Soil, Land Use and Land Capability Report compiled by TerraAfrica Consult, April 2015
Environmental Impact Assessment Report for the Kangra Coal (Pty) Ltd
Kusipongo Resource Project:

I, Mariné Pienaar, declare that -

General declaration:

• I act as the independent Soil, Land Use and Land Capability specialist in the application for a Section 102 amendment application in terms of the National Mineral and Petroleum Resources Development Act (Act No. 28 of 2002,) as amended
• I do not have and will not have any vested interest (either business, financial, personal or other) in the undertaking of the proposed activity, other than remuneration for work performed in terms of the Environmental Impact Assessment Regulations, 2014;
• I have performed the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
• I declare that there are no circumstances that may compromise my objectivity in performing such work;
• I have expertise in conducting the specialist report relevant to this application, including knowledge of the Act, regulations and any guidelines that have relevance to the proposed activity;
• I have complied with the Act, regulations and all other applicable legislation;
• I have no, and will not engage in, conflicting interests in the undertaking of the activity;
• I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
• All the particulars furnished by me in this form are true and correct; and
• I realise that a false declaration is an offence.

Signed: ________________________  Date: 2015-04-16

[Signature]

[Initial]
SOIL, LAND USE AND LAND CAPABILITY REPORT FOR THE PROPOSED KANGRA COAL PROJECT

For and on behalf of TerraAfrica Consult

Approved by: Mariné Pienaar

Position: Principal consultant

Date: 15 April 2015
Executive Summary

The site consists of 14 different soil groups that vary over short distances. These soil groups include soils of the Tukulu, Oakleaf, Clovelly, Avalon, Westleigh, Shortlands, Mispah, Katspruit, Kroonstad, Willowbrook forms as well as rocky outcrops. Most of these soil forms have high arable land capability and maize fields have been established and are still actively being planted in these areas. Soil forms with hydromorphic potential identified include the Katspruit, Kroonstad and Willowbrook forms. These soils are found in lower lying positions in the landscape and are associated with either permanent or seasonal wetness.

The western portion of the proposed project (where the adit and a portion of the conveyor belt will be located) consists of rural houses with associated infrastructure such as water tanks and animal camps. Small maize fields are dotted between grazing fields. Maize is cultivated mostly by mechanized agriculture and tractors have observed driving between fields during the site visit. The fields are used for grazing by cattle and horses. The remaining portion on the west been transformed by mining activities in several areas and associated mining infrastructure such as a large storeroom and conveyor belt is present in the areas directly bordering the study site.

The impacts associated with the proposed mining expansion project are related to the following:

- Loss of arable, grazing and wetland land capability as a result of stripping of topsoil in the proposed project areas
- Loss of grazing land capability where areas have been fenced off for mining purposes and where vegetation was cleared.
- Soil compaction as a result of heavy vehicle movement over the soil surface during all the project phases.
- Chemical soil pollution as a result of possible sewage spills as well as fuel and oil spillage from vehicles.
- Soil erosion because of the impact of rainfall and wind on barren soil surfaces.
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1. Introduction

ERM Southern Africa Pty Ltd appointed TerraAfrica Consult to conduct the soil, land use and land capability study as part of the Environmental Impact Assessment (EIA) process for a mining right application for the Kusipongo Coal Reserve and Adit B (ventilation shaft) and a Section 102 amendment for Adit A (main mine adit) as well as a new overland conveyor system which falls within the Maquasa West Expansion. Adit B is located on the farm Donkerhoek 14HT approximately 1 km to the East of the Ohlelo River and its associated wetland. The Project is located within the Mkhondo and Dr Pixley Kalsaka Seme Local Municipalities which fall within the greater Gert Sibande District Municipality in the Mpumalanga Province of South Africa. See (Figure 1).

2. Environmental legislation applicable to study

The most recent South African Environmental Legislation that needs to be considered for any new or expanding development with reference to management of soil and land use includes:

- Soils and land capability are protected under the National Environmental Management Act 107 of 1998, the Minerals Act 28 of 2002 and the Conservation of Agricultural Resources Act 43 of 1983.
- The National Environmental Management Act 107 of 1998 requires that pollution and degradation of the environment be avoided, or, where it cannot be avoided be minimised and remedied.
- The Conservation of Agricultural Resources (Act 43 of 1983) states that the degradation of the agricultural potential of soil is illegal.
- The Conservation of Agriculture Resources Act 43 of 1983 requires the protection of land against soil erosion and the prevention of water logging and salinization of soils by means of suitable soil conservation works to be constructed and maintained. The utilisation of marshes, water sponges and watercourses are also addressed.
- Government Notice R983 of 4 December 2014, Activity 21. Purpose of the Notice is to identify activities that would require environmental authorisation prior to commencement of that activity.
Figure 1: Locality map of the Kangra Coal Project
Figure 2: Location of soil survey points within the Kangra Coal Project area
3. Terms of reference

The terms of reference applicable to the Soils, Land Capability and Land Use Study include the following:

- A review of available desktop information about the project site;
- Design and execution of a soils field survey covering the proposed adit, conveyor and conveyor servitude footprints;
- A soil, land use and land capability baseline for the project affected area;
- Identification and assessment of potential impacts on baseline soil, land use and land capability properties as a result of the proposed project;
- Development of mitigation and management measures for the identified impacts.

