlakte open pit for disposal. All other inert demolition waste and other non-hazardous waste (if any) will also be disposed at the Dump 6 waste site.
- The respective pit access ramps will remain at scheduled closure but will be made safe for the purposes of potentially utilising available pit water to support game watering.
- Profiling and shaping of the backfilled open pit areas will be done in a similar manner to that which is proposed for the Grootegeluk Coal Mine, to achieve a "waving" surface profile pattern, with associated drainage.
- Embankments will be constructed on the final void pit floor to ensure adequate inundation of pit floor, to limit the potential of spontaneous combustion of exposed carbonaceous material. Additionally, available laterite will be used to line the exposed carbonaceous bench faces and sections of the pit floor where feasible, to limit the generation of acid mine drainage from the pit.
- Surface water quality monitoring will not be required as there are no potentially affected watercourses in the vicinity of Turfvlakte.
- Groundwater quality monitoring, rehabilitation monitoring and aftercare of rehabilitated areas will be conducted for a 10-year period after initial implementation of the closure plan, as per the current requirements of GN R. 1147.

## 14.6 Closure costing summary

The total estimated scheduled closure costs, as at August 2019, amount to approximately R 245 million (including P&Gs and contingencies, but excluding VAT), for the preferred scenario, as summarised in Table 64.

**Table 64: Scheduled closure costs for Grootegeluk Turfvlakte Expansion Project, as at August 2019 (Golder, 2020b)**

| Closure components | | Pit 1 to Pit 2 (Preferred) |
|---|---|---|
| **1 to 4** | **Demolition and rehabilitation costs** | |
| 1 | Infrastructural aspects | R 21,163,746 |
| 2 | Mining aspects | R 145,079,243 |
| 3 | General surface rehabilitation | R 1,128,326 |
| 4 | Runoff management | R 72,504 |
| | **Sub-Total 1** | **R 167,443,819** |
| **5** | **P&Gs, Contingencies and Additional Allowances** | |
| 5.1 | Preliminaries and general | R 25,116,573 |
| 5.2 | Contingencies | R 41,860,955 |
| 5.3 | Additional studies | R 2,735,000 |
| | **Sub-Total 2** | **R 69,712,528** |
| **6** | **Pre-site Relinquishment Monitoring and Aftercare** | |
| 6.1 | Groundwater monitoring | R 5,673,708 |
| 6.2 | Rehabilitation monitoring of rehabilitated areas | R 142,458 |
| 6.3 | Care and maintenance of rehabilitated areas | R 1,730,760 |
| | | **R 7,546,926** |
| | **Grand Total Excl. VAT. (Sub-total 1 +2 +3):** | **R 244,703,273** |

## 14.7 Guarantee that financial provision will be provided as determined

The financial liability for the projects that are not yet operational, in this case the Grootegeluk Turfvlakte Expansion Project, will be covered via agreed bank guarantee.

## 14.8 Recommendations

The following recommendations are made to keep closure planning and the associated closure costing for the Grootegeluk Turfvlakte Expansion Project up to date and applicable/appropriate to on-site conditions:

- Undertake monitoring and investigations throughout the operational period to inform closure planning and post closure monitoring needs.
- Refine closure measures based on detailed engineering designs and information generated during the operational phase.
- The closure cost assessment should be updated on an annual basis, taking cognisance of any changes and/or amendments to operational plans or associated infrastructure/facilities, as well as to the identified closure objectives and rehabilitation approach.

# 15.0 OTHER INFORMATION REQUIRED BY COMPETENT AUTHORITY

## 15.1 Impact on socio-economic conditions of any directly affected persons

The proposed Grootegeluk Turfvlakte Expansion Project will be located within the existing Grootegeluk Coal Mine MRA and will therefore not have a direct impact on socio-economic conditions of persons in the immediate project area.

The potential impacts on the socio-economic conditions of the adjacent landowners and local communities are described in detail in Section 10.3.16 of this report.

## 15.2 Impact on any national estate

It was determined in the heritage resources and palaeontology baseline and impact assessments that the proposed project will not have an impact on any national estate. There is however always the potential for chance finds during any of the project phases. In this event, the chance find procedure, described in section 10.3.14.1, should be followed.

# 16.0 OTHER MATTERS REQUIRED IN TERMS OF SECTION 24(4)(A) AND (B) OF THE NEMA

The consideration of alternatives, as required by section 24(f)(b)(1) of the NEMA, are detailed in section 5.0. Alternatives for the following project components have been considered:

- Opencast vs underground mining (Section 5.1.1).
- Technology and mining approach (Section 5.1.2).
- Location of infrastructure (Section 5.1.3).
- Mine Plan (Section 5.1.4).
- Postponement of the mining project (Section 5.1.6).
- The No Project option (Section 5.1.7).

The location of the proposed project is constrained to the presence of the proven coal reserve and the location thereof within the existing Grootegeluk Coal Mine MRA.

# PART B
# ENVIRONMENTAL MANAGEMENT PROGRAMME REPORT

# 17.0 ENVIRONMENTAL MANAGEMENT PROGRAMME

## 17.1 Details of the Environmental Assessment Practitioner

The required details have been supplied in PART A, Section 2.0 of this report.

## 17.2 Description of the Aspects of the Activity

See Section 2.5 of this report.

## 17.3 Composite Map

Refer to Figure 88 for an illustration of the preferred infrastructure layout and the identified environmental features in the project area and its surrounding areas.

## 17.4 Impact Management Objectives and Statements

### 17.4.1 Environmental Quality and Managing Environmental Impacts

Grootegeluk Coal Mine will endeavour to ensure that local environmental quality is not adversely affected by possible physical effects and chemical contamination arising from the mining of coal, as well as to sustain catchment yield as far as possible following closure, by:

- Limiting dust generation on the rehabilitated infrastructural areas that could cause nuisance and/or health effects to surrounding landowners/communities.
- Conducting dedicated soil surveys over the footprint of the infrastructural site and removing the possible pockets of contaminated soil where it could have occurred.
- Cleaning up of any sources of possible soil contamination still present on the site to protect the pans and downstream receiving environment.
- Monitoring groundwater quality and surface runoff for at least 10 years after closure, longer if warranted by the results; Target water quality objectives will be based on pre-closure groundwater and surface runoff quality up-gradient of the mining activities.
- Providing the required measures to limit at source the generation of contaminants which could adversely affect local groundwater quality.
- Ensuring that the respective rehabilitated areas are free-draining and run-off is routed to local/natural drainage lines.

### 17.4.2 Potential Risk of Acid Mine Drainage

It is stated by Brink and Van der Linde (2020) that the Life of Mine for the Grootegeluk Turfvlakte Expansion Project allows sufficient time for chemical reactions to take place in the mined-out areas and other potential pollution sources to produce Acid Rock Drainage (ARD) conditions. There could also be leaching of hard and soft overburden deposited onto Dump 6 (but not carbonaceous interburden which could produce ARD).

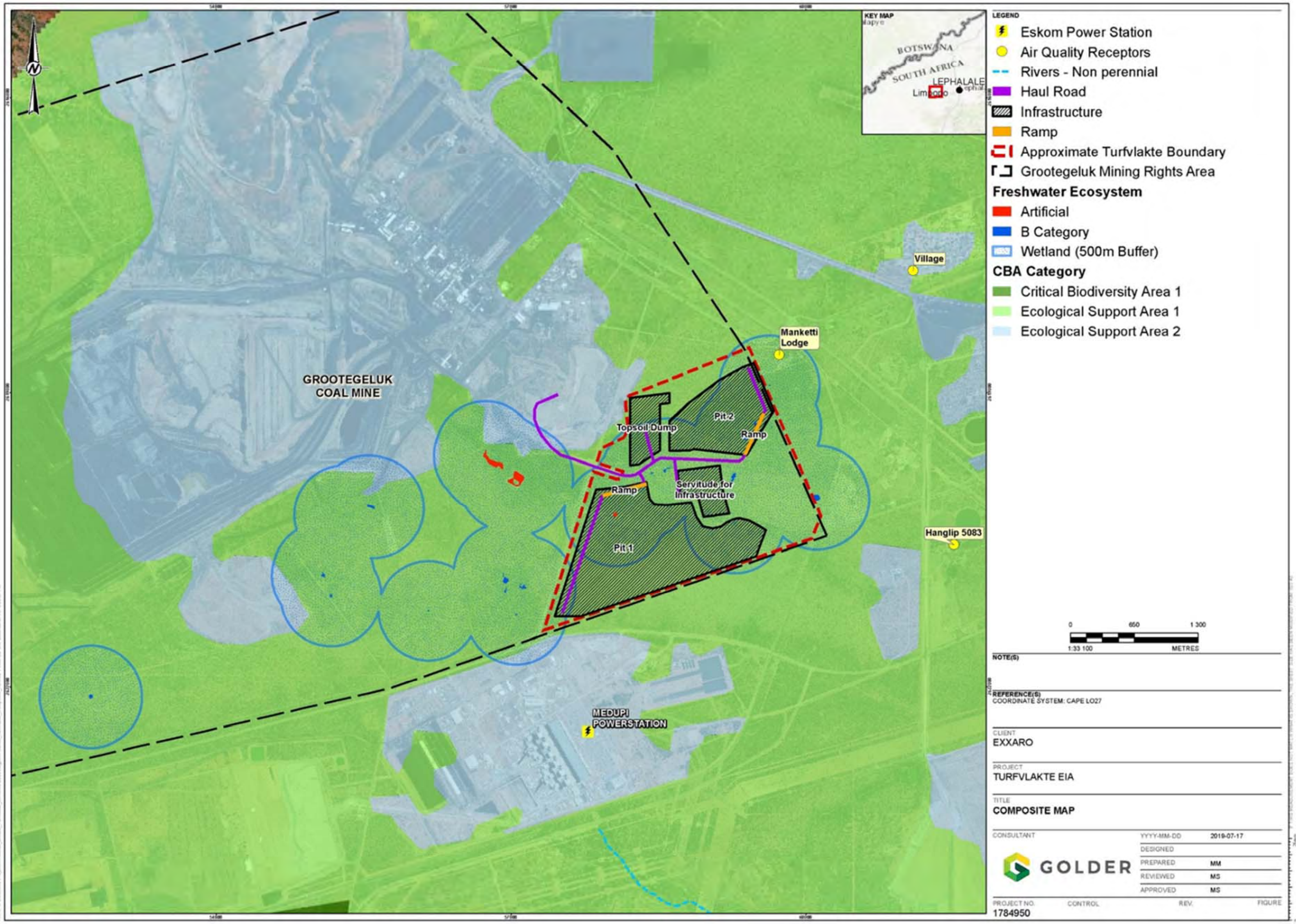



**Figure 87: Composite Map**

In addition to the operational phase, once mining has ceased, ARD and leaching of trace elements is still likely to occur within the backfilled pits due to the contact of water and oxygen through natural processes including rainfall and groundwater seepage. It was concluded that once the ARD forming material is however saturated, the formation of ARD is reduced.

Measures to limit the formation of ARD during the operational and closure phases are included in the impact mitigation tables in Section 0.

## 17.5 Water Use Licence

A Water Use Licence Application (WULA), as required by Section 40 of the NWA, has been submitted to the DWS. The compilation of the WULA is done in accordance with the published in Regulations GN R.267 as published in Government Gazette No 40713 dated 24 March 2017 (Golder, 2020e). The WULA will by large run in parallel with the EIA phase of the project.

All listed water uses being applied for are described in Table 65 and illustrated in Figure 88 .

**Table 65: Water Uses that require authorisation for the Grootegeluk Turfvlakte Expansion Project**

| Water Use | Description of Water Use |
|---|---|
| Section 21 (c): Impeding or diverting the flow of water in a water course<br><br>Section 21 (i) Altering the bed, banks, course or characteristics of a water course | Turfvlakte opencast mining through Pan 1 |
| | Turfvlakte opencast mining through Pan 2 |
| | Turfvlakte opencast mining through Pan 3 |
| | Turfvlakte opencast mining through Pan 4 |
| | Turfvlakte opencast mining in proximity of the Pan 5 |
| | Turfvlakte opencast mining in proximity of the Pan 6 |
| | Turfvlakte opencast mining in proximity of the Pan 7 |
| | Turfvlakte opencast mining in proximity of the Pan 8 |
| | Turfvlakte opencast mining in proximity of the Pan 9 |
| | Turfvlakte opencast mining through Pan 10 |
| | Turfvlakte opencast mining in proximity of the Pan 11 |
| | Turfvlakte opencast mining in proximity of the Pan 12 |
| | Turfvlakte opencast mining in proximity of the Pan 13 |
| | Turfvlakte opencast mining through Pan 14 |
| | Turfvlakte opencast mining through Pan 15 |
| | Turfvlakte opencast mining in proximity of the Pan 16 |
| | Turfvlakte opencast mining in proximity of the Pan 17 |
| | Turfvlakte opencast mining through Pan 18 |

| Water Use | Description of Water Use |
|---|---|
| | Turfvlakte opencast mining through Pan 19 |
| | Turfvlakte opencast mining through Artificial pan |
| Section 21 (g): Disposing of waste in a manner which may detrimentally impact a water resource | Dust suppression on hauls roads and mining areas |
| | In-pit backfilling/ disposal into Pit 1 and Pit 2 |
| Section 21 (j): Removing, discharging or disposing of water found underground for the continuation of an activity or for the safety of people | Dewatering of Pit 1 for safe continuation mining |
| | Dewatering of Pit 2 for safe continuation of mining |

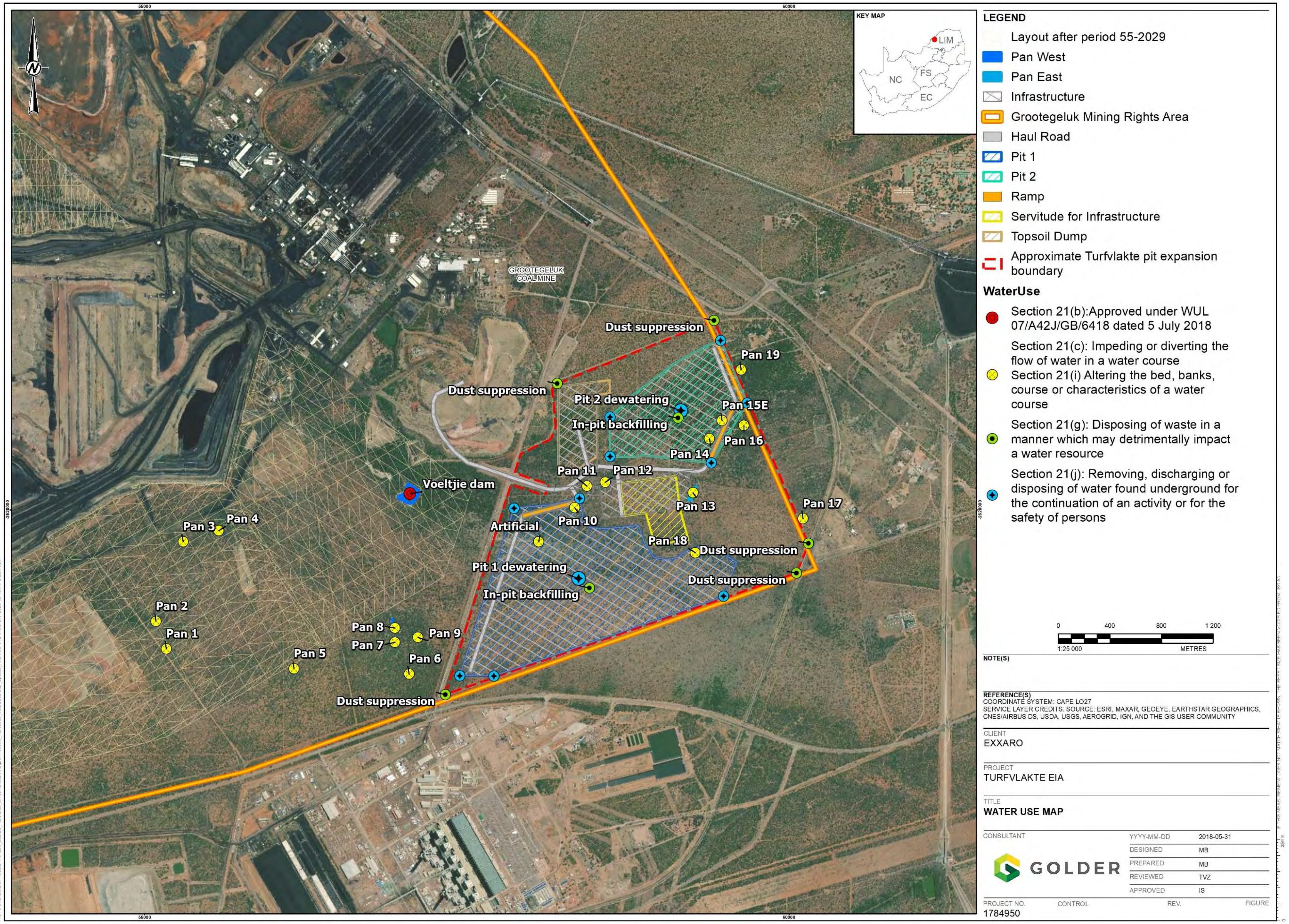



**Figure 88: Water Uses for the Grootegeluk Turfvlakte Expansion Project**

## 17.6 Potential Cumulative Impacts Identified

The following potential cumulative impacts were identified and assessed:

### 17.6.1 Geology

Benches 9A and B and Bench 11 will be removed by the mining operations, resulting in a significant, permanent and irreversible impact on the local subsurface geology. This may be viewed as a cumulative geological impact on the remaining coal deposits in the region. No mitigation is possible or required.

