APPENDIX D: SOIL AND LAND CAPABILITY STUDY

REPORT

for SLR Consulting

SOIL SURVEY FOR THARISA MINERALS, NEAR MOOINOOI

By

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DECLARATION

I hereby declare that I am qualified to compile this report as a registered Natural Scientist: Soil Science (Registration No. 400463/04) and that I am independent of any of the parties involved and that I have compiled an impartial report, based solely on all the information available.

Dr. D.G. Paterson

June 2014

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1. TERMS OF REFERENCE

The Institute for Soil, Climate and Water of the Agricultural Research Council (ARC-ISCW) was requested by SLR Consulting to carry out a soil investigation of part of the farm Elandsdrift 467JQ, north-west of Mooinooi, in North West Province, for the possible establishment of a new rock dump on an existing opencast platinum mine. The investigation was to describe and map the soils occurring, as well as to assess their broad agricultural potential.

The site was visited on 11th and 12th June 2014.

2. STUDY AREA

2.1 Site details

The study area comprises an area of approximately 85 ha in total, and lies some five km to the north-west of the town of Mooinooi, as shown on Figure 1 below.

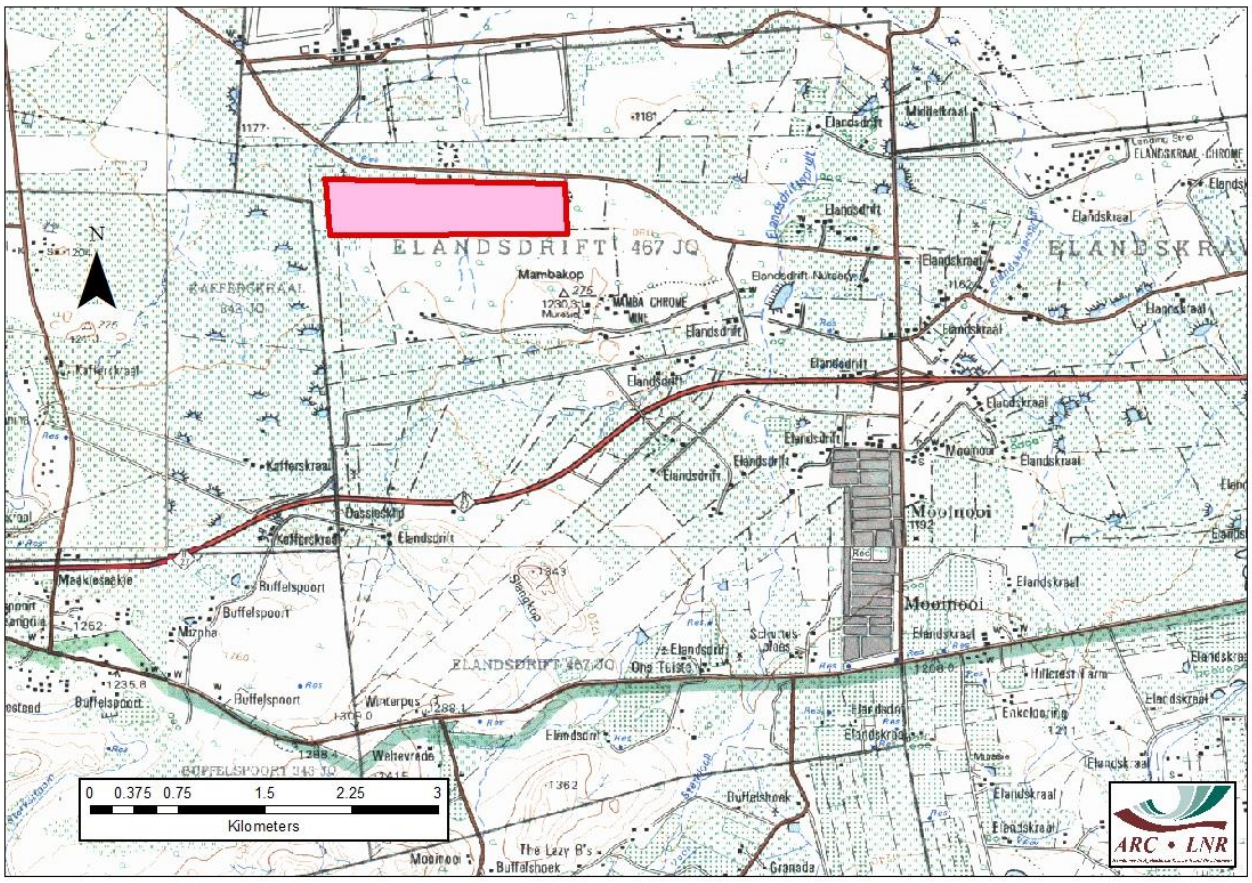

Figure 1 Locality map

The area is relatively flat with gentle slopes towards the north of no more than 2%. It is bordered by the mine haul road on the northern boundary. There is a small non-perennial stream flowing northward through the western end of the area.

The vegetation of the site comprises generally open bush (somewhat thicker in patches), changing to grassland in places.

2.2 Geology

The underlying geology of the site (Geological Survey, 1981) consists of gabbro and norite of the Rustenburg Layered Suite, Bushveld Complex.

2.3 Climate

The main characteristics (Koch, 1987) are shown in Table 1 below.

Table 1 Climate Data

Month	Rainfall (mm)	Min. Temp (^{o}C)	Max. Temp (^{o}C)	Average frost dates
Jan	109.9	16.6	29.8	Start date: 24/05 End date: 38/8 Days with frost: 32
Feb	89.7	16.3	29.2	
Mar	76.6	14.5	28.2	
Apr	40.2	10.7	25.7	
May	18.0	5.6	23.0	
Jun	6.5	2.0	20.4	
Jul	6.2	1.8	20.8	**Heat units (hrs > 10^{o}C)**
Aug	6.5	4.0	23.6	Summer (Oct-Mar): 2213 Winter (Apr-Sept): 796