4. Methodology

4.1 Desktop study and literature review

The following data was obtained and studied for the desktop study and literature review:

- Broad geological, soil depth and soil description classes were obtained from the Department of Environmental Affairs and studied. This data forms part of the Environmental Potential Atlas (ENPAT) of South Africa;
- The most recent aerial photography of the area available from Google Earth was obtained.

4.2 Site survey

A systematic soil survey was undertaken with sampling points between 100 and 150m apart in the study area. The soil profiles were examined to a maximum depth of 1.5m using an auger (Figure 1). Observations were made regarding soil texture, structure, colour and soil
depth at each survey point. A cold 10% hydrochloric acid solution was used on site to test for the presence of carbonates in the soil. The soils are described using the S.A. Soil Classification Taxonomic System (Soil Classification Working Group, 1991) published as memoirs on the Agricultural Natural Resources of South Africa No.15. For soil mapping, the soils were grouped into classes with relatively similar soil characteristics.

4.3 Analysis of samples at soil laboratory

Six representative soil samples were collected (3 top- and subsoil samples each). Soil samples were sealed in soil sampling plastic bags and sent to Nvirotek Labs, Brits for analyses. Samples were sent to Nvirotek Laboratories and were analysed for pH (KCl and H2O), phosphorus (Bray1), exchangeable cations (calcium, magnesium, potassium, sodium), organic carbon (Walkley-Black) and texture classes (relative fractions of sand, silt and clay).

4.4 Land capability classification

Land capability classes were determined using the guidelines outlined in Section 7 of The Chamber of Mines Handbook of Guidelines for Environmental Protection (Volume 3, 1981). The Chamber of Mines pre-mining land capability system was utilised, given that this is the dominant capability classification system used for the mining industry. Table 1 indicates the set of criteria as stipulated by the Chamber of Mines to group soil forms into different land capability classes.

<table>
<thead>
<tr>
<th>Criteria for Wetland</th>
<th>Land with organic soils or</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>A horizon that is gleyed throughout more than 50 % of its volume and is significantly thick, occurring within 750mm of the surface.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Criteria for Arable Land</th>
<th>Land, which does not qualify as a wetland,</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>The soil is readily permeable to the roots of common cultivated plants to a depth of 750mm,</td>
</tr>
<tr>
<td></td>
<td>The soil has a pH value of between 4.0 and 8.4,</td>
</tr>
<tr>
<td></td>
<td>The soil has a low salinity and SAR,</td>
</tr>
<tr>
<td></td>
<td>The soil has a permeability of at least 1,5-mm per hour in the upper 500-mm of soil</td>
</tr>
<tr>
<td></td>
<td>The soil has less than 10 % (by volume) rocks or pedocrete</td>
</tr>
</tbody>
</table>
March 2015

5. Baseline conditions

5.1 Climate data

The study area normally receives about 746 mm of rain per year, with most rainfall occurring during summer. It receives the lowest rainfall (2 mm) in June and the highest (140 mm) in December. The monthly distribution of average daily maximum temperatures shows that the average midday temperatures range from 19.4 °C in June to 26.2 °C in January. The region is the coldest during June when temperature drops to 3.2 °C on average during the night.

5.2 Soil forms in the study area

Fourteen different soil units were identified in the Kangra Coal Project area. The area is dominated by yellow, neo-cutanic soil profiles where multi-colouredness as a result of the presence of channel infillings and cutans and soil particle aggregation is the main differentiating characteristics. Other soil forms found in different positions along the study area includes soil forms consisting of a G-horizon underneath the orthic A-horizon. These soil groups identified has hydromorphic properties and support wetland habitats. The soil chemistry results are still awaited from the laboratory when the report was finalised.
Clovelly
The soil profiles identified in this soil groups have sandy-loam orthic A horizons overlying well-drained yellow-brown apedal B1 horizons also with sandy-loam texture. The yellow-brown apedal horizon is underlain by unspecified material where limited pedogenesis has taken place. The depth of these profiles ranged between 75 and 150 cm. The Clovelly soil form has arable land capability and small maize fields have been established in some areas where the Clovelly soil form is found.

Tukulu
The Tukulu soil profiles identified in this area are medium-deep to deep and have high agricultural potential. The soil forms consists of a sandy-loam orthic A horizons overlying a neocutanic B1 horizon which overlies unspecified materials with signs of wetness. The Tukulu soil form has been identified on hill slopes and lower-lying positions of the landscape and has grazing land capability due to the shallow soil depth.

Oakleaf
The Oakleaf soil profiles identified on site consist of an orthic A horizon (25 cm), overlying a neocutanic B horizon (120cm) on unspecified material. The neocutanic horizons observed have non-uniform colouring and cutans and channel infillings are visible.

