REPORT

On contract research for

SAVANNAH ENVIRONMENTAL

ARC • LNR

SOIL IMPACT ASSESSMENT FOR THE GRID CONNECTION INFRASTRUCTURE FOR THE NAMAS WIND FARM, NORTHERN CAPE

By

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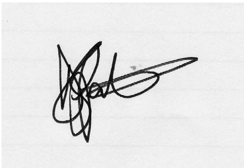
DECLARATION

I have over 30 years' experience in soil surveying, classification and interpretation. I have compiled over 150 soil survey reports, including numerous EIA and related studies. I have a PhD in soil science and am a member of the Soil Classification Working Group of South Africa.

I hereby declare that I am qualified to compile this report as a registered Natural Scientist (SACNASP Registration No. 400463/04) and that I am independent of any of the parties involved and that I have compiled an impartial report, based solely on all the information available.



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1. INTRODUCTION

Genesis Namas Wind (Pty) Ltd proposes the construction and operation of a grid connection solution for the proposed Namas Wind Farm, near Kleinsee, Northern Cape Province. The grid connection solution will include the development of a double-circuit 132 kV power line (known as the Rooivlei-Gromis 132 kV double-circuit power line) and collector substation (known as the Rooivlei Substation) to connect the proposed Namas Wind Farm to the national grid. Other associated infrastructure will also be required for the grid connection solution, including access tracks/roads, administrative buildings and laydown areas.

A corridor 300 m wide and 32 km long is being assessed to allow for the optimisation of the grid and associated infrastructure and to accommodate environmental sensitivities. The grid infrastructure will be developed within the assessed 300 m corridor. The height of the power line pylons will be up to 32 m and the servitude width of the power line will be 31 m. The extent of the Rooivlei Substation will be 100 m x 200 m and the capacity of the substation will be 132 kV. Two grid connection options exist within the 300 m corridor, namely:

- A direct connection from the proposed Rooivlei Substation to the existing Gromis Substation located ~26 km from the northern boundary of the Namas Wind Farm project site. This is considered to be the preferred option from a technical perspective due to the fact that the Gromis Substation is already existing.
- A direct connection from the Rooivlei Substation to the proposed collector substation (known as the Strandveld Substation) which forms part of the Zonnequa Wind Farm grid connection solution. The Strandveld Substation is located ~6 km from the northern boundary of the Namas Wind Farm project site. This option is only viable should the Zonnequa Wind Farm be developed.

The 300m corridor traverses eleven affected properties:

- Portion 3 of the Farm Zonnekwa 328
- Portion 2 of the Farm Zonnekwa 328
- Portion 1 of the Farm Zonnekwa 326
- Remaining extent of the Farm Zonnekwa 326
- Remaining extent of the Farm Honde Vlei 325
- Remaining extent of the Farm Kannabieduin 324
- Remaining extent of the Farm Sand Kop 322
- Remaining extent of the Farm Mannels Vley 321
- Remaining extent of the Farm Dikgat 195
- Portion 15 of the Farm Dikgat 195
- Remaining Extent of Farm Rooivlei 327

2. TERMS OF REFERENCE

The ARC-Institute for Soil, Climate and Water (ARC-ISCW) was contracted by Savannah Environmental to undertake a soil impact assessment near Kleinsee, in the Northern Cape Province. The purpose of the investigation is to contribute to the Impact Assessment process for the **grid connection infrastructure** for the proposed Namas Wind Farm. The objectives of the study are;

- To obtain all existing soil and related information,
- To produce a soil map of the specified area, and
- To assess broad agricultural potential and impacts.

2.1 Legislative and Policy Framework

In terms of the Subdivision of Agricultural Land Act (Act 70 of 1970), any application for change of land use must be approved by the Minister of Agriculture, while under the Conservation of Agricultural Resources Act (Act 43 of 1983) no degradation of natural land is permitted.

