REPORT

On contract research for
Nsovo Environmental Consulting (Pty) Ltd

ARC • LNR

SOIL INFORMATION FOR PROPOSED 400 kV SHONGWENI-HECTOR TRANSMISSION LINE, KWAZULU-NATAL PROVINCE

By

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June 2017

Report No. GW/A/2017/10

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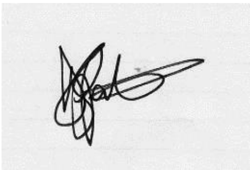
Declaration:

I declare that the author of this study is a qualified, registered natural scientist (soil science), is independent of any of the parties involved and has no other conflicting interests.



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1 INTRODUCTION

The ARC-Institute for Soil, Climate and Water was requested by Nsovo Environmental Consulting to carry out an investigation of the soils and agricultural potential for a proposed 400 kV transmission line in KwaZulu-Natal Province.

The project consists of two parts:

- The transmission line itself, with three alternative corridors
- The proposed Shongweni substation, at the eastern end of the corridor.

2 STUDY AREA

The route runs from the proposed Shongweni substation, near Hillcrest, westward to the existing Hector substation, north of Hammarsdale. Three route corridors (numbered 1, 2 and 3), each of approximately 2.5 km wide, have been identified, and four possible sites for the Shongweni substation (labelled Site E, Site F and Site G) have also been identified. The location of the study area is shown in Figure 1.