### 17.6.2 Air Quality

The neighbouring Eskom coal fired power stations, Matimba and Medupi, are located within 5 km from the project are and are significant emitters of particulate matter. While it is not possible to comment on the accuracy of the fine particulate monitoring data available, the $PM_{10}$ concentrations measured at Medupi in 2017 indicates frequent fluctuations from 5 µg/m$^3$ to 70 µg/m$^3$, with average concentrations of approximately 30 µg/m$^3$ (roughly 40% of the NAAQS) (Golder, 2020a).

It can therefore be predicted that the addition of the Thabametsi, Turfvlakte, Dump 4, 5 and 6 emissions could likely result in exceedances of the NAAQS in the region during peak emission events, such as periods of high wind speeds.

### 17.6.3 Soil, Land Use and Land Capability

Vegetation and topsoil will be stripped from 265 ha of land over the life of mine for the construction of the haul roads, infrastructure laydown area and for the open pit operations. However, the application of rollover mining, with continuous concurrent rehabilitation, will provide significant mitigation towards partially restoring the site to wilderness land capability, with exception of the final voids that will remain post closure due to the material deficits of both operations. With the expected soil degradation occurring, a decline in the overall soil quality and health, may hinder the soil suitability for the end land use.

### 17.6.4 Surface Water

In the absence of mitigation, the mining of coal and associated activities could result in runoff with high silt load and contaminants such as fuel, hydraulic fluids, and chemicals. The topsoil stockpile and uncontrolled surface runoff could contribute to the silt load.

### 17.6.5 Groundwater

The proposed open pit mining operations will result in the lowering of the local groundwater table due to necessary mine dewatering and groundwater contamination with nitrates due to blasting. The effects of dewatering will be in addition to that caused by the existing Grootegeluk Coal Mine pit, located approximately 3 km to the west of Pit 1.

This allows sufficient time for chemical reactions to take place in the mined-out areas and other potential pollution sources to produce. ARD conditions in the mined-out areas and activities associated with the proposed mining could result in groundwater contamination due to spillages of fuels, lubricants, hydraulic fluids and chemicals, in the absence of appropriate mitigation measures.

### 17.6.6 Noise

The proposed mining operations will contribute to the existing noise levels in the area. The noise from the mining machinery will be audible but will not exceed the daytime level for urban districts, beyond the recommended 500 m blast zone boundary and at some sensitive areas along the way as the mining front moves along the length of the coal deposit. However, taking into consideration the noise already generated by the existing Medupi and Matimba Power Stations and Grootegeluk Coal Mine operations, it is not expected that the noise generated by the proposed Grootegeluk Turfvlakte Expansion Project will be off significance in the greater Lephalale area.

### 17.6.7 Blasting and Vibration

Blasting impacts due to the proposed Grootegeluk Turfvlakte Expansion Project mining operations would be cumulative to impacts of blasting at the nearby Grootegeluk Coal Mine. However, the proposed Grootegeluk Turfvlakte Expansion Project will have a much shorter life of mine than the Grootegeluk Coal Mine thereby limiting the potential cumulative impacts to a maximum of 16 years.

### 17.6.8 Visual

The project will add to the existing visual impact due to human activities in the area. The mine's surface infrastructure, moving vehicles and occasional dust plumes will be visible during the daytime and both fixed and moving lights will be visible during the night-time. However, taking into consideration the visual impacts already present as a result of the existing Medupi and Matimba Power Stations and Grootegeluk Coal Mine operations, it is not expected that the potential additional visual impacts from the proposed Grootegeluk Turfvlakte Expansion Project will be off significance in the greater Lephalale area.

### 17.6.9 Terrestrial Ecology

The potential cumulative impact of this proposed project coupled with existing developments and envisaged future mining- and non-mining related developments in the region, may have negative consequences on regional-scale habitat integrity, functioning and connectivity. This has the potential to negatively impact the population dynamics and conservation of threatened wildlife, such as free-roaming wild dog and cheetah, as well as vultures.

### 17.6.10 Heritage

No impact on heritage resources is expected. There are no known heritage resources within the mine-affected area, but the possibility of unearthing buried resources during construction and mining operations cannot be ruled out.

### 17.6.11 Palaeontology

No impact on palaeontological resources is expected. There are no known palaeontological resources within the mine-affected area, but the possibility of unearthing buried resources during construction and mining operations cannot be ruled out.

### 17.6.12 Traffic

Due to the low possibility that the project will create new jobs and that the export coal is currently transported via railway to Richards Bay, the cumulative impact on the current traffic in the area is expected to be negligible.

### 17.6.13 Wetlands

The destruction of some of the pans in the Grootegeluk Turfvlakte Expansion project area will contribute to the cumulative loss of freshwater ecosystems in the region as a result of mining and construction activities. By implementing an offset and rehabilitation plan, the functioning and integrity of identified wetlands within the Manketti Game Reserve and Thabametsi mining right area can be enhanced.

### 17.6.14 Socio-economic

Local residence will experience negative impacts such as noise, dust, visual and population influx, but also modest positive impacts resulting from job sustainability and expenditure on local goods and services.

### 17.6.15 GHG Emissions and Climate Change

The proposed Grootegeluk Turfvlakte Expansion Project's Scope 1 and Scope 2 emissions will contribute to South Africa's GHG emissions, and ultimately to climate change during the construction, operational and closure phases. The contribution of the project's emissions is however deemed to be low compared to the other emitters in the immediate area.

## 17.7 Data Gaps and Assessment Shortcomings

The EIA was limited to the scope of the assessments described in Sections 7.0 to 13.0 and 17.6.

Every effort has been made to engage stakeholders to the extent possible to date, however not every stakeholder may have been consulted or their comments may not have been recorded accurately. A grievance mechanism will be established through which stakeholders are able to raise grievances and continue to contribute their concerns and issues to the Exxaro project team.

### 17.7.1 Soils, Land Use and Land Capability

- Relevant information relating to the project such as general site arrangement drawings, topographical survey data was made available to Golder by Exxaro and was used in the planning of the field survey and overall assessment of impacts.
- The methodologies and procedures applied in this study are generally followed in the pedology and broader soil science community.
- The presented findings in this report is based on our current understanding of the project and the level of information available at the time of the assessment and can be adjusted if additional information becomes available.
- The detailed civil engineering procedures/standards for final landform was not available at the time of preparation of this report. All soil volume estimations are based on current site layout provided to Golder.

### 17.7.2 Surface Water

- The daily rainfall data from the onsite monitoring rainfall station have data gaps during the years 1978 – 1980 and 2004 from the selected data.

### 17.7.3 Terrestrial Ecology

- Little rain had fallen prior to the wet season field visit, and consequently vegetation in the herbaceous layer was mostly dormant with negligible new season growth. This prevented an assessment of the composition and abundance of herbaceous species (i.e. grasses, forbs/herbs) during the optimal growing period; and
- The absence or non-recording of a specific floral or faunal species, at a particular time, does not necessarily indicate that 1) the species does not occur there; 2) the species does not utilise resources in that area; or 3) the area does not play an ecological support role in the life-history of that species.

### 17.7.4 Wetlands

- A number of the positions and extents of the rehabilitation sites are based on the Digby Wells Environmental study (DWE 2018) and were used to inform the wetland offset calculations as well. However, the DWE delineation and assessment report did not include all the systems present in the Manketti and Thabametsi sites and as such, a number of them were delineated by GroundTruth using a combination of aerial imagery (current and historic), an assessment of dendritic drainage line networks and infield verification.

### 17.7.5 Air Quality

- The assessment considered the impacts of dust and fine particulate matter ($PM_{10}$) only. Vehicle exhaust emissions were excluded due to i) the exclusion of vehicle emissions from the Thabametsi and Grootegeluk inventories; and ii) limited available information on the anticipated fleet that will support the Grootegeluk Turfvlakte Expansion Project.

### 17.7.6 Blasting and Vibration

- Surface surroundings change continuously, and this should be taken into account prior to initial blasting operations considered.

### 17.7.7 Visual

- Determining the value, quality and significance of a visual resource or the significance of the visual impact that any activity may have on it, in absolute terms, is not achievable. The value of a visual resource is partly determined by the viewer and is influenced by that person's socio-economic, cultural and specific family background, and is even subject to fluctuating factors, such as emotional mood. This situation is compounded by the fact that the conditions under which the visual resource is viewed can change dramatically due to natural phenomena, such as weather, climatic conditions and seasonal change.

  Visual impact cannot therefore be measured simply and reliably, as is for instance the case with water, noise or air pollution. For this reason, it is impossible to conduct a visual assessment without relying to some extent on the expert professional opinion of a qualified consultant, which is inherently subjective. The subjective opinion of the visual consultant is however unlikely to materially influence the findings and recommendations of this study, as a wide body of scientific knowledge exists in the industry of VIA, on which findings are based.

### 17.7.8 Heritage

- The GPS track log (refer to APPENDIX Q) is not necessary a true reflection of all the tracks routes that the surveyor followed as the track logs were registered with a mounted GPS instrument. Pedestrian surveys from the vehicle were not in all instances recorded whilst tracks were not registered when the GPS lost signal with the satellites.

- Areas that were not covered during the survey comprise a limited number of existing haul road and power line corridors which occur in the Grootegeluk Coal Mine Area which was surveyed in the past and which is severely disturbed as a result of mining activities.

  The heritage survey may have missed heritage resources as heritage sites may occur in in tall grass or thick clumps of vegetation whilst others may be located below the surface of the earth and may only be exposed once development commences. It is also possible that heritage resources may simply have been missed as a result of human failure and the extent of the surface area that was covered.

# 18.0 SUMMARY OF POTENTIAL IMPACTS TO BE MITIGATED IN THEIR RESPECTIVE PHASES

This section summarizes the potential impacts of various aspects of the proposed Grootegluk Turfvlakte Expansion Project in all its stages, from construction, through operations to eventual decommissioning, together with the appropriate mitigation and monitoring measures to manage the identified impacts (Table 66 to Table 68).

Impact management actions as well as impact management outcomes are provided in Table 66 to Table 68. Responsibilities for implementing the mitigation measures are identified and the frequencies with which the results of the various measures are to be monitored are set out in the tables listed above. Additionally, Exxaro must submit environmental audits and performance reports as stipulated in the various authorizations. The responsibility for monitoring and reporting the results to the appropriate level of management within the Grootegeluk Turfvlakte Expansion Project rests with the Environmental Control Officer (ECO).

## 18.1 Construction Phase

Table 66 outlines construction phase impacts that need to be mitigated and monitored and their associated impact management outcomes and impact management actions.

**Table 66: Impacts to be mitigated and monitored in their respective phases, impact outcomes and impact actions – Construction Phase**

| Construction Phase Activities | Aspect | Potential Impact | Detailed Mitigation Measures | Mitigation Type (Modify, Remedy, Control or Stop) | Time Period for Implementation | Standards to Be Achieve | Responsible Person |
|---|---|---|---|---|---|---|---|
| Site clearing and construction of Turfvlakte infrastructure | Air Quality | Dust and fine particulates affecting ambient air quality | ■ Contractors should take preventative measures to minimise complaints regarding dust nuisances (e.g. screening, dust control, timing, pre-notification of Interested and Affected Parties (I&APs).<br>■ Wet suppression must be implemented during materials handling activities.<br>■ Wind speed reduction through sheltering (where possible).<br>■ Wet suppression on construction access roads.<br>■ Speed control on construction access roads.<br>■ Avoidance of dust track-on onto paved routes used to transport construction materials.<br>■ Parking construction vehicles off travelled roadways. | Minimise and Control | Duration of construction period | Compliance with NAAQS at the mine boundary. | Turfvlakte ECO<br><br>HSE Manager |
| Vegetation clearance as project infrastructure are constructed | Soils, land use and land capability | Disturbance of soil, resulting in increased decomposition of soil organic matter from topsoil. | ■ Procedures on land clearance, soils handling and rehabilitation plan to be adhered to. | Control | Duration of construction period | As per Exxaro Land Clearance Procedure<br><br>Soils Stripping and Handling Recommendations | Turfvlakte ECO<br><br>HSE Manager |
| Soil stripping and stockpiling | Soils, land use and land capability | ■ Loss of soils through erosion, particularly for topsoil stockpiles with unvegetated steep slopes<br>■ Homogenization of soil profiles, i.e. Loss of characteristic horizons.<br>■ Loss and/or reduction in soil biodiversity in stockpiled soil.<br>■ Loss of soil nutrients, particularly for unvegetated topsoil stockpiles. | ■ Ensure that the results from the pre-mining soil survey are used effectively for the stripping phase to lead to optimal stockpiling.<br>■ Ensure that there is participation by a soil scientist in the stripping and stockpiling process.<br>■ Limit vehicle traversing on stockpiles<br>■ Implement concurrent rehabilitation measures for soils and protect soil stockpiles from erosion by utilising soils erosion procedures.<br>■ Minimise stockpile height to <3 m.<br>■ Re-use stockpiled soil within as short a period as possible (within 3-5 years). | Control | As required during soil stripping & stockpiling | Stockpile height not exceeding 3 m, where practically possible.<br><br>Re-use stockpiled soil within as short a period as possible (within 3-5 years) | Turfvlakte ECO<br><br>HSE Manager |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | ■ Loss of soil organic matter due to increased aeration (caused by soil disturbance) and subsequent organic matter decomposition.<br>■ Modification of existing landscape and hydrological regimes. | ■ Strip and stockpile soils from seasonal pans separately, ideally in a similar landscape position was its origin, i.e. valley bottom | | | | |
| Construction of access roads, haul roads, stockpile area, laydown areas and substation | Soils, land use and land capability | ■ Burial of soil / covering of soils by camp accommodation facility, haul roads, mine waste facilities and processing plant.<br>■ Soil compaction in areas where active heavy machinery will be mobilised for the development of the accommodation facility, mine infrastructure and associated utilities.<br>■ Increased run-off (and erosion) in compacted areas and modification of natural infiltration.<br>■ Soil contamination from hydrocarbon and chemical spills including sterilisation by cement pollutants. | ■ Final Project infrastructure, laydown and access areas will be clearly indicated in final construction plans provided to contractors/employees. The plans will consider environmental (soils) constraints.<br>■ Access roads (etc.) will be planned to avoid sensitive areas.<br>■ Contractors (in particular heavy machinery) will be restricted to designated areas as defined by the Environmental Department.<br>■ Tracked vehicles will be utilised in soil clearance activities as per soil stripping and handling procedures.<br>■ The extent of the fenced area will be minimised.<br>■ Procedures on land clearance, soils handling and rehabilitation plan to be adhered to.<br>■ Areas to be cleared must be demarcated and approved by the ECO prior to site clearance activities. | ■ Control through management of construction activities on areas allocated for new infrastructure.<br>■ Ensure that activities only occur in designated areas. | Duration of construction period | Contaminant levels below SSV2[7] | Turfvlakte ECO<br>HSE Manager |
| Transportation and use of equipment - potential spills of chemicals (e.g., hydrocarbon). Soil contamination on adjacent land potentially occurring | Soils, land use and land capability | ■ Contamination of soils by hydrocarbon pollutants.<br>■ Increased soil compaction and run-off at equipment and | ■ All vehicles and machinery shall be kept in good working order and inspected on a regular basis for possible leaks and shall be repaired as soon as possible if required.<br>■ Repairs shall be carried out in a dedicated repair area only, unless in-situ repair is necessary as a result of a breakdown. | ■ Identify areas where the soil was impacted.<br>■ Control through management or | Duration of construction period | Contaminant levels below SSV2 | Turfvlakte ECO<br>HSE Manager |

[7] GNR. 331. Norms and Standards for Remediation of Contaminated Land & Soil Quality

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| due to inappropriate waste disposal and potential oil and diesel leakages from vehicles and machinery | | machinery laydown areas. | ■ Drip trays shall at all times be placed under vehicles that require in-situ repairs.<br>■ Drip trays shall be emptied into designated containers only and the contents disposed of at a licenced hazardous material disposal facility.<br>■ Develop detailed procedures for spills containment and soils clean up.<br>■ Ensure proper handling of hazardous chemicals and materials (e.g. fuel, oil, cement, concrete, reagents, etc.) as per their corresponding Safety Data Sheets (SDS).<br>■ Accidental spills (concrete, chemicals, process water, hydrocarbons, waste) need to be reported immediately so that effective remediation and clean-up strategies and procedures can be implemented.<br>■ Soil that is contaminated by fuel or oil spills, for example, from vehicles, will be collected to be treated at a pre-determined and dedicated location, or will be treated in situ, using sand, soil or cold coal-ash as absorption medium. | remediation options.<br>■ Prevent by restricting spillage from construction vehicles;<br>■ Control by implementation of storm water management measures;<br>■ Remedy by treatment of contaminated soils. | | | |
| Waste / hydrocarbon Handling | Soil contamination | ■ Handling of waste and transport of building material can cause various types of spills (hydrocarbons) which can infiltrate and contaminate the groundwater system. | ■ All vehicles and machinery shall be kept in good working order and inspected on a regular basis for possible leaks and shall be repaired as soon as possible if required.<br>■ Repairs shall be carried out in a dedicated repair area only, unless in-situ repair is necessary as a result of a breakdown.<br>■ Drip trays shall at all times be placed under vehicles that require in-situ repairs.<br>■ Drip trays shall be emptied into designated containers only and the contents disposed of at a licenced hazardous material disposal facility.<br>■ Accidental spills (concrete, chemicals, process water, hydrocarbons, waste) need to be reported immediately so that effective remediation and clean-up strategies and procedures can be implemented.<br>■ Soil that is contaminated by fuel or oil spills, for example, from vehicles, will be collected to be treated at a pre-determined and dedicated location, or will be treated in situ, using sand, soil or cold coal-ash as absorption medium. | ■ Identify areas where the soil was impacted.<br>■ Control through management or remediation options.<br>■ Prevent by restricting spillage from construction vehicles;<br>■ Control by implementation of storm water management measures;<br>■ Remedy by treatment of contaminated soils. | Duration of construction period | Impact avoided | Turfvlakte ECO, HSE Manager |

