REPORT

SOIL, LAND USE AND AGRICULTURAL POTENTIAL SURVEY:

PROPOSED DEVELOPMENT OF A HIGH SPEED PROVING GROUND (HSPG) FOR VEHICLE TESTING FOR THE MERCEDES-BENZ RESEARCH AND DEVELOPMENT TEAM IN THE NORTHERN CAPE PROVINCE OF SOUTH AFRICA

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Declaration

I, Johan Hilgard van der Waals, declare that –

- I act as the independent specialist in this application
- I will perform 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 will comply 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 in terms of Regulation 71 and is punishable in terms of Section 24F of the Act.

J.H. VAN DER WAALS
TERRA SOIL SCIENCE

TABLE OF CONTENTS

SOIL, LAND USE AND AGRICULTURAL POTENTIAL SURVEY: PROPOSED DEVELOPMENT OF A HIGH SPEED PROVING GROUND (HSPG) FOR VEHICLE TESTING FOR THE MERCEDES-BENZ RESEARCH AND DEVELOPMENT TEAM IN THE NORTHERN CAPE PROVINCE OF SOUTH AFRICA

1. INTRODUCTION

1.1 TERMS OF REFERENCE

Terra Soil Science was appointed by **WSP Environmental (Pty) Ltd** and **General Planner IngenAix GmbH** on behalf of **Mercedes Benz South Africa** (**MBSA**) to conduct an agricultural potential survey/assessment of the proposed development of a High Speed Proving Ground (HSPG) for vehicle testing for the Mercedes-Benz Research and Development Team in the Northern Cape Province of South Africa.

1.2 AGRICULTURAL POTENTIAL BACKGROUND

The assessment of agricultural potential rests primarily on the identification of soils that are suited to crop production. In order to qualify as high potential soils they must have the following properties:

- Deep profile (more than 600 mm) for adequate root development,
- Deep profile and adequate clay content for the storing of sufficient water so that plants can weather short dry spells,
- Adequate structure (loose enough and not dense) that allows for good root development,
- Sufficient clay or organic matter to ensure retention and supply of plant nutrients,
- Limited quantities of rock in the matrix that would otherwise limit tilling options and water holding capacity,
- Adequate distribution of soils and size of high potential soil area to constitute a viable economic management unit, and
- Good enough internal and external (out of profile) drainage if irrigation practices are considered. Drainage is imperative for the removal (leaching) of salts that accumulate in profiles during irrigation and fertilization.

In addition to soil characteristics, climatic characteristics need to be assessed to determine the agricultural potential of a site. The rainfall characteristics are of primary importance and in order to provide an adequate baseline for the viable production of crops rainfall quantities and distribution need to be sufficient and optimal.

In the case where crop production is not possible due to soil or climatic constraints aspects such as grazing potential and carrying capacity is considered. Grazing capacity is mainly determined by vegetation characteristics of a site and would therefore have to be deduced from vegetation reports

(that do address carrying capacity) or from dedicated discussions with farmers and land users. The combination of the above mentioned factors will be used to assess the agricultural potential of the soils on the site.

2. BRIEF DESCRIPTION OF THE SURVEY AREA

2.1 SURVEY AREA BOUNDARY

The survey area lies between 28° 08' 03" and 28° 15' 08" S and 21° 26' 46" and 21° 32' 42" E approximately 38 km northeast of the town of Upington in the Northern Cape Province (**Figure 1**). The survey site is surrounded by grazing and wilderness land.

