SCOPING PHASE VISUAL IMPACT ASSESSMENT FOR THE SOYUZ 5 WIND ENERGY FACILITY IN THE NORTHERN CAPE, SOUTH AFRICA

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PREPARED FOR:

Soyuz 5 (Pty) Ltd

DATE:

July 2022

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Report date:	21 July 2022
Report number:	02

DECLARATION

I, **Tosca Grünewald**, as an independent consultant compiled this Scoping Visual Impact Assessment and declare that it correctly reflects the findings made at the time of the report's compilation. I further declare that I, act as an independent consultant in terms of the following:

- Do not have any financial interest in the undertaking of the activity, other than remuneration for the work performed in terms of the National Environmental Management Act, 1998 (Act107 of 1998);
- Undertake to disclose, to the competent authority, any material information that has or may have the potential to influence the decision of the competent authority or the objectivity of any report, plan or document required in terms of the National Environmental Management Act,1998 (Act 107 of 1998);
- Based on information provided to me by the project proponent, and in addition to information obtained during the course of this study, will present the results and conclusion within the associated document to the best of my professional judgement.

Tosca Grünewald
Landscape Architect & Environmental Assessment Practitioner
SACLAP Reg nr: 20421
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1. INTRODUCTION

1.1. QUALIFICATION AND EXPERIENCE OF THE PROFESSIONAL TEAM

Nuleaf Planning and Environmental (Pty) Ltd, specialising in Visual Impact Assessments, undertook the Scoping Phase Visual Impact Assessment (VIA) for the proposed development.

The team undertaking the visual assessment has extensive practical knowledge in spatial analysis, environmental modelling and digital mapping, and applies this knowledge in various scientific fields and disciplines. The expertise of these practitioners is often utilised in Environmental Impact Assessments, State of the Environment Reports and Environmental Management Plans.

The visual assessment team is familiar with the "Guidelines for Involving Visual and Aesthetic Specialists in EIA Processes" (Provincial Government of the Western Cape: Department of Environmental Affairs and Development Planning) and utilises the principles and recommendations stated therein to successfully undertake visual impact assessments. Although the guidelines have been developed with specific reference to the Western Cape Province of South Africa, the core elements are more widely applicable.

Nuleaf Planning and Environmental have been appointed as an independent specialist consultant to undertake the visual impact assessment. Neither the author, nor Nuleaf Planning and Environmental will benefit from the outcome of the project decision-making.

1.2. LEGAL FRAMEWORK

The following legislation and guidelines have been considered in the preparation of this report:

- The Environmental Impact Assessment Amendment Regulations, 2017;
- Guideline on Generic Terms of Reference for EAPs and Project Schedules (DEADP, Provincial Government of the Western Cape, 2011).
- Guideline for Involving Visual and Aesthetic Specialists in EIA Processes (DEADP, Provincial Government of the Western Cape, 2005).
- NEMA: Protected Areas Act.
- Renewable Energy Development Zones (REDZ)
- Civils Aviation Act.
- International Finance Corporation (IFC) Performance Standards on Environmental and Social Sustainability, 2012.
- International Finance Corporation (IFC) Environmental, Health, and Safety Guidelines for Wind Energy, 2015.

1.3. INFORMATION BASE

This assessment was based on information from the following sources:

- Topographical maps and GIS generated data were sourced from the Surveyor General, Surveys and Mapping in Mowbray, Cape Town;
- Observations made and photographs taken during site visits;
- Professional judgement based on experience gained from similar projects; and
- Literature research on similar projects.

1.4. ASSUMPTIONS AND LIMITATIONS

This Report has been prepared by Nuleaf on behalf, and at the request, of CES to provide them with an independent specialist assessment. Unless otherwise agreed by Nuleaf in writing, Nuleaf does not accept responsibility or legal liability to any person other than the CES for the contents of, or any omissions from, this Report.

To prepare this Report, Nuleaf utilised only the documents and information provided by CES or any third parties directed to provide information and documents by CES. Nuleaf has not consulted any other documents or information in relation to this Report, except where otherwise indicated. The findings, recommendations and conclusions given in this report are based on the author's best scientific and professional knowledge, as well as, the available information. This report is based on survey and assessment techniques which are limited by time and budgetary constraints relevant to the type and level of investigation undertaken. Nuleaf and its staff reserve the right to modify aspects of the report including the recommendations if and when new information may become available from on-going research or further work in this field, or pertaining to this investigation.