The following section summarises South African Environmental Legislation with regard to soil and agricultural issues:

- The law on ***Conservation of Agricultural Resources*** (Act 43 of 1983) states that the degradation of the agricultural potential of soil is illegal. The Act also requires the protection of land against soil erosion and the prevention of water logging and salinization of soils by means of suitable soil conservation works to be constructed and maintained. The utilisation of marshes, water sponges and watercourses are also addressed.

- The ***Bill of Rights*** states that environmental rights exist primarily to ensure good health and well-being, and secondarily to protect the environment through reasonable legislation, ensuring the prevention of the degradation of resources.

- The Environmental right is furthered in the ***National Environmental Management Act*** (No. 107 of 1998), which prescribes three principals, namely the precautionary principle, the “polluter pays” principle and the preventive principle. It is stated in the above-mentioned act that the individual/group responsible for the degradation/pollution of natural resources is required to rehabilitate the polluted source.

- Soils and land capability are protected under the ***National Environmental Management Act*** (Act 107 of 1998), the ***Environmental Conservation Act*** (Act 73 of 1989) and the ***Conservation of Agricultural Resources Act*** (Act 43 of 1983).

- The ***National Veld and Forest Fire Bill*** of 10 July 1998 and the ***Fertiliser, Farm Feeds, Agricultural Remedies and Stock Remedies Act*** (Act 36 of 1947) can also be applicable in some cases.

- The ***National Environmental Management Act*** (Act 107 of 1998) requires that pollution and degradation of the environment be avoided, or, where they cannot be avoided, it must be minimised and remedied.

2.2 Assumptions and limitations of study

The soil information obtained for this report is of a reconnaissance nature (1:250 000 scale). It is assumed that the information is of a high scientific standard, but the limitation of the scale, and the absence of any source of more detailed soil information, is stated. A Geotechnical report for the project was supplied, but it concentrates on the underlying material and not on the soil profile, or the associated agricultural potential.

3. SITE CHARACTERISTICS

3.1 Location

The 300m corridor is located on the coastal hinterland strip of the west coast, with the proposed Namas Wind Farm shown in red (see Figure 1). However, in order for the wind farm to connect to the national grid system, grid connection infrastructure will be required; the 300 m corridor within which the double-circuit 132 kV power line and the collector substation will be located is shown by the **blue line**.