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| Site clearing and laydown areas for construction contractors | Surface Water | Contaminated run-off from the site; specifically, sediment and hydrocarbons from the machinery used. | ■ Reduce areas that need to be cleared to limit runoff.<br>■ Avoid clearing during the months of November, December and January when short heavy downpours can be expected. This should help to limit erosion.<br>■ Rehabilitate areas as soon as possible once construction is complete in an area.<br>■ Ensure adequately designed berms and stormwater collection facilities to capture sediment before water is released to the environment - this is important as the area will be kept after construction as the haul truck area.<br>■ Ensure clean-up of hydrocarbon spills from machinery is done immediately. | Remedy by rehabilitation of areas disturbed as construction is complete; Control by best practice implementation specifically storm water management and erosion and spill clean-up; | Duration of construction period | Revegetation/ rehabilitation of areas where no construction will take place<br><br>Adequate berms in place to contain contaminated storm water; Spill kits in place; clean-up plan in place with timeframes; spills cleaned within timeframes. | Turfvlakte ECO<br><br>HSE Manager |
| Footprint Clearance / Construction | Groundwater contamination | Clearing topsoil for footprint areas can increase infiltration rates of water to the groundwater system and increase aquifer vulnerability | ■ Mitigation is not possible. Groundwater monitoring should be used to manage the potential impact | ■ Control by management and monitoring | Duration of construction period | WUL groundwater quality guidelines | Turfvlakte ECO<br><br>HSE Manager |
| Vegetation clearing and earth works | Terrestrial Ecology | Habitat loss and degradation | ■ Vegetation clearing should be restricted to the proposed development footprints only, with no clearing permitted outside of these areas. | Minimise and Rehabilitate | Duration of construction period | Impact avoided / mitigated | Turfvlakte ECO<br><br>HSE Manager |
| Vegetation clearing and earth works | Terrestrial Ecology | Habitat fragmentation | ■ Areas to be cleared should be clearly demarcated to prevent unnecessary clearing outside of these sites.<br>■ Removed topsoil should be stockpiled and used to rehabilitate disturbed areas.<br>■ Relavant protected tree and vegetation clearance licenses must be obtained before site clearance commences.<br>■ A suitable rehabilitation programme should be developed and implemented in all disturbed areas. The programme should include:<br>▪ Concurrent rehabilitation, if possible.<br>▪ Stabilisation and active revegetation of all disturbed areas using locally occurring indigenous grass and tree species.<br>▪ Protected tree species should be included in the mix of revegetation species. | Minimise and Rehabilitate | Duration of construction period | Impact avoided / mitigated | Turfvlakte ECO<br><br>HSE Manager |
| Vegetation clearing and earth works | Terrestrial Ecology | Establishment and spread of alien invasive species | ■ An alien invasive species control programme must be developed and implemented on-site during all phases of | Minimise and Rehabilitate | Duration of construction period | Impact avoided / mitigated | Turfvlakte ECO |

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| | | | the proposed project. It is recommended that the programme include:<br>▪ A combined approach using both chemical and mechanical control methods.<br>▪ Periodic follow-up treatments, informed by regular monitoring.<br>▪ Monitoring should take place in disturbed areas, as well as adjacent undisturbed areas.<br><br>■ Rehabilitate all sites that are disturbed by construction phase activities, as per the rehabilitation programme.<br><br>■ Rehabilitate all disturbed footprints during the closure and rehabilitation phases, as per the rehabilitation programme. | | | | HSE Manager |
| Vegetation clearing and earth works | Terrestrial Ecology | Mortality and disturbance of fauna, incl. fauna of conservation importance | Death/injury during vegetation clearing and earth works<br>■ Prior to construction:<br>▪ Large mammals (e.g. antelope, zebra and giraffe) should be actively relocated to unaffected portions of the Manketti Nature Reserve or elsewhere; and<br>▪ Temporary corridors should be created by strategically removing fence portions to allow smaller mammals to disperse from the Grootegeluk Turfvlakte Expansion Project to the adjacent Manketti Game Reserve during construction.<br><br>■ An ECO should be on-site during vegetation clearing to monitor and manage any wildlife-human interactions. The ECO should be trained in inter alia, snake handling.<br><br>■ As appropriate, fences should be erected to prevent fauna gaining access to construction and operational areas, such as open trenches and voids.<br><br>Vehicle-wildlife collisions<br>■ A low speed limit (recommended 20 - 40 km/h) should be enforced on site to reduce wildlife-collisions.<br><br>Hunting, snaring and poisoning<br>■ The handling, poisoning and killing of on-site fauna by mine workers and contractors must be strictly prohibited.<br><br>■ Employees and contractors should be made aware of the presence of, and rules regarding, fauna through suitable induction training and on-site signage.<br><br>Noise, vibrations and lights | Avoid and Minimise | Duration of construction period | Impact avoided / mitigated | Turfvlakte ECO<br><br>HSE Manager |

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| | | | ■ General noise abatement equipment should be fitted to machinery and vehicles; Noise shields, including earth berms, should be constructed around sites of noise origin.<br><br>■ Dust suppression using water bowsers should be undertaken on all mine's roads and other sites where dust entrainment occurs.<br><br>■ Plan the lighting requirements of facilities to ensure that lighting meets the need to keep the site secure and safe, without resulting in excessive illumination. Possible options include:<br>▪ Zoning of areas of high and low lighting requirements.<br>▪ Using motion-activated lights as opposed to permanent lights.<br>▪ Reducing height and angle of lights. | | | | |
| Vegetation clearing and earth works | Terrestrial Ecology | Loss and disturbance of fauna of conservation importance | ■ The ECO should be present during any disturbance (earth works) of pans/ depressions to monitor for the presence of Giant Bullfrog. The current Grootegeluk TOPS permits, for the capture and relocation of various protected species, including Bullfrogs, must be updated to include the Turfvlakte farm area. If these species are detected, construction activities should cease until the specimens can be captured and relocated.<br><br>■ Prior to construction, a grid survey for Baboon spider nests should be conducted, and any taxa encountered should be relocated to adjacent undeveloped, natural areas.<br><br>■ Suitably qualified/trained experts should be appointed to undertake the necessary rescue and relocation operations. | Control, minimise, avoid and rehabilitate | Duration of construction period | Impact avoided / mitigated | Turfvlakte ECO<br><br>HSE Manager |
| Vegetation clearing and earth works | Terrestrial Ecology | Loss and disturbance of flora of conservation importance | ■ Prior to construction, all areas designated for vegetation clearing should be clearly marked and surveyed for flora of conservation importance by a trained botanist.<br><br>■ Based on the results of the survey, rescue/destruction permits must be obtained from the relevant authority before vegetation clearing commences:<br>▪ A permit to clear *Boscia albitrunca, Combretum imberbe, Elaeodendron transvaalense, Sclerocarya birrea subsp. caffra, Securidaca longepedunculata* and *Vachellia erioloba* should be obtained from the Department of Agriculture, Forestry and Fisheries (DAFF).<br>▪ A permit to clear Spirostachys africana should be obtained from the Limpopo Department of Economic Development, Environment and Tourism (LEDET). | Minimise and Rehabilitate | Duration of construction period | Impact avoided / mitigated | Turfvlakte ECO<br><br>HSE Manager |

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| | | | ▪ As far as possible and practical, smaller herbaceous plants of conservation concern should be rescued and relocated to adjacent undisturbed areas. Relocation permits for herbaceous plants will need to be obtained from the LEDET.<br>■ As far as possible, cleared protected trees should be used rather than allowed to stand and decompose. The following potential uses are listed as examples:<br>▪ The wood of *Spirostachys africana* (Tamboti) is highly noxious and not suitable for use as a fuel (i.e. firewood). However, the timber is highly sought after by furniture makers. Exxaro should investigate supplying cleared Tamboti trees to a timber merchant as an alterative to disposal.<br>▪ The wood of *Vachellia erioloba* (Camel Thorn) is hard and is a valuable source of fuel (firewood and charcoal). Exxaro should investigate supplying cleared Camel Thorn trees to local communities as an alternative energy source.<br>■ Protected trees should be included in the mix of revegetation species used during rehabilitation:<br>▪ Exxaro should investigate developing an on-site nursery to manage the propagation and growing of protected trees.<br>▪ Where possible, it is recommended that seeds should be collected from protected trees, growing on local Exxaro owned properties, such as in Manketti Game Reserve; and<br>▪ Propagation should be optimally timed to ensure that trees are the correct size and maturity to survive out planting during rehabilitation. | | | | |
| Vegetation clearing and earth works | Wetlands | Disturbance of wetland habitat | ■ The mitigation measures detailed in the Grootegeluk Coal Mine Offset Study, that includes the Turfvlakte farm, must be implemented so as to mitigate the impact on the pans as a result of the proposed mining activities at the Grootegeluk Turfvlakte Expansion Project.<br>■ Proof of Concept for the relocation and creation of pans within the landscape for the Grootegeluk Coal Mine pans must be implemented.<br>■ Disturbance of wetlands outside the development footprint should be minimised by implementing the following measures: | Control, minimise, avoid and rehabilitate | Duration of construction period | Requirements of Offset Study | Turfvlakte ECO<br>HSE Manager |
| Vegetation clearing and earth works | Wetlands | Increased surface rub-off from bare soil areas and impermeable surfaces | | Control, minimise, avoid and rehabilitate | Duration of construction period | Requirements of Offset Study | Turfvlakte ECO<br>HSE Manager |
| Vegetation clearing and earth works | Wetlands | Increased sedimentation in adjacent wetlands | | Control, minimise, avoid and rehabilitate | Duration of construction period | Requirements of Offset Study | Turfvlakte ECO<br>HSE Manager |
| Vegetation clearing and earth works | Wetlands | Water quality deterioration | | Control, minimise, avoid and rehabilitate | Duration of construction period | Requirements of Offset Study | Turfvlakte ECO<br>HSE Manager |

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| Vegetation clearing and earth works | Wetlands | Establishment and spread of alien invasive species | ▪ Optimise design of surface infrastructure areas to minimise size of development footprint.<br>▪ All disturbance footprints must be separated from adjacent wetlands by a fence, either a security fence or five strand cattle fence.<br>▪ All construction staff should be educated on the sensitivity of wetland areas and should be made aware of all wetland areas in close proximity to the construction sites.<br>▪ Water quality should be regularly monitored and appropriate and timely remedial interventions made in the case of non-compliance<br>▪ Develop and implement a construction stormwater management plan prior to the commencement of site clearing activities.<br>▪ An alien vegetation management plan should be drawn up and implemented to limit the spread of alien vegetation into wetland habitat.<br>▪ All disturbed areas outside the direct development footprints should be rehabilitated and re-vegetated as soon as possible. | Control, minimise, avoid and rehabilitate | Duration of construction period | Requirements of Offset Study | Turfvlakte ECO<br>HSE Manager |
| Site clearance and grubbing of footprint<br>Civil construction and construction activities at the footprint<br>Construction of earth berm around the pit<br>Construction of the haul road<br>Building material and equipment deliveries at the site | Noise | Noise increase at the boundary of the mine footprint and at the abutting residential areas | ▪ All construction vehicles and equipment must be kept in good repair.<br>▪ The laydown area and other noisy fixed facilities should be located well away from noise sensitive areas adjacent to the proposed construction areas.<br>▪ Environmental noise survey to be carried out on a quarterly basis.<br>▪ Use machinery with low noise levels which complies with the manufacturer's specifications.<br>▪ Construction activities should meet the noise standard requirements of the Occupational Health and Safety Act (Act No. 85 of 1993).<br>▪ All construction activities to only take place during daytime periods.<br>▪ Construction staff working in areas where the 8 -hour ambient noise levels exceed 75dBA should wear hearing protection equipment. | Control and minimise | Duration of construction period | Remain within SANS 10103, 2008 limits. | Turfvlakte ECO<br>HSE Manager |

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| Construction vehicles | Noise | Increased traffic noise | ■ The traffic will create a finite type noise as this road is already used by other vehicles on an ad hoc basis. | Control and minimise | Duration of construction period | Remain within SANS 10103, 2008 limits. | Turfvlakte ECO<br><br>HSE Manager |
| Site clearance and pit excavation | Visual | Reduction in visual resource value due to presence of mining infrastructure. | ■ Maintain the construction site in a neat and orderly condition at all times.<br><br>■ Create designated areas for material storage, waste sorting and temporary storage, batching and other potentially intrusive activities.<br><br>■ Limit the physical extent of areas cleared for material laydown and vehicle parking as much as possible, and rehabilitate these area as soon as is feasible.<br><br>■ Repair unsightly and ecologically detrimental erosion to steep or bare slopes as soon as possible, and re-vegetate these areas using a suitable mix of indigenous grass species. | Control and minimise | Duration of construction period | Reduced visual intrusion and no complaints from receptors | Turfvlakte ECO<br><br>HSE Manager |
| Site clearance and pit excavation | Visual | Formation of dust plumes as a result of construction activities, soil stripping and subsequent mining. | ■ Water down haul roads and large bare areas as frequently as is required to minimise airborne dust.<br><br>■ Place a sufficiently deep layer of crushed rock or gravel at vehicle and machinery parking areas.<br><br>■ Apply chemical dust suppressants if deemed necessary.<br><br>■ Enforce a 40 km/h speed limit on-site for all vehicles.<br><br>■ Implement a dust bucket fallout monitoring system. | Control and minimise | Duration of construction period | Reduced visual intrusion and no complaints from receptors | Turfvlakte ECO<br><br>HSE Manager |
| Site clearance and pit excavation | Visual | Light pollution at night. | ■ Utilise security lighting (if feasible) that is movement activated rather than permanently switched on, to prevent unnecessary constant illumination.<br><br>■ Plan the lighting requirements of the facilities to ensure that lighting meets the need to keep the site secure and safe, without resulting in excessive illumination.<br><br>■ Reduce the height and angle of illumination from which floodlights are fixed as much possible while still maintaining the required levels of illumination.<br><br>■ Identify zones of high and low lighting requirements, focusing on only illuminating areas to the minimum extent possible to allow safe operations at night and for security surveillance. | Control and minimise | Duration of construction period | Reduced visual intrusion and no complaints from receptors | Turfvlakte ECO<br><br>HSE Manager |

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| | | | ■ Avoid up-lighting of structures by rather directing lighting downwards and focussed on the area to be illuminated.<br>■ Fit all security lighting with ‘blinkers’ or specifically designed fixtures, to ensure light is directed downwards while preventing side spill. Light fixtures of this description are commonly available for a variety of uses and should be used to the greatest extent possible. | | | | |
| Movement of construction vehicles | Traffic | Construction traffic can cause congestion, driver frustration, safety issues | ■ Use reputable contractors who maintain high standards for vehicles and drivers.<br>■ Require contractors to:<br>▪ Keep their vehicles in good condition.<br>▪ Use properly licensed and skilled drivers.<br>▪ Monitor adherence to traffic regulations.<br>▪ Take effective measures to avoid driver fatigue.<br>▪ Monitor drivers for use of alcohol and other substances that could impair judgment and driving ability.<br>▪ Ensure that loads on trucks are properly secured during transport.<br>■ As far as may be practicable, schedule the arrival and departure of heavy vehicles to avoid the morning and afternoon peak hours.<br>■ Record and respond to all complaints. | Control | Duration of construction period | No complaints from public | Turfvlakte ECO<br>HSE Manager |
| Movement of construction vehicles | Traffic | Risk of collision | ■ Indicate areas where heavy vehicles will be expected with adequate signage. | Control | Duration of construction period | No complaints from public | Turfvlakte ECO<br>HSE Manager |
| Movement of construction vehicles | Traffic | Risk of pedestrian accidents | ■ Clearly indicate pedestrian crossings.<br>■ Educate drivers on potential areas of high pedestrian and cyclist activity.<br>■ Educate community on dangers of construction vehicles new to their area. | Control | Duration of construction period | No complaints from public | Turfvlakte ECO<br>HSE Manager |
| Construction phase | Archaeology and cultural heritage | Possibility of unearthing unknown graves or other buried cultural/archaeological items | Chance find procedure to be implemented immediately should any heritage resources be unearthed:<br>■ Cease all work in the immediate vicinity of the find.<br>■ Demarcate the area with barrier tape or other highly visible means. | Avoid, Mitigate | Duration of construction period | Impact avoided | Turfvlakte ECO<br>HSE Manager |

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| | | | ▪ Notify the South African Heritage Resources Authority (SAHRA) immediately.<br>▪ Commission an archaeologist accredited with the Association for Southern African Professional Archaeologists (ASAPA) to assess the find and determine appropriate mitigation measures. These may include obtaining the necessary authorisation from SAHRA to conduct the mitigation measures.<br>▪ Prevent access to the find by unqualified persons until the assessment and mitigation processes have been completed. | | | | |
| Construction phase | Palaeontology | Possibility of unearthing fossils during earthmoving operations | Chance find procedure to be implemented immediately should any heritage resources be unearthed:<br>▪ Cease all work in the immediate vicinity of the find.<br>▪ Demarcate the area with barrier tape or other highly visible means.<br>▪ Notify the South African Heritage Resources Authority (SAHRA) immediately.<br>▪ Commission an archaeologist accredited with the Association for Southern African Professional Archaeologists (ASAPA) to assess the find and determine appropriate mitigation measures. These may include obtaining the necessary authorisation from SAHRA to conduct the mitigation measures.<br>▪ Prevent access to the find by unqualified persons until the assessment and mitigation processes have been completed. | Avoid, Mitigate | Duration of construction period | Impact avoided | Turfvlakte ECO |
| Construction of the Turfvlakte Infrastructure | Socio-economic considerations | Sustain current employment into the future | ▪ A monitoring system should be put in place to ensure that Exxaro's recruitment policy is adhered to.<br>▪ Communities within the vicinity of the mine should be given special consideration in terms of the benefits arising from the project because they will be the most affected by the project. It is recommended that the following mitigation measures be implemented:<br>  ▪ If not currently in place, a local skills database must be developed and updated regularly. The skills database should be used for recruitment purposes to minimise | Control by management and monitoring | Duration of construction period | N/A | Turfvlakte ECO<br>HSE Manager<br>HR Manager |