Katspruit
The Katspruit soil form comprises of an orthic A-horizon overlying a G-horizon with the orthic horizon between 15 and 30 cm deep and the G-horizon thicker than 100 cm. The orthic A horizon shows significant accumulation of organic material. The G-horizon has developed during long periods of water saturation that gave rise to gleying with the reduction of ferric oxides and hydrated oxides. The G-horizon is dominated by grey, low chroma colours with marked clay illuviation. The Katspruit soil form has wetland land capability.

Kroonstad
The Kroonstad soil form consists of an orthic A-horizon overlying an E-horizon that overlies a gleyed G-horizon with the orthic horizon between 10 and 20 cm deep. Both the bleached colours of the E-horizon and G sub-surface horizon indicate periods of intermittent wetness. This soil form is associated with seasonal wetlands and the soil form has wetland land capability.
Willowbrook
The Willowbrook soil form consists of a melanic A-horizon overlying a gleyed G-horizon. Soil depth of these profiles ranged between 50 cm to 70 cm. The A-horizon is well-structured but do not become massive and hard when dry. This horizon has dark-brown to black colours. The Willowbrook soil form has wetland land capability and is not suitable for crop production.

Westleigh
The Westleigh soil form consists of a shallow sandy-loam orthic A-horizon overlying a soft plinthic B horizon which indicates a soil profile with high water-holding capacity and high arable land capability, especially in drier years following high previous rainfall period.

Mispah and Rocky outcrops
The Mispah form consist of a shallow orthic A horizon (10 to 25 cm) underlain by hard rock or parent material. The orthic A horizon has yellow-brown colours and sandy-loam texture. The shallow soil profiles are not suitable for crop cultivation purposes and supports grassland vegetation. Rocky outcrops with visible rocks and boulders on the surface have been identified on the slopes of hills and at the hilltops. The rocky outcrops are sparsely vegetated and have wilderness land capability.
Figure 3: Locality of soil forms present in the Kangra Coal Project area
5.2 Agricultural potential

The majority of the site consists of deep soil with a medium to high arable agricultural potential. The Tukulu, Oaklands, Clovelly, Westleigh and Avalon soil forms are highly to medium suitable for the purpose of dryland and irrigated crop production. Horses and cattle grazing in these areas were also observed during the site visit. With the soil capability and the high rainfall of the area, the site has the potential for crop production of maize, sunflowers and soy beans as well as for forestry purposes. The larger area surrounding the site is mainly used for forestry and associated activities, cattle farming, crop production on a smaller scale as well as for human settlement in the villages.

5.3 Land use

The site can currently be divided into two different main land uses. The western portion of the proposed project (where the adit and a portion of the conveyor belt will be located) consists of rural houses with associated infrastructure such as water tanks and animal camps. Small maize fields are dotted between grazing fields. Maize is cultivated mostly by mechanized agriculture and tractors have observed driving between fields during the site visit. The fields are used for grazing by cattle and horses. The remaining portion on the west been transformed by mining activities in several areas and associated mining infrastructure such as a large storeroom and conveyor belt is present in the areas directly bordering the study site.

5.4 Land capability

Four land capability classes have been identified for the Kangra Coal Project area. The study area is dominated by land with arable land capability. These areas are mainly associated with soil forms with yellow-brown apedal B1-horizons. Soil of the Katspruit, Kroonstad and Willowbrook forms have wetland capability. The rocky outcrops and Mispah soil form has wilderness land capability where vegetation is absent or more spare than areas with grazing land capability. The remainder areas have grazing land capability and is suitable for grazing by cattle and horses.
Figure 4: Land capability classification for the Kangra Coal Project Area
6. Potential impacts as a result of the proposed Kangra Coal Project

6.1 Potential impacts on soil

The proposed overland conveyor, service road and main adit may impact on soil in the following ways:

- The most significant impact is the topsoil that will be stripped and stockpiled in areas where surface infrastructure will be constructed. This will cause major disturbance to the functionality and productivity of the soil and may also result in a loss of topsoil.
- Soil erosion caused by wind and water movement over the soil surface of the topsoil stockpiles.
- Chemical soil pollution may occur as a result of oil and fuel spills on the surface from trucks, etc.
- Soil compaction will be a potential impact, especially in areas where construction vehicles will drive.

6.2 Potential impacts on land use and agricultural potential

The most significant impact on agriculture will be the loss of the arable areas of the proposed site and the resulting loss of income for farmers in the area. The cumulative impact on land use is that large portions of land that was previously used for crop and/or livestock production in the region are converted into mines which result in loss of agricultural land use on a regional scale. The proposed mine can change areas with arable and grazing land into mining and possibly after rehabilitation wilderness or derelict land.

6.3 Potential impacts on land capability

The land capability of the areas where the proposed mining infrastructure will be constructed will change from arable land capability to industrial. Should the area not be rehabilitated again to pre-mining land capability after mining operations have ceased, the land capability may be reduced to wilderness. Rehabilitation of mined areas will at its best
result in grazing land capability. The source of groundwater may be impacted upon by underground mining activities and may no longer be available and of sufficient quality to be used as drinking water by cattle.

