REPORT

for Arcus Gibb

by
INSTITUTE FOR SOIL CLIMATE AND WATER
AGRICULTURAL RESEARCH COUNCIL

ARC • LNR

SOILS AND AGRICULTURAL POTENTIAL ALONG THE PROPOSED WESTGATE-TARLTON-KROMDRAAI POWER LINE, GAUTENG PROVINCE

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By

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CONTENTS

1. TERMS OF REFERENCE

The Institute for Soil, Climate and Water of the Agricultural Research Council (ARC-ISCW) was requested by Arcus GIBB to carry out an investigation along the route of a proposed power line in the west of Gauteng. The investigation was to describe and map the soils occurring, as well as to assess their broad agricultural potential. A previous version of this report was produced in February 2008, but in the intervening period, adjustments have been made to the proposed routes of the power lines. This report deals with the revised corridors.

2. STUDY AREA

Location and Terrain

The proposed route runs from the proposed Westgate substation, lying to the west of Kagiso, westward to Randfontein and from there, northward. There are a number of alternatives, lying to the west of the Krugersdorp Game Reserve, which run to the Tarlton substation and from there to the proposed Kromdraai substation.

The area of the routes lies at around 1 550 to 1 700 metres above sea level, and consists of undulating plains with occasional steeper ridges, mainly to the east of the Krugersdorp Game Reserve. There are no major watercourses along the routes.

Parent Material

The underlying geology consists mainly of dolomite and chert of the Malmani Subgroup, as well as quartzite, conglomerate and shale of the Black Reef Formation, both of the Transvaal Sequence. Between the Krugersdorp Game Reserve and Randfontein are small patches of Ventersdorp Supergroup geology, namely quartzite, conglomerate and shale of the Government Formation and lava of the Klipriviersberg Formation (Geological Survey, 1986).

Climate

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

Table 1. Climate Data

Month	Rainfall (mm)	Min. Temp (°C)	Max. Temp (°C)	Average frost dates
Jan	128.1	14.3	26.3	Start date: 05/06
Feb	103.3	13.9	25.6	End date: 15/8
Mar	90.0	12.8	24.3	Days with frost: ±16
Apr	43.6	10.3	22.1	
May	21.9	6.9	19.1	
Jun	6.6	4.1	16.5	
Jul	9.7	4.1	16.4	**Heat units (hrs > 10°C)**
Aug	8.6	6.5	19.8	Summer
Sep	21.4	9.1	22.8	(Oct-Mar): 1559
Oct	59.8	11.8	25.0	
Nov	110.4	12.6	25.3	Winter
Dec	115.4	13.7	26.1	(Apr-Sept): 495
Year	**718.8 mm**	**16.2°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 (84.4%) falls between October and March, and frost is common, especially in the lower-lying parts.

3. METHODOLOGY

The area was covered by existing soil maps, at 1:50 000 scale, of the PWV peri-urban soil survey (Yager, 1990). The soils were classified (MacVicar *et al*, 1977) and similar soils were grouped into map units. This information was digitised in ArcGIS and each soil map unit was allocated a class of broad agricultural potential (Section 5).

The soil boundaries are shown on the map in Appendix 1.

4. SOILS

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

Although other soils occur, the soils are predominantly reddish-brown to red and belong to the Hutton form (orthic topsoil on red apedal subsoil, usually on rock). They are predominantly light textured (15-25% clay) and vary in depth, from less than 300 mm in places to over 1.2 metres deep. In some places, the soils are yellow-brown, with a mottled, often gravelly subsoil plinthic horizon, and belong to the Avalon form. Occasional patches of shallow, brown soils, directly overlying the bedrock, belonging to the Mispah form, occur.

5. AGRICULTURAL POTENTIAL

The map units shown on the map have been divided by broad agricultural potential class, corresponding to the colours used on the map. The potential, as referred to here, takes soil factors into account and not climatic conditions.

Table 5. Agricultural Potential

Potential Class	Dominant Soils	Main soil characteristics
High	Hutton (>1200 mm) Shortlands (>1200 mm) Dundee (>1200 mm)	Deep, medium-textured soils with few or no limitations for agriculture
Moderate	Avalon (600-1200 mm) Hutton (300-1200 mm)* Shortlands (600-1200 mm)	Medium-textured soils with somewhat of a depth restriction to underlying rock or plinthite
Low	Hutton (300-600 mm) Mispah (100-400 mm)	Medium-textured, sometimes stony soils with a severe depth restriction to underlying rock
Rocky areas	Hutton (0-250 mm) Mispah (0-250 mm)	Shallow soils with abundant (>40%) surface rock outcrops. Often steeper terrain.
Waste areas	-	Mining and industrial waste areas, such as slimes dams, waste rock dumps etc.
Urban areas	-	Areas not mapped: residential, commercial, industrial, mining, transport etc.

* *Areas containing great variation in soil depth over a short distance, making it very difficult to map specific areas with deeper and shallower soils separately.*

From the map, it can be seen that virtually all the various alternatives traverse areas of soils with varying agricultural potential. Some of the areas with moderate or high potential soils have been developed (such as the area immediately to the west of the Krugersdorp Game Reserve) or lie within mining areas.

From the soil map, it appears that there is no clear alternative that crosses a larger proportion of lower potential soils.

6. IMPACTS

Agricultural Land

The main impact would be the loss of potentially high potential agricultural land. This would be relevant to the map units that are coloured green on the map in the Appendix.

