SOIL AND AGRICULTURAL POTENTIAL ASSESSMENT

PHASE 1 – SITE SENSITIVITY VERIFICATION AND PLAN OF STUDY

FOR THE PROPOSED BCR COAL (PTY) LTD, VLAKFONTEIN COAL MINE, LOCATED IN THE MSUKALIGWA LOCAL MUNICIPALITY, MPUMALANGA

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Final Version
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LAND MATTERS
ENVIRONMENTAL CONSULTING

Declaration of Independence by Specialist

I, Rowena Harrison**,** in my capacity as a specialist consultant, hereby declare that I –

- Act as an independent soil consultant.
- Do not have any financial interest in the undertaking of the activity, other than remuneration for the work performed in terms of the National Environmental Management Act, 1998 (Act 107 of 1998).
- Have and will not have vested interest in the proposed activity proceeding.
- Have no, and will not engage in, conflicting interests in the undertaking of the activity.
- Undertake to disclose, to the competent authority, any material information that has or may have the potential to influence the decision of the competent authority or the objectivity of any report, plan or document required in terms of the National Environmental Management Act, 1998 (Act 107 of 1998).
- Will provide the competent authority with access to all information at my disposal regarding the application, whether such information is favourable to the applicant or not.
- Based on information provided to me by the project proponent and in addition to information obtained during the course of this study, have presented the results and conclusion within the associated document to the best of my professional ability.
- Undertake to have my work peer reviewed on a regular basis by a competent specialist in the field of study for which I am registered.

An abridged CV of the author is provided in Appendix C as per the 'Minimum Report Content Requirements' for Specialist Reports (as per GN 320 GG 43110, dated 20 March 2020)

Rowena Harrison
Soil Scientist
SACNASP Reg. No. 400715/15
Date: 2nd August 2022

EXECUTIVE SUMMARY

Land Matters Environmental Consulting (Pty) Ltd was appointed by Environmental Management Assistance (Pty) Ltd on behalf of BCR Coal (Pty) Ltd to conduct a desktop soil and agricultural potential assessment and inform the required Scoping Report (Phase 1) associated with the proposed establishment of the Vlakfontein Coal Mine. BCR Coal (Pty) Ltd is proposing the establishment of an open pit coal mining operation on Portion (Ptn) 2, Ptn 11 and Ptn 21 of farm Vlakfontein 108 IT and Ptn 1, 7, 14, and 12 of the farm Welgelegen 107 IT, within the Msukaligwa Municipality, Mpumalanga.

The terms of reference for the study were as follows:

- A desktop investigation of the soils associated with the study site. This was obtained from both the Soil and Terrain (SOTER) database as well as the land type database. The land type data are classified according to the Binomial System of 1977. Soil data were extracted from the land type information and re-classified as per the Soil Classification Working Group (2018).
- Describe the geology, topography, watercourses, and climate of the site.
- Describe the broad scale agricultural potential of the site based on the desktop information attained from the land type data, current activities on site, slope climatic data, and wetness.
- Confirm or dispute the project site's current environmental sensitivity classification of High for Agricultural Production as identified by the screening tool.
- Provide a plan of study for the Environmental Impact Assessment phase (Phase 2) of the soil and agricultural assessment.

Due to the desktop assessment nature of the report, a number of databases were investigated including the SOTER database, land type data, topography, and water resources to determine the broad scale agricultural productivity of the proposed mining site. The proposed mining site is located in an area characterised by summer rainfall patterns, with a mean annual precipitation of 883mm. The bulk of the rainfall occurs between October and March (summer months) in the form of storms. Mean temperatures vary between 9.0 ^{O}C to 17.9 ^{O}C for the region. The area is coldest in July and hottest in October to December. The topography of the proposed mining site is characterised by rolling hills, with slopes ranging from 2 % to 10 % and averages of 2.5 %. Slope and topography are not considered a limitation to agricultural production within the site. The National Wetland Map 5 (NWM5) database was utilised to assess the project area. A number of wetland systems were identified within the proposed mining site. These wetland systems are classified as seeps, channelled valley-bottom wetlands, and depressions (pans). Wetland systems are largely located outside of current agricultural activities including cultivation practices. The NWM5 categorises the wetlands as Critically Endangered, poorly protected, or not protected at all, and at high risk to loss, with only the associated depressional systems being classified as Least Concern and at a moderate risk to loss.

Based on the latest available database (2016) under the SOTER model, the site has been classified as containing red, yellow, and greyish soils with low to medium base statuses. These are classified as per the South African classification system as either Oxidic soils or Plinthic soils. The land type database was then investigated to further refine the classification of soils within the site. According to the land type database, the proposed mining site is situated within an area classified as having a plinthic catena.

Potential soils to be found within the study site are therefore most likely to be associated with the plinthic soils. Plinthic soils consist of a topsoil (Orthic A horizon) which grades into a soft or hard plinthic material either directly or indirectly via a red apedal B, yellow brown apedal B or an albic horizon. These soils are identified through the presence of concentrated mottling and as a result of this, are associated with a fluctuating water table and indicate at least seasonal saturation. Soil forms are represented by either Hutton, Bainsvlei, Avalon and Longlands forms as one moves downslope from the top of a hillslope catena, with one or other gley soil (e.g. Rensburg, Willowbrook, Katspruit, Champagne forms) in the valley bottom regions.

Depending on the depth of the plinthic horizon (and therefore the depth of saturation), these soils can present problems for cultivation as a result of periodic waterlogging. However, if the plinthic horizon is identified at depth and is overlain by a red or yellow brown apedal horizon, which is freely draining, these soils can be very productive for the cultivation of crops such as maize. By combining the land type data with the information obtained from the BCR Coal Mining Work Programme and the drilling of exploration boreholes, it was determined that the soils within the proposed mining site (outside of the wetland areas) are likely to consist of a free draining upper solumn of a red apedal, yellow brown apedal, or albic horizon, which then grades into a plinthic horizon. This is the best-case scenario for crop production within the area and as such these soils are classified as productive for cultivation.

Further to the determination of the soils, topography, climate and water resources within the site, an investigation of historic aerial imagery was undertaken to determine the types of activities which have occurred was undertaken. Historic aerial imagery shows that the site has long been utilised for crop cultivation, further implying that the soils within the site are productive. Current aerial imagery of the site shows that approximately 70% of the site is utilised for crop cultivation, with the remaining 30% either classified as wetland systems or more terrestrial grasslands which may be utilised for pasture.

In order to verify the classification of the site as ‘high’ for agricultural production as per the ‘National Web Based Environmental Screening Tool site (Department of Forestry, Fisheries, and the Environment), a number of factors were taken into consideration. These included the potential soil texture, soil depth, soil permeability, slope/topography, current activities on the site as well as the climate. With the exception of soil permeability as a result of saturation of the soils, no other factors are considered limitations to agricultural production, within the site.

The proposed BCR Coal Vlakfontein Mine site therefore consists of both areas which are classified as being productive and areas which are subject to limitations as a result of saturation and the associated presence of wetland systems. Given that the majority of the site (70%) is categorised as agriculturally productive, the site sensitivity classification of ‘high’ for agricultural production is verified. It must be noted that this is based on a thorough desktop assessment of the site, and a field investigation of the soils present within the site is required to ground-truth these findings.

The proposed BCR Coal Vlakfontein Mine will involve both the operations of the open-cast coal mine as well as the development of associated infrastructure. The entire site as well as neighbouring sites

will be impacted by the activities of the mine. Potential impacts to the soils and agricultural potential of the study site are associated with (i) the loss of agricultural land; (ii) soil compaction and exposure of topsoil which could lead to erosion and (iii) potential pollution of the soils as a result of both construction related activities for the associated infrastructure as well as the operations of the mine.

Following the soil and agricultural desktop assessment of the proposed BCR Coal Vlakfontein Mine, the site has been confirmed as being located within an area that has a high sensitivity for agricultural productivity. Given the verified 'high' classification of the proposed mining site for agricultural production, phase 2 of the assessment must include a full Agricultural Agro-Ecosystem Specialist Assessment. This assessment must include a field investigation of the proposed BCR Coal Vlakfontein Mine site and adhere to the reporting requirements for Agricultural Agro-Ecosystem assessments as per the Government Notice No. 320 published in the Government Gazette 43110.

Based on the information obtained during the desktop site sensitivity verification assessment, it is concluded that impacts of the proposed BCR Coal Vlakfontein Mine on the agricultural productivity within the study area will be both direct and indirect Direct loss of agriculturally productive land is likely to occur from the open cast mining operations as well as the development of associated infrastructure. Indirect impacts are likely on neighbouring properties, both from soil and water pollution sources, as well as an increase in air pollution and traffic within the area, having knock-on effects on the viability of agricultural operations within close proximity to the proposed mine.

Based solely on the outcomes of the desktop assessment of the of the agricultural productivity of the proposed mining site, coupled with the location of the site in an agricultural setting, it is the opinion of the author that the mine is not supported from an agricultural perspective. It must be noted that the opinion given in this report should be utilised as preliminary 'red flag' for the proposed activity within the site. The opinion of the author could change depending on the outcomes of phase 2 of the assessment, and in particular the findings of the soil assessment, the current activities on site, as well as the assessment of the current productivity of the site. This information is not yet known and is thus a limitation to the reasoned opinion given. Furthermore, the opinion does not take into consideration any proposed mitigation measures or layout changes that could avoid more productive agricultural areas as well as be utilised to reduce impacts to the agricultural productivity of neighbouring properties. These factors will form part of phase 2 of the assessment.