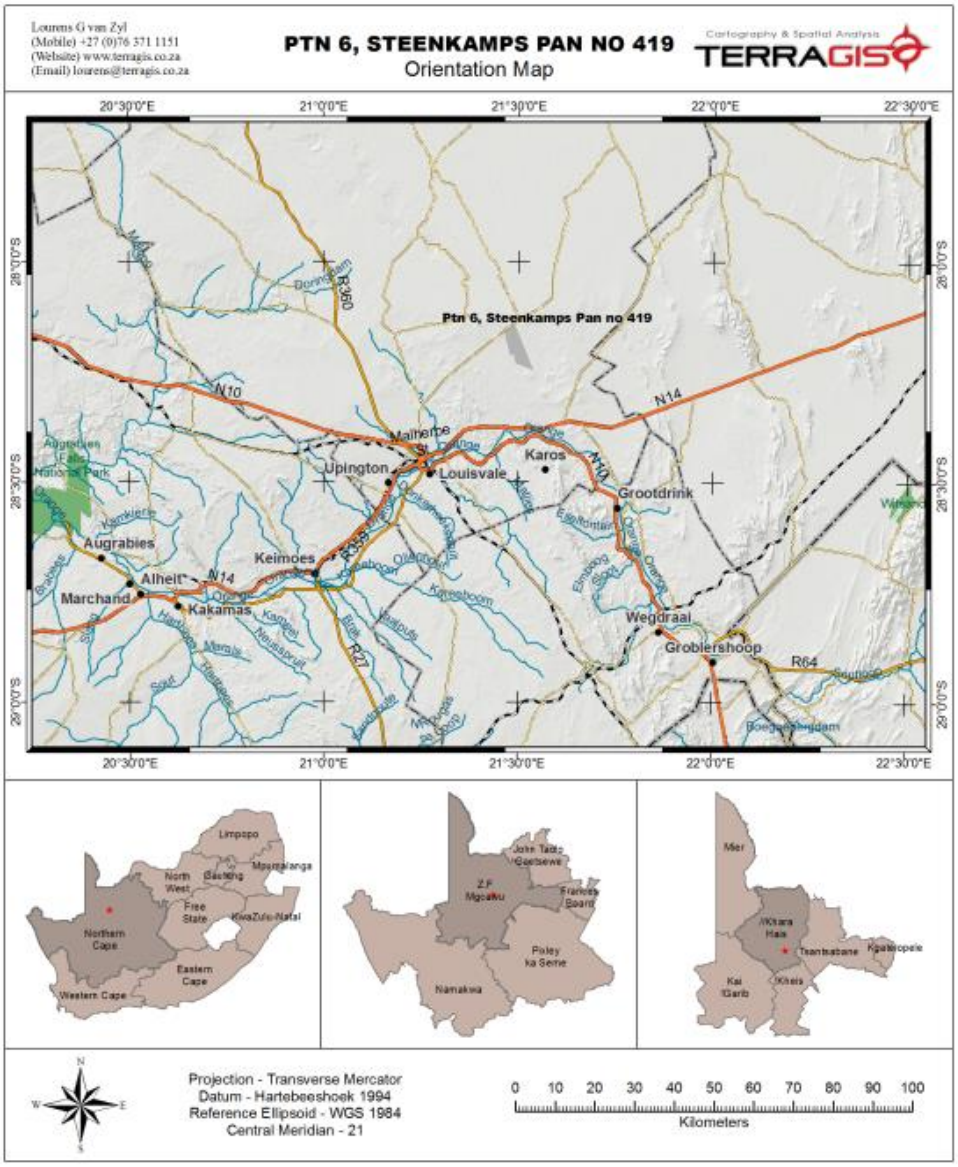

Figure 1 Location of the survey site

2.2 SURVEY AREA PHYSICAL FEATURES

The site lies on relatively flat terrain that is characterised by numerous north to south running permanent dunes. The landscape has a southerly aspect and the altitude ranges from 980 m above mean sea level in the north to 920 m in the south. The geology of the site is comprised of a range of superficial deposits with the most visible and dominant being Aeolian sands. The soils are therefore all of variable depth sandy material overlying hardened deposits of gravels, clays, siltstone, silcrete and calcrete.

3. METHOD OF SOIL AND AGRICULTURAL SURVEY

The survey was conducted in four phases.

3.1 PHASE 1: LAND TYPE DATA

Land type data for the site was obtained from the Institute for Soil Climate and Water (ISCW) of the Agricultural Research Council (ARC) (Land Type Survey Staff, 1972 – 2006). The land type data is presented at a scale of 1:250 000 and entails the division of land into land types, typical terrain cross sections for the land type and the presentation of dominant soil types for each of the identified terrain units (in the cross section). The soil data is classified according to the Binomial System (MacVicar et al., 1977). The soil data was interpreted and re-classified according to the Taxonomic System (The Soil Classification Working Group, 1991).

3.2 PHASE 2: TOPOGRAPHIC AND OTHER BIOPHYSICAL PARAMETERS

The topography of the site was elucidated through the generation of a digital elevation model (DEM) map for the site. Additional information in the form of land cover, geology, vegetation and dominant terrain form was collected (detailed references are provided with the results later in the report.

3.3 PHASE 3: SATELLITE IMAGE INTERPRETATION

A dedicated satellite image (Google Earth) interpretation exercise was conducted to determine the current site conditions as well as the historical land uses. This was done through the accessing of Google Earth images from different periods in the past.

3.4 PHASE 4: SITE VISIT AND SOIL SURVEY

For the soil survey the area was traversed in a vehicle and on foot. The soils were observed at several locations and the findings were gauged against the geotechnical profile descriptions generated by ARQ Consulting Engineers (Pty) Ltd. The geotechnical description of the profiles was interpreted to yield a classification category in the Taxonomic System (The Soil Classification Working Group, 1991).

4. SURVEY RESULTS

4.1 PHASE 1: LAND TYPE DATA

Figure 2 presents the land type distribution for the site and surrounding area. The land type found on the site is **Af7** (Land Type Survey Staff, 1972 – 2006). Below follows a brief description of the land type in terms of soils, land capability, land use and agricultural potential.