7. Study methodology for EIA phase

6.1 Introduction

For the impact assessment, all the following phases of the project cycle were considered for potential impacts on soil and land capability. Below is a description of each of the activities per phase that may result in soil impacts:

Construction phase:
- Establishment of access roads;
- Selective clearing of vegetation in areas designated for surface infrastructure;
- Digging of foundations and trenches;
- Delivery of materials (steel and equipment) as well as transport of construction personnel;
- Blasting (where required);
- General building/construction activities; and
- Topsoil and subsoil stripping and stockpiling.

Operational phase:
- Daily traffic on roads for inspection and maintenance of adit and conveyor;
- And daily mining activities in different areas of the proposed Kangra Coal Mining Project.

Closure:
- Removal of infrastructure from soil surfaces;
- Removal of topsoil from stockpiles and using it to re-establish vegetation in disturbed areas; and
- Increased traffic on roads to transport waste materials out of the mining areas as well as vehicles for rehabilitation.
The following impacts on soil and land capability are anticipated for the project:

- Soil erosion due to steep slopes and vegetation clearance;
- Topsoil degradation;
- Soil compaction due to regular heavy vehicle transport; and
- Chemical soil pollution as a result of potential spillage of petroleum hydrocarbons by vehicles and other soil pollutants such as coal dust from the conveyor.

For the Impact Assessment carried out in the following Sections, the following embedded controls have been assumed:

- Minimising the project footprint to limit surface disturbance;
- Using existing roads to access the site, and limiting linear developments throughout the project development area as much as feasible;
- Using drainage control measures and culverts to control natural runoff and overland flow;
- Stockpiles will be placed in areas far enough from mining activities to prevent contamination.
- Topsoil stripping, stockpiling and management will be planned prior to ground disturbance works commencing to establish the volume of soil to be stripped and areas where it will be stockpiled.

These impacts are assessed in the following sections.

### 6.2 Soil Erosion

**Potential impact**

Soil erosion is caused by the removal of soil particles from the landscape as a result of water and wind movement. For the proposed project, all soil forms will be prone to erosion where vegetation has been removed. The Mispah soil form (2.7 ha) which has been identified have the least susceptibility to soil erosion. The highest impact of erosion is anticipated for the area where Tukulu (80.6 ha) and Oakleaf (37.6 ha) have been identified.
During the construction phase, all soil forms will be susceptible to erosion to some extent because the natural vegetation will be cleared before construction takes place in both the mining and infrastructure areas. During the operational phase, topsoil stockpiles as well as haul roads following steep slopes down valleys will still be susceptible to erosion. Where the overland conveyor crosses streams, structures in the streambed will cause an increase in erosion. Soil surfaces with infrastructure such as concrete slabs will not be exposed to erosion any longer.

With the closure phase, soil surfaces are in the process of being replanted with indigenous vegetation and until vegetation cover has established successfully, all surfaces are still susceptible to potential soil erosion.

**Potential consequence**

The main potential consequences of soil erosion are the reduction in soil quality and the reduced water-holding capacity of many eroded soils. The indirect consequences of soil erosion include disruption of riparian ecosystems and sedimentation leading to reduced water quality.

**Significance of impacts**

The impacts of soil erosion are both direct and indirect. The direct impacts are the reduction in soil quality which results from the loss of the nutrient-rich upper layers of the soil and the reduced water-holding capacity of many eroded soils. The off-site indirect impacts of soil erosion include the movement of the soil particles to waterways and lakes and dams which leads to disruption of riparian ecosystems and reduced water quality. Soil erosion is a permanent impact for once the resource has been lost from the landscape it cannot be recovered. Although there are off-site indirect impacts associated with this, the impact is mainly considered to be local. The impacts may still continue after mining activities have ceased in the case of insufficient vegetation re-establishment. The magnitude of the impact is considered as medium and of a moderate significance (*Table 2*).

**Table 2: Impacts on Soil Erosion**

<table>
<thead>
<tr>
<th>Impact</th>
<th>Soil erosion</th>
<th>Impact Nature</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Negative</td>
</tr>
<tr>
<td>Impact on soils is negative.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Impact Type

<table>
<thead>
<tr>
<th>Direct</th>
<th>Indirect</th>
<th>Induced</th>
</tr>
</thead>
</table>

Impact on soils is direct.

Impact Duration

<table>
<thead>
<tr>
<th>Temporary</th>
<th>Short-term</th>
<th>Long-term</th>
<th>Permanent</th>
</tr>
</thead>
</table>

Impacts are considered long-term, as the impacts will continue past closure with only a very slow recovery rate.

Impact Extent

<table>
<thead>
<tr>
<th>Local</th>
<th>Regional</th>
<th>International</th>
</tr>
</thead>
</table>

Impacts on soils are local to the mine site.

Impact Scale

The scale of the impact is estimated to be restricted to the areas cleared for mining and infrastructure.

Impact Frequency

Throughout the life time of the mining operations as well as once mining has stopped if left unmitigated.

Impact Magnitude

<table>
<thead>
<tr>
<th>Positive</th>
<th>Negligible</th>
<th>Small</th>
<th>Medium</th>
<th>Large</th>
</tr>
</thead>
</table>

Impact magnitude is considered medium.

