REPORT

On contract research for

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SOIL INFORMATION FOR KUDUMANE PROJECT, NEAR HOTAZEL, NORTHERN CAPE

by:
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Declaration:

I declare that the authors of this study are qualified, registered natural scientists (soil science), are independent of any of the parties involved and have no other conflicting interests.

D.G. Paterson

CONTENTS

1. TERMS OF REFERENCE

The ARC-Institute for Soil, Climate and Water (ARC-ISCW) was originally contracted by Metago Environmental Engineers in 2009 to collect soil information for part of the farms York A 279, Devon 277 and Telele 312, located south of Hotazel in the north east of the Northern Cape Province. A report was prepared (Paterson & Seabi, 2009) and supplied.

Subsequently, the project scope was amended to include the farms Hotazel 280 (around the town itself) and Kipling 271. This report deals with that expanded area.

The purpose of the investigation is to contribute to the environmental impact assessment report for the proposed manganese mining operation. The objectives of the study are;

- To classify the soils occurring in the specified area as well as
- To assess the soil potential and soil characteristics in the study area.

2. SITE CHARACTERISTICS

2.1 Location

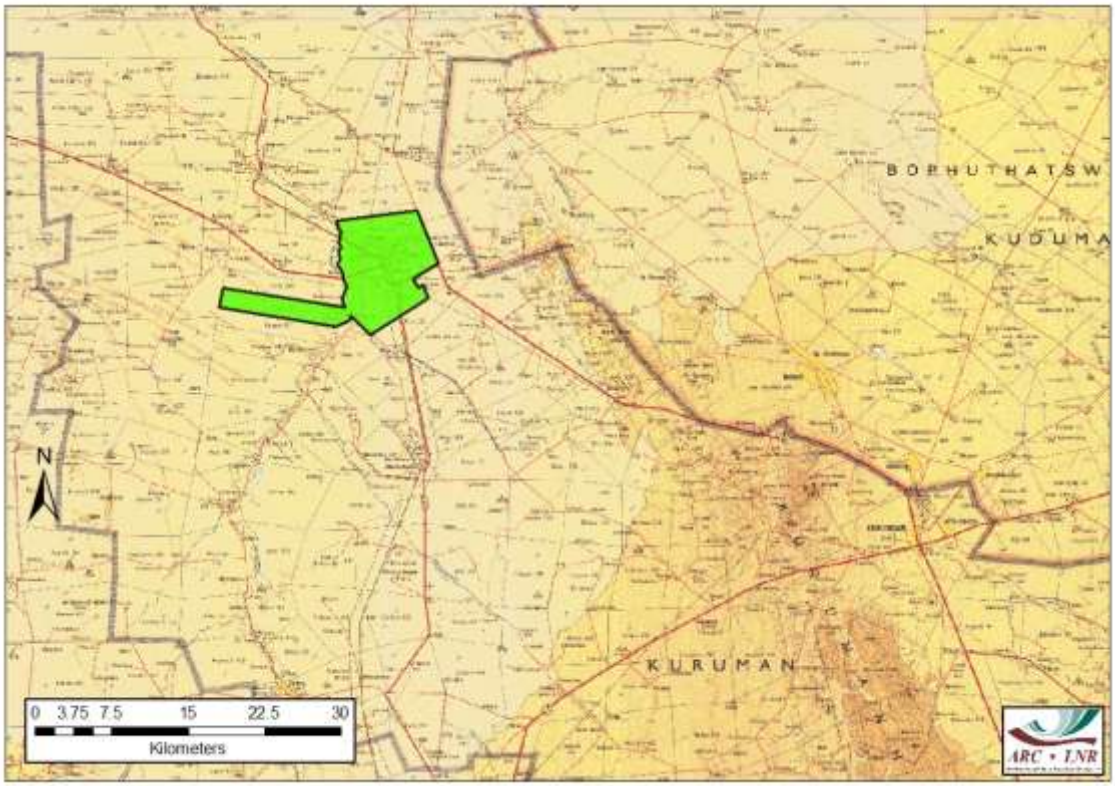

Figure 1: Locality map with the study area in green.

The area that was investigated covers ± 10 000 ha on the farms as mentioned above, lying adjacent to the town of Hotazel in the Northern Cape. The area is shown in Figure 1 above.

2.2 Terrain

The terrain morphological class of the area can be described as plains with low relief, lying at an altitude of around 1 080 meters above sea level (Kruger, 1983). The area is flat with no permanent surface drainage in the area. The current agricultural use of the surveyed area is that of extensive grazing for cattle, as well as current mine infrastructure.