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1 INTRODUCTION

1.1 Project Locality and Description

Land Matters Environmental Consulting (Pty) Ltd was appointed by Environmental Management Assistance (Pty) Ltd on behalf of BCR Coal (Pty) Ltd to conduct a desktop soil and agricultural potential assessment and inform the required Scoping Report (Phase 1) associated with the proposed establishment of the Vlakfontein Coal Mine, located along the N17 between Ermelo and Chrissiesmeer in the Msukaligwa Municipality, Mpumalanga (Figure 1).

BCR Coal (Pty) Ltd is proposing the establishment of an open pit coal mining operation on Portion (Ptn) 2, Ptn 11 and Ptn 21 of farm Vlakfontein 108 IT and Ptn 1, 7, 14, and 12 of the farm Welgelegen 107 IT (Figure 2). The mine will require associated infrastructure in order to operate and these include:

- Access and haul roads including the upgrading of the access point to the mining area.
- Contractor's yard with septic/chemical ablution facilities.
- Offices.
- Weighbridge, workshop, and stores (with septic/chemical ablution facilities).
- Diesel facilities and a hardstand.
- Power and water.
- Stockpiles for topsoil, overburden (waste), subsoil/softs, and ROM.
- Crushing and screening facility.
- Surface water management measures (stormwater diversion berms and trenches; pollution control dams etc).
- Medical station; and a
- Diesel generator

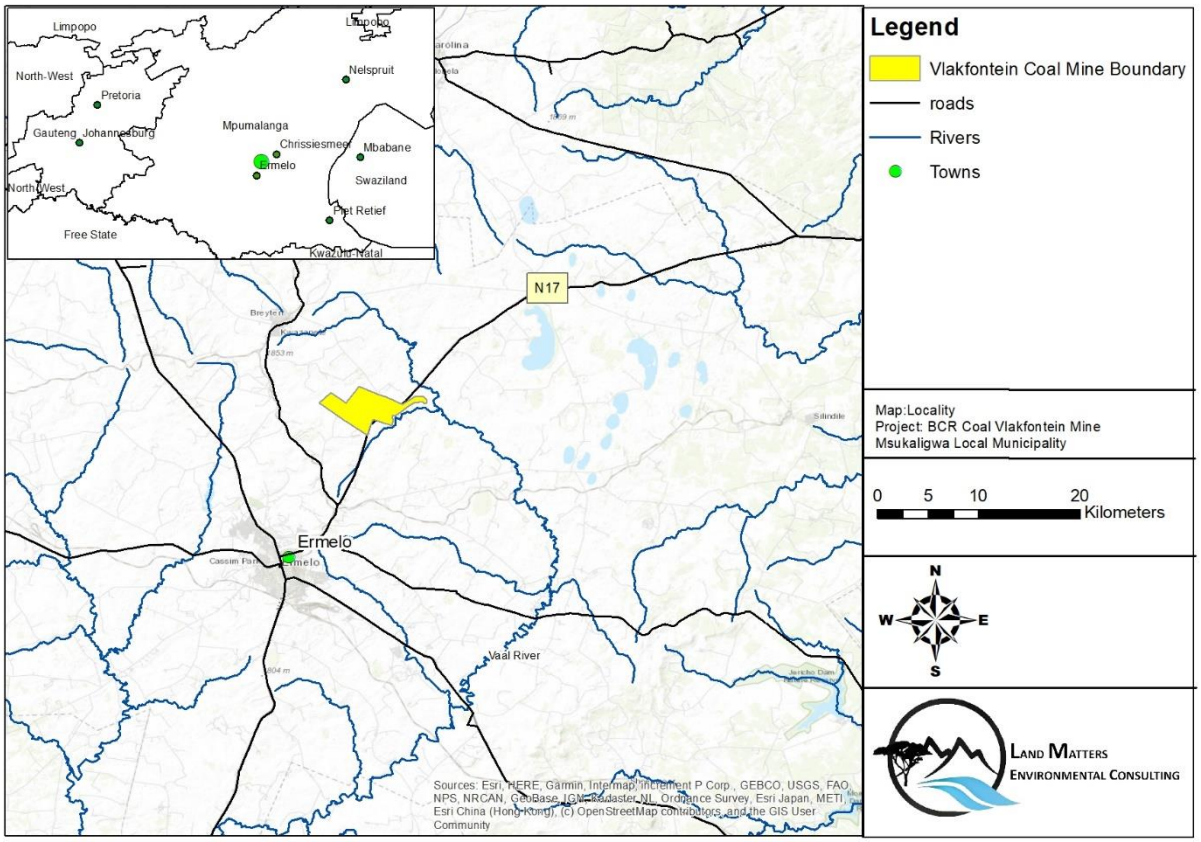

Figure 1: Locality map of the BCR Vlakfontein Coal Mine site

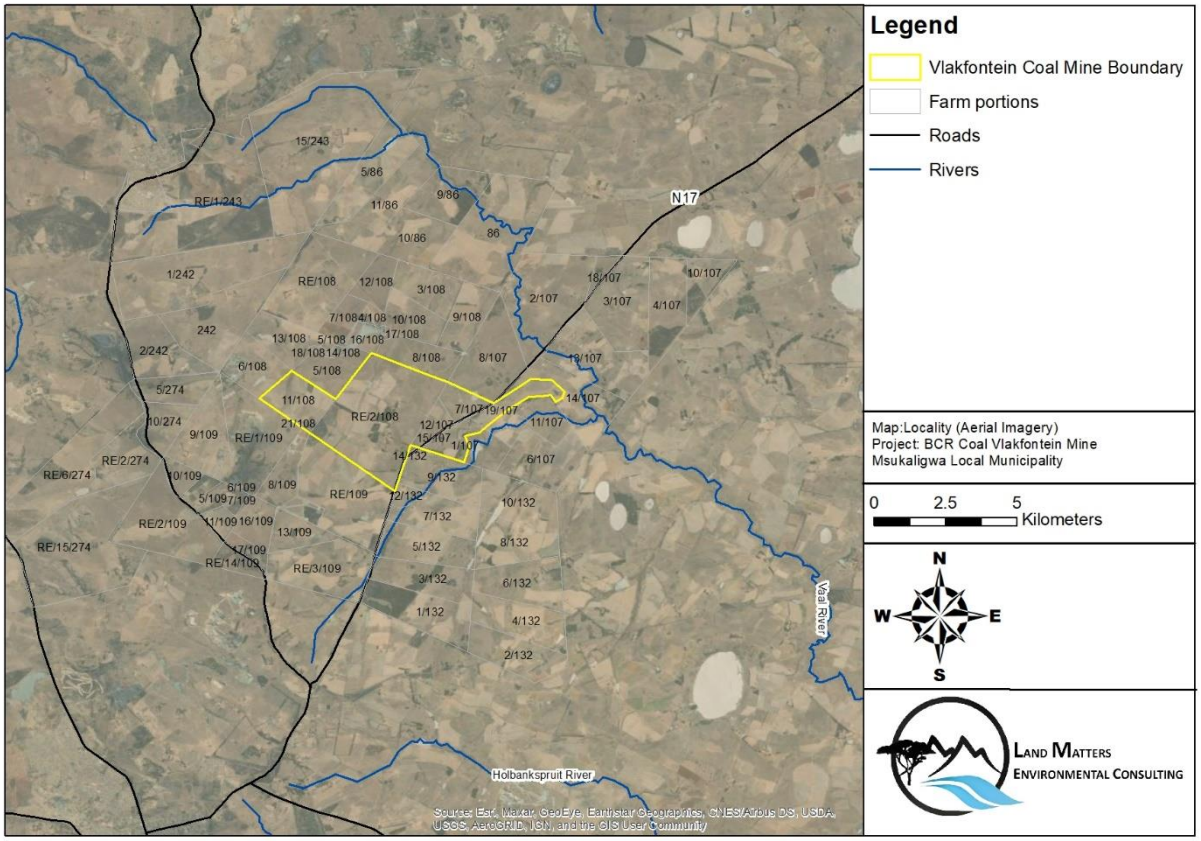

Figure 2: Aerial map of the BCR Vlakfontein Coal Mine site

1.2 Screening tool

The outputs of the 'National Web Based Environmental Screening Tool site (Department of Forestry, Fisheries, and the Environment), indicated that the study site was classified as having a 'high' sensitivity to agricultural production (Figure 3). The primary aim of Phase 1 of this assessment was therefore to confirm or dispute the site's current environmental sensitivity classification of 'high' for agricultural production. This is undertaken by determining the broad scale soil types and agricultural capability and potential of the property on which the proposed coal mine will be contained. Furthermore, a recommended plan of study for completion of the Environmental Impact Assessment phase (Phase 2) was provided. This was undertaken according to the protocols for a specialist Agricultural Assessments as per Government Notice No. 320; Government Gazette No. 43110 of 2020.