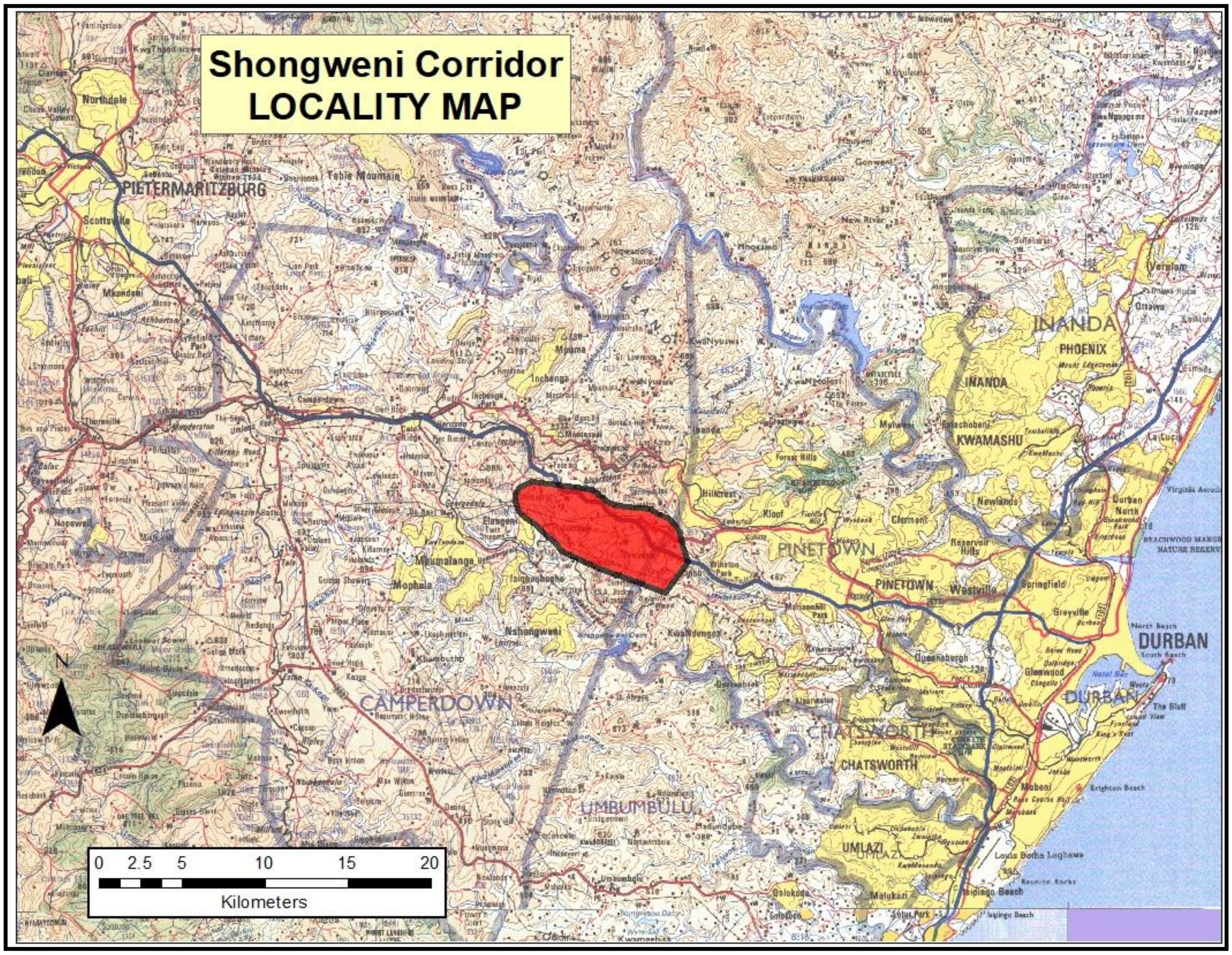

Figure 1 Locality map

2.1 Terrain

The terrain within the study area comprises generally undulating topography of the interior foothills. Slopes will mostly be between 2^o and 10^o, but could be as high as 20^o in places. Altitude is generally around 600-700 m.

No major rivers occur, but several small streams cross the corridors.

2.2 Climate

Climate data was obtained from the national Land Type Survey (Koch *et al.,* 2003).

Rainfall in the study area is around 900 mm per year. Rain falls all year round, but there is a definite summer peak. As expected along the KZN coastal strip, temperatures will be warm, often over 30^{o}C in summer, with no frost hazard. Humidity levels will be high.

2.3 Geology

The area is underlain by varying parent materials, as shown in Figure 2 (Geological Survey, 1984). Most of the southern parts of the corridors are underlain by arenite (sandstone) of the Natal Formation, with small areas of gneiss of the Mapumulo Formation.