Sep	14.2	8.6	27.0	
Oct	51.9	12.7	28.8	
Nov	97.1	14.6	28.7	
Dec	102.2	15.8	29.4	
Year	**619.0 mm**	**18.2^{o}C (Average)**		

The climate of the area can be described as typical of the highveld, with cool to cold, dry winters and moist, warm to hot summers. Most of the rainfall (85.2%) falls between October and March, and frost is common.

3. METHODOLOGY

The area was surveyed by augering on an approximate grid of 150 x 150 m, with the grid points established using GIS and loaded onto a GPS instrument for use in the

field. A hand-held soil auger was used, and the soil was augered to a maximum depth of 1.2 m (or shallower, if a restricting layer, such as rock, was encountered).

The soil map units were then classified (Soil Classification Working Group, 1991) and grouped into map units. These soil units were then used to produce a map shown in the Appendix.

4. SOILS

The soils in the study area are generally of mixed agricultural potential (see Section 5 below).

The soils are predominantly black to dark grey, heavy-textured (40-55% clay) soils with strong structure and a shrink-swell nature ("turf" soils). There are two smaller zones of dark brown, structured clay soils, as well as an excavated area.

The main characteristics are given in Table 2 below.

Table 2 Soil Legend

Map Unit	Depth (mm)	Soil Characteristics	Agric. Potential	Area (ha)
dAr	750-1200+	Dark grey to black, strongly structured, usually calcareous, swelling clay soils on weathering rock. Mainly soils of the ***Arcadia*** form.	Low to moderate	40.0
mAr	450-750	Dark grey to black, strongly structured, usually calcareous, swelling clay soils on weathering rock. Mainly soils of the ***Arcadia*** form.	Low	25.7
Va	900-1200+	Dark brown, weakly to moderately structured, sandy clay loam topsoil on dark brown, moderately structured, sandy clay loam to sandy clay subsoil, often calcareous. Mainly soils of the ***Valsrivier*** form.	Low to moderate	10.8
Se	450-750	Dark brown, weakly to moderately structured, sandy clay loam topsoil on dark brown, moderately structured, sandy clay loam to sandy clay subsoil, often calcareous, on grey-brown, mottled, clay subsoil. Includes lower-lying areas. Mainly soils of the ***Sepane*** form.	Low	5.1
E	-	Area of previous deep (>10 m) excavation, soil removal and disturbance.	None	3.7
			TOTAL	**85.3**