Receptor Sensitivity

<table>
<thead>
<tr>
<th>Low</th>
<th>Medium</th>
<th>High</th>
</tr>
</thead>
</table>

The receptor sensitivity is considered as high.

Impact Significance

<table>
<thead>
<tr>
<th>Negligible</th>
<th>Minor</th>
<th>Moderate</th>
<th>Major</th>
</tr>
</thead>
</table>

Significance of impact is considered to be *Moderate*.

**Mitigation measures, management and monitoring**

Apart from the embedded controls to be included in project design, the following mitigation measures will reduce the significance of soil erosion:

- Stripping of topsoil should not be conducted earlier than required (maintain vegetation cover for as long as possible) in order to prevent the erosion (wind and water) of organic matter, clay and silt.

- Stripped soils should be stockpiled at a slope of not more than 33 percent as a berm upslope (majority) and surrounding the disturbed area.

- Erosion control measures such as intercept drains and toe berms must be constructed where necessary.

- Soil stockpiles must be sampled, ameliorated (if necessary) and re-vegetated as soon after construction as possible. This is in order to limit raindrop and wind energy, as well as to slow and trap runoff, thereby reducing soil erosion. Plant species indigenous to the area are preferred, given both their adaptation to the natural site conditions as well as their lower maintenance requirements. This is highly recommended in order to maintain the natural biological soil life associated with the indigenous vegetation.

- Roads used to access the overland conveyor and ventilation shaft must be well drained in order to limit soil erosion.
The vegetation cover on the soil stockpiles (berms) must be continually monitored in order to maintain a high basal cover. Such maintenance will limit soil erosion due to both water (runoff) and wind (dust) erosion.

The project area has a distinct rainy and dry season. It is recommended that the erosion monitoring programme will include two rounds of evaluation per year during construction and operations (January and June) to determine if any seasonal variations do occur. Thereafter, annual monitoring will take place once per year, preferably at the end of the dry season before the start of the rainy season (August).

Each monitoring round should include a physical observation and reporting of the following:
- Evidence of erosion or land degradation;
- Condition of access roads;
- Condition of cleared areas;
- Condition of perimeter drains (if installed) and associated settlement ponds (if installed); and
- Compliance with applicable regulatory and corporate requirements.

**Significance of residual impacts**

With proper mitigation measures and the embedded controls as recommended above, it is anticipated that the significance of this impact can be reduced to minor. Taking the relatively high rainfall in the area and the slope of the terrain in consideration it is unlikely that soil erosion will have negligible significance.
6.3 Soil Compaction

Potential impact
Soil compaction will take place due to unnatural load and increased traffic due to heavy construction vehicles in the area thus changing the soil structure. During the construction phase, soil is susceptible to compaction from heavy construction vehicles when soil is stripped and stockpiled. During the operational phase, soil compaction increases as the weight of the stockpiles results in further compaction as well as constant traffic on the access roads. During the Closure phase, soil is again compacted as construction vehicles move up and down to remove infrastructure and move topsoil to areas for rehabilitation purposes.

Potential consequence
Soil compaction generally reduces the amount of water that plants can take up. This is because compaction crushes many of the macropores and large micropores into smaller pores, and the bulk density increases. As the clay particles are forced closer together, soil strength may increase beyond about 2000 kPa, the level considered to limit root penetration. Indirectly, compaction also results in aggravation of run-off erosion as compaction reduces the water infiltration rate which results in an off-site impact.

Significance of impacts
The impacts of soil compaction are mainly direct and although the impact only has local extent, it is considered to be permanent as soil compaction is very difficult to remediate and will still continue after the mine closure. The impact is of medium magnitude for some areas such as access roads have already been compacted by farming equipment and vehicles used by the community and the receptors considered only medium sensitive. The impact has moderate significance as soil compaction can be one of the main factors impeding successful mine rehabilitation (Table 3).

Table 3: Impacts on soil compaction

<table>
<thead>
<tr>
<th>Impact</th>
<th>Soil compaction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Impact Nature</td>
<td>Negative</td>
</tr>
<tr>
<td>Impact Type</td>
<td>Direct</td>
</tr>
<tr>
<td>Impact Nature</td>
<td>Neutral</td>
</tr>
<tr>
<td>Impact Type</td>
<td>Indirect</td>
</tr>
<tr>
<td>Impact Nature</td>
<td>Induced</td>
</tr>
</tbody>
</table>
### Impact Duration

<table>
<thead>
<tr>
<th>Temporary</th>
<th>Short-term</th>
<th>Long-term</th>
<th>Permanent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Impacts are considered permanent, as the impacts will continue past closure with only a very slow recovery rate if at all.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Impact Extent

<table>
<thead>
<tr>
<th>Local</th>
<th>Regional</th>
<th>International</th>
</tr>
</thead>
<tbody>
<tr>
<td>Impacts on soils are local to the mine site.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Impact Scale

The scale of the impact is estimated to be restricted to the areas used for access roads and infrastructure as well as areas where topsoil is stockpiled and additional roads constructed.

### Frequency

This impact will still continue after closure of the mine.