Very High sensitivity	High sensitivity	Medium sensitivity	Low sensitivity
	X		

Figure 3: Agricultural theme sensitivities identified (Department of Environmental Affairs, 2022)

1.3 Scope of this Assessment

The terms of reference for the current study were as follows:

- A desktop investigation of the soils associated with the study site. This was obtained from both the Soil and Terrain (SOTER) database as well as the land type database. The land type data are classified according to the Binomial System of 1977. Soil data were extracted from the land type information and re-classified as per the Soil Classification Working Group (2018).
- Describe the geology, topography, watercourses, and climate of the site.

- Describe the broad scale agricultural potential of the site based on the desktop information attained from the land type data, current activities on site, slope climatic data, and wetness.
- Confirm or dispute the project site's current environmental sensitivity classification of High for Agricultural Production as identified by the screening tool.
- Provide a plan of study for the Environmental Impact Assessment phase (Phase 2) of the soil and agricultural assessment.

1.4 Assumptions and Limitations

It is difficult to apply pure scientific methods within a natural environment without limitations or assumptions. The following apply to this study:

i. No field investigation took place for Phase 1 of this study. As such likely soil forms that are present on the site were inferred from the Soil and Terrain (SOTER) database, as well as the land type data for the area.
ii. Given the desktop nature of the study, the results presented relied upon the availability of desktop spatial information pertaining to both the soils and agricultural potential of the site. The accuracy of the information presented is thus strongly dependant on the accuracy of the spatial datasets interrogated. Soil forms and properties could be different from what is presented in this report and need to be ground-truthed during Phase 2 of the assessment. This may have an impact on the identified agricultural potential of the site.

1.5 Reporting Conditions

The findings, results, observations, conclusions, and recommendations provided in this report are based on the author's best scientific and professional knowledge as well as information available at the time of compilation. The author, however, accepts no liability for any actions, claims, demands, losses, liabilities, costs, damages, and expenses arising from or in connection with services rendered, and by the use of the information contained in this document. No form of this report may be amended without the prior written consent of the authors.

2 METHODOLOGY

2.1 Assessment techniques and tools

A desktop investigation was undertaken to compile this site sensitivity verification study.

The desktop study involved the examination of aerial photography and Geographical Information System (GIS) databases. The study made use of the following data sources:

- Google Earth™ satellite imagery was used at the desktop level.
- Relief dataset from the Surveyor General was used to calculate slope.
- Climatic data was obtained using a dataset from 1982 to 2012 on the climate-data.org website.
- Historical imagery was obtained from the Department of Rural Development and Land Reform and the National Geospatial Information website (http://cdngiportal.co.za/cdngiportal/)
- Geology dataset was obtained from the Mining Work Programme (BCR Coal, 2022).

- Vegetation type dataset from Mucina & Rutherford (2006), with amendments by SANBI (NBA, 2018) were used in determining the vegetation type of the study area.
- The National Wetland Map 5 dataset (Van Deventer et al, 2018) was used in determining any wetlands and watercourses within the study site.

Topography was also taken into account during the desktop approach, as together with soil form, it plays a large part in determining the land potential of the study site as well as any rehabilitation measures that may need to be taken. Lastly, climate is used as an important determinant in the agricultural potential of the site. Climate determines the volume of precipitation, the type of precipitation, the seasonal occurrence, soil moisture, evaporation rate, as well as the effect of sunshine hours, heat and chill units on crop yield and ground cover. The information gathered from the desktop assessment was utilised to identify the broad scale agricultural potential of the site.

3 RESULTS

3.1 Climate

The climate of the larger study area is characterised by summer rainfall patterns, with a mean annual precipitation of 883mm. The bulk of the rainfall occurs between October and March (summer months) in the form of storms. These high intensity rainfall conditions are conducive to high levels of surface runoff and subsequent erosion where soils are shallow, occur on steep slopes or are overgrazed. The wettest time of the year is December with an average of 172mm and the driest is June with 7mm. The seasonality of precipitation is a driving factor behind the hydrological cycles of water resources within the area. Typically, watercourses have a higher flow rate during the summer months.

Mean temperatures vary between 9.0^{O}C to 17.9^{O}C for the region. The area is coldest in July with average minimum temperatures of 2.7^{O}C and hottest in October to December with average maximum temperature of 23 ^{O}C (Climate-data.org; Mucina & Rutherford, 2006).

3.2 Topography

The proposed Vlakfontein mining site is located within an area characterised by rolling hills. The study site ranges in altitude from approximately 1670m above sea level in the north-eastern portion to 1760m above sea level in the more southern and western portions (Figure 4). Slopes are generally gentle to moderate and range from 2% to 10%, with averages of 2.5% (Figure 5). As such slope is not expected to be a limitation to agricultural production within the site.

