AGRO-ECOSYSTEM ASSESSMENT FOR PROPOSED EXPANSION OF CHICKEN HOUSES

PREPARED FOR

ENVIRO WORKS

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BACKGROUND

Digital Soils Africa (Pty) LTD (DSA) were tasked by Enviro works to undertake an Agro-Ecosystem Assessment for the Application of an Environmental Authorisation in terms of the National Environmental Management Act, 1998 (Act No. 107 of 1998) ("NEMA"), Environmental Impact Assessment ("EIA") Regulations, 2014. As per GN960 of 2019, read with Section 24(5)(a) of the NEMA, an Environmental Screening Report (ESR) was generated for the application using the National Web-based Screening Tool. The ESR classifies the area as being of very high sensitivity for the *Agricultural* theme. The Agro-Ecosystem Assessment is reported according to the protocol for the specialist assessment and minimum report content requirements for the environmental impacts on agricultural resources (GN320 of 2020).

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PROJECT DESCRIPTION

The proposed development is an expansion of chicken houses on approximately 338 hectares, (Figure 1). Quantum Foods proposes the expansion of a poultry farm that will be expanded from approximately 30 000 to 60 000 chickens (rounded up) on Bulhoek Farm, near Swartruggens, North West Province. It is expected that there will be eight (8) new chicken layer houses constructed, each with a footprint of either 60 m x 13.5 m or 100 m x 12 m depending on the site. The Bulhoek farm will contribute approximately 15 job opportunities.

Waste removal: After the quarantine period on the farm, the chicken carcasses will be taken to the local zoo and the remaining general waste will be disposed of a registered landfill site. The chicken manure is collected by an external farmer to use as fertilizer.

Water source: The water sources presently on site are three (3) boreholes that supply approximately 228 742.31 m3/month. The three (3) reservoirs present on site have a capacity of approximately 100 000 litres.

Sewage and wastewater: Sewage on site is kept in holding tanks until it is removed by a service provider. Wash water is currently disposed of in the field. However, Quantum Foods proposes the development of thirteen (13) evaporation ponds (each being 25m2) to treat the wash water

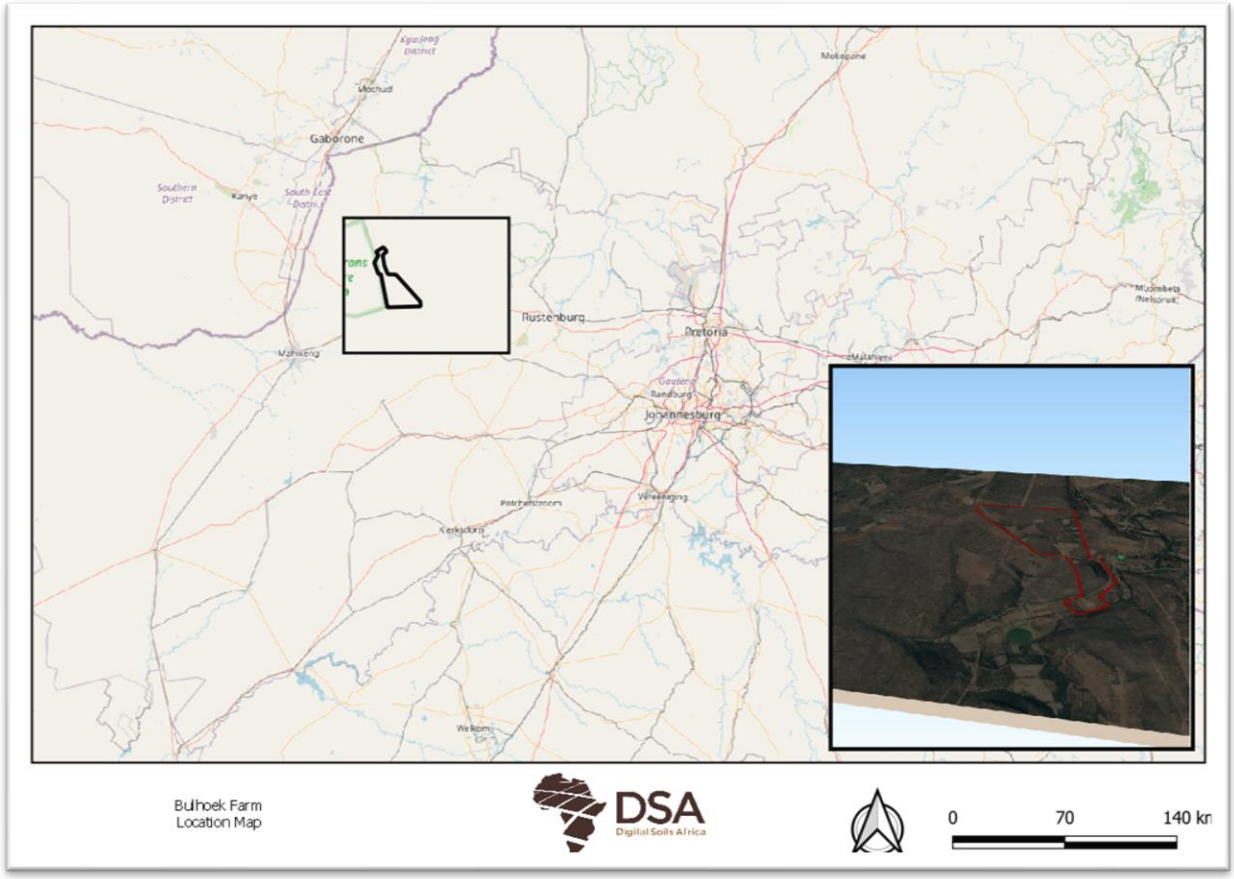
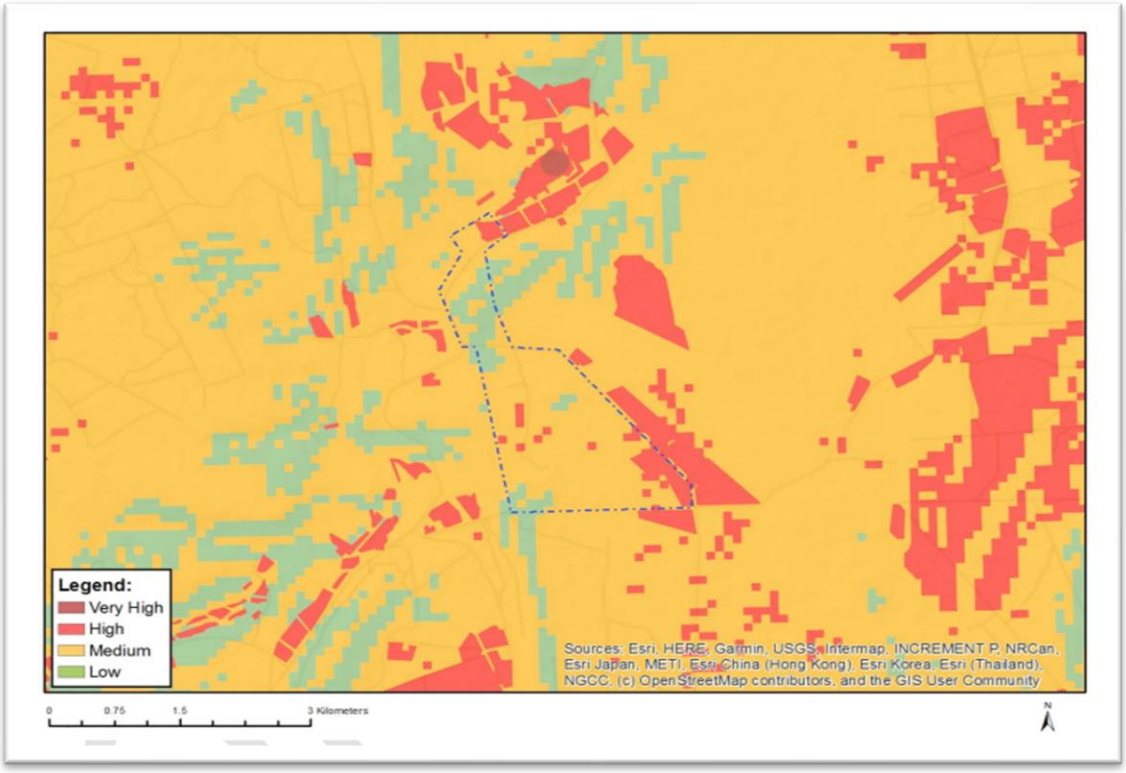


FIGURE 1: LOCATION OF THE STUDY AREA IN THE NORTH-WESTERN PROVINCE.

From the ESR, the area ranges from low Agricultural sensitivity to high Agricultural sensitivity. The new Land capability (DAFF, 2017) has fifteen classes, as opposed to the eight classes described by Schoeman et al. (2002). Classes 1 to 7 are of low land capability and only suitable for wilderness or grazing. Classes 8 to 15 are considered to have the arable land capability with the potential for high yields increasing with the land capability class number.



Very High sensitivity	High sensitivity	Medium sensitivity	Low sensitivity
	X		

Sensitivity Features:

Sensitivity	Feature(s)
High	Land capability;09. Moderate-High/10. Moderate-High
High	Annual Crop Cultivation / Planted Pastures Rotation;Land capability;06. Low-Moderate/07. Low-Moderate/08. Moderate
High	Annual Crop Cultivation / Planted Pastures Rotation;Land capability;01. Very low/02. Very low/03. Low-Very low/04. Low-Very low/05. Low
High	Annual Crop Cultivation / Planted Pastures Rotation;Land capability;09. Moderate-High/10. Moderate-High
Low	Land capability;01. Very low/02. Very low/03. Low-Very low/04. Low-Very low/05. Low
Medium	Land capability;06. Low-Moderate/07. Low-Moderate/08. Moderate

FIGURE 2: RESULTS OF THE SCREENING TOOL.