### Impact Magnitude

<table>
<thead>
<tr>
<th>Positive</th>
<th>Negligible</th>
<th>Small</th>
<th>Medium</th>
<th>Large</th>
</tr>
</thead>
<tbody>
<tr>
<td>Impact magnitude is considered medium as existing roads will be used as far as possible and the soils have already been impacted by compaction in the past.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Receptor Sensitivity

<table>
<thead>
<tr>
<th>Low</th>
<th>Medium</th>
<th>High</th>
</tr>
</thead>
<tbody>
<tr>
<td>The receptor sensitivity is considered as medium for although compaction will most likely occur, it will occur in a limited area.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Impact Significance

<table>
<thead>
<tr>
<th>Negligible</th>
<th>Minor</th>
<th>Moderate</th>
<th>Major</th>
</tr>
</thead>
<tbody>
<tr>
<td>Significance of impact is considered to be <strong>Moderate</strong>.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

---

**Mitigation measures, management and monitoring**

Apart from the embedded controls to be included in project design, the following mitigation measure will reduce the significance of soil compaction:

- Restrict access of vehicles and construction vehicles to existing roads.
- Once stockpiles have been established they should not be moved around to other areas but directly used for rehabilitation again to avoid creating more compacted areas.

**Significance of residual impacts**

With proper mitigation measures and the embedded controls as recommended above, it is anticipated that the significance of this impact cannot feasibly be reduced to moderate and still remains moderate.

### 6.4 Loss and Sterilization of Fertile Topsoil layer

**Potential impact**

The sterilization of the fertile topsoil layer is only considered to be an impact during the construction phase and not during operation and closure phases. During the construction phase, topsoil is stripped and stockpiled for activities such as construction of the adit and
main roads. The reason for stripping topsoil is to have soil material available for
rehabilitation purposes during ongoing rehabilitation and the closure phases. The most
critical and important part of the soil is the uppermost 20 cm as this is the repository for
seeds, tubers, bulbs etc. Under natural conditions most grass seed remains viable for only
about one (1) year (reproductive seedbank life), with only very few species having seed that
can survive for up to 2 - 3 years. Under stockpile conditions it is probable that the seedbank
life will be shorter than under natural conditions.

Potential consequence
The stockpiles will remain for more than six (6) months during which the organic carbon
content of the soil will decompose without availability of new carbon sources from dead
plant roots and leaf litter. This will result in the soil carbon cycle being disturbed. The
disturbance of the soil nutrient cycle will lead to imbalances in the soil microbial population
that form an integral part of the soil-plant ecosystem of the area.

Significance of impacts
The impact on topsoil through stripping and stockpiling is direct but of local extent as it is
restricted to the site area. It is considered a long-term impact as it may be restored to a
certain extent after closure. The impact is considered to be of small magnitude as small
volumes of topsoil will be stripped and stockpiled and topsoil will definitely be lost and
become sterilized to a certain extent, especially with the long duration of the life of mine.
The impact is considered to have minor significance (Table 4).

Table 4 : Impacts on Topsoil Layer

<table>
<thead>
<tr>
<th>Impact</th>
<th>Loss and sterilization of fertile topsoil layer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Impact Nature</td>
<td>Negative</td>
</tr>
<tr>
<td>Impact on soils is negative.</td>
<td></td>
</tr>
<tr>
<td>Impact Type</td>
<td>Direct</td>
</tr>
<tr>
<td>Impact on soils is direct.</td>
<td></td>
</tr>
<tr>
<td>Impact Duration</td>
<td>Temporary</td>
</tr>
<tr>
<td>Impacts are considered long-term and rehabilitation after closure might restore the soil fertility to a large extent.</td>
<td></td>
</tr>
<tr>
<td>Impact Extent</td>
<td>Local</td>
</tr>
<tr>
<td>Impacts on soils are local to the mine site.</td>
<td></td>
</tr>
<tr>
<td>Impact Scale</td>
<td>The scale of the impact is estimated to be restricted to the areas used for mining and infrastructure as well as areas where topsoil is stockpiled and additional roads constructed.</td>
</tr>
</tbody>
</table>
Mitigation measures, management and monitoring

Apart from the embedded controls to be included in project design, the following mitigation measures will reduce the significance of loss and sterilization of topsoil:

- Soil stockpiles must be sampled, ameliorated (if necessary) and re-vegetated as soon after construction as possible. This is in order to limit raindrop and wind energy, as well as to slow and trap runoff, thereby reducing soil erosion. Grassland and shrub species indigenous to the area are preferred, given both their hardy nature as well as their lower maintenance requirements. This is highly recommended in order to maintain the natural biological soil life associated with the indigenous vegetation.

Significance of residual impacts

With proper mitigation measures and the embedded controls as recommended above, it is anticipated that the significance of this impact can feasibly be reduced to negligible.