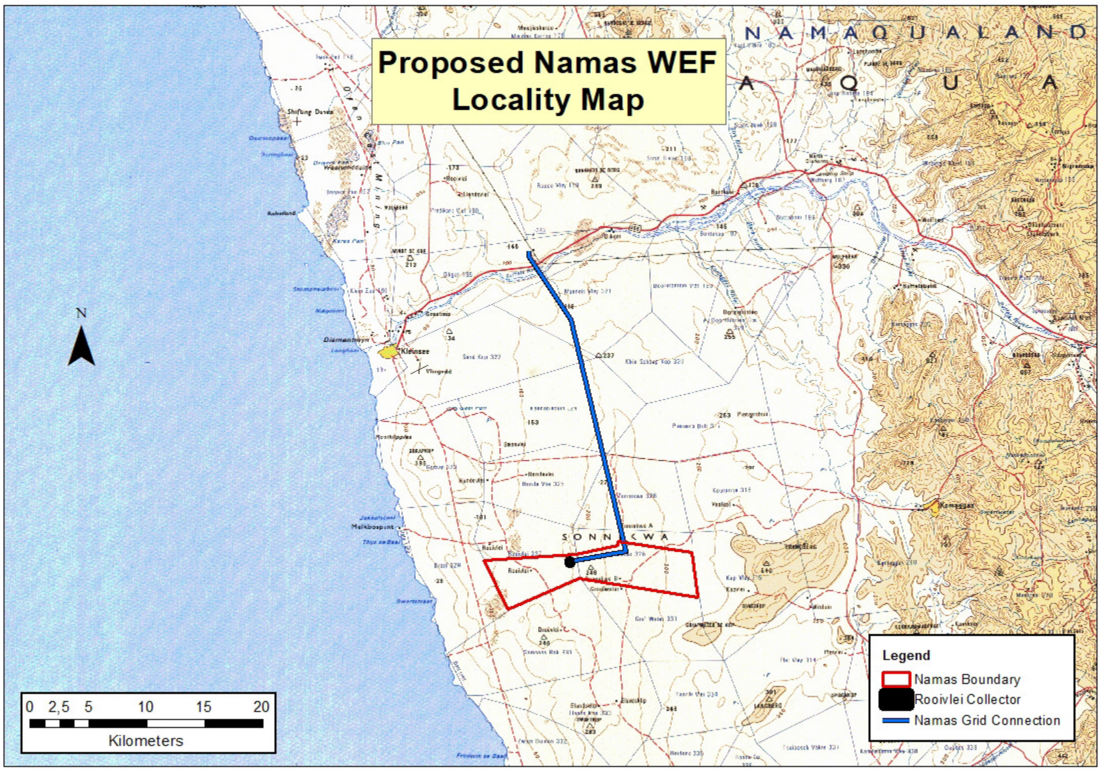

Figure 1 Locality map of the grid connection infrastructure for the Namas Wind Farm. The blue line represents a 300 m corridor within which the Rooivlei-Gromis double-circuit 132 kV power line and Rooivlei collector substation will be placed.

3.2 Terrain

The area consists of slightly undulating topography, with slopes of less than 5% over most of the area, and with an altitude above sea level of between 120 and 246 m.

The current land use being undertaken within the 300 m corridor is extensive grazing (specifically sheep grazing) and the corridor is dominated by natural vegetation. The 300 m corridor also includes a significant proportion of sand dunes.

3.3 Climate

The climate of the area has a mostly all year rainfall distribution, but the annual average is very low, at around 75 mm per year, although this might be slightly higher in the higher parts of the landscape (Koch *et al.*, 1987).

Temperatures will be warm to very hot in summer, but cool to cold in winter, with almost no occurrence of frost.

3.4 Parent Material

The area is underlain by Quaternary sediments, mostly sandy (Geological Survey, 1984).

4. METHODOLOGY (Land Type Survey)

Existing information was obtained from the map sheet 2916 Springbok (Schloms & Ellis, 1987) from the national Land Type Survey, published at a 1:250 000 scale. A ***land type*** is defined as an area with a uniform terrain type, macroclimate and broad soil pattern. The soils are classified according to MacVicar *et al* (1977).

The 300m corridor under investigation is covered by four land types, as shown on the map in the Appendix, namely:

- **Af17** (High base status, red and yellow soils, with dunes)
- **Ah38** (High base status, red and yellow soils)
- **Ai13** (High base status, yellow soils)
- **Hb80** (Grey sands and other soils)

It should be clearly noted that, since the information contained in the land type survey is of a reconnaissance nature, only the general dominance of the soils in the landscape can be given, and not the actual areas of occurrence within a specific land type. Also, other soils that were not identified due to the scale of the survey may also occur.

The 300m corridor was not visited during the course of this study, and so the detailed soil composition of the specific land types within the corridor has not been ground-truthed. However, this is not seen as a limiting factor for the intent of this study, due to the prevailing shallow soils and steep terrain which is restrictive in terms of agricultural activities. It can also be noted that the conclusions from other studies within the surrounding areas of the 300m corridor and in this area of the Northern Cape as a whole are in line with the findings of this report.

5. SOILS

A summary of the dominant soil characteristics of each land type is given in Table 1 below.

Column 6 shows the distribution of agricultural potential per soil class within each land type (see Section 5), with the dominant class shown in **bold**. These figures will always add up to 100%, so that the relative proportions of each potential class within every land type can be determined and easily compared with other land types.

5.1 Erodibility

The soils present along most of the 300m corridor are not considered susceptible to erosion by water. However, if the vegetation cover is disturbed (for example by overgrazing or construction activities) and considering the sandy nature of the topsoils, as well as the dry climate, there is a significant possibility of removal of some or all of the topsoil by wind action.