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| | | | the probability of nepotism or corruption during the recruitment process. | | | | |
| | | Increased economic revenue | ■ Exxaro shall develop and implement its housing model, which will be integrated within the local areas and aligned with the IDP of the region. The model will ensure that Grootegeluk Coal Mine employees are accommodated in their own formal accommodation located within the metropolitan frameworks of the region where the proposed operation will be based.<br>■ Exxaro shall give first preference to appropriate subcontractors/SMMEs located in the surrounding communities, followed by those located in the municipal area and lastly those situated elsewhere or outside the province. | Control by management and monitoring | For duration of construction activities | N/A | Turfvlakte ECO<br>HSE Manager<br>HR Manager |
| | | Health and Safety Risk | ■ A community awareness campaign to be implemented in the surrounding communities to sensitise community members to traffic safety risks and health and communicable disease awareness.<br>■ Exxaro shall be implementing dust-and noise suppression measures in areas where vehicles will use unsealed roads. That must be accompanied by proper road markings and signs.<br>■ Exxaro will need to engage with communities using a dedicated community liaison officer and have in place an effective stakeholder engagement plan, inclusive of a grievance redress mechanism for communities to access which will be used by project-affected stakeholders to lodge complaints.<br>■ Exxaro's community health and safety plan shall be in place and updated regularly. Measures should be in place to ensure the health and safety of the neighbouring guesthouse patrons and staff.<br>■ Roads must be adequately maintained to prevent deterioration of road surfaces due to heavy vehicle traffic.<br>■ The time for blasting activities should be communicated to the surrounding landowners and the local population. – This will be done via signage on the road and by ensuring that blasting times are limited to a specified time of day, where possible. | Control by management and monitoring | For duration of construction activities | Impact avoided | Turfvlakte ECO<br>HSE Manager<br>HR Manager |

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| | | Population Influx | ■ Additionally, relevant stakeholders should be engaged and consulted during the development of the detailed influx management plan.<br>■ Exxaro are to focus their efforts on the need for a local recruitment policy, workforce management, promotion of regional diversified growth strategies, implementation of health and safety education programmes and spatial planning, administration, and resource allocation.<br>■ Regarding any emerging recruitment opportunity, priority shall be given to locals, thus reducing the need for outsiders. | Control by management and monitoring | For duration of construction activities | Impact avoided | HSE Manager |
| Operating Mining and Fleet vehicles | GHG Emissions | Contributing to GHG Emissions | ■ Install telemetry in all construction and fleet vehicles and monitor driver behaviour in terms of speeding, excessive braking, idling and so on. Investigate incidents of excessive consumption. | Control by management and monitoring | Installation prior to start of construction.<br><br>Monitoring for duration of construction phase. | Impact mitigated | HSE Manager |

## 18.2 Operational Phase

Table 67 outlines Operational Phase impacts that need to be mitigated and monitored and their associated impact management outcomes and impact management actions

**Table 67: to be mitigated and monitored in their respective phases, impact outcomes and impact actions – operational phase**

| Operational Phase Activities | Aspect | Potential Impact | Detailed Mitigation Measures | Mitigation Type (Modify, Remedy, Control or Stop) | Time Period for Implementation | Standards to Be Achieve | Responsible Person |
|---|---|---|---|---|---|---|---|
| Mining of Grootegeluk, Thabametsi and Turfvlakte Pits<br><br>Processing ore associated with the mining of the Grootegeluk, Thabametsi and Turfvlakte Pits<br><br>Rehabilitation of Dump 4 and 5 and placement of overburden on Dump 6. | Air Quality | Dust and fine particulates affecting ambient air quality | ■ Continue and expand dust fallout monitoring to include the Grootegeluk Turfvlakte Expansion Project mining operations.<br>■ Dust related complaints should be directed to the site management. Complaints and any actions arising from a complaint will be recorded in a complaint register to be maintained by site management.<br>■ Continuous dust and fine particulate monitoring should be implemented to monitor compliance with NAAQS.<br>■ Wet suppression during materials handling activities as needed (e.g. during periods of high wind speeds).<br>■ Wind speed reduction through sheltering or wind breaks for open exposed areas prone to wind erosion (where possible).<br>■ Promote revegetation or keeping stockpile heights as low as practicable to reduce their exposure to wind erosion and thus dust generation.<br>■ Progressive rehabilitation and re-vegetation.<br>■ Reduction in unnecessary traffic volumes.<br>■ Wet suppression on all unpaved roads with water or a suitable dust palliative (i.e. chemical suppression) to achieve 50% control efficiency or better.<br>■ Park vehicles off travelled roadways.<br>■ Rigorous speed control and the institution of traffic calming measures to reduce vehicle dust entrainment.<br>■ Use of wet suppression or dust capture during drilling.<br>■ Implement best practice blasting measures to minimise dust. | Minimise and Control | Duration of operational phase | Compliance with NAAQS at the mine boundary | Turfvlakte ECO<br><br>HSE Manager<br><br>Mining Contractor |
| Hauling of coal and waste rock for storage in their respective storage facilities. | Soils, land use and land capability | Soil contamination from spillage/poor handling of product and waste rock outside the designated areas. | ■ Implement suitable measures such as bunding and silt traps on/around mining infrastructure to minimise soil contamination by controlling seepage and runoff.<br>■ Implementing regular site inspections for materials handling and storage. | Reduce through eliminating contaminant source | Duration of operational activities | Impact avoided | Turfvlakte ECO<br><br>HSE Manager<br><br>Mining Contractor |

| Operational Phase Activities | Aspect | Potential Impact | Detailed Mitigation Measures | Mitigation Type (Modify, Remedy, Control or Stop) | Time Period for Implementation | Standards to Be Achieve | Responsible Person |
|---|---|---|---|---|---|---|---|
| Spills of chemicals (e.g., hydrocarbon).<br><br>Soil contamination on adjacent land potentially occurring due to inappropriate waste disposal and potential oil and diesel leakages from vehicles and machinery | Soils, land use and land capability | Contamination of soils by hydrocarbon pollutants. | ■ Ensure proper handling of hazardous chemicals and materials (e.g. fuel, oil, cement, concrete, reagents, etc.) as per their corresponding Safety Data Sheets (SDS).<br>■ Accidental spills (concrete, chemicals, process water, hydrocarbons, waste) need to be reported immediately so that effective remediation and clean-up strategies and procedures can be implemented.<br>■ Soil that is contaminated by fuel or oil spills, for example, from vehicles, will be collected to be treated at a pre-determined and dedicated location, or will be treated in situ, using sand, soil or cold coal-ash as absorption medium. | ■ Identify areas where the soil was impacted.<br>■ Control through management or remediation options.<br>■ Prevent by restricting spillage from construction vehicles.<br>■ Control by implementation of storm water management measures.<br>■ Remedy by treatment of contaminated soils. | Duration of operational activities | Contaminant levels below SSV1[8] | Turfvlakte ECO<br><br>HSE Manager<br><br>Mining Contractor |
| Open pit mining operations | Surface Water | Area from which natural run-off to water resources can be expected will be reduced by an additional 2.4% of that already reduced by the Grootegeluk Mine | ■ Storm water management design must be in accordance with GN 704 to ensure that clean and dirty water are separated.<br>■ Clean water must be diverted away from the mining operations and the topsoil storage area to the Sandloop River and pans in the area, and that erosion around the topsoil storage area is limited. | Control by management and monitoring | Duration of operational activities | Regulation GN 704 for storm water management at mines | Turfvlakte ECO<br><br>HSE Manager |

[8] GNR. 331. Norms and Standards for Remediation of Contaminated Land & Soil Quality

| Operational Phase Activities | Aspect | Potential Impact | Detailed Mitigation Measures | Mitigation Type (Modify, Remedy, Control or Stop) | Time Period for Implementation | Standards to Be Achieve | Responsible Person |
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| Contractor laydown area (Haul truck area)<br><br>Haul Roads | Surface Water | ■ Contaminated run-off from laydown areas can be expected due to spillages, e.g. hydrocarbons<br>■ Surface water may be impacted by coal fines at the loading points and hydrocarbons from equipment, and sediments from potential erosion impacts by storm water from the erosion around the roads. | ■ Maintain stormwater collection facilities to capture sediment before water is released to the environment.<br>■ Ensure areas around the haul roads are rehabilitated and maintained as soon as any erosion is noted.<br>■ Clean hydrocarbon spills immediately and dispose of the contaminated soil considering best practice and relevant legislation | Control by management and monitoring | Duration of operational activities | Regulation GN 704 for storm water management at mines | Turfvlakte ECO<br><br>HSE Manager<br><br>Mining Contractor |
| Opencast mining activities | Surface Water | Development of the pits my require dewatering to ensure that mining can continue and will need to be discharged/ disposed.<br><br>Storm water entering the pits will need to be pumped. | ■ Hydrocensus and groundwater modelling to be implemented as discussed in the Groundwater Report, number: 1784950-316664-1 to assess which users may be impacted and may require additional sources of water.<br>■ Monitoring of water quality prior to any discharge to be compliant to water use licence conditions and other legislated requirements. | ■ Control by management and monitoring | Duration of operational activities | Impact managed | Turfvlakte ECO<br><br>HSE Manager<br><br>Mining Contractor |
| Open pit mining | Groundwater contamination | Exposure of geological strata in the open pit areas will result in a deterioration in quality of groundwater flowing into the open pit and the pit water, due to the ARD formation in some strata, and the leaching of various major and trace elements from all strata. | ■ Pits need to be kept as dry as possible to reduce contact time of water and oxygen with exposed rock and therefore keep contamination to a minimum. Mine water must be contained and/or re-used.<br>■ Groundwater water level monitoring must be conducted to confirm that the areas affected by dewatering remains within the predicted area and that no users will be affected.<br>■ Consideration should be given to separate handling of calcrete in the soft overburden so that this material, which is high in neutralisation potential as confirmed by kinetics of the soft overburden, can be used in covers for the backfilled pits, and the base of the final void in Pit 1. | ■ Control through management and monitoring.<br>■ Prevent by restricting coal spillage from mine vehicles.<br>■ Control by implementation of storm water | Duration of operational activities | WUL groundwater quality guidelines | Turfvlakte ECO<br><br>HSE Manager<br><br>Mining Contractor |

| Operational Phase Activities | Aspect | Potential Impact | Detailed Mitigation Measures | Mitigation Type (Modify, Remedy, Control or Stop) | Time Period for Implementation | Standards to Be Achieve | Responsible Person |
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| | | Open pit mining will result in groundwater inflows into the workings which need to be pumped out for mine safety and the resultant dewatering (water level decrease) of the groundwater system in the immediate vicinity of the workings. | ■ During the trial mining or grade control drilling, samples of different lithologies in the hard overburden should be subjected to further acid-base accounting tests to confirm whether they should be precautionarily considered to be potentially acid-generating.<br>■ The numerical flow and contaminant transport model and the geochemical model should be updated every 2 years with the latest monitoring, analysis and structural data. | management measures.<br>■ Remedy by treatment of contaminated soils. | | | |
| Mineral residue handling and disposal at Dump 6 | Groundwater contamination | Dumping of overburden material will result in the contaminated seepage with ARD formation in some strata, and the leaching of various major and trace elements from all strata. | ■ ARD-producing strata must be excluded from placement on Dump 6, meaning that the resulting seepage quality is likely to be not substantially changed. | Control by management and monitoring | Duration of operational activities | Impact avoided | Turfvlakte ECO<br>HSE Manager<br>Mining Contractor |
| Vegetation clearing and earth works | Terrestrial Ecology | Habitat loss and degradation | ■ Vegetation clearing should be restricted to the proposed mining development footprints only, with no clearing permitted outside of these areas.<br>■ Areas to be cleared should be clearly demarcated to prevent unnecessary clearing outside of these sites.<br>■ Removed topsoil should be stockpiled and used to rehabilitate disturbed areas.<br>■ A suitable rehabilitation programme should be developed and implemented in all disturbed areas. The programme should include:<br>▪ Concurrent rehabilitation, if possible.<br>▪ Stabilisation and active revegetation of all disturbed areas using locally occurring indigenous grass and tree species.<br>■ Protected tree species should be included in the mix of revegetation species. | Minimise and Rehabilitate | Duration of operational activities | Impact avoided/mitigated | Turfvlakte ECO<br>HSE Manager<br>Mining Contractor |
| Vegetation clearing and earth works | Terrestrial Ecology | Habitat fragmentation | | | | | |
| Vegetation clearing and earth works | Terrestrial Ecology | Establishment and spread of alien invasive species | ■ An alien invasive species control programme must be developed and implemented on-site during all phases of the proposed project. It is recommended that the programme include:<br>▪ A combined approach using both chemical and mechanical control methods.<br>▪ Periodic follow-up treatments, informed by regular monitoring.<br>▪ Monitoring should take place in disturbed areas, as well as adjacent undisturbed areas. | Minimise and Rehabilitate | Duration of operational activities | Impact avoided / mitigated | Turfvlakte ECO<br>HSE Manager<br>Mining Contractor |

| Operational Phase Activities | Aspect | Potential Impact | Detailed Mitigation Measures | Mitigation Type (Modify, Remedy, Control or Stop) | Time Period for Implementation | Standards to Be Achieve | Responsible Person |
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| | | | ■ Rehabilitate all sites that are disturbed by opencast mining activities, as per the rehabilitation programme. | | | | |
| Vegetation clearing and earth works | Terrestrial Ecology | Mortality and disturbance of fauna, incl. fauna of conservation importance | Death/injury during vegetation clearing and earth works<br>■ An ECO should be on-site during vegetation clearing to monitor and manage any wildlife-human interactions. The ECO should be trained in inter alia, snake handling.<br>■ As appropriate, fences should be erected to prevent fauna gaining access to operational areas, such as open trenches and voids.<br>Vehicle-wildlife collisions<br>■ A low speed limit (recommended 20 - 40 km/h) should be enforced on site to reduce wildlife-collisions.<br>Hunting, snaring and poisoning<br>■ The handling, poisoning and killing of on-site fauna by mine workers and contractors must be strictly prohibited.<br>■ Employees and contractors should be made aware of the presence of, and rules regarding, fauna through suitable induction training and on-site signage.<br>Noise, vibrations and lights<br>■ General noise abatement equipment should be fitted to machinery and vehicles; Noise shields, including earth berms, should be constructed around sites of noise origin.<br>■ Dust suppression using water bowsers should be undertaken on all mine's roads and other sites where dust entrainment occurs.<br>■ Plan the lighting requirements of facilities to ensure that lighting meets the need to keep the site secure and safe, without resulting in excessive illumination. Possible options include:<br>▪ Zoning of areas of high and low lighting requirements.<br>▪ Using motion-activated lights as opposed to permanent lights.<br>■ Reducing height and angle of lights. | Avoid and Minimise | Duration of operational activities | Impact avoided / mitigated | Turfvlakte ECO<br>HSE Manager<br>Mining Contractor |
| Vegetation clearing and earth works | Terrestrial Ecology | Loss and disturbance of fauna of conservation importance | ■ The ECO should be present during any disturbance (earth works) of pans/ depressions to monitor for the presence of Giant Bullfrog. The current Grootegeluk TOPS permits, for the capture and relocation of various protected spp, including Bullfrogs, must be updated to include the Turfvlakte farm area. If these species are detected, construction activities should cease until the specimens can be captured and relocated. | Avoid | Duration of operational activities | Impact avoided / mitigated | Turfvlakte ECO<br>HSE Manager |

| Operational Phase Activities | Aspect | Potential Impact | Detailed Mitigation Measures | Mitigation Type (Modify, Remedy, Control or Stop) | Time Period for Implementation | Standards to Be Achieve | Responsible Person |
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| | | | ■ Suitably qualified/trained experts should be appointed to undertake the necessary rescue and relocation operations. | | | | |
| Open cast mining activities | Wetlands | Disturbance of wetland habitat<br>Increased surface rub-off from bare soil areas and impermeable surfaces<br>Increased sedimentation in adjacent wetlands<br>Water quality deterioration<br>Establishment and spread of alien invasive species | ■ Disturbance of wetlands outside the development footprint should be minimised by implementing the following measures:<br>▪ Optimise design of surface infrastructure areas to minimise size of development footprint.<br>▪ All disturbance footprints must be separated from adjacent wetlands by a fence, either a security fence or five strand cattle fence.<br>▪ All operational staff should be educated on the sensitivity of wetland areas and should be made aware of all wetland areas in close proximity to the construction sites.<br>▪ Water quality should be regularly monitored and appropriate and timely remedial interventions made in the case of non-compliance.<br>▪ Develop and implement an operational stormwater management plan prior to the commencement of site clearing activities for mining.<br>▪ An alien vegetation management plan should be drawn up and implemented to limit the spread of alien vegetation into wetland habitat.<br>■ All disturbed areas outside the direct development footprints should be rehabilitated and re-vegetated as soon as possible. | Control, minimise, avoid and rehabilitate | Duration of operational activities | Requirements of Offset Study | Turfvlakte, ECO<br>HSE Manager<br>Mining Contractor |
| Open cast mining activities at the rim of the open cast pit 1<br>Open cast mining activities at the rim of the open cast pit 2<br>Hauling of coal<br>Maintenance activities<br>Emergency siren<br>Emergency generator | Noise | Noise increase at the boundary of the mine footprint and at the abutting residential areas | ■ Implementation of the noise mitigatory measures and the noise management plan.<br>■ All plant, equipment and vehicles should be kept in good repair.<br>■ Where possible, very noisy activities should not take place at night.<br>■ Noise monitoring to be done at the open cast mining footprint, noise sources within mining footprint and at the abutting residential areas. Noise monitoring will have to be carried out on a monthly basis during all phases of the project until the potential shift in the prevailing ambient noise levels are determined, after which the frequency of monitoring may be changed to a quarterly basis and eventually bi-anually, as per the current noise monitoring programme at Grootegeluk Coal Mine.<br>■ Actively manage the proposed Turfvlakte mining process and the noise management plan must be used to ensure compliance to the noise regulations and/or standards. The noise levels to be evaluated in terms of the baseline noise levels. | Control and minimise | Duration of operational activities | SANS 101033 of 2008 and the applicable noise regulations | Turfvlakte, ECO<br>HSE Manager<br>Mining Contractor |