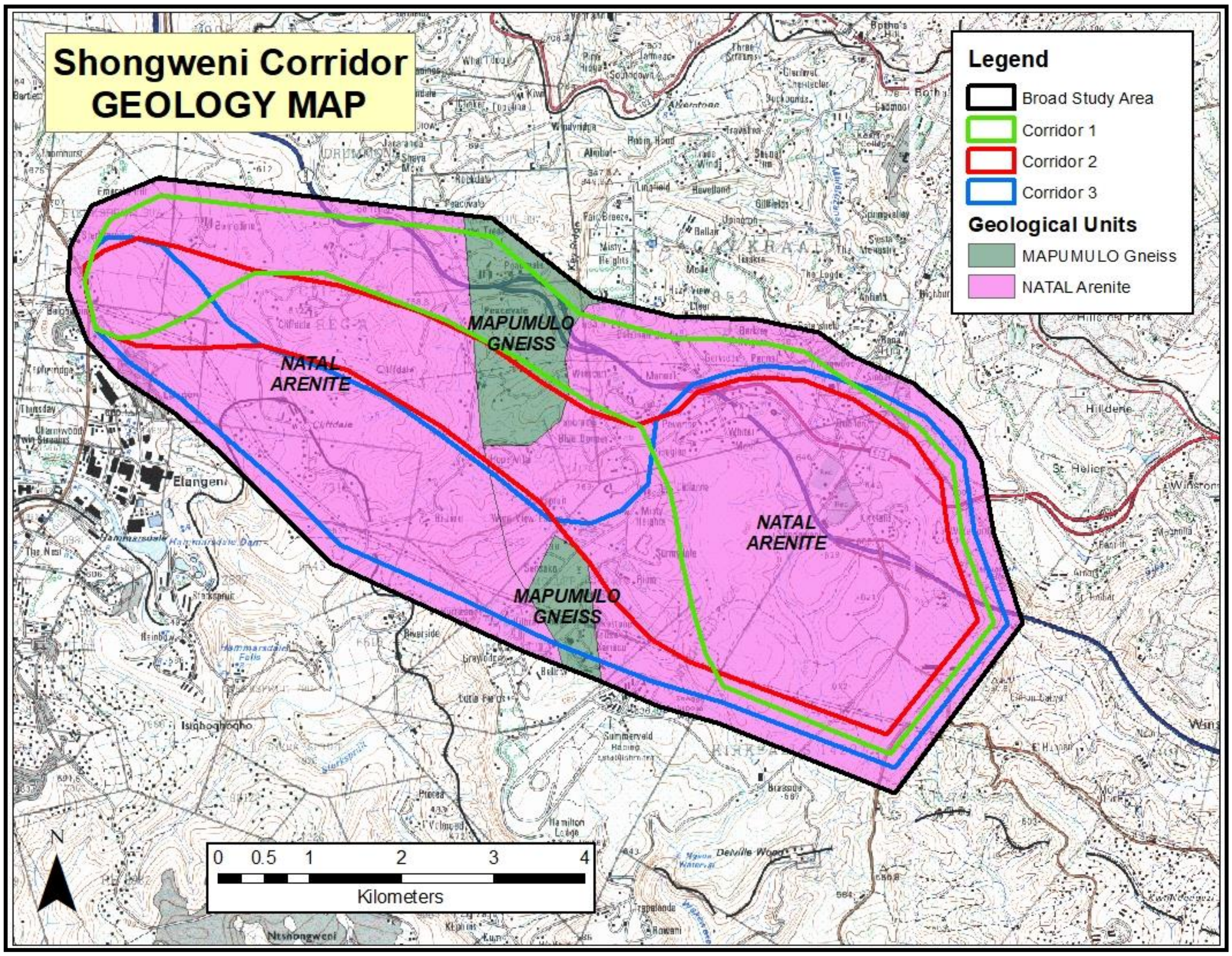

Figure 2 Geological formations

3 METHODOLOGY

As far as existing soil information is concerned, the area is covered by the land type map 2930 Durban at a scale of 1:250 000, which has been digitized using ArcGIS.

Each specific ***land type*** mapping unit is a unique combination of broad soil pattern, terrain type and macroclimate. Where any of these changes, a new land type occurs.

Within any specific land type, the soil forms occurring (MacVicar *et al*, 1977) have been summarized according to their dominance, but the locality or distribution of the various soils within a land type cannot be further determined.

4. SOIL PATTERN

Within the broad study area, there are six land types occurring, falling into two broad soil pattern classes, as follows:

- ***Aa*** Humic topsoils overlying red and/or yellow apedal subsoils
- **Fb** Shallow, and/or rocky, often steep, highly leached (very little lime)

Table 1 shows the summarized soil patterns of the land types that occur within one or more of the various route corridors or substation study areas. The dominant class of agricultural potential is shown **shaded in bold**.

Figure 3 shows the distribution of the land types across the three corridors within the study area.

Table 1 Land types occurring in study area

Land Type	Dominant soils	Depth (mm)	Percent of land type	Characteristics	Agric. Potential (%)
Aa11	Inanda 10/11 Nomanci 10	800-1200+ 500-800	33% 21%	Red, loamy, structureless soils with humic topsoil Brown to dark red, loamy, structureless soils with humic topsoil	***High: 69.3*** Mod: 16.6 Low: 14.1
Fa509	Glenrosa 17/18 Hutton 16	300-700 600-1200	36% 16%	Reddish-brown, loamy, structureless soils Red, loamy, structureless soils	High: 31.9 ***Mod: 53.0*** Low: 16.1
Fa510	Glenrosa 14/15/17/18 Hutton 16/17	150-300 1000-1200	25% 24%	Reddish-brown, sandy/loamy, structureless soils Red, loamy, structureless soils	High: 43.7 Mod: 10.8 ***Low: 45.5***
Fa512	Cartref 21/31 Glenrosa 13/16	600-800 200-400	53% 10%	Grey-brown, sandy, structureless soils Reddish-brown, sandy, structureless soils	High: 8.9 ***Mod: 64.7*** Low: 26.4
Fa513	Cartref 21/22 Glenrosa 14/17	350-500 150-500	38% 21%	Grey-brown, sandy, structureless soils Reddish-brown, sandy, structureless soils	High: 0.0 Mod: 13.6 ***Low: 86.4***
Fa515	Glenrosa 14/15 Cartref 21/31	200-500 300-650	37% 29%	Reddish-brown, sandy/loamy, structureless soils Grey-brown, sandy/loamy, structureless soils	High: 7.1 Mod: 32.9 ***Low: 60.0***

Note: Agricultural Potential, as shown in Table 2, refers to the **soil characteristics only** and does not take account of climatic or any other factors.