This can be mitigated by ensuring that the minimum area is disturbed, and that rehabilitation of surface vegetation is carried out as soon as possible.

Table 1 Land types present within the 300m corridor assessed for the grid connection infrastructure for the Namas Wind Farm (with soils in order of dominance)

Land Type	Dominant soils	Depth (mm)	Percent of land type	Characteristics	Agric. Soil Potential* (%)
Af17	Hutton & Clovelly 31/41 Vilafontes 11/31	>1200 >1200	95% 5%	Red and yellow brown, sandy, structureless soils, sometimes calcareous, with occasional dunes Grey-brown, sandy, structureless soils	High: 0.0 **Mod: 95.0** Low: 5.0
Ah38	Hutton & Clovelly 31/41 Vilafontes 11/31	400-1200 >1200	67% 20%	Red and yellow brown, sandy, structureless soils, sometimes calcareous Grey-brown, sandy, structureless soils	High: 0.0 **Mod:100.0** Low: 0.0
Ai13	Clovelly 31/34/41/44 Pinedene 31/34	600-1200 400-800	63% 13%	Yellow brown, sandy, structureless soils, sometimes calcareous Yellow brown, sandy, structureless soils, on gleyed clay	High: 0.0 **Mod: 92.7** Low: 7.3
Hb80	Fernwood 20/21 Pinedene/Kroonstad	>1200 400-800	36% 24%	Grey-brown, sandy, structureless soils Yellow brown and grey, sandy, structureless soils, on gleyed clay	High: 0.0 **Mod: 76.0** Low: 24.0

***Note** – this describes the **soil characteristics only**, and does not take into account any other limiting factors, such as climate.

6. AGRICULTURAL POTENTIAL

As can be seen from the information contained in Table 1, there are no high potential soils present along the 300m corridor and the soils are of moderate potential at best, due mainly to the sandy texture which will lead to rapid water infiltration and the soils drying out.

In addition, the low rainfall in the area (Section 3.3) means that there is little potential for rain-fed arable agriculture in the area in any case. Arable production would therefore be possible only by irrigation, and no indications of any irrigated areas, within and surrounding the 300m corridor, can be identified through Google Earth.

In general, the soils that do occur along the 300m corridor are suited for extensive grazing at best and furthermore the grazing capacity of the area is very low, at around 26-40 ha/large stock unit (ARC-ISCW, 2004).

6.1 Recommendations

The prevailing potential of the soils for rain-fed cultivation throughout most of the area, as well as the use of irrigation activities for cultivation, is low. Considering the land types and soils located along the 300m corridor and the current land-use activities, it is recommended that no further detailed soil investigation is required for the grid connection infrastructure for the Namas Wind Farm.

7. IMPACTS

Two impacts have been identified to be associated with the development of the grid connection infrastructure for the Namas Wind Farm from a soils perspective; these impacts include:

***Impact 1* (Table 2)**: In most environmental investigations, the major impact on the natural resources of the 300m corridor would be the loss of potential agricultural land due to the construction of the power line pylons, the collector substation and the associated infrastructure. However, in this instance, this impact would be of extremely limited significance and would be local in extent, if at all.

Impact 2 (Table 3): In this area (including the 300m corridor), the sandy soils, coupled with the dry climate, means that a possible impact would be the increased risk of wind erosion of the topsoil when vegetation cover is removed or disturbed. This would be especially relevant for the construction of access roads, to serve the double-circuit 132kV power line.