2.3 Parent Material

Parent material comprises red to flesh-coloured, wind-blown sand and surface limestone of Tertiary to recent age. A few outcrops of course-grained brown quartzite and subgreywacke occur. Portions of land type Ah9 comprise Aeolian sand of recent age with a few outcrops of Tertiary Kalahari beds (Geological Survey, 1979).

2.4 Climate

The climate of the area can be regarded as typical of the northern interior, with cool to cold, dry winters and hot, dry summers (Koch & Kotze, 1986). The main climatic indicators are given in Table 1.

Table 1. Climate Data

Month	Average Rainfall (mm)	Average Min. Temp (°C)	Average Max. Temp (°C)	Heat units (hrs > 10°C)
Jan	58.6	17.8	32.0	Summer (Oct-Mar): 2 350 Winter (Apr-Sept): 719
Feb	59.7	17.1	30.8	
Mar	65.7	15.1	28.4	
Apr	34.7	10.9	25.1	
May	15.6	6.4	21.1	
Jun	5.6	2.5	18.2	
Jul	2.9	2.5	18.3	
Aug	5.4	4.6	20.9	
Sep	6.2	8.3	24.5	
Oct	17.1	12.1	27.8	
Nov	26.8	14.9	29.7	
Dec	38.1	16.9	31.6	
Year	**336.4 mm**	**18.3 °C (Average)**		

The long-term average annual rainfall is 336.4 mm, of which 266 mm, or 79%, falls from October to March. Temperatures vary from an average monthly maximum and minimum of 36.7ºC and 11.4ºC for January to 23.2ºC and –2.9°C for July respectively. The extreme high temperature that has been recorded is 41.6°C and the extreme low –7.5ºC.

2.5 Vegetation

According to Low & Rebelo (1996), the dominant vegetation type is that of Kalahari Plains Thorn Bushveld and falls into the Savanna Biome. The Kalahari Plains Thorn Bushveld is characterised by a fairly well-developed tree stratum, the shrub layer is moderately developed and the grass cover depends on the amount of rainfall during the growing season.

3. METHODOLOGY

For a variety of reasons (outlined below), it was decided not to carry out a field survey.

Firstly, the land type survey of the region (Eloff *et al*, 1986) indicated that the study area comprises land types Ae6, Ah5, Ag110, Af28 and Ah9. The land type inventories for these land types show that more than 90% of the landscape comprises deep (>1 200 mm), sandy, red and yellow soils of the Hutton and Clovelly forms with a high degree of homogeneity of soil properties.

Secondly, a previous survey (Dreyer & Paterson, 2006) was carried out immediately to the south of the study area. That survey involved around 95 auger observations on a 250 x 250 m grid and found that virtually the whole area was covered by deep, sandy Hutton soils. In addition, 16 soil samples were collected and analysed, confirming that the soils are sandy in texture, neutral in pH and have a low CEC value, leading to infertility.

Finally, the low annual rainfall and hot temperatures (Table 1) mean that this area, despite the deep, friable soils, will have a low potential for arable agriculture and that the area is best suited for extensive grazing.

4. SOILS

The survey area is made up largely of deep Hutton and Clovelly soils with a small percentage of rock outcrops and Mispah soils with shallow depth of soil to the underlying rock. The Hutton and Clovelly soils cover approximately 90% of the area. The remainder of the area consists of shallow Mispah soils and rock outcrops. The land type boundaries are shown on the map in the Appendix.

The map units are shown on the soil map in the Appendix (with land type boundaries in blue).

Table 2 below gives a summary of the main soil characteristics and the dryland agricultural potential of each unit.

Table 2. Summary of the main soil characteristics

MAP UNIT	DOMINANT SOIL FORM/ FAMILY	SUBDOMINANT SOIL FORM/FAMILY	EFFECTIVE DEPTH (mm)	DESCRIPTION OF MAPPING UNIT	AGRIC. POTENTIAL*	AREA (ha)
Red, yellow sandy soils						
Ae6	Hutton (91%)	Clovelly & Oakleaf	900-1200+	Reddish-brown (occasionally yellowish brown), structureless, fine-grained sandy loam soils.	Low	2 007
Af28	Hutton (98%)	Mispah	600-1200+	Reddish-brown, structureless, fine- to medium-grained sandy soils, occasionally on rock or calcrete. Sand dunes occur frequently	Low	2 451
Ag110	Hutton (shallow) and Mispah (80%)	Hutton (moderately deep)	0 – 300	Reddish-brown, structureless, fine-grained sandy soils, on rock and calcreete.	Low	84
Ah5	Hutton & Clovelly (92%)		> 1200	Reddish-brown and yellowish-brown, structureless, fine-grained sandy soils.	Low	27
Ah9	Hutton & Clovelly (92%)		> 1200	Reddish-brown and yellowish-brown, structureless, fine-grained sandy soils.	Low	1 925
					Total	**6 494**