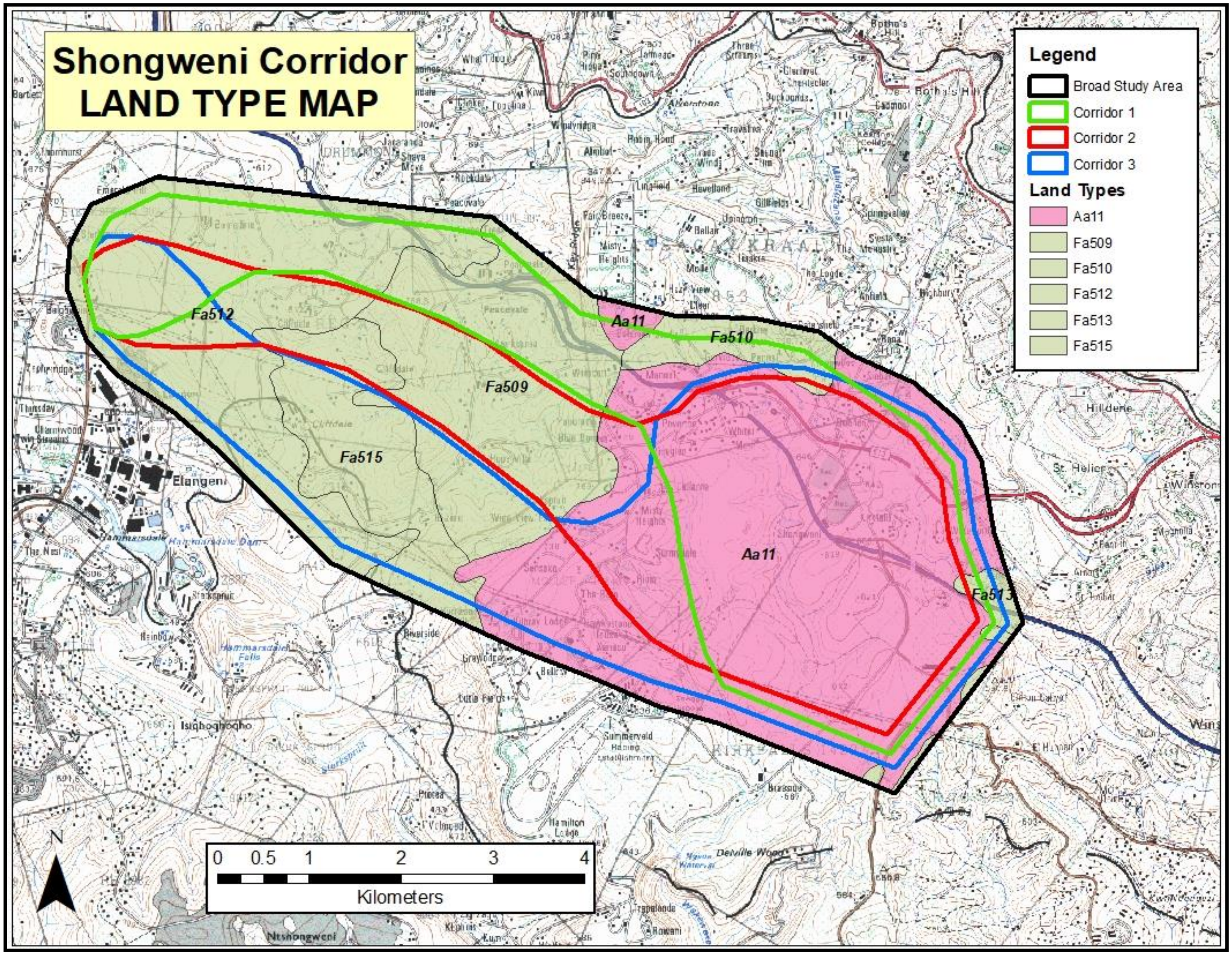

Figure 3 Land type map

5. AGRICULTURAL POTENTIAL

5.1 Transmission Line Corridors

The occurrence and characteristics of the soils occurring in each land type have been summarized and assessed in terms of broad agricultural potential. This is expressed in the percentage of soils within a land type that can be regarded as being of high potential, so that land types with a higher potential of such soils would be regarded as more suitable for agriculture, especially cultivation.

Soils falling into this category will include freely-drained, loamy soils with a sufficient rooting depth (generally >900 mm), lacking strong structure, stoniness or any signs of wetness.

The map of general agricultural potential is shown in Figure 4. Here, it can clearly be seen that the major area with high potential soils (>60% of the landscape) occurs in the east of the study area, where deep, apedal soils with a humic (more organic-rich) topsoil predominate.