The significance of the impacts can be summarized as follows:

Table 2 Loss of agricultural land

Nature: Loss of potentially productive agricultural land *(both construction and operation phase)*		
	Without mitigation	**With mitigation**
Extent	Low (1)	Low (1)
Duration	Long-term (4)	Long-term (4)
Magnitude	Low (4)	Minor (2)
Probability	Probable (3)	Improbable (2)
Significance (E+D+M)x P	**Low (27)**	**Low (14)**
Status (positive or negative)	Negative	Negative
Reversibility	Low	High
Irreplaceable loss of resources?	No, due to the low agricultural potential of the land	No, due to the low agricultural potential of the land
Can impacts be mitigated?	Yes	
Mitigation: The main mitigation measures would be: • To avoid any cultivated land (if present) • To minimise the footprint of construction as much as possible.		
Cumulative impacts: likely to be low, as all soil-related aspects will be confined to the corridor, and the prevailing agricultural potential in the area is low.		
Residual Risks: likely to be low, since the implementation of the appropriate mitigation measures will enable more or less complete rehabilitation during and after the life of the project.		

Table 3: Soil erosion

Nature: Increased soil erosion hazard by wind *(construction and operation phase)*		
	Without mitigation	**With mitigation**
Extent	Medium (3)	Low (1)
Duration	Permanent (5)	Short-term (2)
Magnitude	High (8)	Minor (2)
Probability	Highly probable (4)	Improbable (2)
Significance (E+D+M) x P	**High (64)**	**Low (10)**
Status (positive or negative)	Negative	Negative
Reversibility	Low	High
Irreplaceable loss of resources?	Very possible	No
Can impacts be	Yes	

mitigated?	
Mitigation: The main mitigation measures would be: • To minimise the footprint of construction as much as possible. • Where soil is removed/disturbed, ensure it is stored for rehabilitation and re-vegetated as soon as possible. • Implement all appropriate soil conservation measures, including contouring, culverts etc. (for road construction), geotextiles and slope stabilisation (for all infrastructure).	
Cumulative impacts: likely to be high, as wind erosion can carry soil particles for a considerable distance, depending on wind strength and direction, as well as soil texture.	
Residual Risks: if mitigation is not carried out, long-term wind erosion is expected to occur, with results such as loss of valuable topsoil.	

The main impact would be the excavation for the pylons and connecting infrastructure (mainly access roads). It is anticipated that the proposed grid connection infrastructure will require a parallel access road (specifically for the double-circuit power line), where wind erosion could also be a problem.

7.1 Cumulative Impacts

The likelihood of cumulative impacts for wind erosion is large, if not mitigated. This is because other wind farm developments (and their associated grid infrastructure) are proposed close to the Namas Wind Farm project site and the 300m corridor; this is summarised in Table 4 below. **Figure 2** illustrates the other wind farms planned within the surrounding area of the Namas Wind Farm project site.

As identified above, the most significant cumulative impact from a soils perspective will be the effects of wind erosion. Within the surrounding areas of the 300m corridor only three other facilities are proposed. These facilities are located to the north, south, east and west of the wind farm project site. When considering the impact of wind erosion solely within the Namas Wind Farm project site and the 300m corridor (as per Table 3 above) the impact is identified as having a medium extent with a permanent duration without the implementation of appropriate mitigation measures. With the implementation of the appropriate mitigation measures at the Namas Wind Farm project site and within the 300 corridor, the impact will have a low extent with a short-term duration.

When considering the other wind farm developments (and the associated grid infrastructure) within the surrounding area, it is assumed that the impact of erosion and appropriate mitigation measures at a site-specific level for each of the facilities have been considered and the mitigation measures recommended are sufficient for the management and mitigation of erosion. Therefore, considering that the impact of erosion at each facility (including grid infrastructure) will be low in extent, subject to the implementation of the recommended mitigation measures, and managed for each facility separately, the cumulative impact for erosion is considered to be low. Under these circumstances, the loss associated with erosion is therefore considered to be acceptable loss, without detrimental consequences.

Regarding loss of agricultural potential, the prevailing natural resources (mainly climate, but also soil) mean that the level of potential is very low, so that there will be little or no significant cumulative impacts.