*Refers to dryland (rain-fed) potential

5. AGRICULTURAL POTENTIAL

The entire study area is considered to be of low agricultural potential due to the low clay content of the soils and the low annual rainfall which qualifies the area as suited for grazing purposes only. According to the criteria of Schoeman (2004), land in the Northern Cape is only considered to be of high potential if it is under permanent irrigation.

5.1 Dryland

The soils of the area are sandy and deep (> 1 200 mm). They will therefore drain rapidly. Due to this tendency, along with the lack of fertility as shown by the low CEC values from previous surveys, they have a low dryland agricultural potential.

Coupled with the hot, dry nature of the climatic regime, it can be seen that this area is not suited to dryland arable agriculture, and most of the farming enterprises in the vicinity are either game farms or cattle ranches. This is the optimum land use option, given the prevailing environment.

Satellite imagery confirms that there is no sign of any agricultural activity in the area (Figure 2).

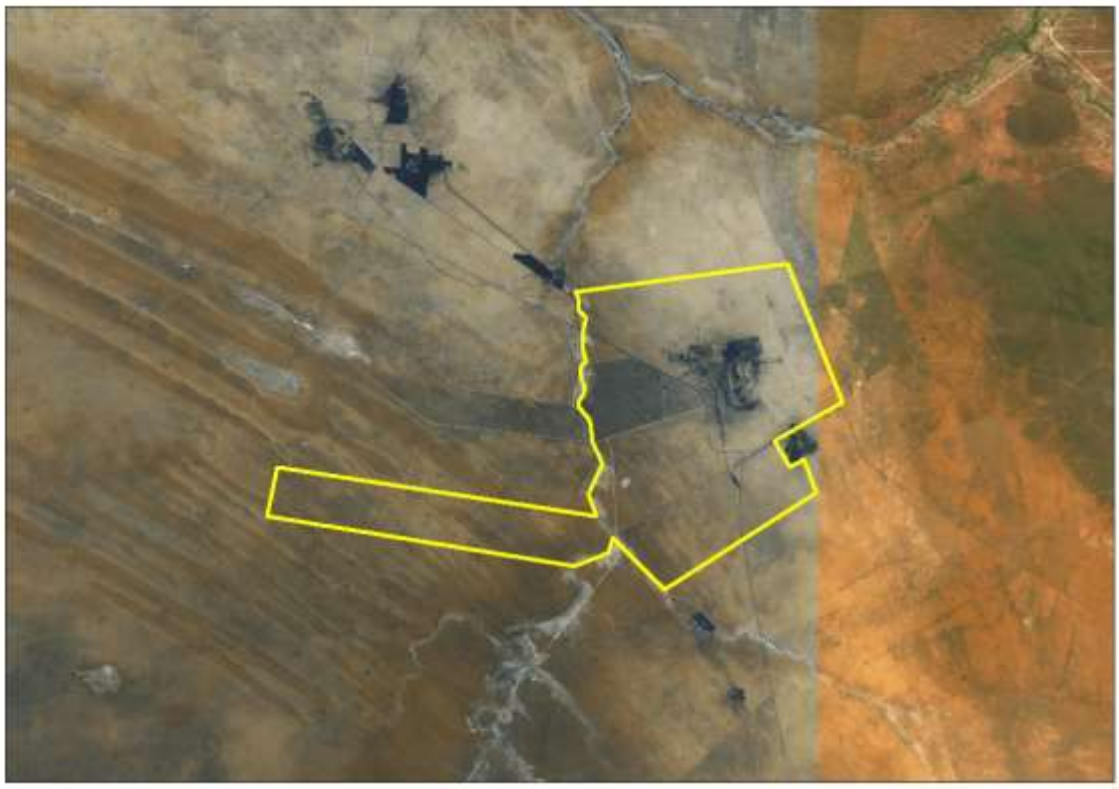

Figure 2 Satellite image of Hotazel area, showing study area

5.2 Irrigation

The soils would have at best a moderate potential for irrigation, due to the very low clay content. The sandy nature of the soils would necessitate very careful scheduling because of the very low water-holding capacity of the soils. The soils would require a substantial and reliable supply of water to ensure optimum soil moisture at all times, as well as good irrigation management practices.