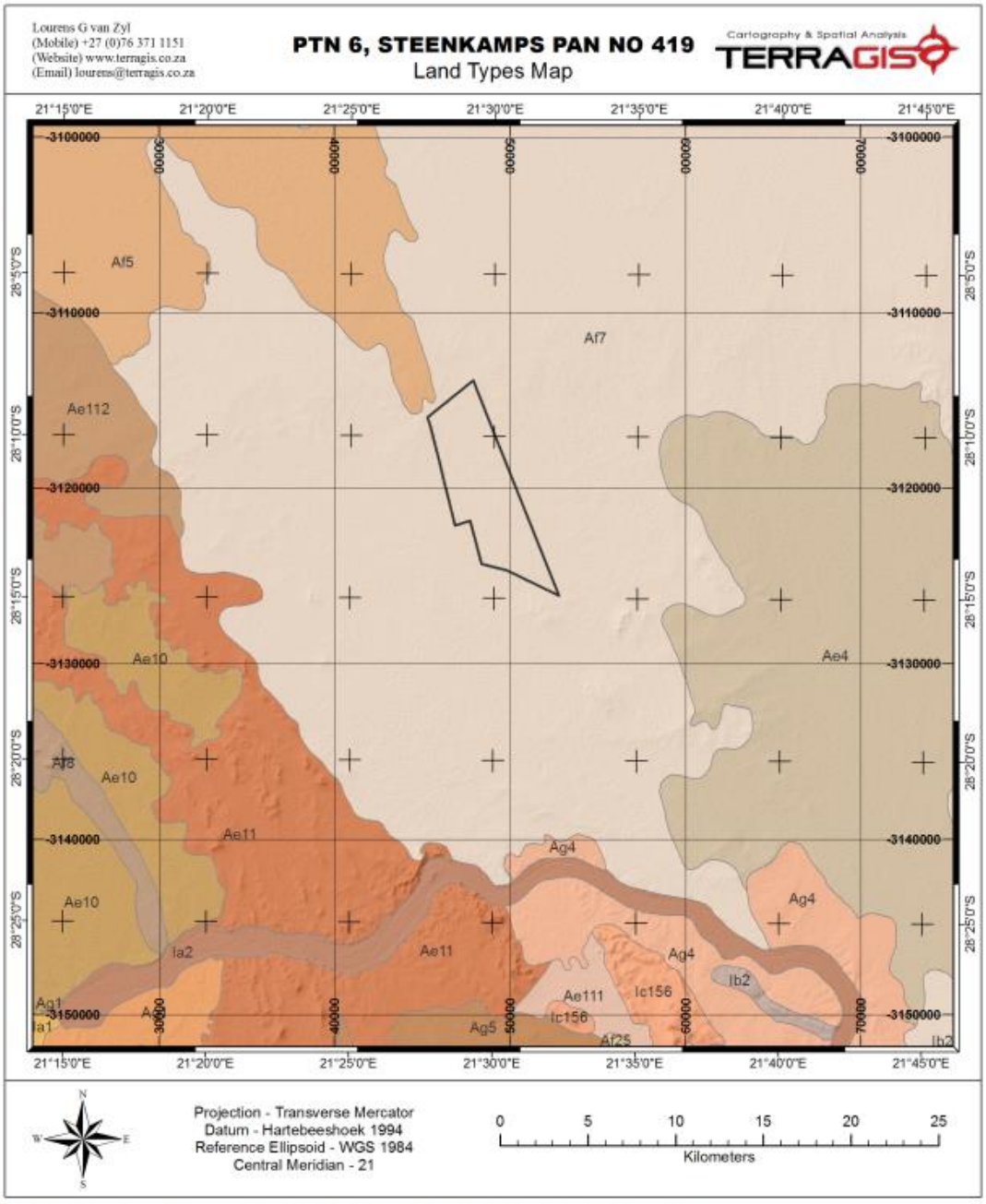

Figure 2 Land type map of the survey site and its surrounding area

Land Type Af7

Land Type – General: Af land types denote areas with dominantly deep red high base status soils (eutrophic and lime containing) with regularly occurring dunes.

Soils: Soils are red coloured, eutrophic sandy soils derived from Aeolian deposits. The depths vary according to position in the landscape with soils overlying rock outcrops being shallow and soils comprising dunes being relatively deep.

Land capability and land use: The land use in the general land type area is limited to extensive and low intensity grazing due to the very low biological productivity associated with low rainfall and arid conditions. The land capability mimics the land use.

Agricultural potential: The agricultural potential is very low due to the low rainfall and aridity (**Figure 3**). The distinct presence of dunes in this landscape precludes the area from being developed for irrigated agriculture purposes due to the significant effort required to level the terrain.