DATA LIMITATIONS, ASSUMPTIONS, AND STUDY GAPS

1. No data was available for historical production figures of the project area.
2. It was also assumed that the desktop grazing capacity (DAFF, 2016) and yield estimation (Schulze, 2007) data are correct for the site.

INTRODUCTION

Agriculture is a large contributor to the economy and food security of South Africa. Notably, a large portion of the employment is in the Agricultural Sector. Therefore, it is extremely important that valuable agricultural land is protected from being developed in an unsustainable way and appropriate soil and land capability assessments must forego all developments.

METHODOLOGY

DESKTOP STUDY

A desktop study was being conducted to determine the climate, agricultural potential, soil erosion sensitivity, topography, vegetation, and land use from the best available sources.

- Climate and soil erosivity from (Climate-data.org, 2021)
- Agricultural potential from the Land Type Survey Staff (1972-2006).
- Topography from the SRTM 30m DEM.
- Land use from South African National Land Cover (2018).
- Natural vegetation will be determined from Mucina and Rutherford, 2010.
- Long Term Grazing Capacity for South Africa from Department of Agriculture, Forestry and Fisheries (2016)

FIELD VISIT

The field survey was conducted on the 1st of September 2021. Observations were made with a hand auger.

- The soils were described and classified according to the Soil Classification Working Group (2018).
- Visual observations of land degradation were made. The data will be compared to the soils data from the land type survey and the agricultural capability will be refined.

RESULTS

DESKTOP

ELEVATION

The site is characterized by a high lying mid-slope surrounded by high hills (Figure 3). The general direction of water flow is from the south in a north-western direction.

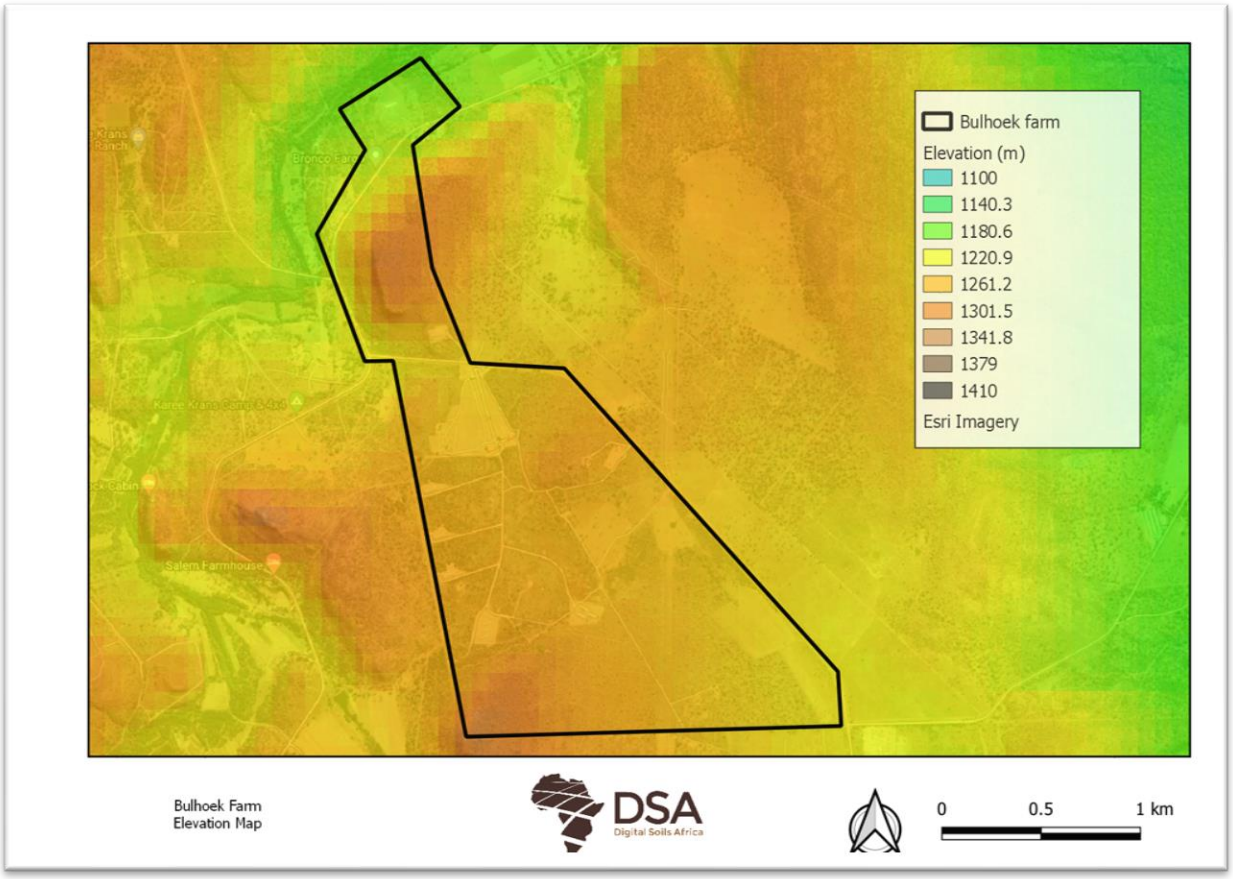


FIGURE 3: ELEVATION OF THE STUDY AREA.

SLOPE

Most of the survey area has a slope of less than 4°. There are steeper slopes in -western and northern sides with the increased elevation (Figure 4).

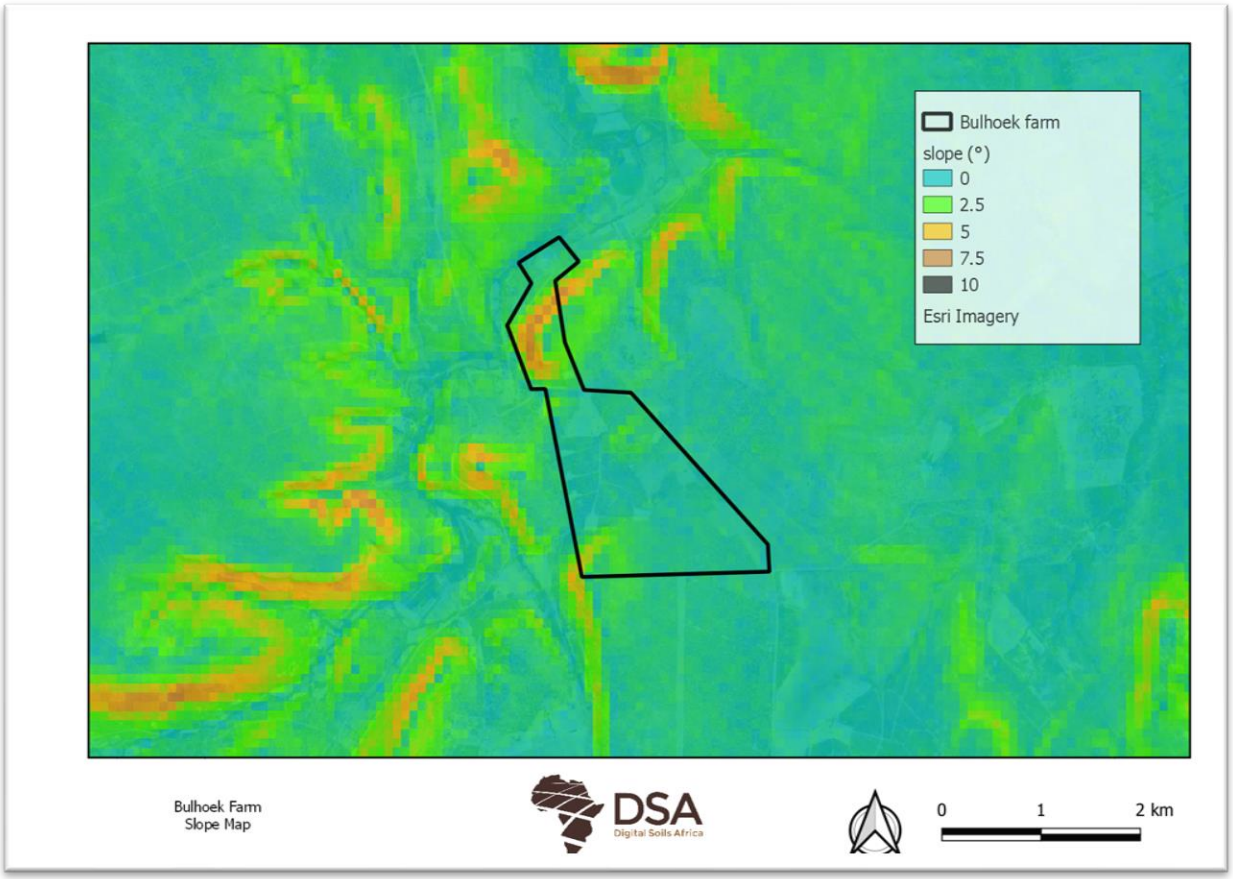


FIGURE 4: SLOPE OF THE SURVEY AREA.

LAND TYPE INFORMATION

The study area was categorized by only one land type, namely Ae59 (Appendix 1). The criteria for an area to qualify for inclusion in the land types are a Red Apedal structured high-base status soils, freely drained and has an average depth of 466 mm, with a clay content of 21.3 %. (Hutton, Nkonkoni soil forms).