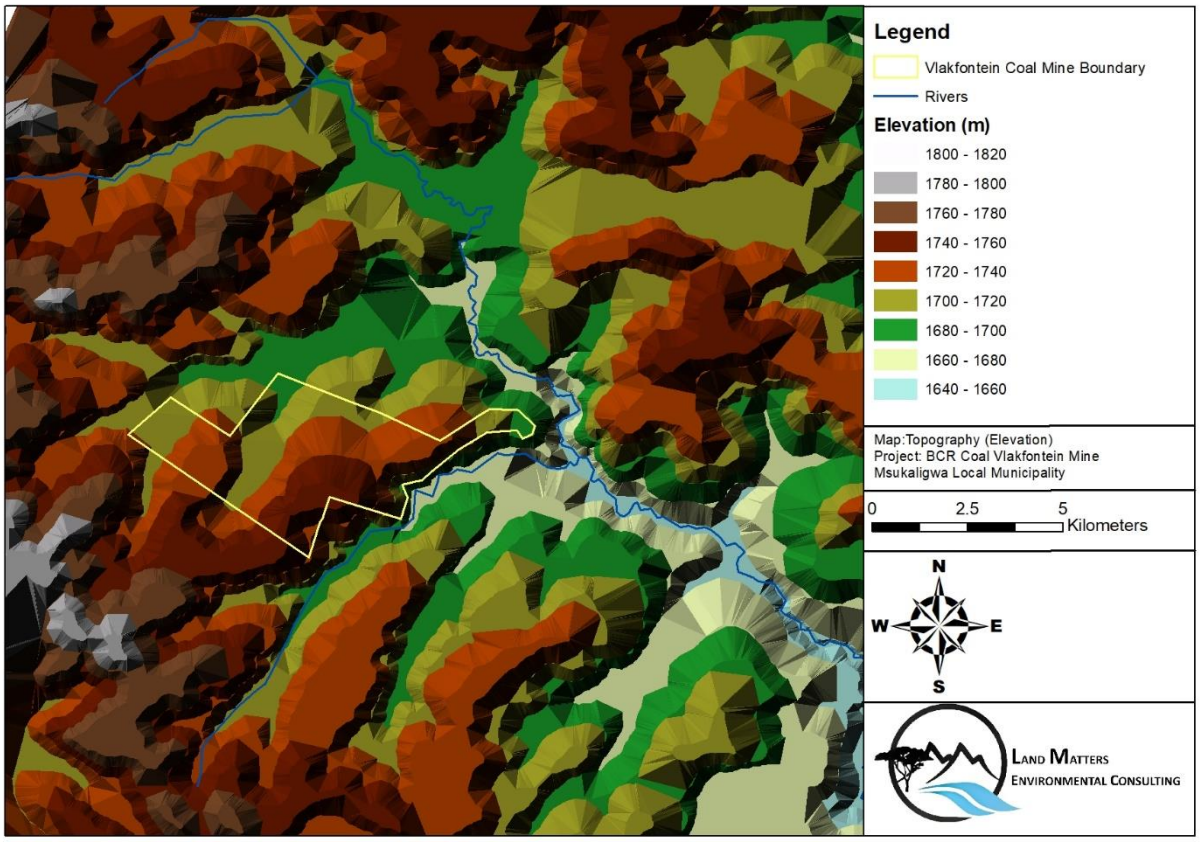

Figure 4: Topography (elevation) associated with the BCR Vlakfontein Mine site

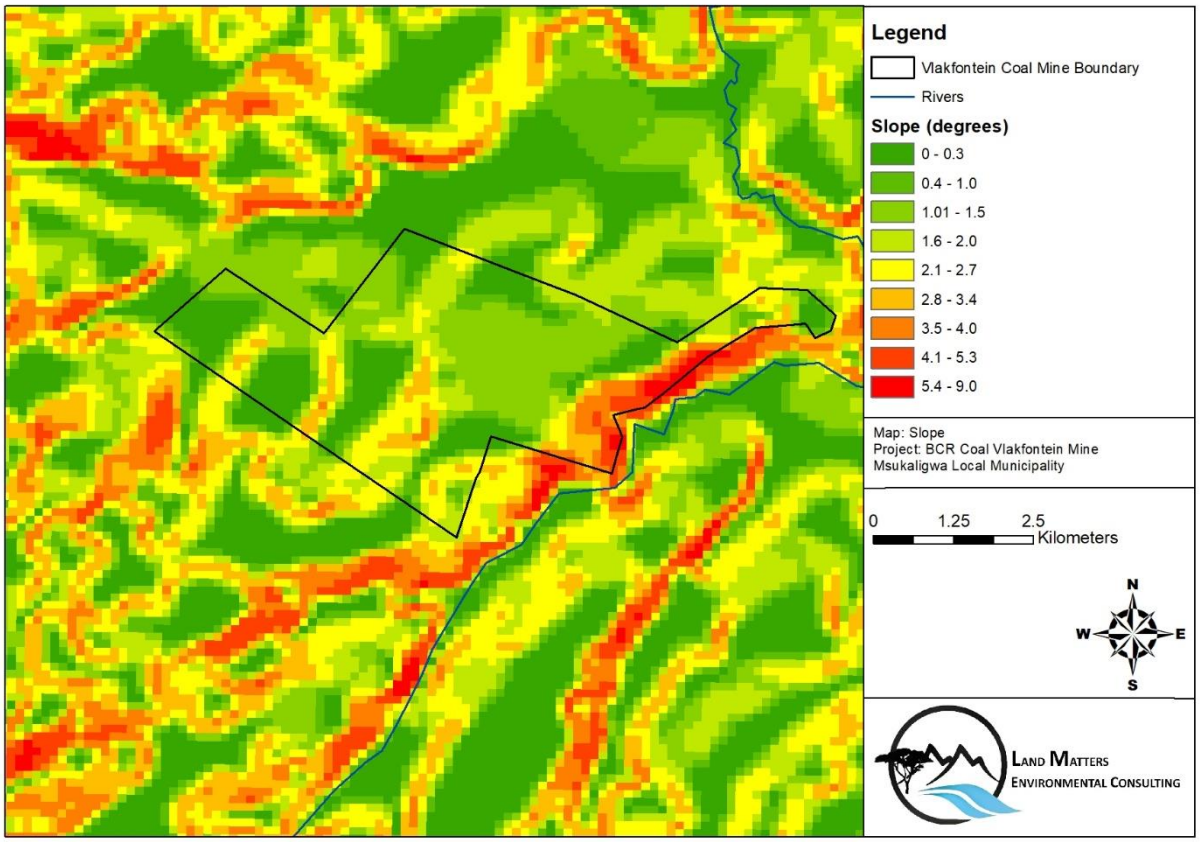

Figure 5: Slope of the BCR Vlakfontein Mine site in degrees

3.3 Wetland systems

The recent publication of the National Wetland Map 5 (Van Deventer et al, 2019) (NWM5) database forms part of the National Biodiversity Assessment (2018), within the category of the Inland Aquatic (Freshwater) Realm. This project is a multi-partner project through the CSIR and SANBI. The NWM5 has significantly improved the representation of inland wetland ecosystem types. The representation of the extent of inland wetlands has improved by 123%, whereas the incorrect representation of terrestrial ecosystems as wetlands has been reduced (Van Deventer et al, 2018).

The NWM5 was utilised to assess the project area. As shown in Figure 6, a number of wetland systems are located within the proposed mining site. These wetland systems are classified as seeps, channelled valley-bottom wetlands, and depressions. Wetland systems are largely located outside of current agricultural activities including cultivation practices. The NWM5 categorises the wetlands as Critically Endangered, poorly protected or not protected at all, and at high risk to loss, with only the associated depressional (pan) systems being classified as Least Concern and at a moderate risk to loss (Van Deveter et al., 2019).

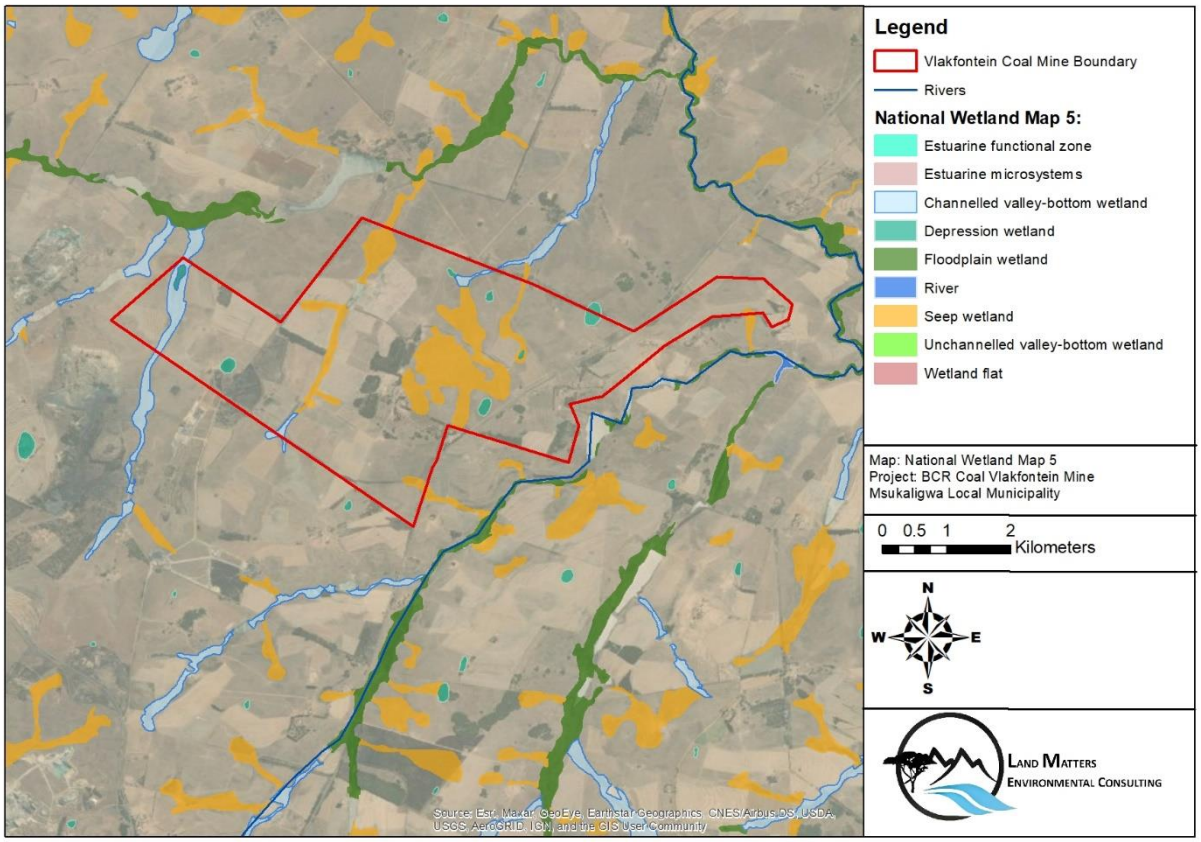

Figure 6: Wetlands identified within the proposed BCR Vlakfontein Mine site as indicated by the National Wetland Map 5 (NBA, 2018)

3.4 Soil and Terrain (SOTER) database

The Soil and Terrain (SOTER) database was established in 1986 by the Food and Agricultural Organization of the United Nations (FAO), the United Nations Environmental Programme and the International Soil Reference and Information Centre (ISRIC), under the auspices of the International Soil Science Society (ISRIC, 2016). It was developed using key soil and terrain properties that provide relevant input into agricultural and environmental applications, such as agricultural production of areas, food projection studies, climate studies, land evaluation and hydrological catchment modelling. The database is created at a large scale of 1:1 million and is used to gain a general idea of soils that may be identified within a particular area.

Based on the latest available database (2016) under the SOTER model, the site has been classified as containing red, yellow, and greyish soils with low to medium base statuses. These are classified as per the South African classification system as either Oxidic soils or Plinthic soils (Figure 7).

3.5 Land type data

In order to identify potential soils within the BCR Coal Vlakfontein Mine site at a finer scale, the land type data for the site was obtained from the Agricultural Research Council (ARC). The land type data is presented at a scale of 1:250 000 and entails the division of land types, typical terrain cross sections for the land type and the presentation of dominant soil types for each of the identified terrain units (in the cross section). The soil data is classified according to the Binomial System. The soil data was interpreted and re-classified according to the Taxonomic System (Land Type Survey Staff, 1972-2006).

The project site is situated within the Bb21 land type (Figure 8) as defined in the relevant Land Type Map (2430 Pilgrims Rest). Bb indicates land that qualifies as a plinthic catena.