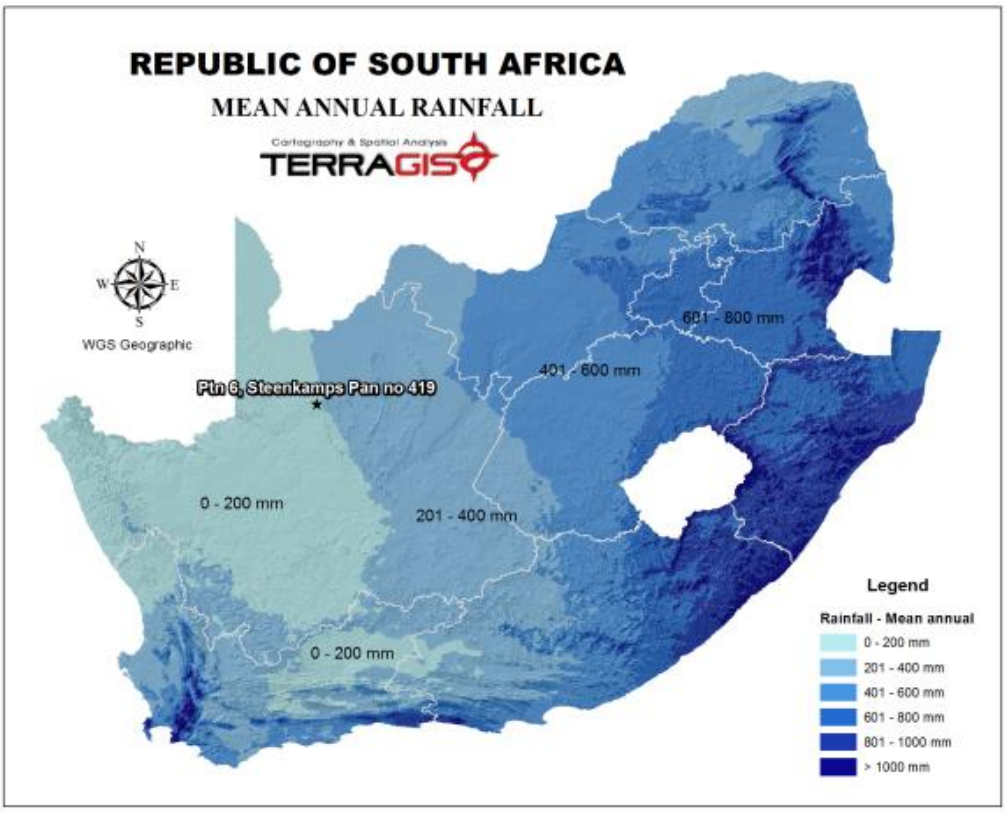

Figure 3 Rainfall map of South Africa indicating the survey site

4.2 PHASE 2: TOPOGRAPHIC AND OTHER BIOPHYSICAL PARAMETERS

A digital elevation model (DEM – **Figure 4**) of the site and surrounding area was generated from the United States Geological Survey (USGS) obtained NASA Shuttle Radar Topography Mission (SRTM) 1 Arc Second DEM data (http://earthexplorer.usgs.gov/).

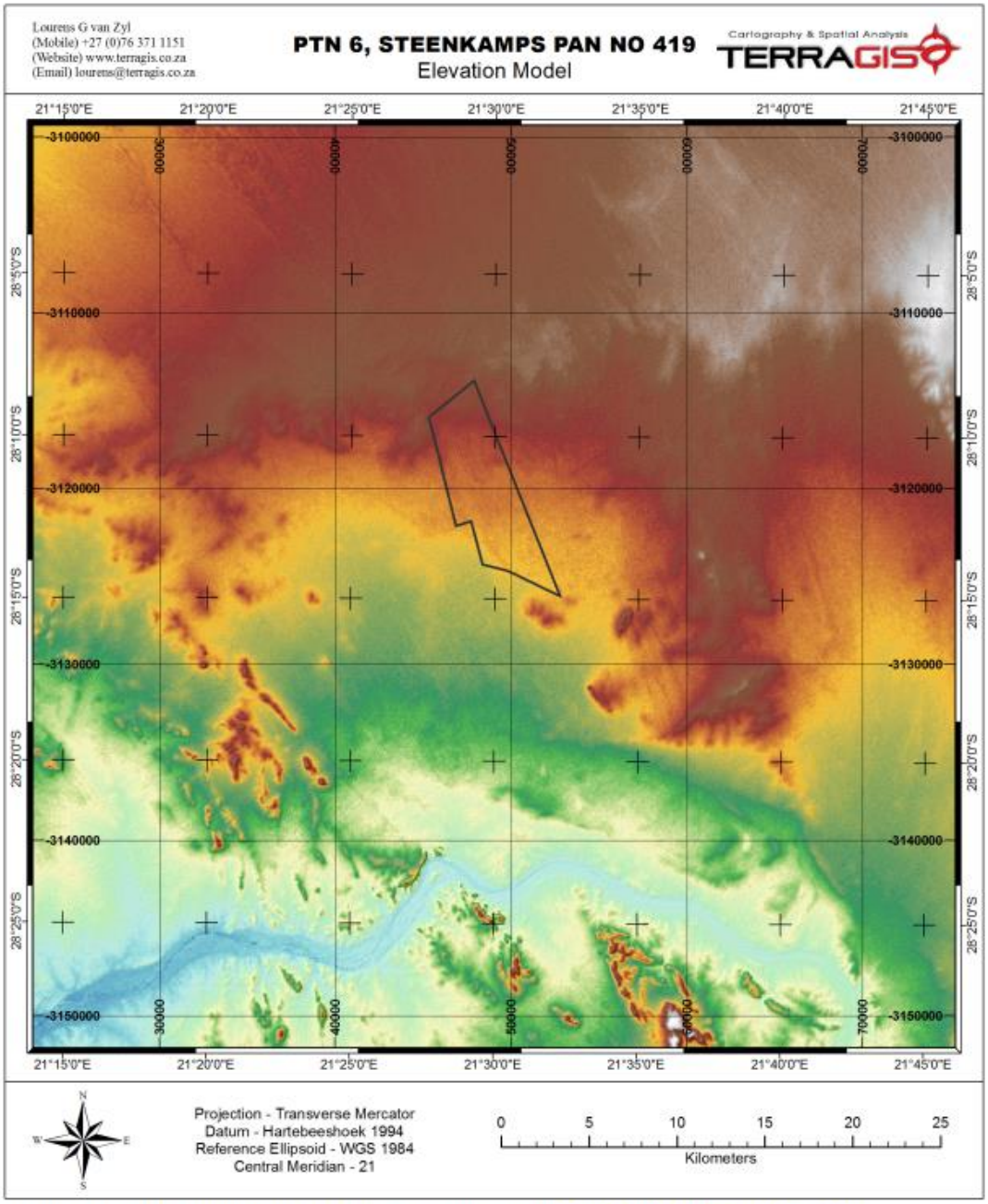

Figure 4 Digital elevation model for the survey site (http://earthexplorer.usgs.gov/)

A geological map (**Figure 5**) was produced from the 1:1 000 000 geology data obtained from the Council for Geoscience (https://www.arcgis.com).