The map unit symbols that are shown on the soil map (Appendix) are explained by the following example:

dAr
40 ha

where **dAr** refers to the map unit as explained in Table 2, and **40 ha** is the area of the specific map unit.

5. AGRICULTURAL POTENTIAL

The agricultural potential of the various map units in the study area (as shown in Table 2) varies with soil depth.

The map units, their areas, percentages and soil potential classes are given in Table 4.

Table 4 Agricultural Potential

Potential Class	**Map Unit**	**Main limiting factor(s)**	**Area (ha)** ***(+ % of study area)***
Low to moderate	***dAr, Va***	Impeded drainage due to high clay content and strong soil structure	50.9 ha *(59.6%)*
Low	***mAr, Se***	As above, plus somewhat restricted depth to parent material	30.8 ha *(36.1%)*
None	***Ex***	Removal and disturbance of entire soil profile	3.7 ha (4.3%)
		Total	**85.3 ha** *(100%)*

The **dAr** and **mAr** map units are is comprised mainly of soils of a smectitic nature, with consequent shrinking and swelling properties. These soils have a narrower moisture range for cultivation than most other agricultural soils. If these swelling clay soils become wet, the pores fill up, they saturate easily and drain slowly, causing anaerobic conditions (especially under irrigation) and a deficit of oxygen in the root zone. If allowed to dry out, however, these soils can crack, damaging roots. Surface crusting is also a potential problem, due to the swelling and sealing nature of the soils, which can lead to decreased infiltration rates. However, these black clay soils are naturally fertile, with high cation exchange capacities and moderately high organic carbon contents. If well managed, they can be productive soils.

The **Va** and **Se** map units also contain structured clay soils, but with different clay mineralogy, so that the shrink-swell tendencies are not so pronounced. The **Se** map unit has areas with signs of wetness lower in the soil profile, due mainly to the lower landscape position, where there will be a waterlogging hazard in the summer rainy season.

7. LAND CAPABILITY

The land capability system specified in the rehabilitation guidelines (Coaltech/Chamber of Mines, 2007) has proposed four classes, namely wetland, arable land, grazing land and wilderness land. The allocation of land capability class for the study area is as follows:

Table 5 Land capability

Land Capability Class	**Map Unit**	**Main limiting factor(s)**	**Area (ha) *(+ % of study area)***
Wetland	***Se***	Potential saturation hazard in summer.	5.1 ha *(5.9%)*
Arable *(low potential)*	***dAr, Va, mAr,***	Impeded drainage due to high clay content and strong soil structure. Restricted depth in places.	76.5 ha *(89.7%)*
Wilderness	***Ex***	Removal and disturbance of entire soil profile.	3.7 ha (4.4%)
		Total	**85.3 ha** *(100%)*

It should be noted that while the clay soils in the study area can be classed as arable, their high clay content, strong degree of structure and reduced water permeability makes them difficult to cultivate, so that they cannot be regarded as arable soils of the highest potential.

REFERENCES

Coaltech 2020/Chamber of Mines of South Africa, 2007. Guidelines for the rehabilitation of mined land.

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Koch, F.G.L., 1987. Climate data. In: Land types of the maps 2526 Rustenburg and 2528 Pretoria. *Mem. Agric. Nat. res. S. Afr*. No. 8. Dept Agric. & Water Supply, Pretoria.