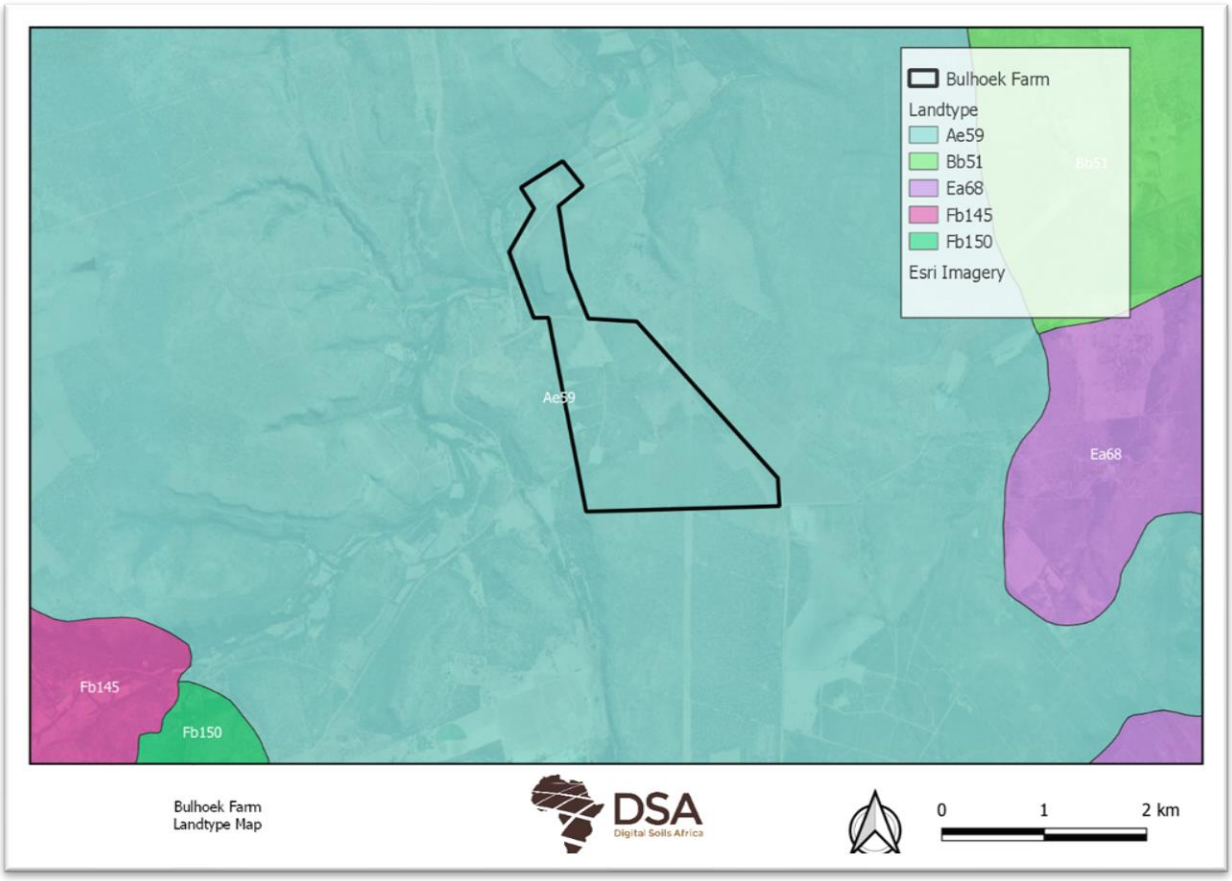


FIGURE 5: LAND TYPES OCCURRING IN THE STUDY AREA (LAND TYPE SURVEY STAFF, 1972 – 2002).

GEOLOGY

The geology of the surveyed area consists of volcanic rock (Figure 6). The dominating geology group is the Daspoort family, Pretoria group. Figure 7 shows an exposure of soil on top of weathered shale.

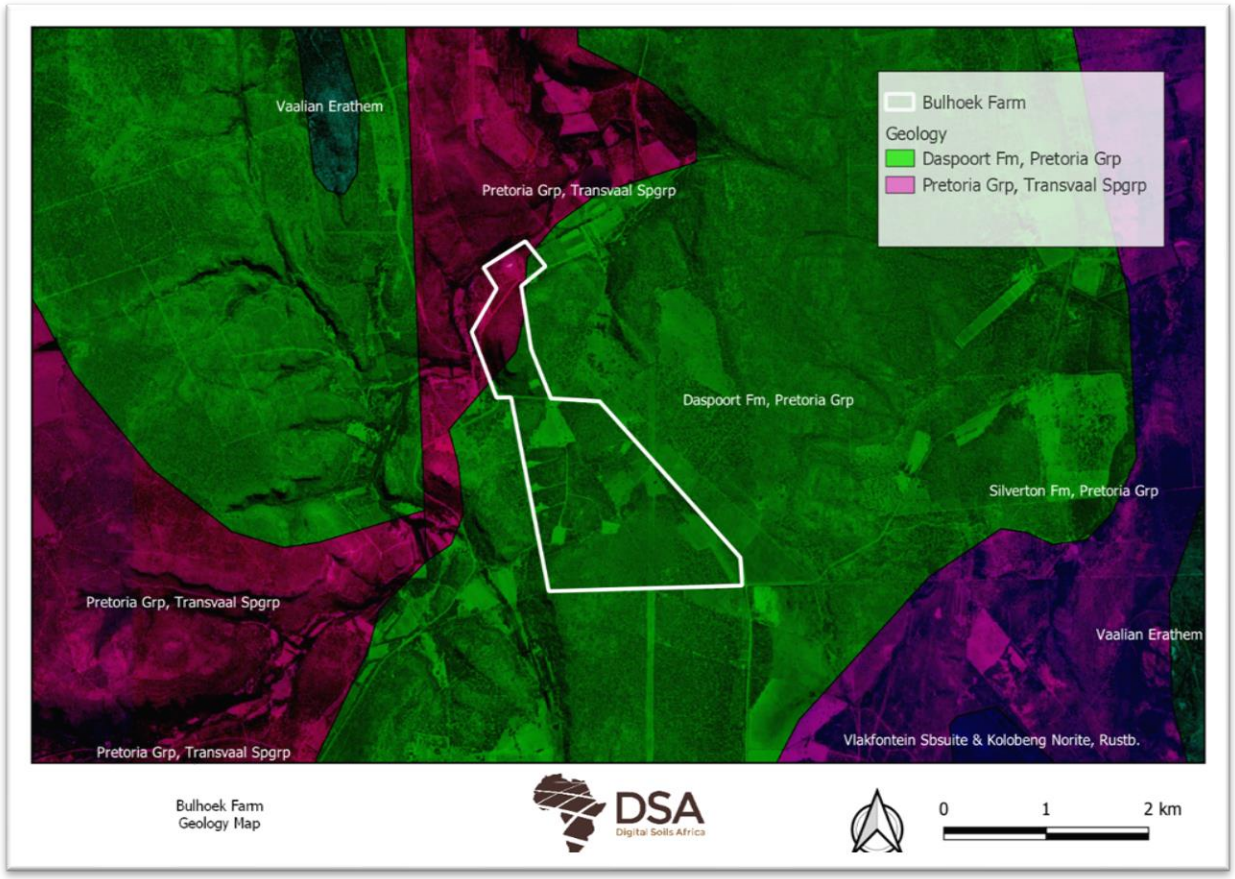


FIGURE 6: GEOLOGICAL MAP OF THE SURVEY AREA (COUNCIL FOR GEOSCIENCE, 2007).

FIGURE 7: EXPOSURE OF SOIL ON WEATHERED SHALE.

CLIMATE

CLIMATIC INFORMATION FOR THE SITE WAS OBTAINED FROM THE SOUTH AFRICAN ATLAS OF CLIMATOLOGY AND AGROHYDROLOGY (SCHULZE, 2007). SELECTED CLIMATIC PARAMETERS ARE PRESENTED IN

Table 1. The site is semi-arid with hot and dry conditions. This is reflected in the high average temperatures of the area.

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TABLE 1: SELECTED CLIMATOLOGICAL ATTRIBUTES FOR THE STUDY SITE, (CLIMATE-DATA.ORG, 2021)

JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER	
AVG. TEMPERATURE °C (°F)	23 °C	22.8 °C	21.3 °C	18.3 °C	15.1 °C	12.2 °C	12 °C	15.5 °C	19.4 °C	21.7 °C	22.3 °C	22.8 °C
MIN. TEMPERATURE °C (°F)	17.8 °C	17.6 °C	16.1 °C	12.8 °C	8.6 °C	5.6 °C	4.9 °C	8 °C	11.8 °C	14.6 °C	15.9 °C	17.4 °C
MAX. TEMPERATURE °C (°F)	28.3 °C	28.1 °C	26.8 °C	24 °C	21.8 °C	19.2 °C	19.3 °C	22.9 °C	26.9 °C	28.7 °C	28.7 °C	28.3 °C
PRECIPITATION / RAINFALL MM (IN)	99	96	76	37	18	7	3	7	15	51	76	117
HUMIDITY (%)	60%	57%	58%	58%	50%	48%	42%	35%	31%	38%	47%	58%
RAINY DAYS (D)	11	9	8	5	2	1	1	1	2	5	8	11