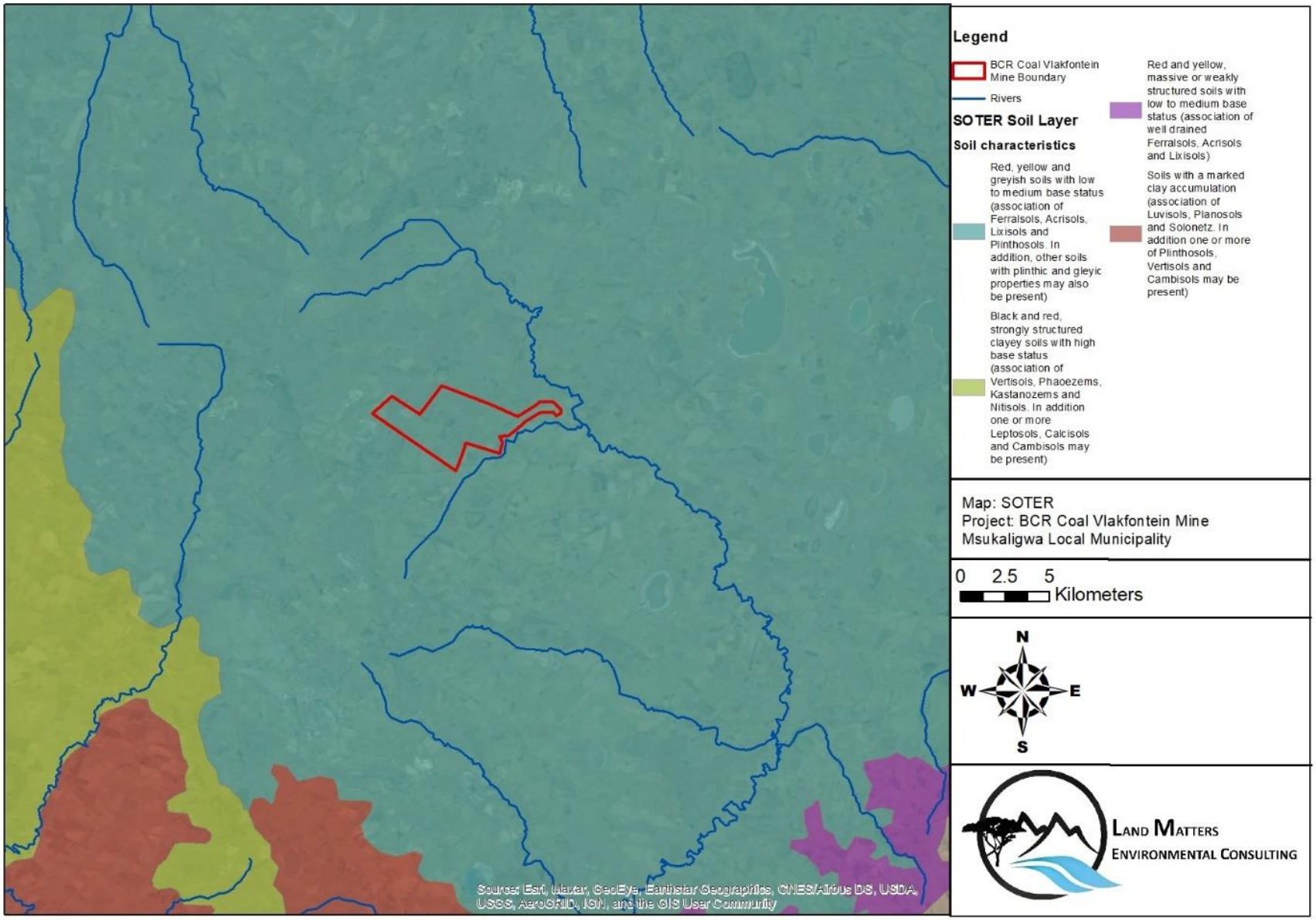

Figure 7: SOTER database for South Africa showing the potential soils identified within the BCR Coal Vlakfontein Mine site

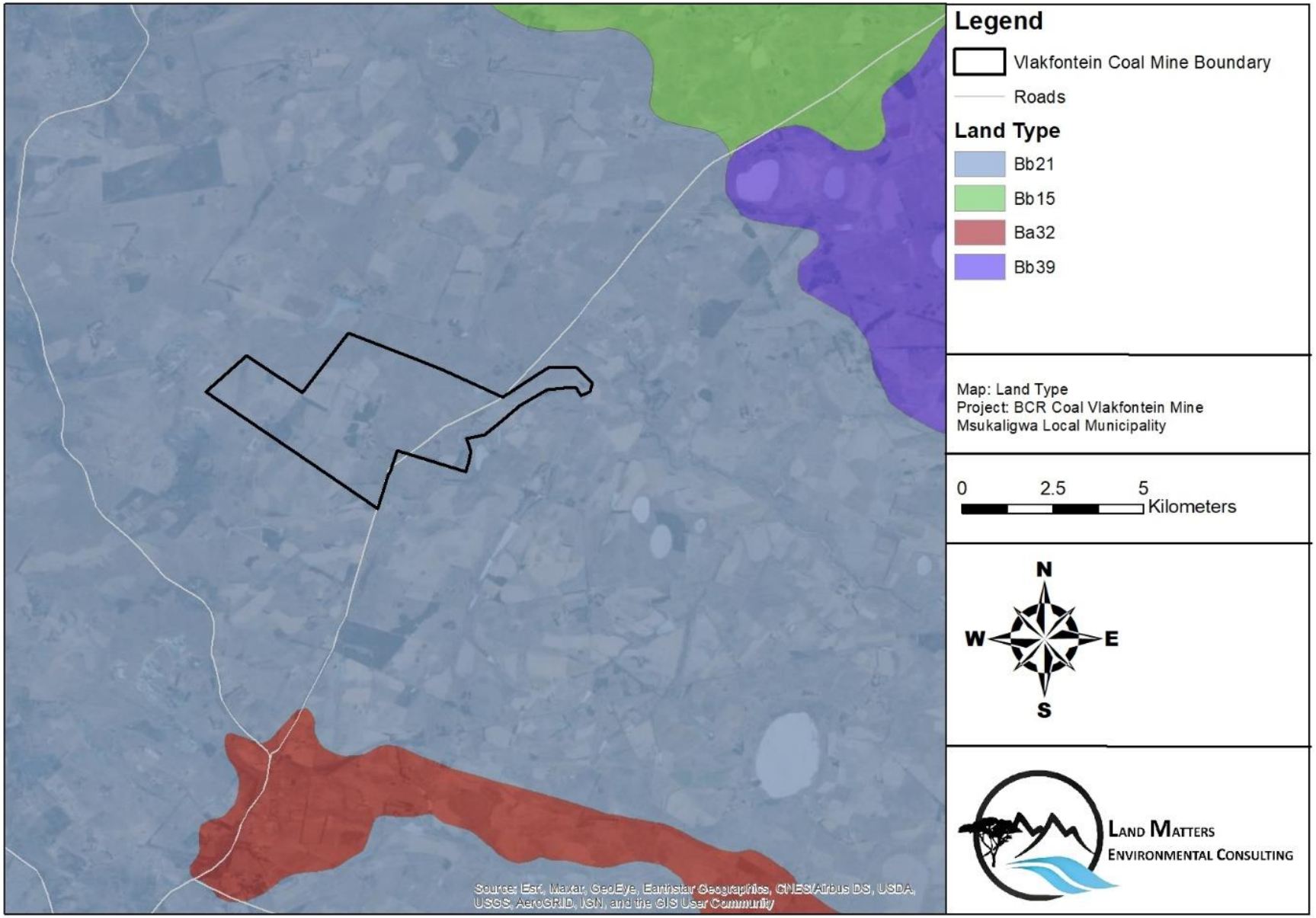

Figure 8: Land type information for the BCR Coal Vlakfontein Mine site

3.6 Potential soils and their characteristics

Potential soils to be found within the study site are therefore most likely to be associated with the plinthic soils. Plinthic soils consist of a topsoil (Orthic A horizon) which grades into a soft or hard plinthic material either directly or indirectly via a red apedal B, yellow brown apedal B or an albic horizon. They are easily identified by their iron oxides which are found segregated and concentrated in the soil, forming mottling and cementation. These distinct mottles are indicative of a fluctuating water table, and the soils indicate at least seasonal saturation. Soil forms are represented by either Hutton, Bainsvlei, Avalon and Longlands forms as one moves downslope from the top of a hillslope catena, with one or other gley soil (e.g. Rensburg, Willowbrook, Katspruit, Champagne forms) in the valley bottom regions.

Depending on the depth of the plinthic horizon (and therefore the depth of saturation), these soils can present problems for cultivation as a result of periodic waterlogging. They are suited to shallow rooted crops such as vegetables, and/or pastures.

If the plinthic horizon is however identified at depth and is overlain by a red or yellow brown apedal horizon, which is freely draining, these soils can be very productive for the cultivation of crops such as maize. These types of soils are common within the Mpumalanga area in which the proposed BCR Coal Vlakfontein mine is located and are often prized by farmers due to their free draining upper profile and wetter lower soil profile, which holds water for crop production during dry periods or drought conditions (Fey, 2010). Provided cultivation occurs outside of the wetland systems, these soils are therefore considered productive, and their presence increases the agricultural productivity of an area.

Information obtained from the Mining Work Programme (BCR Coal, 2022), showed that of all the boreholes drilled within the site, the soil profile was determined to be between approximately 2m to 6m deep, before the drilling encountered sandstone. These implies that the soils within the site (outside of the wetland systems) consist of a free draining upper solumn of a red apedal, yellow brown apedal, or albic horizon, which then grades into a plinthic horizon. This is the best-case scenario for crop production within the area and as such these soils are classified as productive for cultivation.

3.7 Historic and current activities on site

An investigation of historic aerial imagery was undertaken to determine the types of activities which have occurred within the proposed BCR Coal Vlakfontein Mine site. As shown in aerial imagery from 1955 and 1963 (Figures 9 and 10) cultivation practices have occurred within the site, outside of the wetland systems for at least several decades. This further enhances the likelihood that the soil characteristics outside of the wetland systems are productive for crop cultivation.