| Operational Phase Activities | Aspect | Potential Impact | Detailed Mitigation Measures | Mitigation Type (Modify, Remedy, Control or Stop) | Time Period for Implementation | Standards to Be Achieve | Responsible Person |
|---|---|---|---|---|---|---|---|
| Open cast mining activities | Vibration | Ground vibration Impact on houses and structures | ■ Blasts design:<br>▪ Blast design can be reviewed prior to first blast panned and done. Possible use of electronic initiation rather than conventional timing systems should be considered. This will allow for single blast hole firing - thus less charge mass per delay and less influence.<br>▪ Test blasting should be done to confirm levels and ground vibration and air blast.<br>▪ Detailed monitoring to be done during test blasting, and results should be used to help define blasting operations going forward.<br><br>■ Stemming length:<br>▪ Stemming lengths provides for some control on fly rock. Recommended stemming length should range between 20 and 30 times the blast hole diameter. Increasing the stemming lengths to 30 and 34 times the blast hole diameter, will contribute to more acceptable air blast levels.<br><br>■ Safe blasting distance and evacuation:<br>▪ The calculated minimum safe distance is 305m. The final blast designs were not available, therefore the final safe distance to evacuate people and animals must be decided upon prior to first blasting. This distance may be greater than 305m, pending the final code of practice of the mine and responsible blaster's decision on safe distance. The use of minimum 500 m exclusion zone is rather recommended, and it will be required that evacuation be negotiated when blasting.<br><br>■ Road Closure:<br>▪ The district roads in the vicinity of the project area (D1675) is located 401m from Pit 1, thus road closure needs to be considered when blasting closer than 500m from the road. Smaller roads not necessarily reflected on all maps should also be considered for closures when blasting is done.<br><br>■ Photographic inspections:<br>▪ It is recommended that a photographic survey of all structures up to 1500m, from the centre of the proposed pit areas is completed.<br>▪ Ground vibration monitoring must be done.<br><br>■ Blasting days and times of blasting:<br>▪ A further consideration of blasting times is when weather conditions could influence the effects yielded by blasting operations. It is recommended not to blast too early in the morning when it is still cool or when there is a possibility of atmospheric inversion or too late in the afternoon in winter.<br>▪ Do not blast in fog.<br>▪ Do not blast in the dark.<br>▪ Refrain from blasting when wind is blowing strongly in the direction of an outside receptor. | Control and minimise | Duration of operational phase | Remain within SANS 10103, 2008 limits.<br>Impacts avoided | Turfvlakte, ECO<br><br>HSE Manager<br><br>Mining Contractor |
| | Vibration | | | | | | |
| | Blasting | | | | | | |
| | Blasting | Air blast impact on houses and structures | | | | | |
| | Blasting | Air blast impact on industrial surface infrastructure | | | | | |
| | Blasting | Air blast impact on roads and road structures | | | | | |
| | Blasting | Fly rock impact on houses and structures | | | | | |
| | Blasting | Fly rock impact on industrial surface infrastructure | | | | | |
| | Blasting | Fly rock impact on roads and road structures | | | | | |

| Operational Phase Activities | Aspect | Potential Impact | Detailed Mitigation Measures | Mitigation Type (Modify, Remedy, Control or Stop) | Time Period for Implementation | Standards to Be Achieve | Responsible Person |
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| | | | ▪ Do not blast with low overcast clouds. These 'do nots' stem from the influence that weather has on air blast. The energy of air blast cannot be increased but it is distributed differently and therefore is difficult to mitigate.<br>▪ It is recommended that a standard blasting time is fixed and blasting notice boards setup at various routes around the project area that will inform the community of blasting dates and times.<br>■ Third party monitoring:<br>▪ Third party consultation and monitoring should be considered for all ground vibration and air blast monitoring work. Monitoring could be done using permanent installed stations.<br>■ Relocation:<br>▪ A relocation program should be considered for all households within 305m of the proposed pit area. | | | | |
| Opencast mining activities | Visual | Reduction in visual resource value due to presence of the offices and related infrastructure. | ■ To reduce the visual intrusion of the buildings, roofing and cladding material should not be white or shiny (e.g. bare galvanised steel that causes glare).<br>■ Where possible, construct and/or paint offices and workshop buildings in colours that are complementary to the surrounding landscape, such as olive green, light grey, grey green, blue grey, dark buff, rust, ochre variations of tan.<br>■ Utilise construction materials that have matt textures where possible. | Control and minimise | Duration of operational phase | Reduced visual intrusion and no complaints from receptors | Turfvlakte, ECO<br>HSE Manager<br>Mining Contractor |
| Opencast mining activities | Visual | Reduction in visual resource value due to the open pits and topsoil stockpile. | ■ Shape slopes and embankments of the topsoil stockpile to a maximum gradient of 1:4 and vegetate, to prevent erosion and improve their appearance.<br>■ Avoid using berms as visual screening devices, except in instances where vegetative screens are not feasible, as they are usually as intrusive as the elements that they are screening.<br>■ Shape and vegetate topsoil stockpiles to prevent erosion.<br>■ Retain existing trees wherever possible, as they already provide valuable screening.<br>■ Plant indigenous trees in all landscaped areas to break structural form and provide visual screens.<br>■ Implement and maintain landscaping using indigenous plants and water-wise methods wherever visitors are expected, to improve the overall appearance of the operation. | Control and minimise | Duration of operational phase | Reduced visual intrusion and no complaints from receptors | Turfvlakte, ECO<br>HSE Manager<br>Mining Contractor |

| Operational Phase Activities | Aspect | Potential Impact | Detailed Mitigation Measures | Mitigation Type (Modify, Remedy, Control or Stop) | Time Period for Implementation | Standards to Be Achieve | Responsible Person |
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| Opencast mining activities | Visual | Formation of dust plumes as a result of construction activities, soil stripping and subsequent mining. | ▪ Water down haul roads and large bare areas as frequently as is required to minimise airborne dust.<br>▪ Place a sufficiently deep layer of crushed rock or gravel at vehicle and machinery parking areas<br>▪ Apply chemical dust suppressants if deemed necessary.<br>▪ Enforce a 40 km/h speed limit on-site for all vehicles.<br>▪ Implement a dust bucket fallout monitoring system. | Control and minimise | Duration of operational phase | Reduced visual intrusion and no complaints from receptors | Turfvlakte, ECO<br>HSE Manager<br>Mining Contractor |
| Opencast mining activities | Visual | Light pollution at night. | ▪ Utilise security lighting (if feasible) that is movement activated rather than permanently switched on, to prevent unnecessary constant illumination.<br>▪ Plan the lighting requirements of the facilities to ensure that lighting meets the need to keep the site secure and safe, without resulting in excessive illumination.<br>▪ Reduce the height and angle of illumination from which floodlights are fixed as much possible while still maintaining the required levels of illumination.<br>▪ Identify zones of high and low lighting requirements, focusing on only illuminating areas to the minimum extent possible to allow safe operations at night and for security surveillance.<br>▪ Avoid up-lighting of structures by rather directing lighting downwards and focussed on the area to be illuminated.<br>▪ Fit all security lighting with 'blinkers' or specifically designed fixtures, to ensure light is directed downwards while preventing side spill. Light fixtures of this description are commonly available for a variety of uses and should be used to the greatest extent possible. | Control and minimise | Duration of operational phase | Reduced visual intrusion and no complaints from receptors | Turfvlakte, ECO<br>HSE Manager<br>Mining Contractor |
| Movement of construction vehicles | Traffic | Construction traffic can cause congestion, driver frustration, safety issues | ▪ Use reputable contractors who maintain high standards for vehicles and drivers.<br>▪ Require contractors to:<br>  ▪ Keep their vehicles in good condition.<br>  ▪ Use properly licensed and skilled drivers.<br>  ▪ Monitor adherence to traffic regulations.<br>  ▪ Take effective measures to avoid driver fatigue. | Control | Duration of operational phase | No complaints from public | Turfvlakte, ECO<br>HSE Manager<br>Mining Contractor |

| Operational Phase Activities | Aspect | Potential Impact | Detailed Mitigation Measures | Mitigation Type (Modify, Remedy, Control or Stop) | Time Period for Implementation | Standards to Be Achieve | Responsible Person |
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| | | | ▪ Monitor drivers for use of alcohol and other substances that could impair judgment and driving ability.<br>▪ Ensure that loads on trucks are properly secured during transport.<br>■ As far as may be practicable, schedule the arrival and departure of heavy vehicles to avoid the morning and afternoon peak hours.<br>■ Record and respond to all complaints. | | | | |
| Movement of construction vehicles | Traffic | Risk of collision | ■ Indicate areas where heavy vehicles will be expected with adequate signage. | Control | Duration of operational phase | No complaints from public | Turfvlakte, ECO<br><br>HSE Manager<br><br>Mining Contractor |
| Movement of construction vehicles | Traffic | Risk of pedestrian accidents | ■ Clearly indicate pedestrian crossings.<br>■ Educate drivers on potential areas of high pedestrian and cyclist activity.<br>■ Educate community on dangers of construction vehicles new to their area. | Control | Duration of operational phase | No complaints from public | Turfvlakte, ECO<br><br>HSE Manager<br><br>Mining Contractor |
| Open cast mining activities | Heritage Resources | No impacts expected, but chance finds with potentially high impacts could occur | Chance find procedure to be implemented immediately should any heritage resources be unearthed:<br>■ Cease all work in the immediate vicinity of the find.<br>■ Demarcate the area with barrier tape or other highly visible means.<br>■ Notify the South African Heritage Resources Authority (SAHRA) immediately.<br>■ Commission an archaeologist accredited with the Association for Southern African Professional Archaeologists (ASAPA) to assess the find and determine appropriate mitigation measures. These may include obtaining the necessary authorisation from SAHRA to conduct the mitigation measures.<br>■ Prevent access to the find by unqualified persons until the assessment and mitigation processes have been completed. | Avoid | Duration of operational phase | Impact avoided | Turfvlakte, ECO<br><br>HSE Manager<br><br>Mining Contractor |

| Operational Phase Activities | Aspect | Potential Impact | Detailed Mitigation Measures | Mitigation Type (Modify, Remedy, Control or Stop) | Time Period for Implementation | Standards to Be Achieve | Responsible Person |
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| Open cast mining activities | Palaeontology | No impacts expected, but chance finds with potentially high impacts could occur | Chance find procedure to be implemented immediately should any heritage resources be unearthed:<br>■ Cease all work in the immediate vicinity of the find.<br>■ Demarcate the area with barrier tape or other highly visible means.<br>■ Notify the South African Heritage Resources Authority (SAHRA) immediately.<br>■ Commission an archaeologist accredited with the Association for Southern African Professional Archaeologists (ASAPA) to assess the find and determine appropriate mitigation measures. These may include obtaining the necessary authorisation from SAHRA to conduct the mitigation measures.<br>■ Prevent access to the find by unqualified persons until the assessment and mitigation processes have been completed. | Avoid | Duration of operational phase | Impact avoided | Turfvlakte, ECO<br>HSE Manager<br>Mining Contractor |
| Open pit mining operations | Socio-economic considerations | Skills transfer and development | As per Exxaro's SLP, Exxaro will:<br>■ Comply with the requirements of the Skills Development Act, which includes the submission of a Workplace Skills Plan and an Annual Training Report as per the Sector Education and Training Authority's requirements.<br>■ Appoint a dedicated skills development facilitator within six months of the commencement of operations.<br>■ Submit a five-year plan for learnerships at once operations commence.<br>■ Provide employees with the opportunity to participate in mentoring relationships with an individual they feel could add value to their growth and development.<br>■ Implement a bursary scheme which aims to develop suitable students who once they have completed their studies are afforded professional career opportunities within our organisation. | Control by management and monitoring | For duration of operational activities | N/A | Turfvlakte ECO<br>HSE Manager<br>HR Manager |
| | Socio-economic considerations | Community Development | ■ The community development aspects will be carried out as per Exxaro's SLP. During this process, Exxaro will engage stakeholders in the area to gauge whether they can align with any of their efforts to collaborate on some development initiatives planned for the communities. Additionally, the selection of project beneficiaries should be fair and directly affected parties should be given first preference. | Control by management and monitoring | For duration of operational activities | N/A | Turfvlakte ECO<br>HSE Manager<br>HR Manager |
| Open pit mining operations | Socio-economic considerations | Regional and economic development | ■ Exxaro shall pay royalties and tax to the government.<br>■ Exxaro shall adhere to their SLP commitments. | Control by management and monitoring | For duration of operational activities | N/A | Turfvlakte ECO<br>HSE Manager |

| Operational Phase Activities | Aspect | Potential Impact | Detailed Mitigation Measures | Mitigation Type (Modify, Remedy, Control or Stop) | Time Period for Implementation | Standards to Be Achieve | Responsible Person |
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| | | | | | | | HR Manager |
| Open pit mining operations | Socio-economic considerations | Health and Safety Risk | ▪ The mine shall be maintained during its lifetime in a manner that ensures a safe working environment for mine personnel.<br>▪ Ensure a safe environment for neighbouring communities.<br>▪ Adherence to rigorous operational health and safety programmes.<br>▪ Exxaro shall develop measures to comply with regional air quality studies recommendations. | Control by management and monitoring | For duration of operational activities | N/A | Turfvlakte ECO<br><br>HSE Manager<br><br>HR Manager |
| Operating Mining and Fleet vehicles – Diesel Fuel | GHG Emissions | Contributing to GHG Emissions | ▪ Install telemetry in all construction and fleet vehicles and monitor driver behaviour in terms of speeding, excessive braking, idling and so on. Investigate incidents of excessive consumption. | Control by management and monitoring | Monitoring for duration of operational phase. | Impact managed | Engineering Manager<br><br>HSE Manager |
| | | | ▪ Investigate feasibility of using biofuel blend (up to 20% blend) in mining and fleet vehicles. Implement if found to be feasible and does not void warranty of vehicles (confirm with suppliers). | Control by management and monitoring | Prior to start of the operational phase. | Impact managed | Engineering Manager<br><br>HSE Manager |
| | | | ▪ Investigate feasibility of using diesel additives in mining and fleet vehicles. Implement if found to be feasible and does not void warranty of vehicles (confirm with suppliers). | Control by management and monitoring | Prior to start of the operational phase. | Impact managed | Engineering Manager<br><br>HSE Manager |
| Beneficiation Plant – Purchased Electricity | GHG Emissions | Contributing to GHG Emissions | ▪ Develop and implement an energy management system based on ISO 50001 methodology at the beneficiation plants (or site-wide) to reduce energy consumption (and GHG emissions) from diesel and grid electricity consumption. | Control by management and monitoring | Prior to start of the operational phase and maintain for duration of operational phase. | Impact managed | Engineering Manager<br><br>HSE Manager |
| | | | ▪ Investigate feasibility of installing wind turbines and/or a solar photovoltaic system onsite to reduce the usage of grid electricity which is relatively carbon intensive. | Control by management and monitoring | Prior to start of the operational phase. | Impact managed | Engineering Manager<br><br>HSE Manager |

| Operational Phase Activities | Aspect | Potential Impact | Detailed Mitigation Measures | Mitigation Type (Modify, Remedy, Control or Stop) | Time Period for Implementation | Standards to Be Achieve | Responsible Person |
|---|---|---|---|---|---|---|---|
| | | | ■ Investigate feasibility of purchasing renewable energy from an independent power producer through a wheeling agreement. | Control by management and monitoring | Prior to start of the operational phase. | Impact managed | Engineering Manager<br><br>HSE Manager |
| Land use change | GHG Emissions | Contributing to GHG Emissions | ■ Where possible, undertake concurrent rehabilitation of disturbed areas to reinstate biomass (aboveground and below-ground) carbon stocks as soon as possible. | Remedy and rehabilitate | During the operational phase. | Impact managed | HSE Manager |
| Open Pits | Climate Change | A decrease in average annual rainfall will reduce direct rainfall onto the open pits, surface runoff, and groundwater infiltration, thereby reducing pit dewatering requirements. | ■ Limit the area in the immediate vicinity of the open pits that will be graded to drain towards the open pits.<br>■ Construction of diversion channels and ditches to direct non-contact water away from the open pits.<br>■ Use of pit floor sumps to pump excess water to pit water to Grootegeluk Coal Mine where it will be used for dust suppression and process water. | Control by management and monitoring | During the operational phase. | Impact managed | HSE Manager |
| Haul roads and ramps | Climate Change | An increase in the number of extreme rainfall days can make access roads temporarily impassable, impacting negatively on the transport of overburden, interburden, and coal from the pits to Grootegeluk Coal Mine. | ■ Ensure that haul roads and ramps are maintained in good condition by attending to potholes, corrugations, and stormwater damage as soon as these develop. | Control by management and monitoring | During the operational phase. | Impact managed | HSE Manager |
| Topsoil Dump | Climate Change | An increase in the number of extreme rainfall days can lead to increased erosion of the exposed soil stockpiles, and sedimentation of the stormwater system or receiving environment. | ■ Construction of upslope diversion berms to divert stormwater runoff around the topsoil dump.<br>■ Construction of conduits to direct runoff from the topsoil dump to a stormwater outfall point. | Control by management and monitoring | During the operational phase. | Impact managed | HSE Manager |
| Employees and contractors | Climate Change | An increase in average monthly temperatures and number of hot days can increase the risk of employees suffering from heat stroke and dehydration, which can adversely affect their health and well-being. | ■ Develop and implement an employee health awareness program to educate Exxaro's employees and contractors about the importance of drinking water and identifying the signs of early signs of heat stroke. | Control by management and monitoring | During the operational phase. | Impact managed | HSE Manager |
| Employees and contractors | Climate Change | Variations in climatic conditions, such as temperature, rainfall | ■ Monitor malaria incident reports. | Control by management and monitoring | During the operational phase. | Impact managed | HSE Manager |