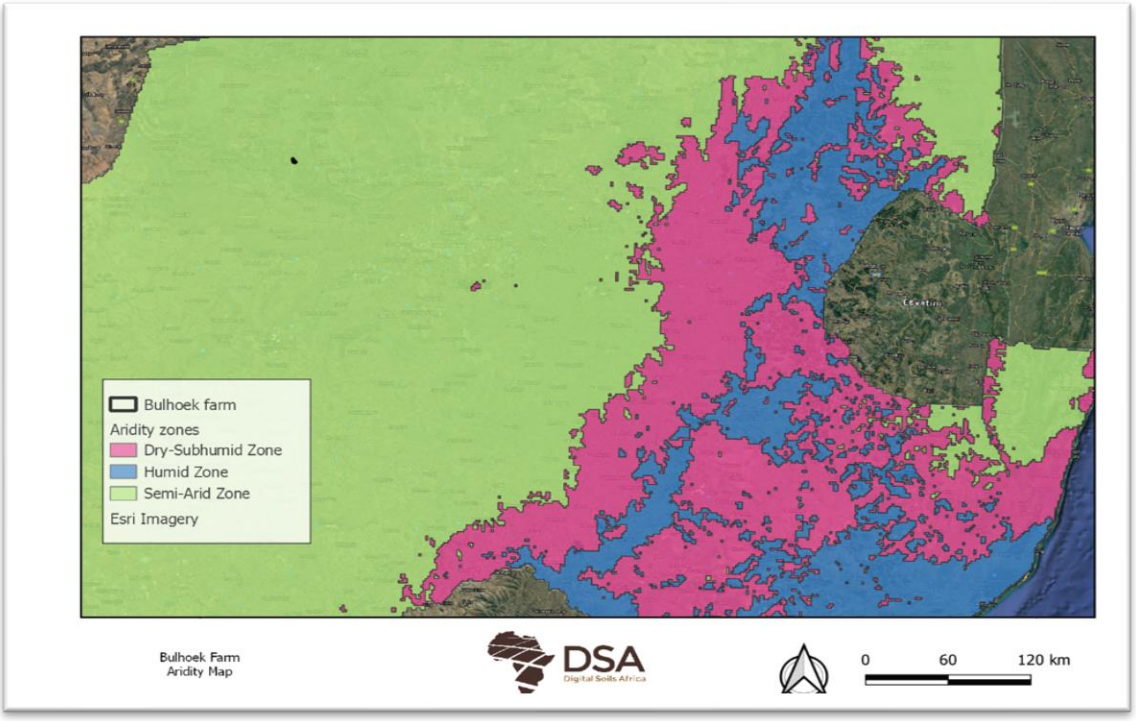

FIGURE 8: ARIDITY ZONES OF THE SITE AND SURROUNDING AREA (SCHULZE, 2007).

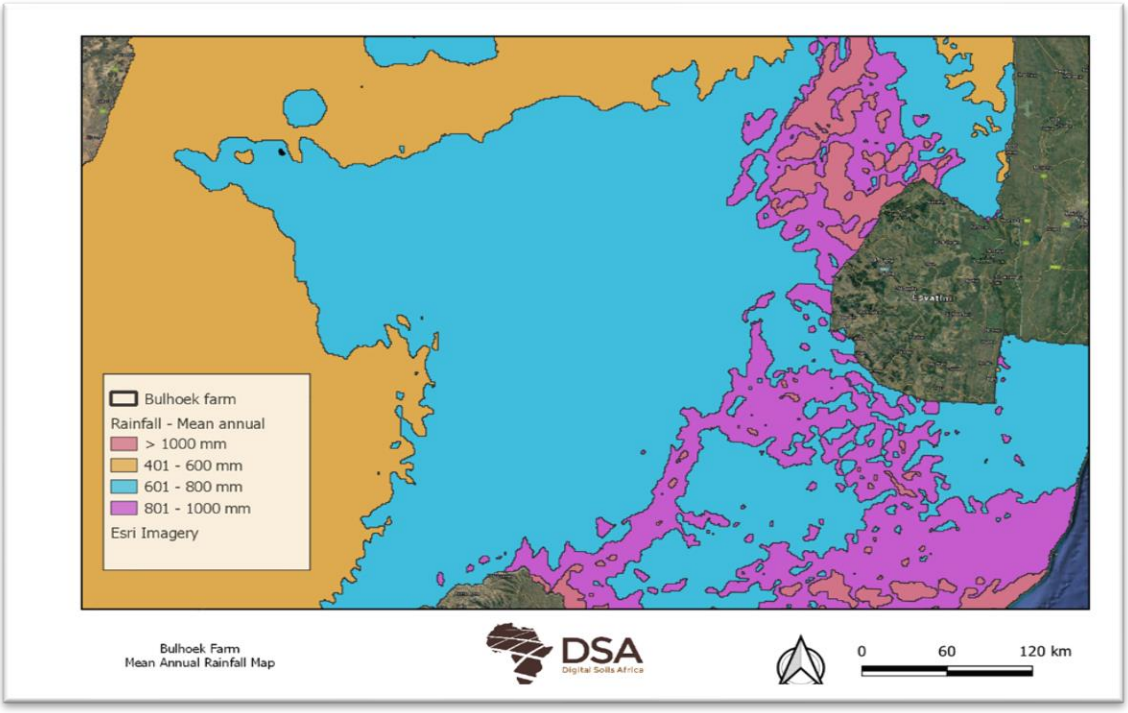

FIGURE 9: MEAN ANNUAL RAINAFALL OF THE SITE AND SURROUNDING AREA (SCHULZE, 2007).

VEGETATION, CURRENT LAND USE, AND AGRICULTURAL ACTIVITIES

The vegetation according to Mucina and Rutherford (2010) (Figure 8), is dominated by Dwasrberg-Swartruggens Mountain Bushveld in the study area. The grazing capacity (Figure 9) is Moderate-high reaching 8 LSU/ha. Approximately 42 large livestock units would be able to graze the area. Implementing rotational grazing, within camps would increase this number.

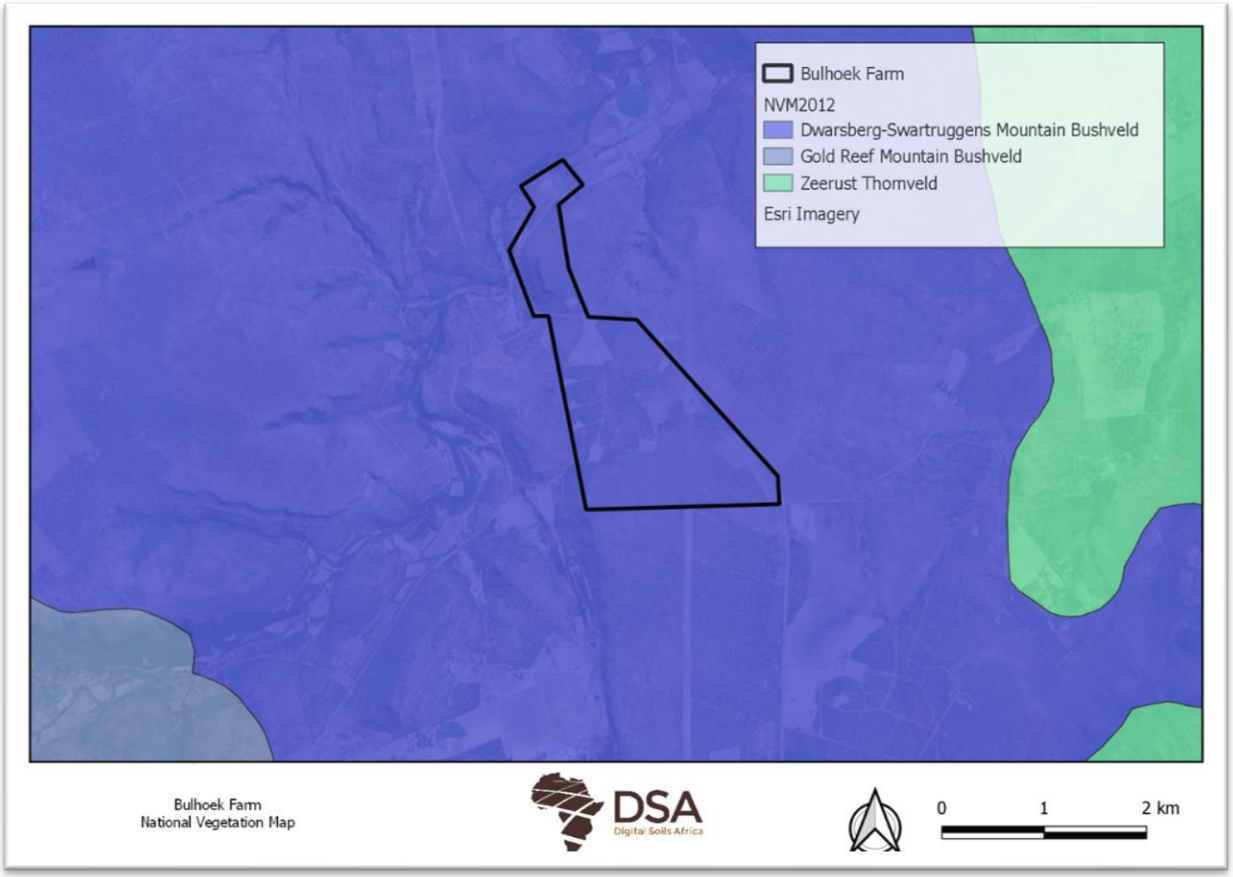

FIGURE 8: VEGETATION MAP OF THE SITE (MUCINA AND RUTHERFORD 2010).