Towards the western end of the study area, the soils become shallower which, coupled with slightly more undulating terrain, leads to a lower class of agricultural potential

5.2 Proposed substation sites

The three sites, marked E, F and G, all occur within land type Aa11, which has a generally high agricultural potential. Closer inspection reveals that the sites have also been chosen due to their generally level terrain. There is thus no distinction that can be made between the sites at this level of detail, and a more detailed soil survey would need to be carried out to look at the soils occurring and the associated agricultural potential.

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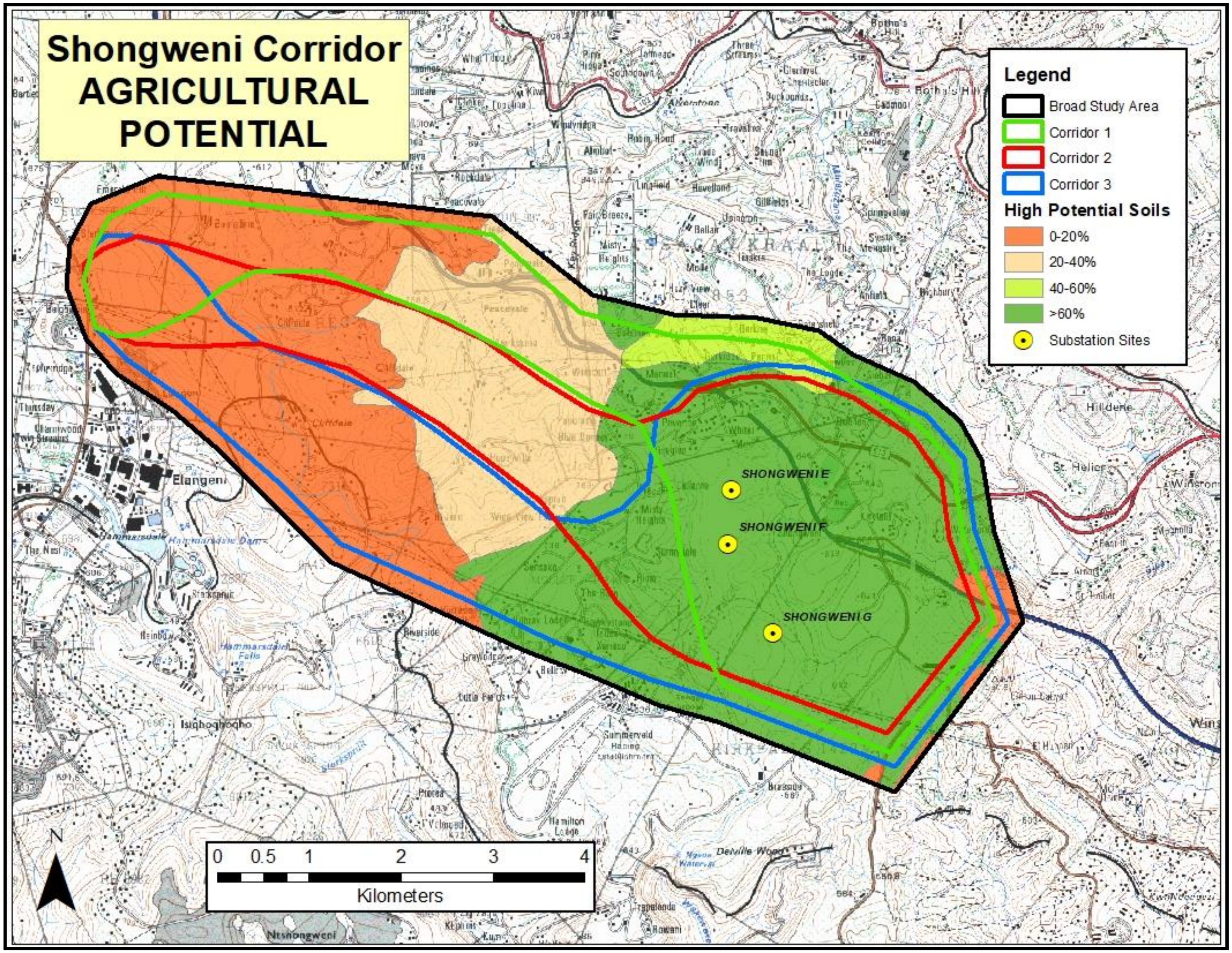