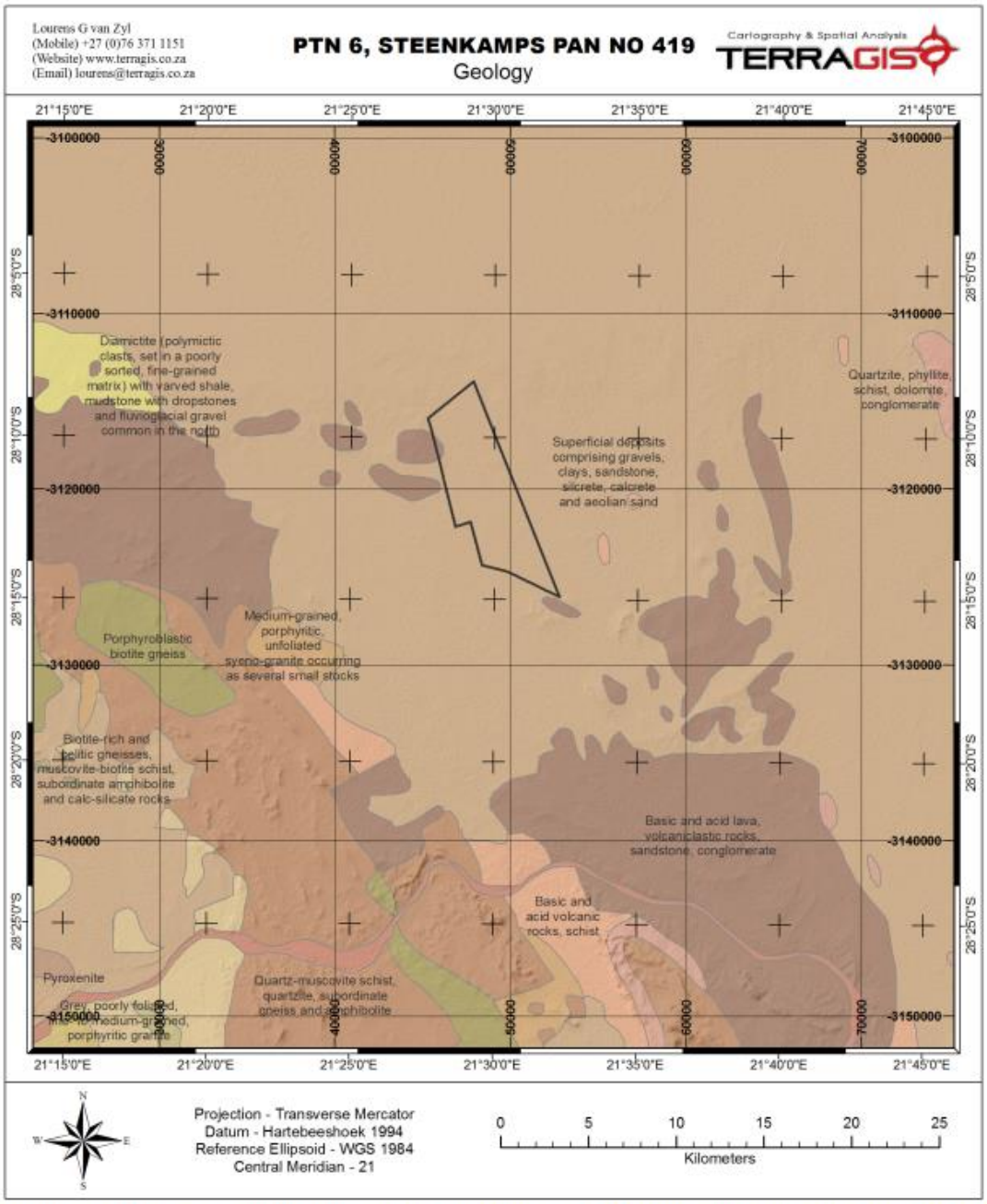

Figure 5 Geology map of the survey site (from 1:1 000 000 geology data from Council for Geoscience - https://www.arcgis.com)

The land cover of the site and surrounding area is presented in **Figure 6**. The data was obtained from http://bgis.sanbi.org. The site falls entirely into the low shrubland category.