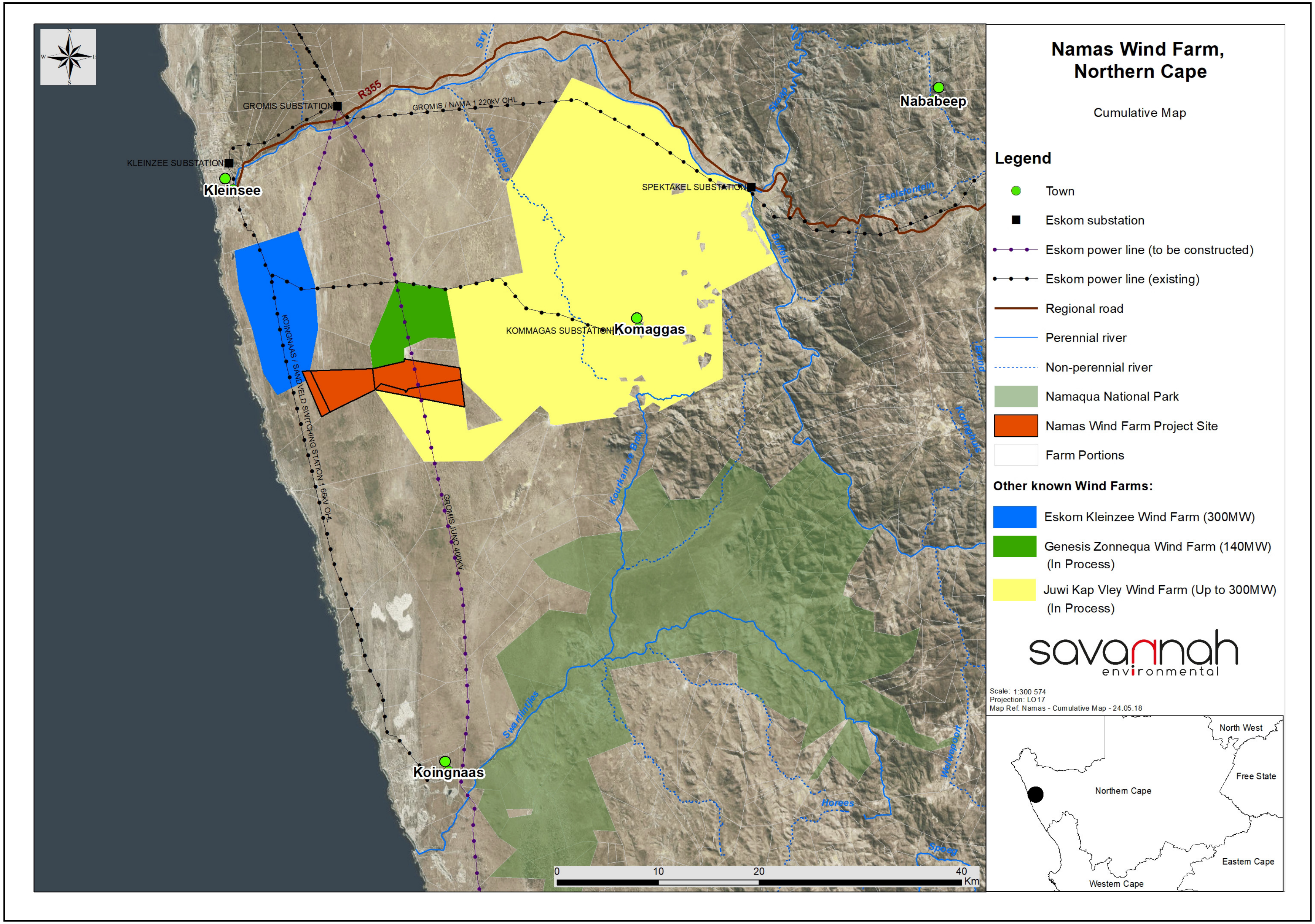

Figure 2: Namas Wind Farm Cumulative Map

Here, the Namas study area is shown in orange, with other proposed developments on all four sides. The Eskom Kleinsee and Juwi Kap Vley projects have received authorisation, while the other applications are in process. However, if there is large scale development of wind energy facilities in the area, any failure to prevent wind erosion of topsoil on one project could lead to that material being deposited on any or all neighbouring properties.