Figure 5 Broad agricultural potential

6 ERODIBILITY

Most of the study area is not significantly susceptible to erosion. The area has a relatively high rainfall, with good natural vegetation cover. However, slopes may be relatively steep in places, which can increase the erosion susceptibility.

Under any circumstances, if vegetation cover is disturbed or removed (such as during the construction phase of a transmission line) and especially on steeper slopes, then erosion can occur. Therefore, clear mitigation measures should be implemented, namely.

- Roads should avoid steep slopes wherever possible
- Where steep slopes are used, road stabilization measures (culverts, run-off trenches, banking of bends etc) should be implemented
- Restrict areas cleared of vegetation to road surfaces only

In addition, the possibility of erosion occurring in the future exists, so regular monitoring and inspection should take place, so that if any signs of soil erosion commencing are observed, measures can be put in place as timeously as possible.

7 IMPACTS AND RECOMMENDATIONS

7.1 Impacts

The impacts of constructing a transmission line will be negative, as the natural environment will be disturbed. However, the specific significance on the potential loss of agricultural soil, as well as soil disturbance, needs to be assessed.

This is summarized in Table 2.

Table 2 Impact assessment

Impact: Loss of agricultural soil resource					
Extent (E)	**Duration (D)**	**Magnitude (M)**	**Probability (P)**	**Significance (E+D+M) x P**	**Significance Class**
Site (1)	Long-term (4)	Low (2)	Medium (3)	21	Low

The isolated nature of the transmission towers means that the impact on the soil resource will be small. Most agricultural activities can still be practiced next to or underneath a transmission line.

The exception is where irrigation, especially by overhead or other spray actions, is practiced. Therefore, as far as possible, the transmission line should avoid such areas.

Mitigation measures will include the rehabilitation of any bare soil areas caused by the construction process (including any access roads or tracks) and wherever possible, the siting of pylons away from any cultivated lands, but rather to use servitudes and boundary lines. Special care should be given to areas with steeper topography.

7.2 Fatal Flaws

There are **no fatal flaws** regarding the study area. However, there are a number of sensitive areas that should be avoided, namely wetland soils along the river courses.

8 ALTERNATIVES

The proposed 400kV transmission line will make little difference to the impact on the soil resource and agricultural potential. The impacts and mitigation measures as outlined above must be implemented.

Regarding the alternative routes (Figure 5)**,** it would appear that all of the corridors traverse similar soil patterns, with a similar grade of agricultural potential (lower in the west, higher in the east). Whether the southernmost corridor (Corridor 3, shown in blue) or the northernmost one (Corridor 1, shown in green) is used, the differences will be relatively insignificant.

As previously mentioned, there is little or no discernable difference between the substation sites at this stage.

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