The non-perennial (usually dry) Ga-Mogara river runs through the study area, but there is not enough underground water from this source for any irrigation.

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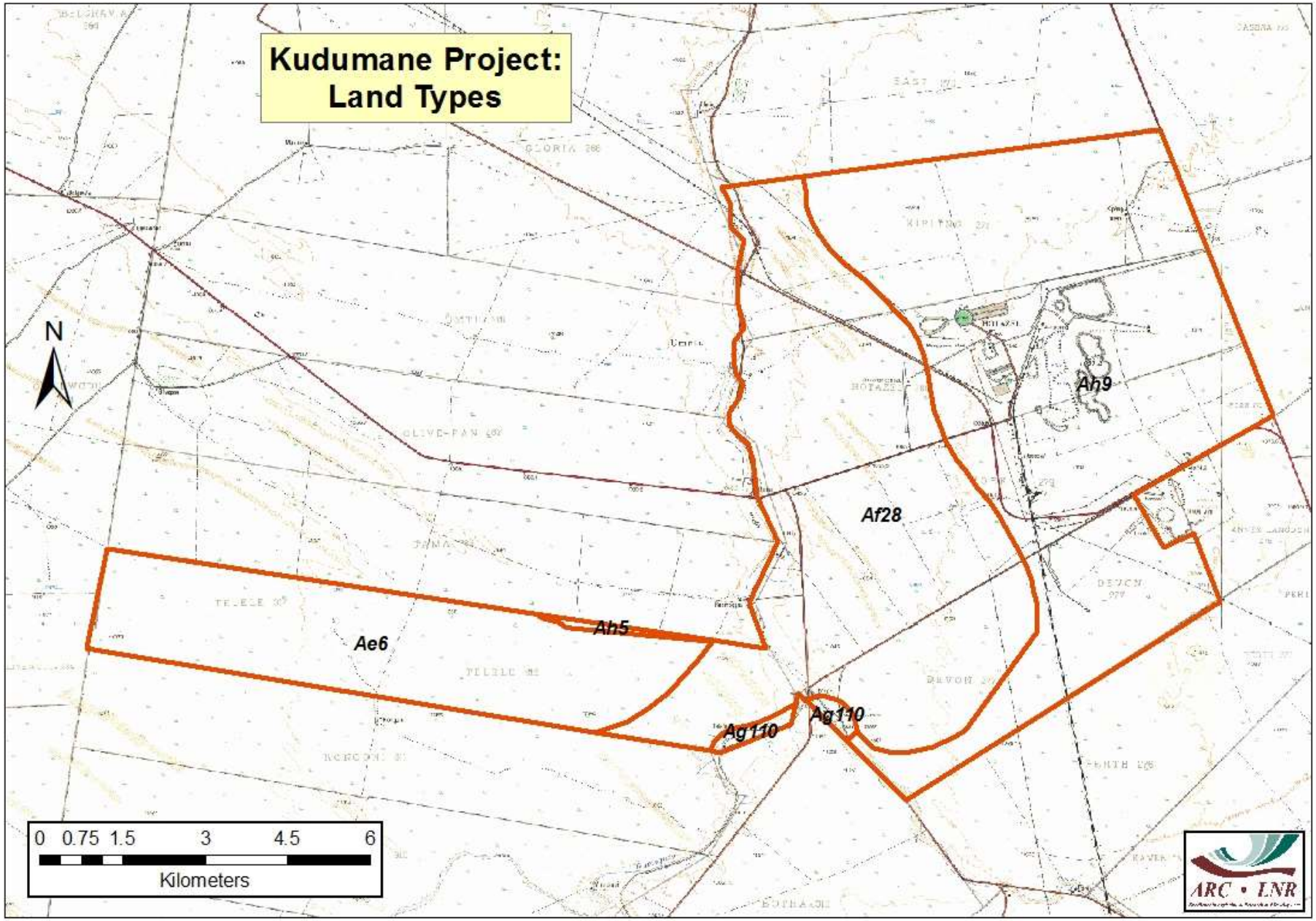
APPENDIX:

LAND TYPE MAP


Kudumane Project:
Land Types
N
Ah9
Af28
Ah5
Ae6
Ag110
Ag110
0 0.75 1.5 3 4.5 6
Kilometers
ARC • LNR