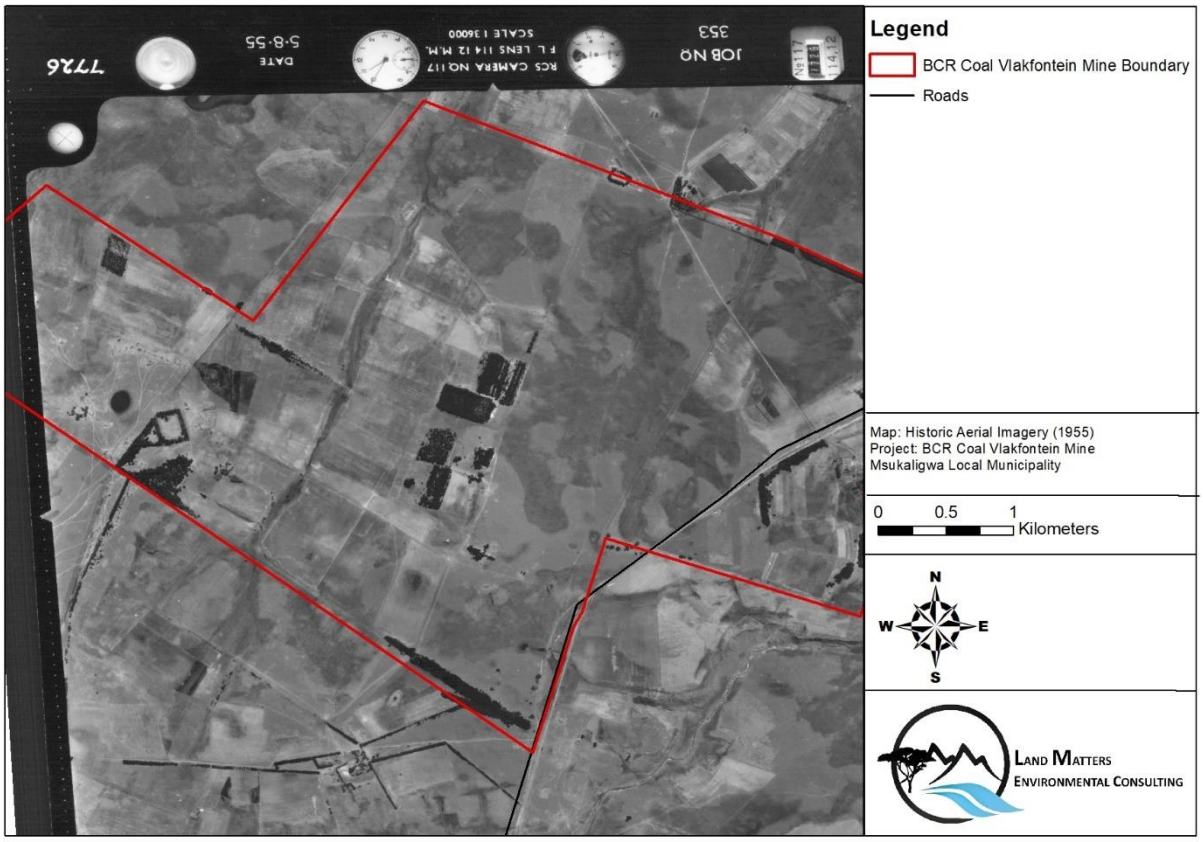

Figure 9: Historic aerial imagery from 1955, showing the use of the BCR Coal Vlakfontein Mine site for agricultural activities including crop cultivation

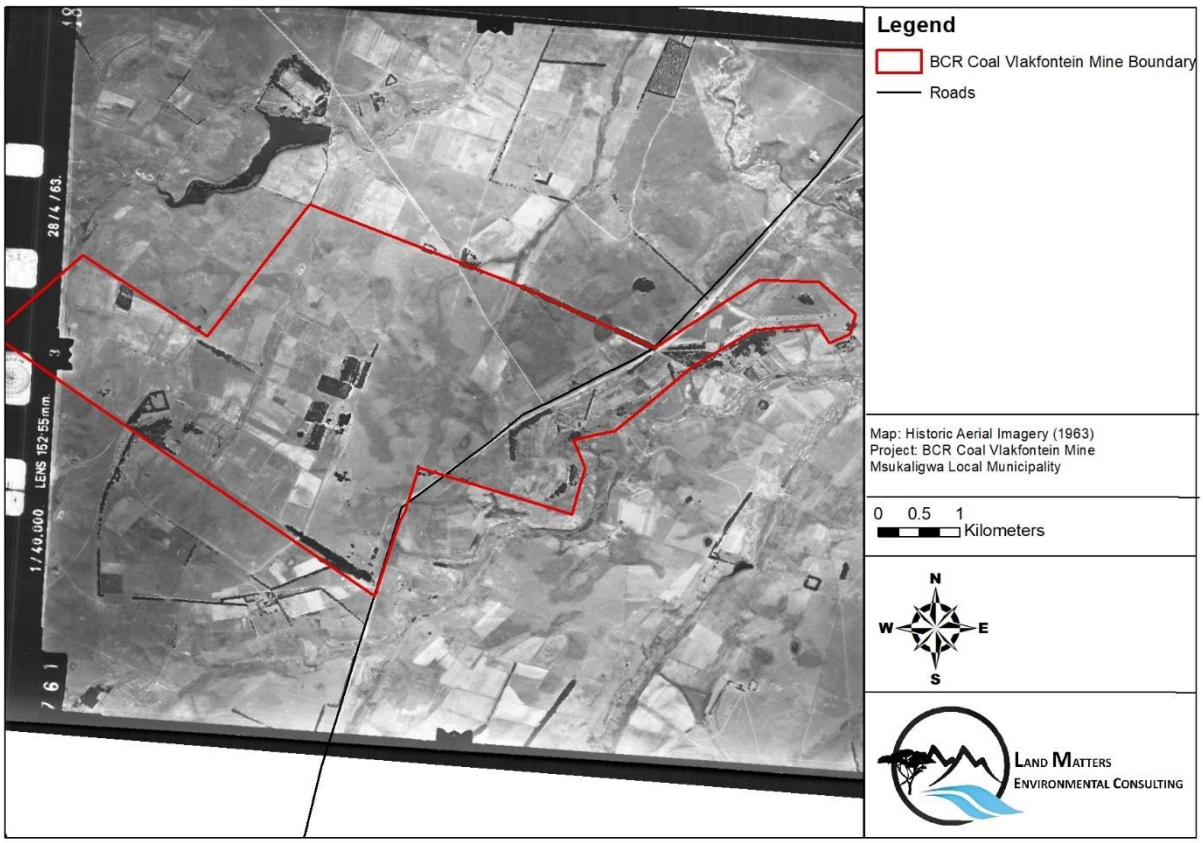

Figure 10: Historic aerial imagery from 1963, showing the use of the BCR Coal Vlakfontein Mine site for agricultural activities including crop cultivation

More recent aerial imagery of the proposed BCR Coal Vlakfontein Mine site, shows the same areas under cultivation as well as expansion of cultivation areas into wetland systems. This is most likely due to the drainage of some of these wetland systems. A broad scale mapping exercise of areas currently under cultivation was undertaken on current aerial imagery of the site (Figure 11). This current cultivation occupies approximately 900 hectares of the 1301-hectare mining application site. This equates to approximately 70% of the site utilised for crop cultivation. The remaining portion of the proposed site is classified as either wetland systems or more terrestrial grasslands, which may be utilised as pastures.