| Operational Phase Activities | Aspect | Potential Impact | Detailed Mitigation Measures | Mitigation Type (Modify, Remedy, Control or Stop) | Time Period for Implementation | Standards to Be Achieve | Responsible Person |
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| | | patterns, and humidity, can increase malaria transmission, which can adversely affect the health and well-being of employees and contractors. | ▪ If local incidents are reported, implement fogging and spraying at the mine during the wet season (September to April).<br>▪ Develop and implement an employee health awareness program to educate Exxaro's employees and contractors about Malaria and preventative measures. | | | | |
| Grootegeluk Coal Mine Beneficiation Plants | Climate Change | A decrease in average annual rainfall will reduce direct rainfall onto the open pits, surface runoff, and groundwater infiltration, thereby reducing the availability of pit water for the beneficiation plants at Grootegeluk Coal Mine. | ▪ Develop a water conservation/water demand management plan for the Grootegeluk Turfvlakte Expansion Project and incorporate it into the existing water conservation/water demand management plan for Grootegeluk Coal Mine for implementation. | Control by management and monitoring | During the operational phase. | Impact managed | HSE Manager |
| Grootegeluk Coal Mine Pit | Climate Change | Marked increases in daily or seasonal temperatures will increase the rate of oxidation, thereby increasing exothermic reactions and the risk of spontaneous combustion of the coal discards in the backfill of the Grootegeluk Coal Mine Pit. | ▪ Where possible, cap each bench to minimise the exposed surface area for exothermic reactions and to prevent the ingress of oxygen and moisture.<br>▪ Annual thermographic surveys of the pit backfill to identify 'hotspots' for signs of spontaneous combustion. | Control by management and monitoring | During the operational phase. | Impact managed | HSE Manager |

## 18.3 Closure and Rehabilitation Phase

Table 68 outlines Decommissioning and closure phase impacts that need to be mitigated and monitored and their associated impact management outcomes and impact management actions.

**Table 68: Impacts to be mitigated and monitored in their respective phases, impact outcomes and impact actions – closure and rehabilitation phase**

| Construction Phase Activities | Aspect | Potential Impact | Detailed Mitigation Measures | Mitigation Type (Modify, Remedy, Control or Stop) | Time Period for Implementation | Standards to Be Achieve | Responsible Person |
|---|---|---|---|---|---|---|---|
| Decommissioning of the Turfvlakte Infrastructure | Air Quality | Dust and fine particulates affecting ambient air quality | ■ Contractors should take preventative measures to minimise complaints regarding dust nuisances (e.g. screening, dust control, timing, pre-notification of Interested and Affected Parties (I&APs)).<br>■ Implement wet suppression during materials handling activities.<br>■ Implement wind speed reduction through sheltering (where possible).<br>■ Implement wet suppression on construction access roads.<br>■ Speed control on all unpaved roads.<br>■ Avoidance of dust track-on onto paved routes used to transport rehabilitation materials.<br>■ Parking construction vehicles off travelled roadways. | Minimise and Control | Continuous through decommissioning and closure phase | Compliance with NAAQS at the mine boundary. | Turfvlakte ECO<br><br>HSE Manager<br><br>Rehabilitation Manager |
| Removal of redundant infrastructure | Soils, land use and land contamination | ■ Spillage of chemical solutions during the dismantling of plant equipment, pipelines or pumps which were in contact with chemicals solution may contaminate the soils.<br>■ Spillage of diesel, oils and greases from the dismantled plant equipment, resulting in hydrocarbon contamination of exposed soils. | ■ Ensure proper handling of hazardous chemicals and materials (e.g. fuel, oil, cement, concrete, reagents, etc.) as per their corresponding Safety Data Sheets (SDS).<br>■ Dismantling of plant equipment and machinery at Grootegeluk Coal Mine should be carried out in designated appropriate facilities fitted with spillage containment, floors and sumps to capture any fugitive oils and greases. Develop detailed procedures for spills containment and soils clean up.<br>■ Conduct soil assessment to determine post decommissioning/closure soil quality on rehabilitated infrastructural footprint. | Control through minimizing occurrence of contaminant source | Decommissioning & Closure Phase | Contaminant levels below SSV1 | Turfvlakte ECO<br><br>HSE Manager<br><br>Rehabilitation Manager |
| Backfilling of Turfvlakte Pits | Soils, land use and land contamination | Spilling of backfill material during haulage outside the designated areas. | ■ Ensure proper handling and transportation of backfill material. | Control through minimizing occurrence of contaminant source | Decommissioning & Closure Phase | Contaminant levels below SSV2 | Turfvlakte ECO |

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| Grading of project site to ensure long-term drainage conditions on site | Soils, land use and land contamination | ■ Soil compaction in areas where active heavy machinery will be mobilised for the shaping of the final landform.<br>■ Loss of soil organic matter due to increased aeration (caused by soil disturbance) and subsequent organic matter decomposition. | ■ Re-use stockpiled soil within as short a period as possible (within 3-5 years).<br>■ Use appropriate soil handling machinery (NOT heavy earth moving equipment used for mining operations) to minimize compaction.<br>■ Limit vehicle traversing on both stockpiles and rehabilitated areas as far as possible.<br>■ Prepare rehabilitated areas properly and monitor regularly.<br>■ Ensure that the newly created soil profile is free draining (except in re-instated seasonal pan areas). | Control through management and monitoring | Decommissioning & Closure Phase | End landform objectives | Turfvlakte ECO<br><br>HSE Manager<br><br>Rehabilitation Manager |
| Soil placement and revegetation of project site | Soils, land use and land contamination | ■ Soil handling to convey soil from topsoil stockpile to project site for surface rehabilitation activities, may result in degradation of soil quality due to soil disturbance.<br>■ Contamination of soil by handling of soil with contaminated earth moving machinery (machinery previously used for handling mine waste such as waste rock or tailings material).<br>■ Insufficient soil volumes to meet | ■ Re-use stockpiled soil within as short a period as possible (within 3-5 years).<br>■ Use appropriate soil handling machinery (NOT heavy earth moving equipment used for mining operations) to minimize compaction<br>■ Limit vehicle traversing on both stockpiles and rehabilitated areas as far as possible.<br>■ Prepare rehabilitated areas properly and monitor regularly.<br>■ Ensure that the newly created soil profile is free draining (except in re-instated seasonal pan areas).<br>■ Consider topsoil cover thickness similar to pre-mining topsoil depths (60% of project footprint has an average topsoil thickness of 20 cm). Stockpile topsoil and subsoil horizons separately and maintain stockpile soil quality. | Control through management and monitoring | Decommissioning & Closure Phase | End land use objectives | Turfvlakte ECO<br><br>HSE Manager<br><br>Rehabilitation Manager |

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| | | end land use soil requirements. | | | | | |
| Rehabilitated Pits | Surface Water | ■ Storm water entering the remaining opencast void of Pit 1 and Pit 2 may fill the void and decant into surrounding environment | ■ Closure options must ensure that clean and dirty water are separated, and clean water is diverted to the Sandloop River or pans in the area.<br>■ Monitoring of water quality prior to any discharge to be compliant to water use licence conditions and other legislated requirements. Pumping to Grootegeluk Coal Mine will need to continue should the water quality be unfit for discharge. | Minimise and control through management and monitoring. | Decommissioning & Closure Phase | Compliance with GN 704 | Turfvlakte ECO<br>HSE Manager<br>Rehabilitation Manager |
| Contractor laydown area | Surface Water | ■ Run-off during rehabilitation phase may contain contaminants, including hydrocarbons from equipment used, coal fines and sediment. | ■ Areas cleared during rehabilitation, such as the topsoil stockpile must be revegetated with indigenous plants to prevent erosion and allow the area to return to a natural state.<br>■ Areas will be sloped to ensure run-off towards the Sandloop and pans.<br>■ Monitoring of the water quality of the pans will continue until the trends indicate no changes. | Minimise and control through management and monitoring. | Decommissioning & Closure Phase | Compliance with GN 704<br>Impact avoided | Turfvlakte ECO<br>HSE Manager<br>Rehabilitation Manager |
| Open pit mining operations | Surface Water | ■ Area from which natural run-off to water resources can be expected will be reduced by an additional 2.4% of that already reduced by the Grootegeluk Mine | ■ Hydrocensus and groundwater modelling as discussed in Groundwater Report, number: 1784950-316664-1 to assess which users may be impacted and may require additional sources of water.<br>■ Monitoring of water quality prior to any discharge to be compliant to water use licence conditions and other legislated requirements. | Minimise and control through management and monitoring. | Decommissioning & Closure Phase | Regulation GN 704 for storm water management at mines | Turfvlakte ECO<br>HSE Manager<br>Rehabilitation Manager |
| Partially backfilled open pit with final void | Groundwater quantity | ■ Exposure of geological strata and backfill material will result in the contamination of the pit water with ARD and other material leached from the backfill. | ■ Groundwater levels in the partially backfilled pits will recover to levels determined by evaporation from the final void. The pits will act as sinks, preventing contaminants from migrating away from the pits.<br>■ All mined areas should be flooded as soon as possible to minimise free oxygen reacting with remaining pyrite.<br>■ Groundwater monitoring should be done to establish a database of plume movement trends, to aid eventual mine closure.<br>■ The drilling of boreholes into backfilled areas is recommended so that recovery of water in mining areas can be monitored. The absence of groundwater users should be assessed bi-annually.<br>■ A pit lake feasibility study should be conducted to determine the optimal size of the final void to ensure minimal post closure impacts. In addition, the | Minimise control through management and monitoring. | Post Closure | Impact avoided | Turfvlakte ECO<br>HSE Manager<br>Rehabilitation Manager |

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| | | | geochemical assessment should be updated based on the likely final void/pit lake dimensions. | | | | |
| Site rehabilitation and closure | Terrestrial Ecology | Establishment and spread of alien invasive species | ■ An alien invasive species control programme must be developed and implemented on-site during all phases of the proposed project. It is recommended that the programme include:<br>▪ A combined approach using both chemical and mechanical control methods.<br>▪ Periodic follow-up treatments informed by regular monitoring.<br>▪ Monitoring should take place in disturbed areas, as well as adjacent undisturbed areas.<br>■ Rehabilitate all sites that are disturbed by construction and operational phase activities, as per the rehabilitation programme.<br>■ Rehabilitate all disturbed footprints during the closure and rehabilitation phases, as per the rehabilitation programme. | Minimise and Rehabilitate | Continuous through decommissioning and closure phase | | Turfvlakte ECO<br><br>HSE Manager<br><br>Rehabilitation Manager |
| Site rehabilitation and closure | Wetlands | Disturbance of wetland habitat | ■ Disturbance to of wetlands outside the development footprint should be minimised by implementing the following measures:<br>▪ All disturbed footprints must be separated from adjacent wetlands by a fence, either a security fence or five strand cattle fences until rehabilitated.<br>▪ All staff should be educated on the sensitivity of wetland areas and should be made aware of all wetland areas in close proximity to the construction sites.<br>▪ Water quality should be regularly monitored and appropriate and timely remedial interventions made in the case of non-compliance<br>▪ Develop and implement a rehabilitation phase stormwater management plan prior to the commencement of site rehabilitation activities.<br>▪ An alien vegetation management plan should be drawn up and implemented to limit the spread of alien vegetation into wetland habitat.<br>▪ All disturbed areas outside the direct development footprints should be rehabilitated and re-vegetated as soon as possible. | Minimise and Rehabilitate | Continuous through decommissioning and closure phase | Impact mitigated | Turfvlakte ECO<br><br>HSE Manager<br><br>Rehabilitation Manager |
| Open cast mining activities | | Increased surface rub-off from bare soil areas and impermeable surfaces | | | | | |
| Open cast mining activities | | Increased sedimentation in adjacent wetlands | | | | | |
| Open cast mining activities | | Water quality deterioration | | | | | |
| Open cast mining activities | | Establishment and spread of alien invasive species | | | | | |
| Demolition of all infrastructure | Noise | Noise increase at the boundary of the mine footprint and at the abutting residential areas | ■ Machinery with low noise levels which complies with the manufacturer's specifications to be used.<br>■ Activities to take place during daytime period only.<br>■ Vehicles to comply with manufacturers' specifications.<br>■ Noise monitoring to be carried out on a monthly basis until the potential shift in the prevailing ambient noise levels are determined, thereafter monitoring frequency may change to a quarterly basis (dependent on the duration of the decommissioning and closure phase. | Control and minimise | Continuous through decommissioning and closure phase | No complaints from receptors | Turfvlakte ECO<br><br>HSE Manager<br><br>Rehabilitation Manager |

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| Revegetation of rehabilitated areas | | Noise increase at the boundary of the mine footprint and at the abutting residential areas | | | | | |
| Site rehabilitation and closure | Visual | Reinstatement of visual resource value due to dismantling of mining infrastructure and subsequent rehabilitation of footprint areas.<br><br>Permanent alteration of site topographical and visual character of due to presence of mined areas and material stockpiles/dumps.<br><br>Visible dust plumes during rehabilitation. | ■ Dismantle and remove all visible surface infrastructure during decommissioning.<br>■ Re-shape all footprint areas to be as natural in appearance as possible<br>■ Fill and stabilise the pits using material from stockpiles/dumps, and contour/shape to ensure it is free draining.<br>■ Distribute topsoil over all disturbed footprints and actively revegetate (using grasses and if possible, endemic trees) to establish a vigorous and self-sustaining vegetation cover.<br>■ The berms surrounding the remaining voids at both pits should also be revegetated.<br>■ Conduct on-going monitoring and maintenance of the rehabilitated areas to ensure that they establish successfully, and that erosion does not occur.<br>■ Continuously assess condition of vegetation cover of rehabilitated areas for adequate cover density and species composition. Due to the unpredictable nature of vegetation growth the effectiveness of the re-vegetation will only become apparent after several years. Where specimens die, grow poorly, or do not affect sufficient coverage, the cause of the problem should be established and the afflicted specimens replaced, or a more suitable alternative established, based on a case-to-case basis.<br>■ Employ control measures to eradicate weedy and alien invader plant species as required. | Avoid | Continuous through decommissioning and closure phase | Reduced visual intrusion and no complaints from receptors | Turfvlakte ECO<br><br>HSE Manager<br><br>Rehabilitation Manager |
| Decommissioning and removal of the Turfvlakte infrastructure | Socio-economic considerations | Loss of employment | ■ Timely and adequate consultation with employees who are dependent on the mine for employment.<br>■ Assisting employees in seeking alternative employment at other power plants or related facilities.<br>■ Training and education of employees to equip them with skills that could benefit them in other industries. During the operational phase, members of the workforce will be encouraged to obtain skills or qualifications that are recognised by the National Qualifications Framework and are registered through the Mining Qualifications Authority. These qualifications include non-mining skills that will assist employees in areas other than mining.<br>■ Initiatives should be aligned with SLP commitments relating to downscaling and retrenchment. | Minimise control through management and monitoring. | Decommissioning & Closure Phase | Impact managed | Turfvlakte ECO<br><br>HSE Manager<br><br>HR Manager |

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| Decommissioning and removal of the Turfvlakte infrastructure | Socio-economic considerations | Reduced regional economic development | Engage local and regional government concerning the decommissioning phase. | Minimise and control through management and monitoring. | Decommissioning & Closure Phase | Impact managed | Turfvlakte ECO<br><br>HSE Manager<br><br>HR Manager |
| Decommissioning and removal of the Turfvlakte infrastructure | Socio-economic considerations | Reduced community investment | Exxaro shall develop exit strategies for all its community development initiatives. | Minimise and control through management and monitoring. | Decommissioning & Closure Phase | Impact managed | Turfvlakte ECO<br><br>HSE Manager<br><br>HR Manager |
| Rehabilitated mining areas | Climate Change | A decrease in average annual rainfall, coupled with an increase in average monthly temperatures and evaporation rates, will reduce the water availability to the plants used in rehabilitation of mining areas. This can impact negatively on the establishment of vegetation on these areas, and their stability in the long-term. | Post-closure monitoring of the re-vegetated areas on an annual basis. If required, apply new topsoil, fertilise, reseed/replant, and water areas where plants have been washed away or struggling to become established. | Minimise and control through management and monitoring. | Decommissioning & Closure Phase | Impact managed | Turfvlakte ECO<br><br>HSE Manager |

# 19.0 MECHANISMS FOR MONITORING COMPLIANCE WITH AND PERFORMANCE ASSESSMENT AGAINST THE ENVIRONMENTAL MANAGEMENT PROGRAMME AND REPORTING THEREON

The mechanisms for compliance monitoring with and performance assessment against the environmental management programme and reporting thereof, include:

- Monitoring of impact management actions.
- Monitoring and reporting frequency.
- Responsible persons.
- Time period for implementing impact management actions; and
- Mechanisms for monitoring compliance.