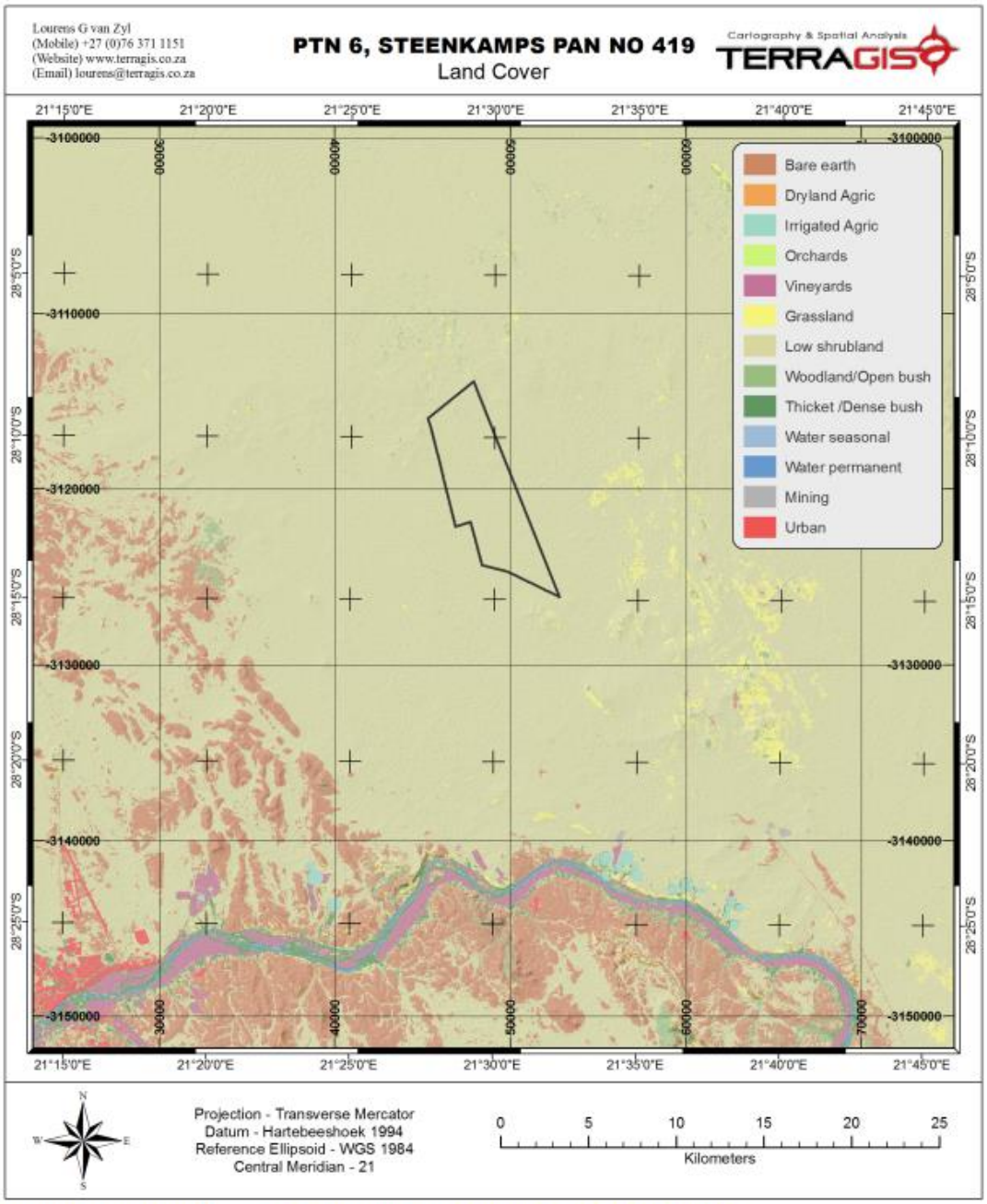

Figure 6 Land cover map of the survey site (from http://bgis.sanbi.org)

The vegetation data of the site and surrounding area is presented in **Figure 7**. The data was obtained from http://bgis.sanbi.org and indicates that the site falls into the Gordonia Duneveld. This is consistent with the land cover data presented earlier.