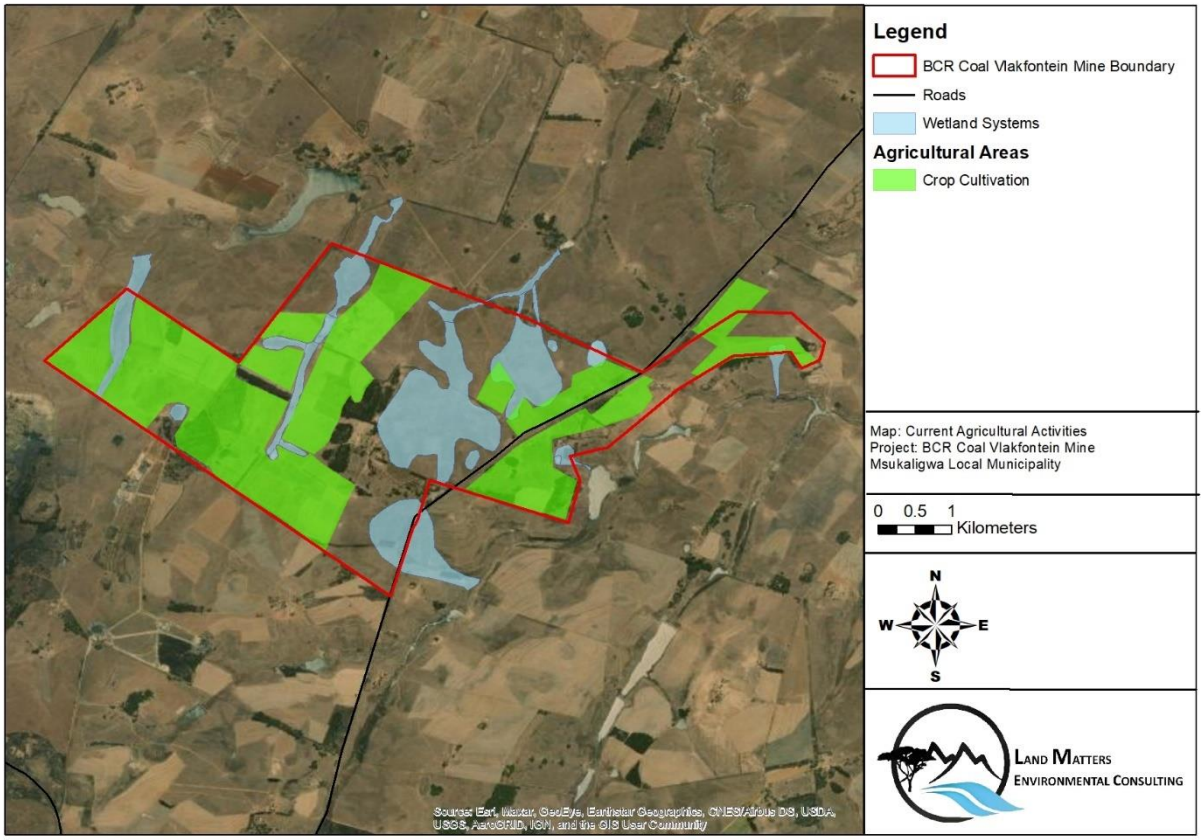

Figure 11: Current agricultural activities within the BCR Coal Vlakfontein Mine site

4 SITE SENSITIVITY VERIFICATION

In order to verify the classification of the site as 'high' for agricultural production as per the 'National Web Based Environmental Screening Tool site (Department of Forestry, Fisheries, and the Environment), a number of factors were taken into consideration. These included potential:

- **Soil texture:** Plinthic soils are generally luvic in nature and therefore have an increase in clay content with depth of the soil profile. They can have texture classifications ranging from sandy loam, silty loam to sandy clays and silty clays. The plinthic horizons are often weak in structure and therefore do not contain high percentages of clay. Clay is therefore not seen as a limitation to crop production within these soil types.

- **Soil depth:** As per the Mining Work Programme (BCR Coal, 2022) soil depths range from approximately 2 m to 6 m before drilling encountered a harder sandstone layer. Soil depth outside of the wetlands is therefore not considered a limitation to crop production. Within wetland systems, saturation of the soils, particularly the lower horizons will be a limitation to crop production. However, given that the majority of current cultivation activities takes place outside of the wetland systems, soil depth is not considered a limitation to the agricultural potential of the site.
  Soil permeability: The permeability of the soils is dependent on the saturation levels of any soft plinthic horizons that may be present within the site. The depth to the plinthic horizon is expected to be shallower within the wetland systems and deeper in the more terrestrial systems. Within the wetland systems, soil permeability is therefore expected to be a limitation to crop production. However, within the terrestrial areas, the presence of freely draining upper profiles allow for quick drainage and therefore no limitation to crop production.
- **Slope/Topography:** The site consisted of gentle terrain with the slope percentages recorded in the 0-10% category. Slope is therefore not a limitation to cultivation.
- **Current activities on site:** As shown in historic and current aerial imagery, agricultural activities are present within the site including both crop cultivation as well as likely pasture grazing. Current activities as shown in the aerial imagery of the site, therefore show the general productive nature of the site for agricultural activities.
- **Climate:** The climate of the area is not expected to be a limitation to crop production. Maize is a dominant crop grown within the Mpumalanga region and it is expected that this is the crop cultivated within the site.

The proposed BCR Coal Vlakfontein Mine site therefore consists of both areas which are classified as being productive and areas which are subject to limitations as a result of saturation and the associated presence of wetland systems. Given that the majority of the site (70%) is categorised as agriculturally productive, the site sensitivity classification of 'high' for agricultural production is verified. It must be noted that this is based on a thorough desktop assessment of the site, and a field investigation of the soils present within the site is required to ground-truth these findings.

5 PROVISIONAL IDENTIFICATION & DESCRIPTION OF POTENTIAL IMPACTS

Any activity in a natural system will have an impact on the surrounding environment. The purpose of this phase of the study was to provisionally identify impacts on the soil and agricultural activities within the proposed mining site. The proposed BCR Coal Vlakfontein Mine will involve both the operations of the open-cast coal mine as well as the development of associated infrastructure. The entire site as well as neighbouring sites will be impacted by the activities of the mine. Potential impacts to the soils and agricultural potential of the study site are associated with (i) the loss of agricultural land; (ii) soil compaction and exposure of topsoil which could lead to erosion and (iii) pollution of the soils as a result of both construction related activities for the associated infrastructure as well as the operations of the mine.

5.1 Loss of Agricultural Land

Loss of agricultural land, particularly the loss of arable land within the site and within adjacent properties will potentially occur. The identified agriculturally productive soils located outside of the wetland systems, will

be lost to the open cast mining footprint as well as the associated infrastructural development. Further, the BCR Coal Vlakfontein Mine site will potentially have an impact on adjacent properties where agricultural activities are currently taking place. Impacts during the construction phase for the associated infrastructure as well as the operations of the open cast mine are associated with excessive dust, noise pollution and the pollution and sedimentation of wetlands and dams that may be utilised by adjacent agricultural activities.

5.2 Soil compaction, soil exposure and erosion

The clearing of vegetation, the stripping and stockpiling of soil for the operations of the mine as well as the creation of new pits, tailings facilities and the construction of the associated infrastructure for the mine will result in the exposure of soil to environmental factors including rainfall and wind. Furthermore, the use of heavy machinery or vehicles as well as daily traffic on the haul roads will lead to the compaction of disturbed soils. This will increase the soil bulk density, reduce the porosity and the hydraulic conductivity, leading to a greater potential for the formation of erosion gullies.

In the long-term, soil compaction and the formation of erosion gullies have an impact on nutrient cycling, with knock on effects on the fertility of the soil. This reduces the viability of the soils for use in the rehabilitation of areas and additional soils will need to be brought in for this purpose. This not only has cost implications but also increases the likelihood of contaminant introduction within an area such as the introduction of alien invasive species (both floral and faunal).

5.3 Soil pollution

Sediment releases (particularly contaminated sediments) from mining environments into the receiving environment is one of the most common forms of waterborne pollution and air pollution. Furthermore, mismanagement of waste and pollutants including hydrocarbons and other hazardous chemicals will result in these substances entering and polluting the soil profile. Further to this, there will be an increase in the volume of traffic to the site in order to operate the mine, increasing the potential for additional sources of pollutants. Stormwater runoff from any parking lot and internal roads may potentially be contaminated with pollutants including petroleum residues, metals from brake linings, rubber particles from tires, nitrous oxide from car exhausts, and grease. These pollutants enter the soil profile and affect water quality if the stormwater is not treated before it is released.

6 CONCLUSION

6.1 Summary of desktop verification outcome

Following the soil and agricultural desktop assessment of the proposed BCR Coal Vlakfontein Mine, the site has been confirmed as being located within an area that has a high sensitivity for agricultural productivity (Table 1).

Table 1: Screening tool results for the proposed BCR Coal Vlakfontein Mine study area

SCREENING TOOL SENSITIVITY	VERIFIED SENSITIVITY	OUTCOME STATEMENT/PLAN OF STUDY	RELEVANT SECTION MOTIVATING VERIFICATION
AGRICULTURAL IMPACT ASSESSMENT			
High	High	Agricultural Agro-Ecosystem Specialist Assessment	Section 4

6.2 Plan of study for the Environmental Impact Assessment (phase 2)

Given the verified 'high' classification of the proposed mining site for agricultural production, Phase 2 of the assessment must include a full Agricultural Agro-Ecosystem Specialist Assessment. This assessment must include a field investigation of the proposed BCR Coal Vlakfontein Mine site. The field investigation will include taking soil samples using an auger to a depth of 1200mm or to refusal. At each sample location the soils will be classified, and a description of the physical soil characteristics will be conducted. These characteristics will include:

- Diagnostic soil horizons and their respective sequence.
- Depth of the identified soil horizons.
- Soil field texture.
- Colour.
- Effective rooting depth.
- Surface crusting.
- Depth to saturation (water table), if encountered.
- Terrain morphological units/Landscape position (slope %); and
- Rockiness.

The field data will be utilised to refine the agricultural land capability of the specific study site for the project. This will consider the terrain and soil properties, as well as the climatic, water and vegetation data. Land use impacts of the proposed mine will be evaluated. An impact assessment will be undertaken to determine the significance of impacts to the agricultural land capability of the site for any direct, indirect, and cumulative impacts. Risk assessments and various management options must be recommended.

Further to the above-mentioned plan for phase 2 of the agricultural assessment the following minimum requirements for Agricultural Agro-Ecosystem assessments will be adhered to as per the Government Notice No. 320 published in the Government Gazette 43110. These include

- An assessment of the soil form/s, soil depth (effective and total soil depth), top and sub-soil clay percentage, terrain unit and slope.