Table 69 lists the main environmental aspects that will be subjected to performance monitoring during all phases of the project. The monitoring requirements, frequencies and responsible parties are also listed.

The rehabilitation performance of all areas rehabilitated after decommissioning and closure, but prior to site relinquishment (i.e. the pre-site relinquishment monitoring period), will be documented in a dedicated biannual rehabilitation performance report until site relinquishment criteria are met. The report should reflect on the findings of the monitoring undertaken, rehabilitation performance, and whether corrective action is required.

The rehabilitation monitoring programme and proposed preliminary site relinquishment criteria (including required analysis criteria for surface rehabilitation and surface and groundwater) are presented in Table 70.

**Table 69: Mechanisms for monitoring compliance**

<table>
<tr><th rowspan="2">Aspect</th><th rowspan="2">Impacts requiring monitoring programmes / objectives</th><th colspan="3">Functional requirements for monitoring</th><th rowspan="2">Roles and responsibilities</th><th rowspan="2">Frequency of submission of performance assessment report</th></tr>
<tr><th>Detailed Actions</th><th>Monitoring Location</th><th>Parameters</th></tr>
<tr><td>Air quality</td><td rowspan="2">Emissions concentrations causing exceedances of the NAAQS beyond the mine boundary</td><td>Continued dust fallout monitoring using single direction dust buckets.</td><td>Continuous dust fallout monitoring at the mine boundary.</td><td>In accordance with the limits stipulated in the National Dust Control Regulations, 2013:<br><table><tr><th>Restriction areas</th><th>Dust fall rate ($mg/m^2$/day over a 30-day average)</th><th>Permitted frequency of exceedance</th></tr><tr><td>Residential areas</td><td>Dust fall < 600</td><td>Two per annum (not in sequential months)</td></tr><tr><td>Non-residential areas</td><td>600 < Dust fall < 1200</td><td>Two per annum (not in sequential months)</td></tr></table></td><td>Turfvlakte ECO<br>HSE Manager</td><td rowspan="2">Monthly internal reporting should be used to identify problem areas/ activities to target mitigation.</td></tr>
<tr><td>Air quality</td><td>Continuous fine particulate monitoring using an E-sampler or similar at 2 locations at the mine boundary.</td><td>Continuous $PM_{10}$ at the mine boundary.</td><td>In accordance with the limits stipulated in the NAAQS for $PM_{10}$:<br><table><tr><th>Pollutant</th><th>Averaging Period</th><th>Limit Value ($\mu g/m^3$)</th><th>Frequency of Exceedance</th><th>Compliance Date</th></tr><tr><td rowspan="2">Particulate matter <10 micrometres in diameter ($PM_{10}$) (c)</td><td>24 hours</td><td>75</td><td>4</td><td>Immediate</td></tr><tr><td>1 year</td><td>40</td><td>0</td><td>Immediate</td></tr></table></td><td>Turfvlakte ECO<br>HSE Manager</td></tr>
<tr><td>Soil quality</td><td>Maintain the soil quality along areas which will be developed for mining as well as areas adjacent to mine waste storage facilities.</td><td>Collection of at least one sample per hectare for developed areas or where visible signs of contamination is noted (spillage or seepage areas/zones)</td><td>All areas which will be developed for mining</td><td>- pH and salinity<br>- Major anions and cations<br>- Sulphate, phosphate, Nitrate, total dissolved solids, electrical conductivity<br>- Heavy metals and hydrocarbons</td><td>Turfvlakte ECO<br>HSE Manager</td><td>Annually</td></tr>
<tr><td>Soil stockpiles</td><td>Maintain and minimise the quality</td><td>Collection of at least one composite sample per stockpile</td><td>Soil stockpiles</td><td>- pH and Salinity<br>- Major anions and cations</td><td>Turfvlakte ECO</td><td>Annually</td></tr>
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| | and degradation of soil stockpiles | | | ■ Organic matter content for the topsoil<br>■ Content of major plant nutrients (CEC)<br>■ Major cations and anions<br>■ Metal and hydrocarbons<br>■ Stockpile height (<3 m) | HSE Manager | |
| Soil erosion | Mitigate and minimise soil erosion | Infrastructure and surface water bodies on-site to be maintained in accordance with the surface water management plan | Soil stockpiles<br>Developed areas<br>Haul roads | ■ Assess soil stockpile heights and conditions (i.e. gullies and rills)<br>■ Assess the condition and effectiveness of vegetation on the stockpiles<br>■ Assess any evidence of erosion (as per the Surface water management plan)<br>■ Assess the effectiveness of water versus other dust suppression substances (e.g. molasses or bitumen) | Turfvlakte ECO<br>HSE Manager | Annually, after rainy season |
| Land Use | Maintain and minimise land use change within the project area | Evaluation of land use within the project area using satellite imagery | Grootegeluk Turfvlakte Expansion project area | Collection of satellite imagery | Turfvlakte ECO<br>HSE Manager | Every two years |
| Surface water | To understand possible impacts on the Sandloop River water quality as a result of the opencast mining operations. | Continue with existing surface water monitoring conducted at the Sandloop River as stipulated in the Grootegeluk WUL. | As per the existing Grootegeluk Coal Mine WUL | Surface water quality parameters as stipulated in the WUL. | Turfvlakte ECO<br>HSE Manager | Monthly |
| Groundwater | To understand possible impact on groundwater quality during the operational phase. | Include the existing 9 boreholes, and any new boreholes, in the Grootegeluk Turfvlakte Expansion project area in the existing Grootegeluk Coal Mine groundwater monitoring plan to monitor the baseline/background conditions and groundwater quality at the Turfvlakte project area. | Existing 9 boreholes at the Turfvlakte project area as well as any new borehole locations as suggested by the hydrogeologist. | Groundwater quality parameters as stipulated in the WUL. | Turfvlakte ECO<br>HSE Manager | Bi-annually |
| Groundwater | Impact on groundwater level as a result of opencast mining operations. | Monitor static groundwater levels to ensure that any deviation of the groundwater flow from the idealised predictions are detected in time for intervention to be undertaken. | Existing 9 boreholes at the Grootegeluk Turfvlakte Expansion project area as well as any new borehole locations as suggested by the hydrogeologist. | Surrounding groundwater levels. | Turfvlakte ECO<br>HSE Manager | Bi-annually |
| Groundwater | Impact on groundwater flow as | Measure groundwater inflow in the backfilled pit areas. | The pit water levels should be monitored once mining and rehabilitation has ceased. | Groundwater inflow rate and recovery. | Turfvlakte ECO<br>HSE Manager | Quarterly |

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| | a result of opencast mining operations. | | | | | |
| Terrestrial ecology | Establishment and spread of alien invasive species. | ■ An alien invasive species (AIS) control programme must be developed and implemented on site during all phases of the proposed project.<br><br>■ It is recommended that the programme include:<br>▪ A combined approach using both chemical and mechanical control methods.<br><br>▪ Periodic follow-up treatments informed by regular monitoring.<br><br>▪ Monitoring should take place in disturbed areas, as well as adjacent undisturbed areas. | AIS control should be undertaken in both the project site, and natural habitat and rehabilitated areas immediately adjacent to the site. | Presence of alien invasive species as classified in accordance with the National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004) Alien and Invasive Species Regulations | Turfvlakte ECO<br><br>HSE Manager | Monthly |
| Wetlands / Pans | Impact on pans outside development footprint. | Monitoring of the water quality of the pans will continue until the trends indicate no changes. | Pans outside development footprint, inside project area. | Surface water quality parameters as stipulated in the WUL. | Turfvlakte ECO<br><br>HSE Manager | Quarterly |
| Noise | Noise increase at the boundary of the mine footprint and at the abutting residential areas | ■ Environmental noise monitoring must be done with calibrated Class 1 noise monitoring equipment:<br>▪ Monitoring data must be collated and discussed on a quarterly basis and noise levels to be evaluated in terms of the baseline noise levels during the construction phase.<br><br>▪ At the boundaries of the identified residential areas as well as at the mine footprint boundaries of the different mining areas.<br><br>▪ Monitoring reports must be compiled for each monitoring cycle and the results must be compared to the previous set of results to determine if there was a shift in the prevailing ambient noise levels | Boundary of the Grootegeluk Turfvlakte Expansion project area.<br><br>Boundaries of identified residential areas. | In accordance with the requirements of SANS 101033 of 2008 and the applicable noise regulations. | Turfvlakte ECO<br><br>HSE Manager | Monthly - until the potential shift in the prevailing ambient noise levels are determined<br><br>Quarterly – for the duration of the construction and closure phases.<br><br>Bi-annually during the operational phase when |

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<td></td>
<td></td>
<td><ul><li>Noise surveys to be conducted in terms of the recommendations of SANS 101033 of 2008 and the applicable noise regulations, by an environmental noise specialist.</li></ul></td>
<td></td>
<td></td>
<td></td>
<td>quarterly monitoring has indicated that noise levels have remained consistent.</td>
</tr>
<tr>
<td>Vibration</td>
<td>Air blast and Vibration</td>
<td>Monitoring programme for recording blasting operations:<ul><li>Ground vibration and air blast results</li><li>Blast information summary</li><li>Meteorological information at time of the blast</li><li>Video recording of the blast</li><li>Fly rock observations.</li></ul></td>
<td>At a minimum of seven monitoring positions identified for Pit 1 and Pit 2.
<table>
<tr><th>Description</th><th>Y</th><th>X</th></tr>
<tr><td>Railway line</td><td>59965.28</td><td>-2620795.17</td></tr>
<tr><td>Buildings / Structures</td><td>57422.05</td><td>-2621705.43</td></tr>
<tr><td>Bridge</td><td>57836.83</td><td>-2619761.73</td></tr>
<tr><td>D1675 Road</td><td>57595.00</td><td>-2621480.66</td></tr>
<tr><td>Building / Structure</td><td>58141.47</td><td>-2618979.14</td></tr>
<tr><td>Manketti Lodge</td><td>59746.58</td><td>-2618652.80</td></tr>
<tr><td>Buildings / Structures</td><td>61862.18</td><td>-2619759.82</td></tr>
<tr><td colspan="3">Note: These points will need to be re-defined after the first blasts done and the monitoring programme defined.</td></tr>
</table></td>
<td><ul><li>Ground vibration and air blast results</li><li>Blast information summary</li><li>Meteorological information at time of the blast</li><li>Video recording of the blast</li><li>Fly rock observations.</li></ul></td>
<td>Turfvlakte ECO<br>HSE Manager</td>
<td>Every blast</td>
</tr>
<tr>
<td>Vibration</td>
<td>Structural damage to nearby properties</td>
<td>Photographic surveys of all structures up to 1 500m from the pit areas.</td>
<td><table>
<tr><th>Description</th><th>Y</th><th>X</th></tr>
<tr><td>Railway Line</td><td>-57724.34</td><td>2618072.60</td></tr>
<tr><td>Medupi Power Station</td><td>-57431.65</td><td>2622390.43</td></tr>
</table></td>
<td>Visual observations</td>
<td>Turfvlakte ECO<br>HSE Manager</td>
<td>Pre-construction, thereafter biennially during the operational phase.</td>
</tr>
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| | | |
|---|---|---|
| Water Reservoirs | -59047.13 | 2621928.00 |
| Tailings Dams | -58687.76 | 2621786.30 |
| Buildings / Structures | -57977.92 | 2621532.99 |
| Buildings / Structures | -57284.09 | 2622152.11 |
| Buildings / Structures | -57422.05 | 2621705.43 |
| Conveyor | -57325.56 | 2621340.99 |
| Conveyor | -57608.62 | 2620471.60 |
| Conveyor | -57962.09 | 2619399.15 |
| D1675 Road | -57595.00 | 2621480.66 |
| D1675 Road | -58885.43 | 2621495.06 |
| D2649 Road | -60045.97 | 2621891.74 |
| Building / Structures | -58141.47 | 2618979.14 |
| Industrial Buildings | -57675.66 | 2618241.97 |
| D2816 Road | -59890.91 | 2618242.77 |
| D2001 Road | -60171.39 | 26185446.16 |
| D2001 Road | -59541.31 | 2618027.52 |
| Reservoir | -60314.01 | 2618920.85 |
| Buildings / Structures | -60262.50 | 2618342.33 |
| Buildings / Structures | -60030.53 | 2617805.13 |

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<tr><td></td><td></td><td></td><td><table>
<tr><td>Conveyor</td><td>-58447.32</td><td>2617801.36</td></tr>
<tr><td>Conveyor</td><td>-59658.90</td><td>2617479.64</td></tr>
<tr><td>Buildings / Structures</td><td>-60474.89</td><td>2620003.81</td></tr>
<tr><td>Buildings / Structures</td><td>-60872.99</td><td>2620138.16</td></tr>
<tr><td>Buildings / Structures</td><td>-60886.47</td><td>2620875.22</td></tr>
<tr><td>Buildings / Structures</td><td>-60876.52</td><td>2619666.49</td></tr>
</table></td><td></td><td></td><td></td></tr>
<tr><td>Traffic</td><td>- Risk of vehicle collision<br>- Risk of pedestrian accidents</td><td>Monitoring of traffic patterns and adherence to regulations and rules</td><td>Road D2001 (District Road)<br><br>Grootegeluk Coal Mine Entrance road</td><td>Unannounced visual observations</td><td>Turfvlakte ECO<br><br>HSE Manager</td><td>Weekly, until relaxation to monthly and quarterly justified as per traffic management plan.</td></tr>
<tr><td>Traffic</td><td>Degradation of Public Roads</td><td>The deterioration of public roads over time must be monitored and a maintenance plan must be negotiated with the Provincial Authority</td><td>Road D2001 (District Road)<br><br>Grootegeluk Coal Mine Entrance road</td><td>Visual observations</td><td>Turfvlakte ECO<br><br>HSE Manager</td><td>Quarterly</td></tr>
<tr><td>Socio-economic</td><td>Socio-economic considerations related to the project.</td><td>Local employment<br><br>Procurement sustainability of local economic development projects</td><td>N/A</td><td>As per the requirements of the Grootegeluk Coal Mine Social and Labour Plan</td><td>Turfvlakte ECO<br><br>HSE Manager</td><td>Annually</td></tr>
<tr><td>All Environmental Aspects</td><td>Dust emissions<br><br>Noise<br><br>Blasting and vibration<br><br>Surface and groundwater quality and quantity<br><br>Visual intrusion<br><br>Traffic</td><td>Maintaining a complaint register<br><br>Complaints should be investigated immediately and mitigative action taken where possible/ necessary.</td><td>N/A</td><td>N/A</td><td>Turfvlakte ECO<br><br>HSE Manager<br><br>Appointed Contractors</td><td>Monthly internal reporting on complaints received, including mitigation actions taken and feedback provided to complainants.</td></tr>
</table>

| | | | | | | |
|---|---|---|---|---|---|---|
| | Socio-economic considerations | | | | | |
| Rehabilitated areas | Maintain the quality and condition of rehabilitated areas | Continuous monitoring of rehabilitated areas for closure compliance | Disturbed areas | ■ Organic content of topsoil<br>■ Content of major plant nutrients<br>■ Contamination assessment (pH, metals, hydrocarbons, electrical conductivity, total dissolved solids, nitrates, sulphate and phosphates)<br>■ Volume of soil replaced | Turfvlakte ECO<br>HSE Manager | Annually |