6.4 Chemical soil pollution

Potential impact

During the construction phase, chemical soil pollution can result from oil and fuel leakages from construction vehicles. During the operational phase, dust and spillages from the overland conveyor can cause soil and water pollution. Spillages from fuel storage units and leakages from construction vehicles can also result in chemical pollution. With the closure phase, soil surfaces are exposed to chemical soil pollution when stored fuel is transported off-site and by leakages from vehicles.
Potential consequence

The use of vehicles can result in oil and fuel spills on site as well as waste generation by construction and construction workers. Spillage of coal and coal dust from the overland conveyor system can also cause contamination.

These soil contaminants can have significant deleterious consequences for ecosystems. There are radical soil chemistry changes which can arise from the presence of many hazardous chemicals even at low concentration of the contaminant species. These changes can manifest in the alteration of metabolism of endemic microorganisms and arthropods resident in a given soil environment. The result can be virtual eradication of some of the primary food chain, which in turn could have major consequences for predator or consumer species. Even if the chemical effect on lower life forms is small, the lower pyramid levels of the food chain may ingest pollutant chemicals, which normally become more concentrated for each consuming rung of the food chain.

Contaminated or polluted soil can also directly affect human health through direct contact with soil or via the infiltration of soil contamination into groundwater aquifers used for human consumption, sometimes in areas apparently far removed from any apparent source of above ground contamination.

Significance of impacts

Chemical soil pollution will have a negative impact on soil and will directly impact the soil where the pollution occurs. The duration of pollution once it has taken place is long term, depending on the nature and properties of the specific pollutant. It is considered to have high receptor sensitivity and be of major significance as soil chemical pollution may have a negative impact on ecosystem and/or human health (Table 5).

<table>
<thead>
<tr>
<th>Impact</th>
<th>Chemical soil pollution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Impact Nature</td>
<td>Negative</td>
</tr>
<tr>
<td>Impact Type</td>
<td>Direct</td>
</tr>
<tr>
<td>Impact Duration</td>
<td>Temporary</td>
</tr>
</tbody>
</table>
Impacts are considered long-term, as the impacts will continue past closure with only a very slow recovery rate.

**Impact Extent**
- Local
- Regional
- International

Impacts on soils are local to the mine site.

**Impact Scale**
The scale of the impact is dependent on the type of pollutant but would mainly be restricted to the mine site.

**Frequency**
Throughout the life time of the mining operations and during closure phase.

**Impact Magnitude**
- Positive
- Negligible
- Small
- Medium
- Large

Impact magnitude is considered medium depending on the type of chemical and the volume of spillage.

**Receptor Sensitivity**
- Low
- Medium
- High

The receptor sensitivity is considered as Medium.

**Impact Significance**
- Negligible
- Minor
- Moderate
- Major

Significance of impact is considered to be Moderate.

**Mitigation measures, management and monitoring**
Apart from the embedded controls to be included in project design, the following mitigation measure will reduce the significance of chemical soil pollution:

- Any chemical spillage should be cleaned up immediately and treated or disposed by contractors who specialize in hazardous waste.
- An intercept drain should be constructed upslope of construction and operational areas, in order to re-direct clean water away to avoid soil chemical pollution to clean groundwater resources.
- An intercept drain should possibly be constructed downslope of polluted areas, in order to drain potentially polluted water into a pollution control dam.
- Drains and intercept drains should be maintained to ensure that they continue to redirect clean water away from the polluted areas.
- Conduct proper chemical waste management to avoid spillage of chemicals during all the phases of the project cycle.

**Significance of residual impacts**
With proper mitigation measures as recommended above, it is anticipated that the significance can be mitigated to minor.

**6.5 Loss of current Land Capability**

**Potential impact**
During the construction and operational phases the footprint areas of the adit and overland conveyor will change the arable and grazing land capability because topsoil will be stripped and stockpiled or occupied by the infrastructure of the conveyor and by access roads. With the closure phase, infrastructure will be removed and soil rehabilitation will be done which will have a possible positive impact on the land capability of the disturbed areas.

**Potential consequence**

The stripping and stockpiling of soil cause a loss in fertility, loss of structure and compaction of soil which compromise the arable and grazing land capability of the soil. It will have a negative impact on the ability to produce food or make a living on such land.

**Significance of impacts**

The loss of arable land capability will have a negative impact on current land users. The duration of arable land capability loss is permanent and grazing land capability loss is long term, depending on the nature of the disturbance. It is considered to have high receptor sensitivity and be of major significance as the loss of arable land capability may have a negative impact on food security (Table 6).