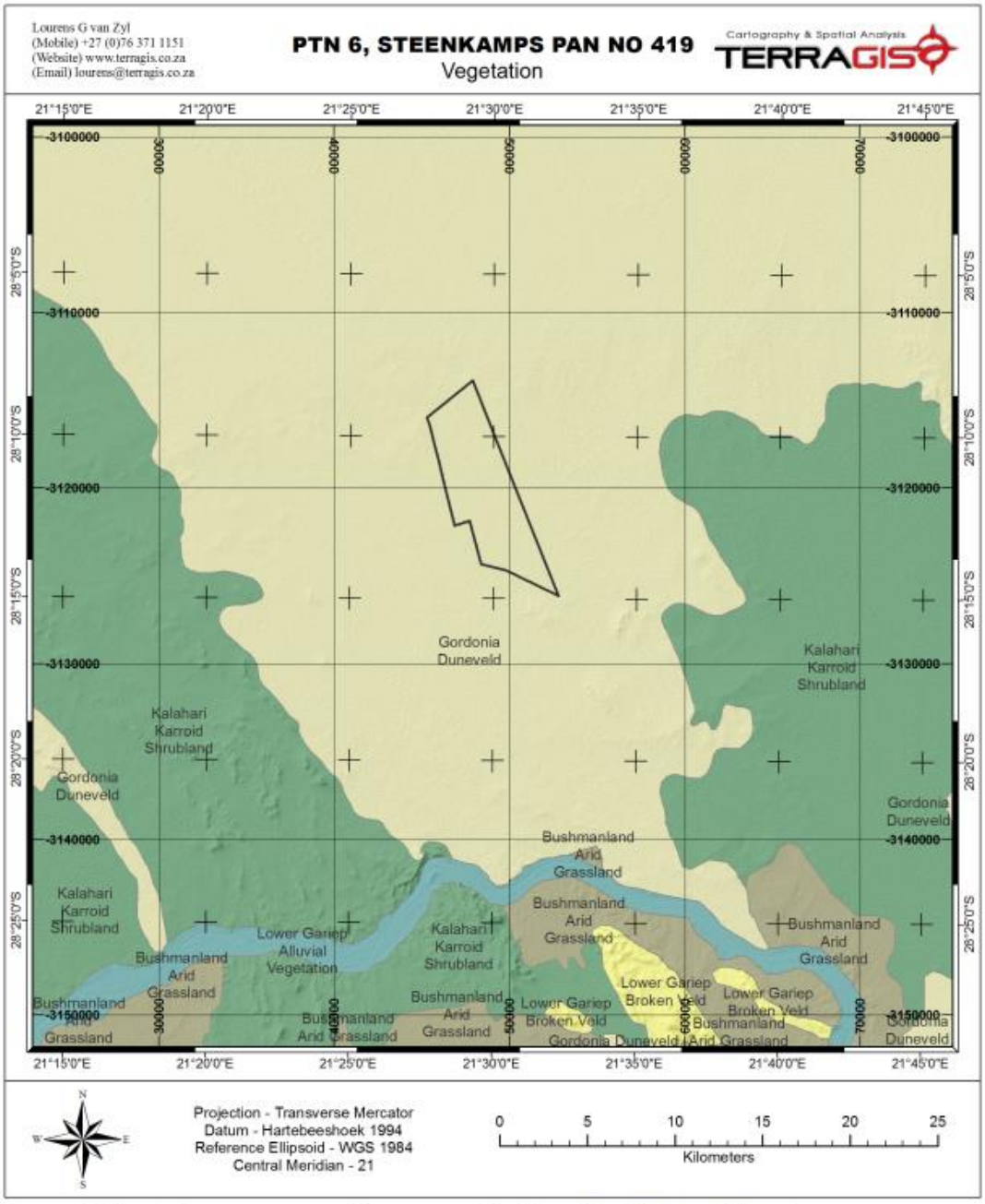

Figure 7 Vegetation zone map of the survey site (from http://bgis.sanbi.org)

4.3 PHASE 3: SATELLITE IMAGE INTERPRETATION

The satellite image of the site and surrounding area is provided in **Figure 8**. Although the general characteristics of the area surrounding the site are evident from the image the longitudinal permanent dunes are not very clear. These, however, are evident on the orthophoto of the site itself (**Figure 9**). From the images it is evident that there is only one land use on the site namely extensive grazing / wilderness.