However, a power line will have only a limited impact, due to the occasional placement of the pylons. Most cultivated agriculture can take place below power lines.

Table 6. Impact on agricultural land

Impact	Intensity	Extent	Duration	Probability	Consequence	Confidence
Loss of agric. land	Low	Local	Short-term	Improbable	Low	High

As far as mitigation is concerned, the actual area of agricultural land that would be lost is quite small, namely the pylons of the line and any substations that are constructed. This would be permanent, so no mitigation is possible.

In the construction phase, however, as well as for the maintenance of any access roads that might be required to service the power line, care should be taken to minimise any possible soil erosion. No significantly erodible soils are expected in the area, and most of the steeper slopes are rocky, which adds to the soil stability. However, measures should involve minimal vegetation removal and construction of contours and drainageways on any areas with steeper slopes.

Where the power line (and any service road) crosses a waterway, as long as normal mitigation measures are followed in the construction of a bridge (avoiding excess sedimentation, avoiding disturbing normal stream flow etc), there should be no adverse impact.

Table 7. Significance rating

Impact	Consequence	Probability	Significance	Confidence
Loss of Agricultural Land	Low	Probable	LOW	High
With mitigation	Low	Probable	LOW	High

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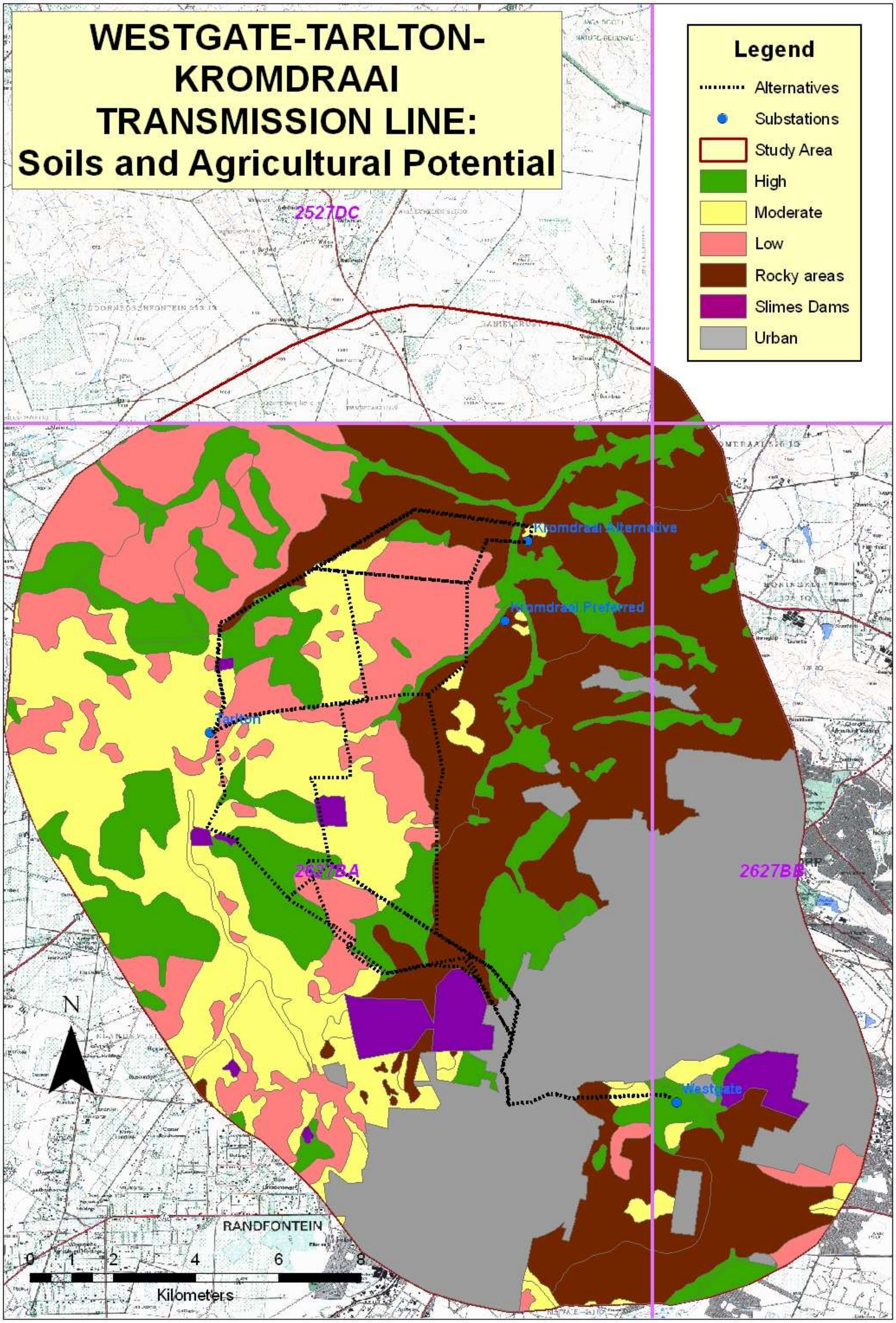
APPENDIX:

SOIL MAP



WESTGATE-TARLTON-KROMDRAAI TRANSMISSION LINE:
Soils and Agricultural Potential
Legend
Alternatives
Substations
Study Area
High
Moderate
Low
Rocky areas
Slimes Dams
Urban
2527DC
2627BA
2627BB
Kromdraai Alternative
Kromdraai Preferred
Tarlton
Westgate
RANDFONTEIN
N
0 1 2 4 6 8
Kilometers