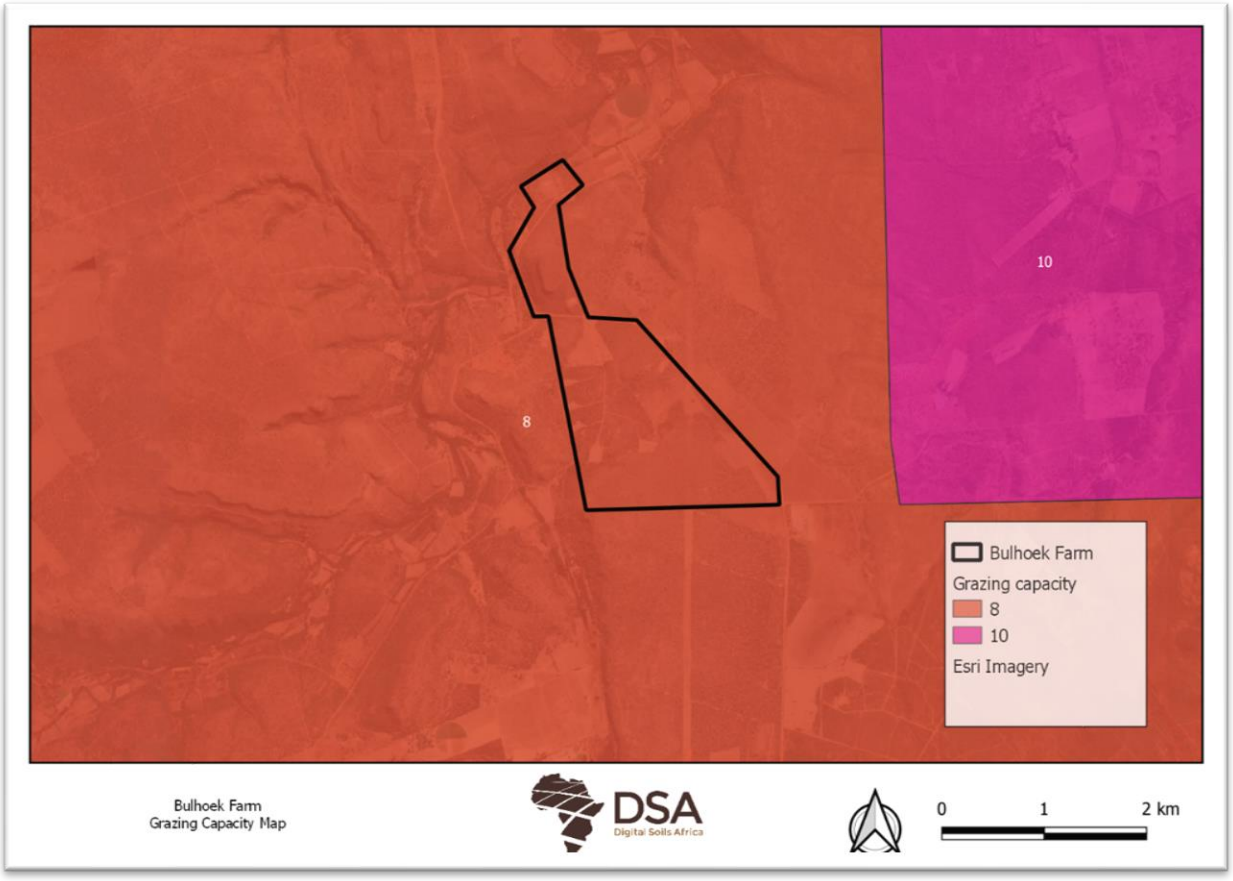

FIGURE 9: LONG-TERM GRAZING CAPACITY OF THE SITE AND SURROUNDING AREA.

South African National Land-Cover 2018 (SANLC 2018) (Figure 10) was used as a guide and verified with field observations. The mainland uses are- fallow land and old fields, although it seems as if the lands have not been cultivated in recent years.

TABLE 2:LEGEND TO FIGURE 11

No.	Class Name	Class Definition
3	Dense Forest & Woodland	Natural tall woody vegetation communities, with canopy cover ranging between 35 - 75%, and canopy heights exceeding 2.5 meters. Typically represented by dense bush, dense woodland, and thicket communities.
4	Contiguous & Dense Planted Forest	Dense to contiguous cover, planted tree forests, consisting primarily of exotic timber species, with canopy cover exceeding 35%, and canopy heights exceeding 2.5 meters. Typically represented by mature commercial plantation tree stands. This class also includes smaller woodlots and windbreaks, where they have been identified by the same spectral-based image modeling procedures used to detect the plantation forests.
6	Open & Sparse Planted Forest	Open to sparse cover, planted tree forests, consisting primarily of exotic timber species, with canopy cover ranging between 5 - 35%, and canopy heights exceeding 2.5 meters. Typically represented by young or recently planted commercial plantation tree stands. This class also includes smaller woodlots and windbreaks, as per class 5 above.

13	Natural Grassland	Natural and/or semi-natural indigenous grasslands, typically devoid of any significant tree or bush cover, and where the grassland component is typically dominant over any adjacent bare ground exposure. Typically representative of low, grass-dominated vegetation communities in the Grassland and Savanna Biomes.
25	Natural Rock Surfaces	Naturally occurring areas of non-vegetated, exposed rock and consolidated substrate
40	Cultivated Commercial Annuals Non-Pivot / Non-Irrigated	Active or recently active cultivated lands used for the production of agricultural crops, in this case specifically associated with commercial annual crops, The plants only remain in the field for one growing seasons and one harvest, and are grown non-irrigated, rainfed fields.
43	Fallow Land & Old Fields (Bush)	Long-term, non-active, previously cultivated lands that are *now* overgrown with bush dominated woody vegetation. Typically, the cultivated land unit is no longer image detectable. Historical field boundaries (supplied by SANBI) have been mapped from archival topographical 1:50,000 maps circa 1950's-70. This class is only represented if it has not been modified to a more recent, alternative land-cover or land-use class.
44	Fallow Land & Old Fields (Grass)	Long-term, non-active, previously cultivated lands that are now overgrown with grass dominated woody vegetation. Typically the cultivated land unit is no longer image detectable. Historical field boundaries (supplied by SANBI) have been mapped from archival topographical 1:50,000 maps circa 1950's-70's. This class is only represented if it has not been modified to a more recent, alternative land-cover or land-use class.
45	Fallow Land & Old Fields (Bare)	Long-term, non-active, previously cultivated lands that are now predominately non-vegetated bare ground surfaces. Typically the cultivated land unit is no longer image detectable. Historical field boundaries (supplied by SANBI) have been mapped from archival topographical 1:50,000 maps circa 1950's-70's. This class is only represented if it has not been modified to a more recent, alternative land-cover or land-use class.
55	Village Scattered	Built-up areas primarily associated with scattered rural settlements and associated utilities. It may include some adjacent areas of subsistence farming, especially if the village structures and fields are inter-mixed. This class is also associated with both structures on individual (commercial or smallholding) farming units, depending on clustering and size. Scattered villages are defined as those represented by contiguous / adjacent village-classified cells which collectively do not form the majority cover in a surrounding 1 ha window.Note that the class extent includes both bare / non-vegetated and low vegetation covered areas within the village boundary. Woody cover is excluded from this class and represented separately (i.e. classes 2 – 4).
56	Village Dense	Built-up areas primarily associated with scattered rural settlements and associated utilities. It may include some adjacent areas of subsistence farming, especially if the village structures and fields are inter-mixed. This class is also associated with both structures on individual (commercial or smallholding) farming units, depending on clustering and size. Dense villages are defined as those represented by contiguous / adjacent village-classified cells which collectively do form the majority cover in a surrounding 1 ha window. Woody cover is excluded from this class and represented separately (i.e. classes 2 – 4).
66	Industrial	Built-up areas primarily containing formally planned and constructed industrial structures and associated utilities. Includes both light and heavy industry, power generation, airports, rail terminals and ports. In the agricultural sector this class also represents (chicken and pig) animal batteries, greenhouses and tunnels and intensive feedlots.