Figure 8 Satellite image of the survey site and surrounding area

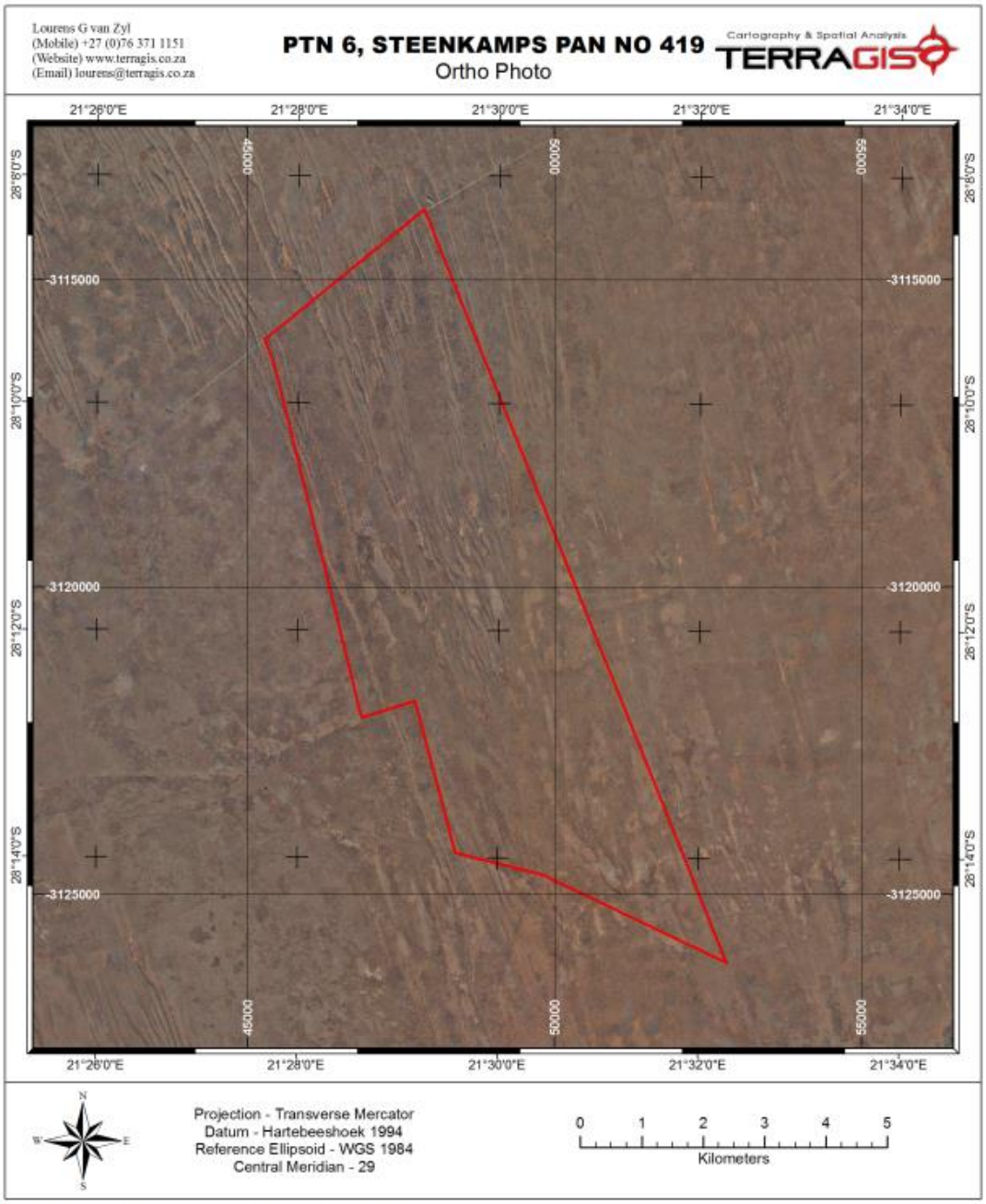

Figure 9 Orthophoto image of the survey site

4.4 PHASE 4: SITE VISIT AND SOIL SURVEY

The soil survey revealed the presence of two main soil zones or associations. These are 1) rocky and shallow soils and 2) red dune soils. The rocky and shallow zones occur interspersed with dune areas. In both cases the dominant soils are of the Mispah (orthic A horizon / hard rock), Glenrosa (orthic A horizon / lithocutanic B horizon) and Hutton (orthic A horizon / red apedal B horizon / unspecified – usually hard or weathering rock in the area). Calcrete areas are limited and the dominant soils are Coega (orthic A horizon / hardpan carbonate). An endorheic type depression is found in the south where soils of the Brandvlei (orthic A horizon / soft carbonate B horizon) dominate. In the specific context the Brandvlei soils indicate areas with secondary lime accumulation due to more regular wetness when compared to the surrounding landscape. In the main the geotechnical investigation data confirms the observations during the field and soil survey.

The soils are considered to be of low agricultural potential due to the shallow and rocky profiles. The sandy deeper dune soils have a low water holding capacity and are not suited to irrigation land uses due to significant local topographical variation.

The grazing potential of the site is low and in excess of 20 ha per large stock unit. This value will vary on a yearly basis depending on rainfall distribution over seasons, management aspects such as rotation and control of fires. The most persistent plants are shrubs that have a relatively low potential. After wetter periods significant grass growth can be observed and in which case the potential increases. However, the dry nature of the area leads to a significant fire hazard once the grasses dry out and wind speeds start to increase. Due to the continuous nature of veld in the area (and poor disaggregation due to lack of roads and fire breaks) fires pose significant risks to grazing potential with a subsequent risk of destruction of large swathes of grazing veld. It is therefore imperative that grazing be managed on the site to ensure regular removal of excess dry grass biomass.

5. AGRICULTURAL POTENTIAL

5.1 AGRICULTURAL POTENTIAL OF THE SITE

The agricultural potential is linked to the depth and rockiness of the soils. As is evident from the geotechnical investigation as well as the site visit conducted for this investigation the soils are predominantly rocky and shallow or deeper on dunes. The agricultural potential of the site is therefore considered to be low.

The rainfall is variable and the average is below 200 mm per year. This constitutes a very arid environment with a subsequent poor biomass production. This aspect is a further limitation on agricultural potential.

5.2 SOIL POTENTIAL LINKED TO CURRENT LAND USE AND STATUS

The current land use is exclusively extensive grazing and it is limited to more than 20 ha per large stock unit. Due to the low biological productivity of the site as determined by the rainfall grazing has to be managed to ensure adequate utilisation of various shrub and grass species (when present). The current land status appears to be consistent with the quality and potential expected for the general area. The soils on the site are not considered suitable for irrigation uses due to distinct spatial and local topographical variation.

5.3 CURRENT ACTIVITIES / DEVELOPMENTS / BUILDINGS

The current site activities are restricted to extensive grazing with a limited number of farm dwellings and associated buildings being present on the site.

5.4 SURROUNDING DEVELOPMENTS / LAND USES / ACTIVITIES WITHIN A 500 M RADIUS

The surrounding land uses are limited to those described in this report.

5.5 CURRENT STATUS OF LAND

The current status of the land is as discussed above under the relevant headings.

5.6 POSSIBLE LAND USE OPTIONS FOR THE SITE

Due to the dominance of shallow and rocky soils as well as low rainfall the possible land uses are limited to extensive grazing or non-agricultural intensification.

6. CONCLUSIONS AND RECOMMENDATIONS

It is concluded that:

1. The site is dominated by shallow and rocky soils interspersed with longitudinal dunes with deeper soils.
2. The rainfall in the area is limited and leads to a very low biological productivity.
3. The agricultural potential of the site is low and crop production is not possible.
4. The only possible agricultural use of the site is for extensive grazing and then at intensities lower than 20 ha per large stock unit.
5. The development of a facility that will sterilise a limited surface area of the site is not considered to have a detrimental effect on the current grazing potential. The main reasons being that:
    a. Hard surfaces lead to runoff of water that results in localised increased biological productivity;

b. With adequate fencing and management the bulk of the site remains useful for grazing purposes.

6. It is imperative that grazing land uses be continued to ensure utilisation of biomass, on a controlled basis, to aid in minimising fire hazards to surrounding land.

References

Land Type Survey Staff. 1972 – 2006. Land Types of South Africa: Digital map (1:250 000 scale) and soil inventory databases. ARC-Institute for Soil, Climate and Water, Pretoria.

MacVicar CN, De Villiers JM, Loxton RF, Verster E, Lambrechts JJN, Merryweather FR, Le Roux J, Van Rooyen TH, Harmse HJ von M. 1977. Soil Classification. A binomial system for South Africa. *Sci. Bull. 390. Dep. Agric. Tech. Serv., Repub. S. Afr.*, Pretoria.

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