The cumulative impacts are summarised in Table 4 below.

Table 4 Cumulative Impact

Nature: Cumulative impact of the proposed grid connection infrastructure in terms of wind erosion		
	Overall impact of the proposed project considered in isolation[1]	**Cumulative impact of the project and other projects in the area**[2]
Extent	Low (1)	Low (2)
Duration	Short-term (2)	Short-term (2)
Magnitude	Minor (2)	Minor (2)
Probability	Improbable (2)	Improbable (2)
Significance (E+D+M)x P	**Low (10)**	**Low (12)**
Status (positive/negative)	Negative	Negative
Reversibility	High	High
Loss of resources?	No	No
Can impacts be mitigated?	Yes	
Confidence in findings: High.		
Mitigation: The main mitigation measures would be: • To minimise the footprint of construction as much as possible. • Where soil is removed/disturbed, ensure it is stored for rehabilitation and re-vegetated as soon as possible. • Implement all appropriate soil conservation measures, including contouring, culverts etc. (for road construction), geotextiles and slope stabilisation (for all infrastructure). • Ensure that equal responsibility and co-operation is accepted if more than one facility will be using the same access road, or if the possibility exists of sediment transfer (by wind or water) from one site to another.		
Residual Risks: Significant risk of accelerated soil erosion by wind if mitigation measures of each facility are not applied correctly.		

[1] It is assumed that the appropriate mitigation measures have been implemented.
[2] It is assumed that the appropriate mitigation measures have been implemented.

8 CONCLUSION AND RECOMMENDATIONS

The main recommendation is that care should be taken within all aspects of the construction phase to ensure that erosion is managed and mitigated appropriately. The 300m corridor is a dry area, with fragile vegetation and sandy topsoils and will be susceptible to uncontrolled topsoil removal by wind. The long-term effects of ignoring this aspect could be severe, both for the project and for the surrounding environment.

8.1 Measures for inclusion in the Environmental Management Programme

OBJECTIVE: Conservation, as far as possible, of the existing soil resource, both in the corridor and in adjoining areas.

Project component/s	Construction of all infrastructure where topsoil will be disturbed
Potential Impact	Loss of topsoil leading to wind erosion
Activity/risk source	Construction activities
Mitigation: Target/Objective	To retain all topsoil with a stable soil surface

Mitigation: Action/control	**Responsibility**	**Timeframe**
• Storage of all topsoil that is disturbed (maximum height 2 m; maximum length of time before re-use 18 months)	Construction Engineer	Construction
• Immediate replacement of topsoil after the undertaking of construction activities within an area	Construction Engineer	Construction
• Soil conservation measures must be put in place to ensure soil stabilisation	Construction Engineer	Post-Construction

Performance Indicator	No indications of visible topsoil loss
Monitoring	Visual inspection every 6 months (minimum) of all areas where disturbance has taken place (for the duration of the project, as erosion can start at any time) If soil loss is suspected, acceleration of soil conservation and rehabilitation measures must be implemented (as specified above)

Considering the findings of the report and the current soils environment within which the grid connection infrastructure for the Namas Wind Farm is proposed, it is the opinion of the specialist that the proposed activities should be authorised, subject to the implementation of the recommended mitigation measures. The activities proposed are considered to be acceptable from a soils perspectives considering the characteristics and potential of the soils present within the 300 m corridor.