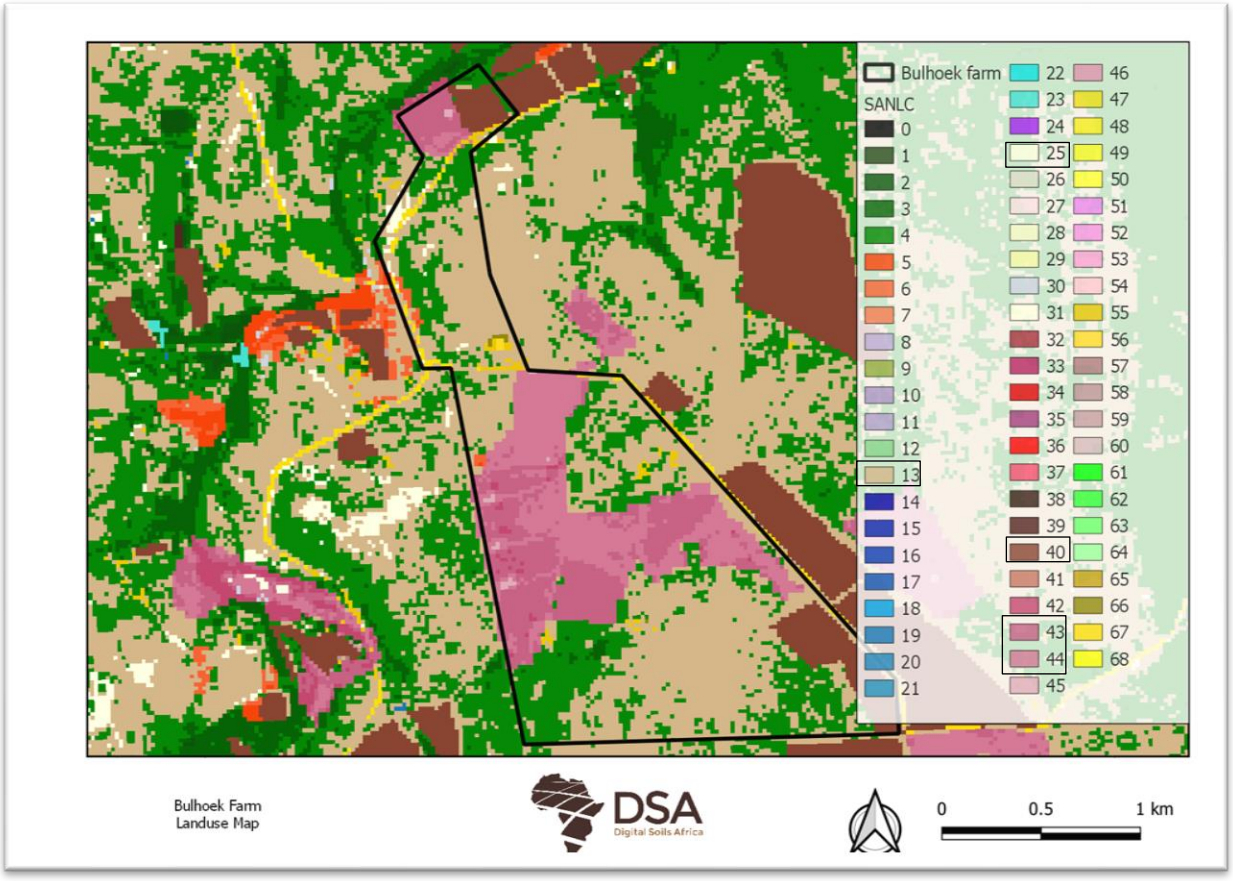

FIGURE 10: SOUTH AFRICAN NATIONAL LAND-COVER 2018 (SANLC 2018).

SOIL SURVEY

The soil map was created using soil observations and continuous soil covariate data, including terrain derivatives from the 30 m SRTM DEM and satellite imagery. The descriptions of the soil characteristics are found in Table 3 and a description of the observations is found in Appendix 2.

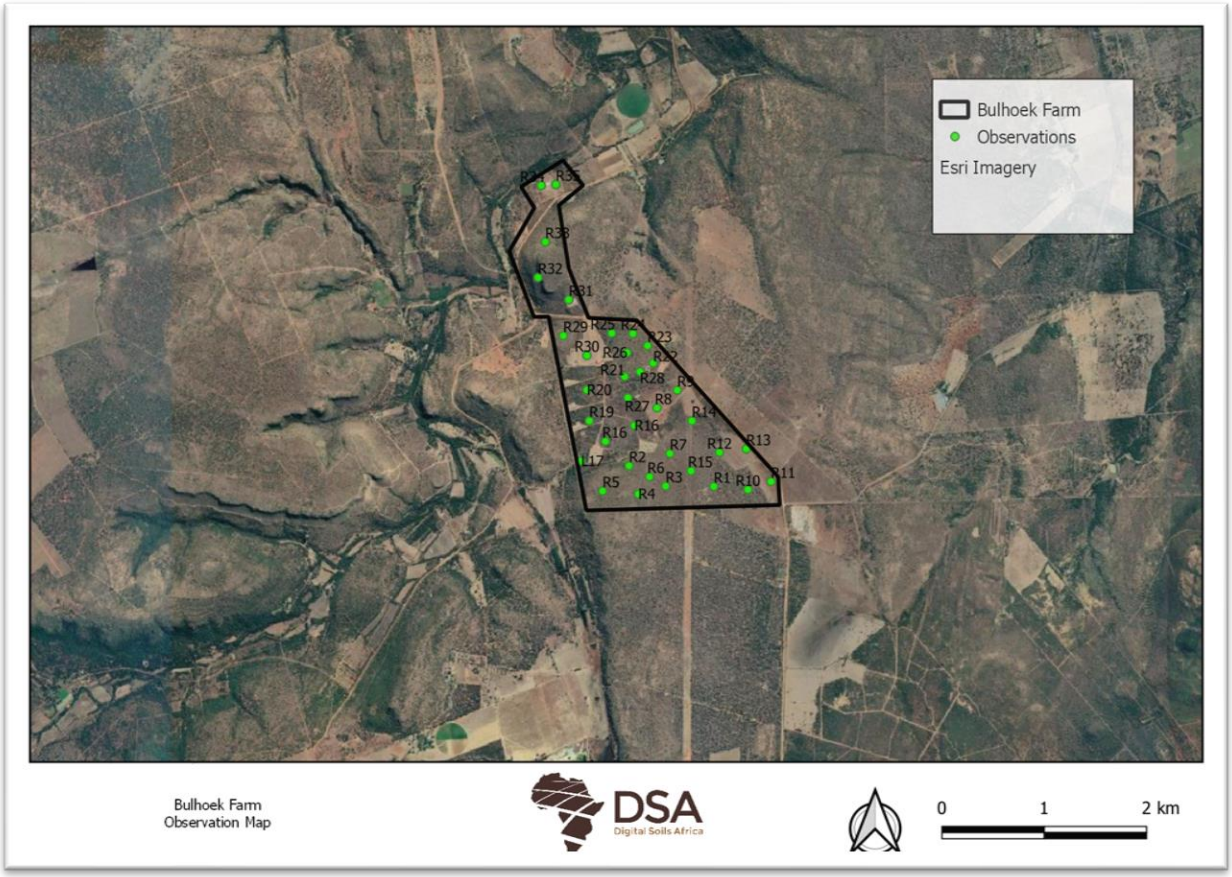

FIGURE 11: OBSERVATIONS USED DURING THE STUDY.

TABLE 3: DESCRIPTION OF SOIL ASSOCIATION UNITS

SOIL FORM	FAMILY	DESCRIPTION	LAND CAPABILITY CLASS
NKONKONI	2111	WEAK APEDAL STRUCTURE, WITH ROOTING DEPTH DEEPER THAN 800 MM, UNDERLYING MATERIAL SAPROLITHIC.	7
ERMELO	2110	WEAK STRUCTURE WITH ROOTING DEPTH DEEPER THAN 1500 MM.	7
VAALBOS	2111	WEAK STRUCTURE, WITH ROOTING DEPTH 400 MM, UNDERLYING MATERIAL FRACTURED ROCK	5
CAROLINA	2111	SIMILAR TO ERMELO SOIL, WITH UNDERLYING MATERIAL BEING FRACTURED ROCK	7
HUTTON	2210	WEAK TO MODERATE APEDAL STRUCTURE, WITH ROOTING DEPTH DEEPER THAN 1500 MM	7
MISPAH	2110	FRACTURED ROCK, WITH SOIL DEPTHS ONLY REACHING 250 MM	2

The soils in the survey area are dominated by deep Hutton soils, in some areas the clay content within the Red Apedal was high while along with the mountain areas the Red Apedal was sandier. It is for this reason that most of the soils were classified as Hutton soil form, consisting of a chromic topsoil, and a Red Apedal B horizon that is non-calcareous. The depths of the Hutton reached 1500 mm. This is important for agricultural potential because the depth of soil will determine root penetration and water holding capacity. In the areas where the Red Apedal had a higher clay, water holding capacity will be higher than areas where it was sandier. The agricultural potential of the area is only moderate, due to annual rainfall of 600

- Orthic A-Horizon – Chromic topsoil. Generally, thin topsoil never exceeding 250 mm.
- Yellow/Brown-Apedal Horizon – Has a sandy texture, and was also more yellow than brown. The color was 10YR 5/8
- Red-Apedal Horizon - Content contained more sand than clay, Had a Munsell color of 5YR 5/8.
- Lithic Horizon – The lithic horizon was saprolithic with hematite and goethite being prominent. The rock fragment size was between 10 mm and 20 mm.
- Hard rock Horizon-Fractured rock, with volcanic rock being dominant

Figure 12 shows photographs of the soils found in the Bulhoek farm area. A- Deep Hutton soils dominate the area. B- Vaalbos soil form is classified as low due to shallow depth. C- Ermelo soil D- Carolina soil form E- Nkonkoni soil form, only found in a very small area F- Mispah, dominated by ironstone.