- An assessment of the vegetation composition, available water sources as well as agro-climatic information.
- An assessment of the current productivity of the land based on production figures for all agricultural activities undertaken on the land for the past 5 years, expressed as an annual figure and broken down into production units.
- An assessment of the current employment figures (both permanent and casual) for the land for the past 3 years, expressed as an annual figure.
- An assessment of the existing impacts on the site, located on a map (e.g. erosion, alien vegetation, non-agricultural infrastructure, waste, etc.).
- An assessment of impacts, including change in productivity, and change in employment, which must be considered as a minimum in the predicted impact of the proposed development on the agroecosystem.
- The agro-ecosystem assessment must at a minimum include:
    - the duration, date and season of the site inspection and the relevance of the season to the outcome of the assessment,
    - a description of the methodology used to undertake the on-site assessment inclusive of the equipment and models used, as relevant,
    - a map showing the proposed development footprint (including supporting infrastructure) with a 50m buffered development envelope, overlaid on the agricultural sensitivity map generated by the screening tool,
    - an indication of the potential losses in production and employment from the change of the agricultural use of the land as a result of the proposed development,
    - an indication of possible long-term benefits that will be generated by the project in relation to the benefits of the agricultural activities on the affected land,
    - additional environmental impacts expected from the proposed development based on the current status quo of the land including erosion, alien vegetation, waste, etc
    - information on the current agricultural activities being undertaken on adjacent land parcels,
    - an identification of any areas to be avoided, including any buffers,
    - a substantiated statement from the soil scientist or agricultural specialist with regards to agricultural resources on the acceptability or not of the proposed development and a recommendation on the approval or not of the proposed development
- The findings of the Agricultural Agro-Ecosystem Specialist Assessment must be incorporated into the Basic Assessment Report or Environmental Impact Assessment Report, including the mitigation and monitoring measures as identified, which are to be contained in the EMPr.

6.3 Reasoned opinion

Based on the information obtained during the desktop site sensitivity verification assessment, it is concluded that impacts of the proposed BCR Coal Vlakfontein Mine on the agricultural productivity within the study area will be both direct and indirect. Direct loss of agriculturally productive land is likely to occur from the open cast mining operations as well as the development of associated infrastructure. Indirect impacts are likely on neighbouring properties, both from soil and water pollution sources, as well as an increase in air pollution and traffic within the area, having knock-on effects on the viability of agricultural operations within close proximity to the proposed mine.

Further to this, the Preservation and Development of Agricultural Land Bill (2021) which has been introduced at the National Assembly and which aims to promote the preservation and sustainable development of agricultural land must be taken into consideration. The Bill seeks to prevent the fragmentation of agricultural land and to minimise the loss of agricultural land by promoting viable farming units and to encourage the optimal use of agricultural land for the promotion of food security, as well as increase the contribution of agriculture to the Gross Domestic Product. Given that the proposed BCR Coal Vlakfontein site is at least 70% agricultural productive and is located within an area dominated by agricultural activities, one must consider the aims of the Bill and minimise the loss of agriculturally viable land.

Based solely on the outcomes of the desktop assessment of the of the agricultural productivity of the proposed mining site, coupled with the location of the site in an agricultural setting, it is the opinion of the author that the mine is not supported from an agricultural perspective. It must be noted that the opinion given in this report should be utilised as preliminary 'red flag' for the proposed activity within the site. The opinion of the author could change depending on the outcomes of phase 2 of the assessment, and in particular the findings of the soil assessment, the current activities on site, as well as the assessment of the current productivity of the site. This information is not yet known and is thus a limitation to the reasoned opinion given. Furthermore, the opinion does not take into consideration any proposed mitigation measures or layout changes that could avoid more productive agricultural areas as well as be utilised to reduce impacts to the agricultural productivity of neighbouring properties. These factors will form part of phase 2 of the assessment.

7 BIBLIOGRAPHY

BCR Coal Pty (Ltd) (2022). Mining Work Programme. Submitted for a Mining Right Application.

Department of Environmental Affairs. (2022). Screening Report for an Environmental Authorisation as required by the 2014 EIA Regulations - Proposed Site Environmental Sensitivity. EIA Reference Number: MP 30/5/1/2/2/10293 MR.

ISRIC, (2016). SOTER Data Model v2.0. ISRIC–World Soil Information, Wageningen. http://dx.doi.org/10.17027/isric-wdcsoils.20180003

Land Type Survey Staff. (1972 - 2006). Land Types of South Africa: Digital Map (1:250 000 Scale) and Soil Inventory Databases. Pretoria: ARC-Institute for Soil, Climate, and Water.

Mucina, L., Rutherford, M.C. and Powrie, L.W. (eds). (2006). Vegetation Map of South Africa, Lesotho and Swaziland, edn 2, 1:1 000 000 scale sheet maps. South African National Biodiversity Institute, Pretoria. ISBN 978-1-919976-42-6.

Fey, M. (2010). Soils of South Africa. Their distribution, properties, classification, genesis, use and environmental significance. Cambridge University Press. Cape Town

Jennings, K., Le Roux, P.A.L., Van Huyssteen, C.W., Hensley, M., and Zere, T.B. (2008). Redox conditions related to interflow in a soil of the Kroonstad form in the Weatherley catchment, South African Journal of Plant and Soil, 25:4, 204-213, DOI: 10.1080/02571862.2008.10639918

Ollis, D., Snaddon, K., Job, N. and Mbona, N. (2013). Classification Systems for Wetlands and other Aquatic Ecosystems in South Africa. User Manual: Inland Systems. SANBI Biodiversity Series 22. Pretoria: South African National Biodiversity Institute.

Soil Classification Working Group (2018). Soil Classification: A Natural and Anthropogenic System for South Africa. ARC-Institute for Soil, Climate and Water. Pretoria.

Van Deventer, H., Smith-Adao, L., Collins, N.B., Grenfell, M., Grundling, A., Grundling, P.-L., Impson, D., Job, N., Lötter, M., Ollis, D., Petersen, C., Scherman, P., Sieben, E., Snaddon, K., Tererai, F. & Van der Colff, D. (2019). *South African National Biodiversity Assessment 2018: Technical Report. Volume 2b: Inland Aquatic (Freshwater) Realm*. CSIR report number CSIR/NRE/ECOS/IR/2019/0004/A. South African National Biodiversity Institute, Pretoria, South Africa.

8 ABRIDGED SPECIALIST CV

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PERSONAL DETAILS

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ACADEMIC QUALIFICATIONS

2019 – present	PhD Candidate - Soil Science (University of Free State and the University of Burgundy, France)
2015	Certificate in Wetland Rehabilitation – University of the Free State
2009	MSc (Soil Science) – University of KwaZulu-Natal
2008	Certificate course in Wetland Delineation, Legislation and Rehabilitation, University of Pretoria
2006	BSc (Environmental Science) – University of KwaZulu-Natal
2005	BSc (Applied Environmental Science) – University of KwaZulu-Natal

EMPLOYMENT RECORD

July 2021 – Present	Land Matters Environmental Consulting (Pty) Ltd – Director (Soil Scientist and Wetland Specialist)
April 2016 – June 2021	Malachite Specialist Services (Pty) Ltd – Director (Soil Scientist and Wetland Specialist)
March 2014 – March 2016	Afzelia Environmental Consultants (Pty) Ltd. – Soil Scientist and Wetland Specialist
Sept 2012 – February 2014	Strategic Environmental Focus (Pty) Ltd – Junior Wetland Specialist
February 2008 – December 2009	Afzelia Environmental Consultants cc. – Soil Scientist and Junior Environmental Assessment Practitioner

PROFESSIONAL AFFILIATIONS

- South African Council for Natural Scientific Professions – SACNASP (Pr. Sci.Nat 400715/15: Soil Science)
- International Association for Impact Assessments – IAIAsa
- South African Wetland Society

PUBLICATIONS

Harrison, R.L., van Tol, J., and Toucher, M.L. (2022). Using hydropedological characteristics to improve modelling accuracy in Afromontane catchments. Journal of Hydrology: Regional Studies. 39. https://doi.org/10.1016/j.ejrh.2021.100986.

Harrison, R., and van Tol, J. (2022). Digital Soil Mapping for hydropedological purposes of the Cathedral Peak research catchments, South Africa. In Remote Sensing of African Mountains. Springer. (in publication)

PROJECT EXPERIENCE

Rowena has obtained a MSc. In Soil Science from the University of KwaZulu Natal, Pietermaritzburg. She is professionally affiliated to the South African Council for Natural Scientific Professions (Pr. Sci. Nat) and has 13 years consulting experience in the wetland and soil science field. She has conducted numerous wetland, hydropedology and soil assessments for a variety of development types across South Africa, Swaziland, Cameroon, and the Democratic Republic of Congo.

She is a member of the International Association for Impact Assessment (IAIA) as well as a founding member of the South African Wetland Society. She is currently a joint PhD candidate at the University of the Free State and the University of Burgundy in France. Her research is focused on the interactions of dissolved organic carbon and hydropedology at a catchment scale.