**Table 6 : Loss of Land Capability**

<table>
<thead>
<tr>
<th>Impact</th>
<th>Loss of current land capability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Impact Nature</td>
<td>Negative</td>
</tr>
<tr>
<td></td>
<td>Positive</td>
</tr>
<tr>
<td></td>
<td>Neutral</td>
</tr>
<tr>
<td>Impact Type</td>
<td>Direct</td>
</tr>
<tr>
<td></td>
<td>Indirect</td>
</tr>
<tr>
<td></td>
<td>Induced</td>
</tr>
<tr>
<td>Impact Duration</td>
<td>Temporary</td>
</tr>
<tr>
<td></td>
<td>Short-term</td>
</tr>
<tr>
<td></td>
<td>Long-term</td>
</tr>
<tr>
<td></td>
<td>Permanent</td>
</tr>
<tr>
<td>Impact Extent</td>
<td>Local</td>
</tr>
<tr>
<td></td>
<td>Regional</td>
</tr>
<tr>
<td></td>
<td>International</td>
</tr>
<tr>
<td>Impact Scale</td>
<td>The scale of the impact is dependent on the nature of the disturbance but would mainly be restricted to the mine site.</td>
</tr>
<tr>
<td>Frequency</td>
<td>Throughout the life time of the mining operations and during closure phase.</td>
</tr>
<tr>
<td>Impact Magnitude</td>
<td>Positive</td>
</tr>
<tr>
<td></td>
<td>Negligible</td>
</tr>
<tr>
<td></td>
<td>Small</td>
</tr>
<tr>
<td></td>
<td>Medium</td>
</tr>
<tr>
<td></td>
<td>Large</td>
</tr>
<tr>
<td>Receptor Sensitivity</td>
<td>Low</td>
</tr>
<tr>
<td></td>
<td>Medium</td>
</tr>
<tr>
<td></td>
<td>High</td>
</tr>
<tr>
<td>Impact</td>
<td>Negligible</td>
</tr>
<tr>
<td></td>
<td>Minor</td>
</tr>
<tr>
<td></td>
<td>Moderate</td>
</tr>
<tr>
<td></td>
<td>Major</td>
</tr>
</tbody>
</table>
Significance

Significance of impact is considered to be **Major**.

**Mitigation measures, management and monitoring**

Apart from the embedded controls to be included in project design, the following mitigation measure will reduce the significance of land capability loss:

- On the adit area, replace the soil layers in the correct order as far as possible.
- Ameliorate the soil and revegetate as soon as possible with natural vegetation.
- After removal of the overland conveyor, remove the polluted layer, rip the soil to counteract the compaction and revegetate as soon as possible.

**Significance of residual impacts**

It is not anticipated that areas where arable land capability was lost, will be remediated to such an extent that the land capability will return. At most the site will be rehabilitated to wilderness or grazing land capability.

With proper mitigation measures as recommended above, it is anticipated that the significance can be mitigated to moderate.

### 6.6 Change of Land use

**Potential impact**

During the construction and operational phases the footprint areas of the adit and overland conveyor the land use will change from natural vegetation and agriculture (livestock grazing and crop production) to industrial. With the closure phase, infrastructure will be removed and soil rehabilitation will be done which will have a possible positive impact on the reversal of land use to agriculture.

**Potential consequence**

The adit area where large volumes of soil will be stripped and stockpiled will probably never be used for crop production again. The overland conveyor will form a barrier which cannot be crossed by people or their livestock.

**Significance of impacts**
The loss of arable soil will have a negative impact on current land users. The overland conveyor will form a barrier for livestock and communal farmers may be cut off from their grazing land or drinking water for cattle. The duration of arable soil loss is permanent and grazing land loss is long term, depending on the nature of the disturbance. It is considered to have medium receptor sensitivity and be of moderate significance as the loss of arable soil and the barrier caused by the conveyor may have a negative impact on the livelihood of the community (Table 7).

Table 7: Change of Landuse

<table>
<thead>
<tr>
<th>Impact</th>
<th>Change of land use</th>
</tr>
</thead>
<tbody>
<tr>
<td>Impact Nature</td>
<td>Negative</td>
</tr>
<tr>
<td>Impact Type</td>
<td>Direct</td>
</tr>
<tr>
<td>Impact Duration</td>
<td>Temporary</td>
</tr>
<tr>
<td>Impact Extent</td>
<td>Local</td>
</tr>
<tr>
<td>Impact Scale</td>
<td>The scale of the impact is dependent on the nature of the change but would mainly be restricted to the mine site.</td>
</tr>
<tr>
<td>Frequency</td>
<td>Throughout the life time of the mining operations and during closure phase.</td>
</tr>
<tr>
<td>Impact Magnitude</td>
<td>Positive</td>
</tr>
<tr>
<td>Impact significance</td>
<td>Impact magnitude is considered medium depending on the nature of the disturbance</td>
</tr>
<tr>
<td>Receptor Sensitivity</td>
<td>Low</td>
</tr>
<tr>
<td>Impact Significance</td>
<td>Negligible</td>
</tr>
<tr>
<td>Significance of impact is considered to be Moderate.</td>
<td></td>
</tr>
</tbody>
</table>

**Mitigation measures, management and monitoring**

Apart from the embedded controls to be included in project design, the following mitigation measure will reduce the significance of the change in land use:

- Elevate the structure of the overland conveyor where depressions in the landscape will be crossed to allow cattle and people to pass underneath.
- Rehabilitate the adit area in such a way that the land use can change to at least livestock grazing.
After decommisioning of the overland conveyor, remove the polluted soil, rip organic material into the soil to improve fertility of the soil and alleviate compaction and revegetate as soon as possible.

**Significance of residual impacts**

It is anticipated that areas where land was used for crop production, will be remediated to such an extent that the land could be used for grazing after decommissioning. With proper mitigation measures as recommended above, it is anticipated that the significance can be mitigated to moderate.
7. **Reference list**