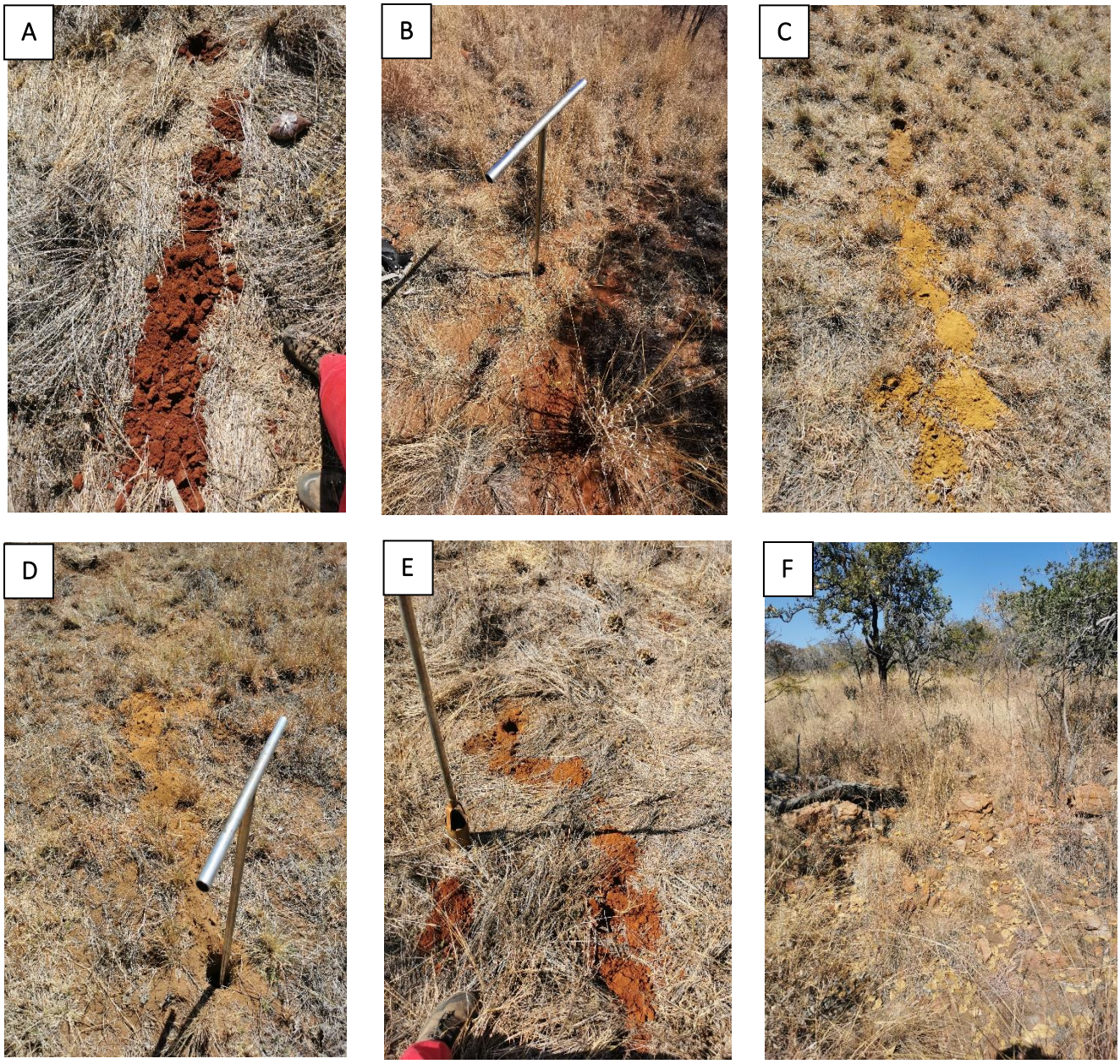

FIGURE 12: PHOTOGRAPHS OF SELECTED SOILS AND SOIL PROPERTIES FOUND IN THE STUDY AREA- A) HUTTON SOIL, B) VAALBOS SOIL, C) ERMELO SOIL, D) CAROLINA SOIL, E) NKONKONI SOIL, F) MISPAH.

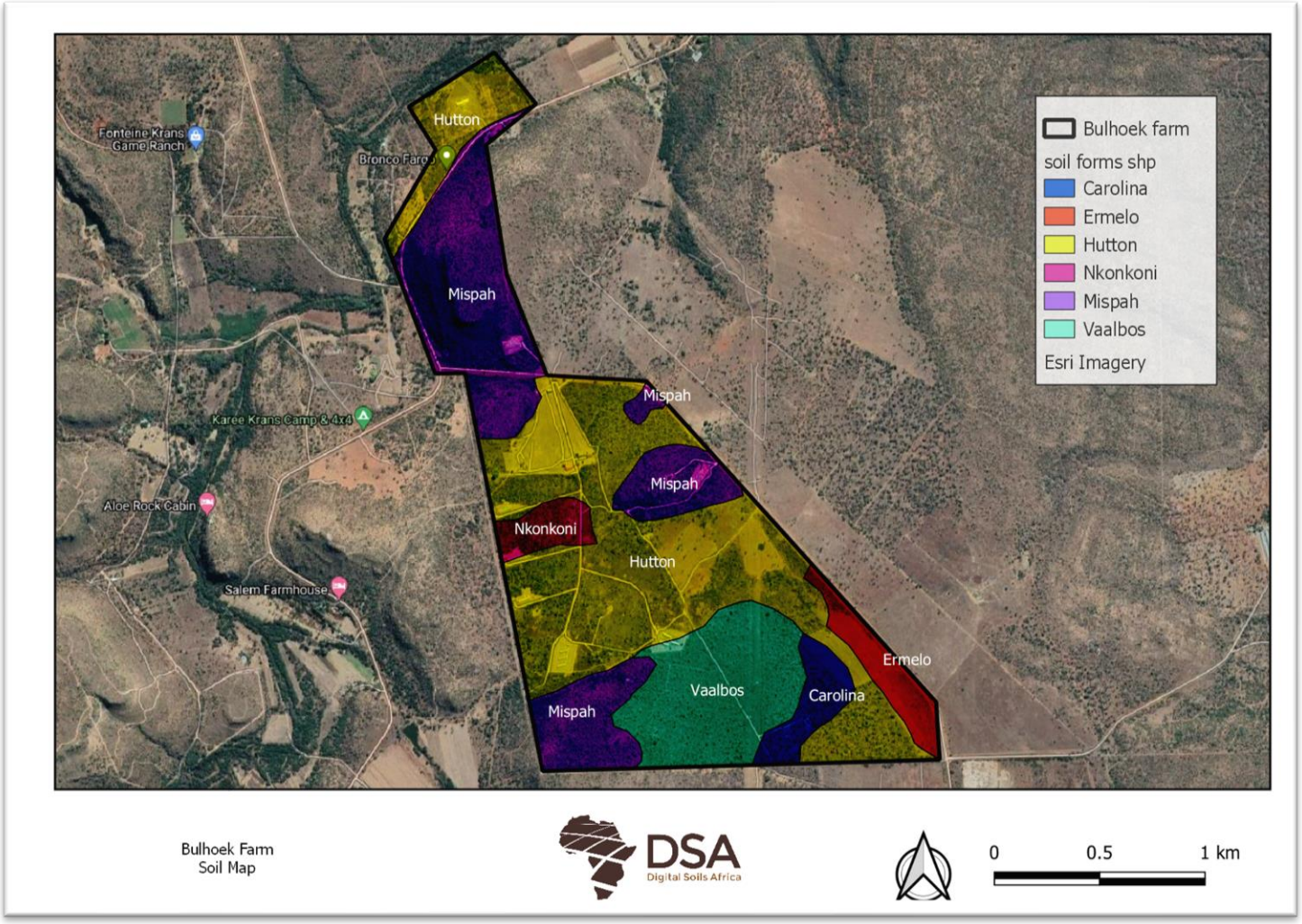

FIGURE 13: SOIL TYPES FOUND IN THE STUDY AREA

Approximately 8 new chicken houses (indicated in black) are to be established in the study area. The chicken houses, as seen in Figure 15 are placed opposite existing chicken houses. Site 6 and 7 are the only sites where low potential soil were found. Additionally, the rest of the sites are placed on moderate to high soil potential areas, of which were also considered to be marginal agricultural soils.