**Table 70: Proposed Monitoring Programme and Preliminary Site Relinquishment Criteria at closure**

| Monitoring | | | | Site relinquishment criteria | | Reporting and corrective action | |
|---|---|---|---|---|---|---|---|
| **Component/ aspect** | **Monitoring objective** | **Monitoring network** | **Monitoring method and frequency** | **Metrics/target** | **Initial criteria (performance success)** | **Reporting** | **Recommended corrective action** |
| **Surface water** | | | | | | | |
| **In-stream surface water quality and flow** | Not expected to be relevant to the Grootegeluk Turfvlakte Expansion project area as the site has no defined surface drainage lines, however, should be re-evaluated and monitored after closure of Grootegeluk | N/A | | | | | |
| **Biomonitoring** | | N/A | | | | | |
| **Groundwater** | | | | | | | |
| **Groundwater quality** | To monitor ground water quality in both natural aquifers and mine workings, to track water quality changes (improvements) over time as a result of closure rehabilitation activities | Review operational groundwater monitoring and sampling network and revise as advised by a specialist | Review the operational groundwater monitoring plan and program, and revise to meet post-mining monitoring needs by:<br><br>Ensuring that key borehole sampling sites are retained (or new ones introduced as required) to monitor groundwater quality at key points in the mining rights area<br><br>Continuing to monitor the comprehensive suite of water quality parameters that allow an ion balance to be calculated (same as those analysed during operations) - provides assurance on accuracy of lab results, and ensure that all potentially harmful cations and anions are analysed<br><br>Groundwater samples will be collected bi-annually for chemical analysis by an accredited water laboratory<br><br>Monitoring of boreholes will continue for at least 5 years post-closure (or until a closure certificate is issued) | Water quality analyses show that groundwater at and beyond the mine boundary meets the National Water Quality Standards for potable water at 95$^{th}$ percentile (or as a minimum have a chemistry typical of baseline groundwater quality of the area)<br><br>The groundwater monitoring plan is able to demonstrate the movement and extent of any contaminated groundwater plumes<br><br>Offsite borehole water qualities are not impacted by the closed mine, and do not impact neighbours<br><br>The calculated ion balance for each water sample does not exceed a 5% imbalance (sanity check on lab results) | Groundwater samples show improving water qualities trending towards background levels | Results and findings will be compiled into a quarterly water report, with attached laboratory results<br><br>An annual compliance report will be compiled and submitted to the authorities for evaluation and comment as per license requirements. | Investigate the cause of any non-compliance in borehole water qualities (using the source – pathway – receptor model) and develop appropriate mitigation measures to reduce the generation of contamination at source where possible, or to contain or intercept polluted groundwater movement towards sensitive receptors where this is necessary |

| Monitoring | | | | Site relinquishment criteria | | Reporting and corrective action | |
|---|---|---|---|---|---|---|---|
| **Component/ aspect** | **Monitoring objective** | **Monitoring network** | **Monitoring method and frequency** | **Metrics/target** | **Initial criteria (performance success)** | **Reporting** | **Recommended corrective action** |
| **Groundwater flows/ levels** | To monitor the piezometric (water table) levels in all monitoring borehole openings to determine the dewatering impacts of mining, and to measure the rate of recharge to underground workings in closed mining areas | Water table heights measured at the same borehole sampling sites as above | Groundwater levels measured bi-annually<br><br>Monitoring will continue for at least 10 years post-closure (or until a closure certificate is issued) | Movements in groundwater level (mamsl/mbgl) to determine groundwater recharge rate | Rate of recharge of mine water corresponds with modelled predictions of the recharge rate<br>Mine water levels stabilise at predicted levels and do not enhance predicted seepage/decant rates | Results and findings will be compiled into a bi-annual site groundwater water report | Reassess and revise groundwater management plan for the mine to manage and mitigate possible water contamination |
| **Surface rehabilitation** | | | | | | | |
| **Land capability** | To measure rehabilitation performance against the land capability objectives committed to as part of next land use planning | All areas disturbed by mining activities and land reinstated by rehabilitation activities | Conduct a post-mining land capability assessment that includes:<br><br>An assessment of soil depth and soil bulk density on a 100 x 100 m grid<br>Digging of a soil test pit every 9 ha, to:<br><br>Collect soil samples for lab analysis of soil properties (bulk density & soil texture), record rooting depth, root density, and bio-perturbation, collect soil samples for lab analysis of soil (pH, resistance, organic carbon, major cations and anions)<br><br>Create land capability map for rehabilitated sites according to the Chamber of Mines' Rehabilitation Guidelines (2018)<br><br>Land capability assessment is typically a once-off exercise on rehabilitated units within 3 years of completion of the rehabilitation work | Land capability commitments are achieved | Site has an accurate post-mining land capability map based on ongoing assessment according to site-wide land capability commitments<br><br>The areas rehabilitated to different land capability classes in the post-mining landscape do not vary by more than 10% from defined land capability targets | | Consult with DMR on any land capability shortfalls that cannot be addressed with available topsoil resources and agree new post-mining land capability targets that will determine the scope of post-mining land uses, that can then be communicated with key stakeholders as part of the mine closure process<br><br>Use topsoil stockpile reserves, if available, to improve land capability, where possible<br><br>In-fill areas where differential settling has occurred, and re-shape to be free draining (towards maintaining prescribed land capability depths) |

| Monitoring | | | | Site relinquishment criteria | | Reporting and corrective action | |
|---|---|---|---|---|---|---|---|
| **Component/ aspect** | **Monitoring objective** | **Monitoring network** | **Monitoring method and frequency** | **Metrics/target** | **Initial criteria (performance success)** | **Reporting** | **Recommended corrective action** |
| **Soil fertility** | To achieve basal soil fertility levels that will support a self-sustaining vegetation cover (within 5 – 10 years of completion of rehabilitation) | All areas disturbed by mining activities and land reinstated by rehabilitation activities | Sample rehabilitated soils annually for the first 3 years, and every 3 years thereafter until fertility targets met or a closure certificate is issued<br><br>Analyse samples at a certificated soils laboratory | Soil fertility meets the minimum requirements for maintenance of the target vegetation communities.<br><br>Soil analyses indicated:<br>■ pH in range of 5.0 to 8.5<br>■ Resistance is >300 Ω,<br>■ P is >20 mg/kg, and<br>■ K is >100 mg/<br>■ N is in adequate supply so as not to induce yellowing of vegetation | Soil analyses indicate that soils on rehabilitated areas are not salinized, have the correct pH, and have sufficient levels of fertility to support a sustainable vegetation cover. | Findings will be reported in a soil fertility report, after each assessment | Where soil is deficient, ameliorate sufficiently to address the deficiency and to provide a sustainable vegetation cover in support of the next land use |
| **Surface erosion** | To monitor rehabilitated areas for soil erosion to ensure that a self-sustaining vegetation cover is established that will minimise soil loss through raindrop impact and rainfall runoff erosion | All areas disturbed by mining activities and land reinstated by rehabilitation activities | Conduct visual inspections for erosion (sheet, rill, and gulley erosion) on an annual basis for the first 3 years (end of wet season), and every 5 years thereafter until landform equilibrium is met | Visual inspections of rehabilitated areas indicate that erosion has been stabilised by rehabilitation activities, and is not significantly higher than surrounding natural areas | No new erosion seen on rehabilitated land after 5 years | Findings will be reported in an internal rehabilitation report after each assessment | Eroded areas will be stabilised by infilling and reshaping, and by establishing vegetation on the repaired areas/ bare patches, as required |
| **Vegetation establishment** | To ensure the successful establishment of suitable perennial grass species where appropriate, as well as the envisaged tree stations on rehabilitated areas, and that these perennial species persist in the rehabilitated landscape | All areas disturbed by mining activities and land reinstated by rehabilitation activities | Monitor the establishment and persistence of vegetation on rehabilitated areas (species composition and basal cover), using standard pasture assessment methods. To be undertaken by a suitably qualified specialist<br><br>Monitor annually for 3 years, then every 3 years until a sustainable vegetation cover has been established | The vegetation established on rehabilitated areas should comprise appropriate perennial grass species, one of which is a creeping grass, and which collectively provide a minimum basal cover of 15% after 3 years; as well as locally representative woody shrub species through natural succession | The vegetation established on rehabilitated areas should comprise appropriate perennial grass species, one of which is a creeping grass, and which collectively provide a minimum basal cover of 15% after 3 years; as well as locally representative woody shrub species through natural succession | Findings will be reported in an annual rehabilitation report | Where the rehabilitation targets for vegetation establishment are not met, re-seed and apply appropriate adaptive management strategies to correct any deterioration in the species composition and cover (e.g. review defoliation/ fertilisation practices and modify accordingly) |

| Monitoring | | | | Site relinquishment criteria | | Reporting and corrective action | |
|---|---|---|---|---|---|---|---|
| **Component/ aspect** | **Monitoring objective** | **Monitoring network** | **Monitoring method and frequency** | **Metrics/target** | **Initial criteria (performance success)** | **Reporting** | **Recommended corrective action** |
| **Invasive alien species** | To eradicate or control declared Category 1, 2 and 3 invader species on both rehabilitated land and on unmined areas within the mining rights area. To minimise the threat posed by invasive species to reinstated natural ecosystems and habitats, and biodiversity | All areas disturbed by mining activities and land reinstated by rehabilitation activities | Conduct a visual inspection for invasive species over the site on an annual basis, focussing on rehabilitated and previously disturbed areas, and on areas where invasive species have been eradicated<br><br>Inspect annually for the first 3 years after closure, and then every 5 years, at least, until closure | The site is free of declared alien invasive plant species (Cat 1 – 3 invader species as per CARA, 1983 & Cat 1a, 1b and 2 as per NEM:BA, 2004) | The site is free of declared alien invasive species (CARA Cat 1 – 3 & NEMBA 1a, 1b and 2) invader species), and if not compliant the control programmes in place are effective and are eradicating alien invasive plant species | Findings will be reported in a rehabilitation report after each assessment | Where measures do not effectively control/eradicate alien invasive plant species, review control measures and modify to improve effectiveness. |

# 20.0 IMPLEMENTATION OF THE EMPR

A number of activities must take place before commencement of construction. Some of these activities are not directly related to physical work on site, but are presented below, as they should be addressed before commencement of, or during the early phases of construction

## 20.1 Responsibility for EMPr Implementation

- Responsibility for implementation of the EMPr will rest with the Exxaro Coal (Pty (Ltd) Grootegeluk General Manager and the management team. The appointed Sustainability Manager will be responsible to ensure that all environmental activities, delegated to contractors operating at the open pit construction site, are implemented, the Sustainability Manager will be supported by the Groootegluk Environmental Section. Similarly, the Sustanability Manager will ensure that all conditions of the EMPr are implemented. It will furthermore be the responsibility of the Sustainability Manager to resolve any conflicts that may arise between Exxaro and contracting parties regarding implementation of the EMPr. (Such responsibilities are captured by the legal appointment of the Sustaiability Manager).
- Exxaro will ensure that the responsibility for implementing and adhering to the conditions of the EMPr forms part of the conditions of appointment of all contractors.
- Exxaro will ensure that all contracting companies, tendering for work, receive a copy of this EMPr and understand their responsibility to operate within the framework of the measures defined in this EMPr. When adjudicating tenders, Exxaro will ensure that contractors have made appropriate allowance for management of environmental matters.
- Exxaro will ensure that, upon appointment, all contracting companies, operating on the site, receive a copy of this EMPr and understand their responsibility to operate within the framework of the measures defined in this EMPr.
- Exxaro will ensure that contractor Safety, Health and Environmental (SH&E) induction includes environmental and social issues and awareness training ("Environmental Awareness Plan", see Section 21.0 of this report) to build capacity of the Grootegeluk Turfvlakte Expansion Project personnel and contract staff regarding management of the environment.
- The Sustanability Manager or a representative will brief contractors about no development/no go areas. These will include:
  - No access to neighbouring properties without prior approval; and
  - No access to fenced-off sensitive areas.
- Exxaro will appoint a fulltime Environmental Control Officer (ECO) to oversee the implementation of the EMPr during all phases of the project.
- Exxaro will appoint a responsible person to audit the implementation of, and adherence to this EMPr. This party will be an independent environmental practitioner.
- The Sustaiability Manager will bring to the attention of the General Manager any major environmental incident or breach of the conditions of the EMPr, within 24 hours of occurrence of such event. If the environmental incident constitutes a breach of any permit or licence condition, the General Manager will notify the controlling authority within 48 hours of such an incident.

## 20.2 Responsibility of contractors

- Each contracting company will receive a copy of the EMPr at time of tender. Each contractor must familiarise himself with the required environmental management measures and ensure that contracting prices allow for environmental costs.
- Appointed contractors must keep their copies of the EMPr on site. It is the responsibility of the contractors to ensure that all their staff are aware of the measures applicable to their area of work.
- It is the responsibility of the contractors to bring to the attention of the Turfvlakte Sustainability Manager any environmental incident or breach of the conditions of the EMPr, within 24 hours of occurrence of such event through the company's Incident Reporting System.

# 21.0 ENVIRONMENTAL AWARENESS PLAN

As stipulated in Section 20.0 above, environmental conditions will be included in any operational contracts, thereby making contractors aware of the potential environmental risks associated with the project and the necessity of implementing good environmental and housekeeping practices.

The following principles and training will apply to the Environmental Awareness Plan and the Environmental Management System (EMS):

- All personnel, including contactors, will as a minimum undergo general SHE induction and environmental management system (EMS) training.
- The SHE Manager will identify the SHE training requirements for all Grootegeluk Turfvlakte Expansion Project personnel and contractors. The training requirements will be recorded in a training needs matrix, indicating particular training that must be undertaken by identified personnel and contractors. The training matrix will be administered by Exxaro's Human Resources Department (HRD).
- Development of the Training Programme, which will include:
  - Job specific training – training for personnel performing tasks which could cause potentially significant environmental impacts.
  - Assessment of extent to which personnel are equipped to manage environmental impacts.
  - Basic environmental training.
  - EMS training.
  - Comprehensive training – on emergency response, spill management, etc.
  - Specialised skills.
  - Training verification and record keeping.
  - Periodic re-assessment of training needs, with specific reference to new developments, newly identified issues and impacts and associated mitigation measures.

## 21.1 General Awareness Training

The HRD Manager, together with the SHE Manager, will be responsible for the development of, or facilitating the development of, the required general SHE induction and awareness training. A general environmental awareness training module will be developed and integrated into the general induction programme. The general awareness training must include the Environmental Policy, a description of the environmental impacts and aspects and the importance of conformance to requirements, general responsibilities of Exxaro personnel and contractors with regard to the environmental requirements and a review of the emergency procedures and corrective actions.

A Training Practitioner or the Environmental Control Officer (ECO) will conduct the general awareness training. The training presenter will keep a record of the details of all persons attending general awareness training. Such attendance registers shall indicate the names of attendants and their organisations, the date and the type of training received.

## 21.2 Specific Environmental Training

- Specific environmental training will be in line with the requirements identified in the training matrix; and
- Personnel whose work tasks can impact on the environment will be made aware of the requirements of appropriate procedures/work instructions. The SHE Manager will communicate training requirements to responsible supervisors to ensure that personnel and contractors are trained accordingly.

## 21.3 Training Evaluation and Re-training

- Effectiveness of the environmental training will be reflected by the degree of conformance to EMPr requirements, the result of internal audits and the general environmental performance achieved at Grootegeluk Coal Mine.
- Incidents and non-conformances will be assessed through the Internal Incident Investigation and Reporting System, to determine the root cause, including the possible lack of awareness/training.
- Should it be evident that re-training is required, the SHE Manager will inform the Heads of Departments of the need and take the appropriate actions.
- General awareness training of all personnel shall be repeated annually.
- The re-induction shall take into consideration changes made in the EMPr, changes in legislation, Grootegeluk Coal Mine’s current levels of environmental performance and areas of improvement.

## 21.4 Emergency Procedures

Grootegeluk Coal Mine has a procedure in place in the event of an environmental emergency. This plan will also be applicable to the Grootegeluk Turfvlakte Expansion Project operations and is:

- Available from members of the Emergency and Rescue Teams. A copy is kept at their place of work, their vehicles and their private residences.
- The plan is revised on an annual basis.
- The Head of Risk Control Management is responsible to revise and co-ordinate the issuing of the plan. The revision is done in consultation with the Manager Sustainablity and the Environmental Specialsits.
- The divisional managers are responsible for updating/review of the page/s with regard to their divisions before the next revision is date.
- The updating/review is done in electronic format within the scheduled timeframe.
- All previous revisions are destroyed on publishing the latest revision.

The Mine Emergency Plan can be obtained from Grootegeluk Coal Mine for more detailed information.

The following emergency procedures and responses are relevant to the project:

- The Sustaianbility Manager shall define emergency reporting procedures for the Grootegeluk Turfvlakte Expansion Project in line with existing emergency procedures implemented at Grootegeluk Coal Mine.
- All personnel shall be made aware of emergency reporting procedures and their responsibilities.
- Any spills will be cleaned up immediately in accordance with relevant legislation and approved operational procedures.
- Telephone numbers of emergency services, including the local firefighting service, shall be conspicuously displayed.

# 22.0 UNDERTAKING

The environmental assessment practitioner hereby confirms:

- The correctness, to the best of her knowledge, of the information provided in the specialist reports and of information provided by Exxaro. The information was accepted as being as reliable as information generated during an EIA, and provided in good faith, can be.
- The inclusion of comments and inputs from stakeholders and I&APs.
- The inclusion of inputs and recommendations from the specialist reports where relevant.
- That the information provided to I&APs and the responses to comments and inputs made by the I&APs are correctly reflected herein.

## 23.0 UNDERTAKING REGARDING CORRECTNESS OF INFORMATION

**I, Marié Schlechter herewith undertake that the information provided in the foregoing report is correct and that the comments and inputs from stakeholders and I&APs have been correctly recorded in this report.**

**Date: ___________________________**

## 24.0 UNDERTAKING REGARDING LEVEL OF AGREEMENT

**I, Marié Schlechter herewith undertake that the information provided in the foregoing report is correct and that the level of agreement with I&APs and stakeholders has been correctly recorded and reported herein.**

**Date: ___________________________**

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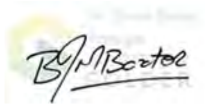
# Signature Page

**Golder Associates Africa (Pty) Ltd.**

Marié Schlechter
*Environmental Assessment Practitioner*



Dr Brent Baxter
*Environmental Assessment Practitioner*

MS/BB/ms

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**APPENDIX A**

# Document Limitations

**APPENDIX B**

# CV of Environmental Assessment Practitioner (EAP)

**APPENDIX C**

# Stakeholder Database

**APPENDIX D**

# Stakeholder Letter, Registration and Comment Sheet

**APPENDIX E**

# Newspaper Advert and Site Notice

**APPENDIX F**

# Authority Correspondence

**APPENDIX G**

# Comment and Response Report (CRR)

**APPENDIX H**

# Air Quality Assessment

**APPENDIX I**

# Noise Assessment

**APPENDIX J**

# Blasting and Vibration Assessment

**APPENDIX K**

# Visual Assessment

**APPENDIX L**

# Traffic Assessment

**APPENDIX M**

# Terrestrial Ecology Assessment

**APPENDIX N**

# Protected Trees Assessment

**APPENDIX O**

# Wetland Assessment

**APPENDIX P**

# Soil, Land Use and Land Capability Assessment

**APPENDIX Q**

# Cultural and Heritage Assessment

**APPENDIX R**

# Palaeontology Assessment

**APPENDIX S**

# Socio-economic Assessment

**APPENDIX T**

# Groundwater Assessment

**APPENDIX U**

# Surface Water Assessment

**APPENDIX V**

# Greenhouse Gas Assessment

**APPENDIX W**

# Decommissioning, Rehabilitation and Mine Closure Plan, Environmental Risk Assessment and Annual Rehabilitation Plan

**APPENDIX X**

# Climate Change Assessment

**APPENDIX Y**

# National Environmental Screening Tool – Grootegeluk Turfvlakte Expansion Project Assessment

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