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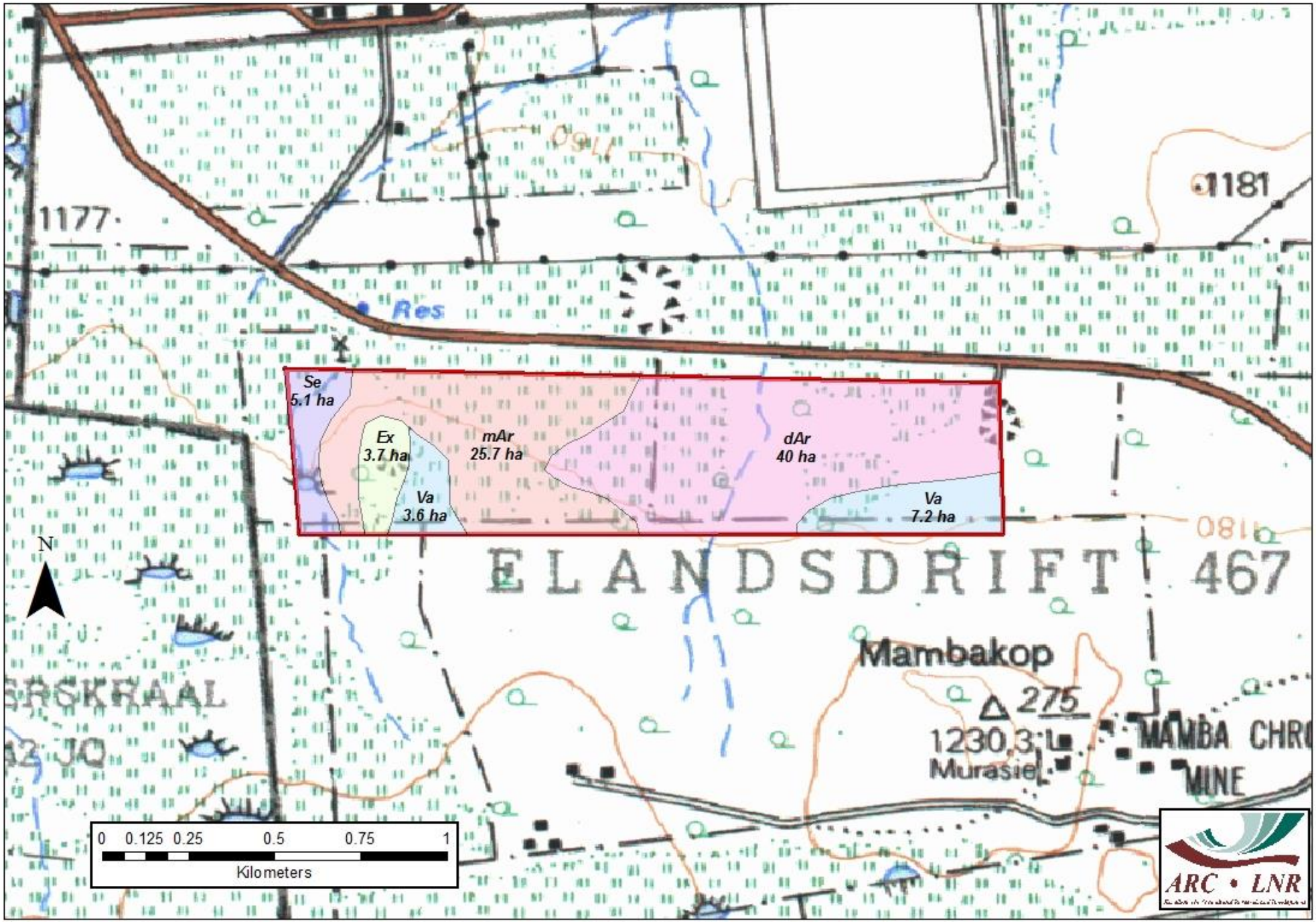
APPENDIX:

Soil Map


1177
1181
Res
Se
5.1 ha
Ex
3.7 ha
mAr
25.7 ha
dAr
40 ha
Va
3.6 ha
Va
7.2 ha
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275
1230.3
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0 0.125 0.25 0.5 0.75 1
Kilometers
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