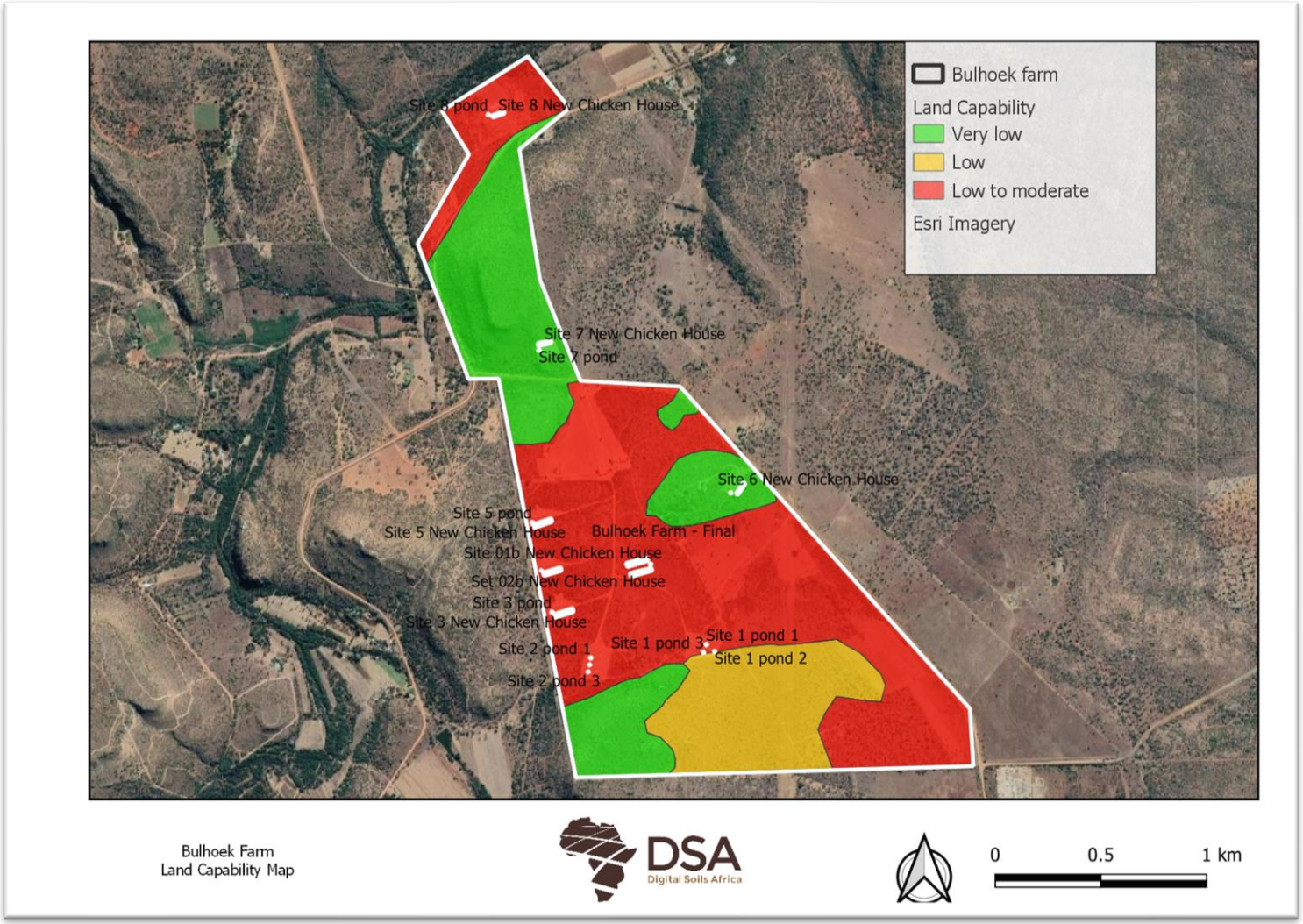

FIGURE 14: LAND CAPABILITY CLASS MAP OF THE AREA AND THE PROPOSED LAYOUT.

FINDINGS AND RECOMMENDATIONS

Areas classified as low to moderate land capability could be considered suitable for cultivation. The soil capability could be moderate due to the high-water holding capacity of the deep apedal soils. These soils are classified as Hutton, Carolina, Ermelo, and Nkonkoni soil forms. Areas classified as Low land capability consisted of Mispah and Vaalbos soil forms and were found within the mountain areas. The climate plays a dominant role since the rainfall is moderate but the temperatures are very high. Areas with natural vegetation generally consisted of the Mispah, Vaalbos, Carolina, and parts of the Hutton soils. Other parts of the Hutton soil form and the Ermelo soil form were classified on old fallow land.

CONCLUSIONS

This report describes the Agro-Ecosystem Assessment study of Farm Bulhoek. North West contributes about 9 % of South Africa's poultry production (Agriseta, 2020). The Bulhoek farm will contribute to higher employment rates, with approximately 15 job opportunities being made. In terms of land potential, there are moderate potential soils, but due to low rainfall and high evaporation rates, these soils are termed marginal agricultural soils where only specific crops would be able to grow. Furthermore, no new chicken houses are proposed on existing lands.

Therefore, the small loss in agricultural output is outweighed by the poultry production. In terms of agricultural sensitivity, the proposed development should thus be allowed to proceed at the identified site.

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APPENDIX 1: LANDTYPE

Site:	BULHOEK FARM					Soil form:	Hutton
Map/Photo example:	Figure 13 A					Soil family:	2210
GPS Position:	26.9144952985	- 25.5851562086				Colour	Red/Brown
Surface stones:	0%					Occurrence of flooding:	Low
Altitude:	1254m					Wind erosion potential:	low
Terrain unit:	Upper slope					Water erosion potential:	moderate
Slope:	1%					Vegetation/Land use:	Grasses
Slope shape:	Planform		Straight	Profile	Straight	Water table:	1500 mm
Aspect:	None						
Micro-relief:	None					Described by:	JD Marx
Parent material solum:	Dolomite, Iron stone					Date described:	2021-09-01
Geological group:	Daspoort Fm, Pretoria Grp					Weathering of underlying material:	low

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Site:	BULHOEK FARM					Soil form:	Mispah
Map/Photo example:						Soil family:	1100
GPS Position:	26.909216169	25.5924679945				Colour	Red
Surface stones:	50%					Occurrence of flooding:	Low
Altitude:	1309 m					Wind erosion potential:	Low
Terrain unit:	Foot slope					Water erosion potential:	Low
Slope:	2%					Vegetation/Land use:	Grasses
Slope shape:	Planform	Straight	Profile	Straight		Water table:	None
Aspect:	None						
Micro-relief:	None					Described by:	JD Marx
Parent material solum:	Dolomite					Date described:	2021-09-01
Geological group:	Daspoort Fm, Pretoria Grp					Weathering of underlying material:	Moderate

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APPENDIX 2: OBSERVATIONS

Lat	Long	Observation	Soil form	Depth/Rooting depth	Land Capability
-25.5920778392	26.9199942336	R1	CAROLINA	1000	Low to moderate
-25.5902521567	26.9117848697	R2	MISPAH	100	Very low
-25.5920392156	26.9153291284	R3	MISPAH	100	Very low
-25.5927452983	26.9126841422	R4	VAALBOS	400	Low
-25.5924679945	26.9092161691	R5	MISPAH	100	Very low
-25.5912127267	26.9137690479	R6	VAALBOS	1000	Low
-25.5891717907	26.9157405158	R7	VAALBOS	1100	Low
-25.5851562086	26.9144952985	R8	HUTTON	1500	Low to moderate
-25.5835985266	26.9164603234	R9	HUTTON	1500	Low to moderate
-25.5923551778	26.9232989174	R10	HUTTON	1500	Low to moderate
-25.5916507097	26.9255322077	R11	ERMELO	1500	Low to moderate
-25.5890778891	26.9205462166	R12	CAROLINA	700	Low
-25.5887667450	26.9231419790	R13	ERMELO	1500	Low to moderate
-25.5862964719	26.9178714180	R14	HUTTON	1500	Low to moderate
-25.5906974836	26.9177965116	R15	MISPAH	100	Very low
-25.5867038454	26.9123094431	R16	HUTTON	1500	Low to moderate
-25.5880909236	26.9094893248	R16	HUTTON	1500	Low to moderate
-25.5898350370	26.9071460534	R17	HUTTON	1500	Low to moderate
-25.5862909407	26.9079415124	R19	HUTTON	1500	Low to moderate
-25.5835751314	26.9077109065	R20	NKONKONI	500	Low to moderate
-25.5823970865	26.9113638548	R21	MISPAH	100	Very low
-25.5812105346	26.9141388830	R22	MISPAH	100	Very low
-25.5796883008	26.9135834668	R23	HUTTON	1500	Low to moderate
-25.5786206879	26.9121692003	R24	MISPAH	100	Very low

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-25.5785780591	26.9101159671	R25	HUTTON	1500	Low to moderate
-25.5802963120	26.9115976181	R26	HUTTON	1500	Low to moderate
-25.5819747126	26.9128473702	R28	MISPAH	100	Very low
-25.5842580765	26.9116776509	R27	HUTTON	1500	Low to moderate
-25.5788030365	26.9054181916	R29	HUTTON	1500	Low to moderate
-25.5805330659	26.9077039931	R30	HUTTON	1500	Low to moderate
-25.5756328678	26.9059488950	R31	MISPAH	100	Very low
-25.5736815565	26.9029837658	R32	MISPAH	100	Very low
-25.5705520338	26.9036825250	R33	MISPAH	100	Very low
-25.5655929711	26.9032942823	R34	HUTTON	1500	Low to moderate
-25.5655010150	26.9047075080	R35	HUTTON	1500	Low to moderate

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APPENDIX 3 SPECIALIST CV

DR DARREN BOUWER

EDUCATION

PhD Soil Science	University of the Free State	2018
M.Sc. Soil Science	University of the Free State	2013
B.Sc. Soil Science (Hon)	University of the Free State	2009
B.Sc. Soil Science	University of the Free State	2008
Matric certificate	Queens College	2005

PROFESSIONAL AFFILIATIONS

- SACNASP- Pri Nat Sci 400081/16
- Member of the Soil Science Society of South Africa
- Member of the Soil Classification Work Group
- Member of South African Soil Surveyors Organisation

WORK EXPERIENCE

- Digital Soils Africa / Soil Scientist - May 2012 – Present
- Ghent University / Researcher- January 2016 - December 2016
- University of the Free State/ Assistant Researcher- January 2011- December 2015

PUBLICATIONS

Total Consultancy reports: 97
Total peer reviewed publications: 5

Most relevant:

Bouwer, D. & van Tol, J. J., 2020. Identification of hydropedological flowpaths in Stevenson-Hamilton catena from soil morphological, chemical, and hydraulic properties. Koedoe, Vol 62 No 2.

Bouwer, D., Le Roux, P. A., van Tol, J. J., & van Huyssteen, C. W., 2015. Using ancient and recent soil properties to design a conceptual hydrological response model. Geoderma, 241, 1–11.

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SPECIALIST DECLARATION

I, Darren Bouwer, declare that –

- I act as the independent specialist in this application;
- I regard the information contained in this report to be true and correct;
- I do not have a conflict of interest in this project;
- I will conduct the work relating to the project in an objective manner.

Dr Darren Bouwer
PhD Soil Science
Pri Nat Sci 400081/16

JAN-DIRK MARX

EDUCATION

B.Sc. Soil Science	University of the Free State	2019
Matric certificate	Secunda High School	2015

PROFESSIONAL AFFILIATIONS

WORK EXPERIENCE

- **Digital Soils Africa** / Soil Scientist -January 2020– Present

SPECIALIST DECLARATION

I, Jan-Dirk Marx, declare that –

- I act as the independent specialist in this application;
- I regard the information contained in this report to be true and correct;
- I do not have a conflict of interest in this project;
- I will conduct the work relating to the project in an objective manner.

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Jan-Dirk Marx

- SACNASP- 132344