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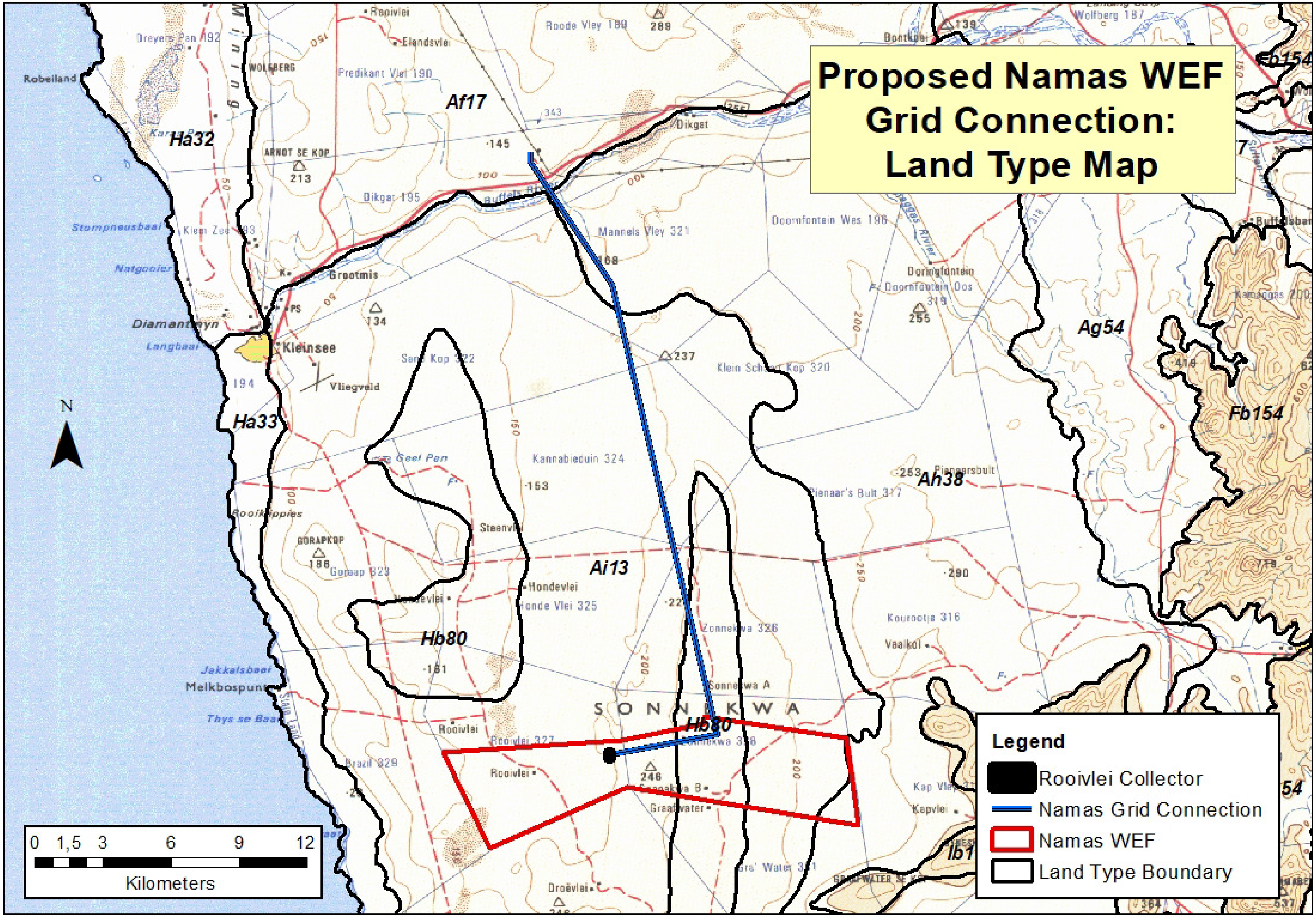
APPENDIX

MAP OF LAND TYPES



Proposed Namas WEF
Grid Connection:
Land Type Map
Legend
Rooivlei Collector
Namas Grid Connection
Namas WEF
Land Type Boundary
0 1,5 3 6 9 12
Kilometers
N
Af17
Ha32
Ha33
Hb80
Ai13
Ah38
Ag54
Fb154
Kleinsee
S O N N K W A