Although Nuleaf exercises due care and diligence in rendering services and preparing documents, Nuleaf accepts no liability, and CES, by receiving this document, indemnifies Nuleaf and its directors, managers, agents and employees against all actions, claims, demands, losses, liabilities, costs, damages and expenses arising from or in connection with the services rendered, directly or indirectly by the use of the information contained in this document.

This report must not be altered or added to without the prior written consent of the author. This also refers to electronic copies of this report which are supplied for the purposes of inclusion as part of other reports. Similarly, any recommendations, statements or conclusions drawn from or based on this report must make reference to this report. If this report is used as part of a main report, the report in its entirety must be included as an appendix or separate section to the main report.

This assessment was undertaken during the planning stage of the project and is based on information available at that time. It is assumed that all information regarding the project details provided by CES (the EAP) is correct and relevant to the proposed project. No public participation had been undertaken at the time of this Scoping Phase VIA Report, and will only commence once the Scoping Report has been prepared by the EAP's. This Scoping Phase Visual Impact Assessment and all associated mapping has been undertaken according to the worst-case scenario with a layout provided.

1.5. LEVEL OF CONFIDENCE

Level of confidence[1] is determined as a function of:

- The information available, and understanding of the study area by the practitioner:
    - **3**: A high level of information is available of the study area and a thorough knowledge base could be established during site visits, surveys etc. The study area was readily accessible.
    - **2**: A moderate level of information is available of the study area and a moderate knowledge base could be established during site visits, surveys etc. Accessibility to the study area was acceptable for the level of assessment.
    - **1**: Limited information is available of the study area and a poor knowledge base could be established during site visits and/or surveys, or no site visit and/or surveys were carried out.
- The information available, understanding of the project and experience of this type of project by the practitioner:
    - **3**: A high level of information and knowledge is available of the project and the visual impact assessor is well experienced in this type of project and level of assessment.
    - **2**: A moderate level of information and knowledge is available of the project and the visual impact assessor is moderately experienced in this type of project and level of assessment.
    - **1**: Limited information and knowledge is available of the project and the visual impact assessor has a low experience level in this type of project and level of assessment.

These values are applied as follows:

Table 1: Level of confidence

	Information on the project & experience of the practitioner			
Information on the study area		**3**	**2**	**1**
	3	9	6	3
	2	6	4	2
	1	3	2	1

[1] *Adapted from Oberholzer (2005).*

The level of confidence for this assessment is determined to be **9** and indicates that the author's confidence in the accuracy of the findings is Moderate to High:

- The information available, and understanding of the study area by the practitioner is rated as **3**
- The information available, understanding and experience of this type of project by the practitioner is rated as **3**

2. METHODOLOGY

This scoping assessment was undertaken using Geographic Information Systems (GIS) software as a tool to generate viewshed analyses and to apply relevant spatial criteria to the proposed development. A detailed Digital Terrain Model (DTM) for the study area was created from 5m interval contours from the National Geo-spatial Information data supplied by the Department: Rural Development and Land Reform.

The approach utilised to identify potential issues related to the visual impact included the following activities:

- Undertaking a site visit (undertaken on the 02 April 2022);
- The creation of a detailed digital terrain model (DTM) of the potentially affected environment;
- The sourcing of relevant spatial data. This includes cadastral features, vegetation types, land use activities, topographical features, site placement, etc.;
- The creation of a preliminary viewshed analyses from the proposed area in order to determine the potential visual exposure and the topography's potential to absorb the potential visual impact. The viewshed analysis takes into account the dimensions of the proposed structures in their proposed locations as per the layout provided by the applicant;
- The identification of sensitive receptors upon which the proposed Soyuz 5 WEF could have a potential visual impact.
- Analysis of the potential shadow flicker zone around the proposed WEF to identify if any turbines could have a potential shadow flicker impact on sensitive receptors.

This report (scoping VIA) sets out to identify the possible visual impacts related to the proposed **Soyuz 5 WEF**, as well as, offer potential no development areas, if required. The methodology as described above has been followed for the assessment of the visual impacts in the scoping phase. This methodology complies to the International Finance Corporation (IFC) Performance Standards on Environmental and Social Sustainability, 2012 and Environmental, Health, and Safety Guidelines for Wind Energy, 2015.

3. PROJECT DESCRIPTION

The applicant, Soyuz 5 (Pty) Ltd, is proposing the development of a commercial Wind Energy Facility (WEF) and associated infrastructure on a site located approximately 58 km South of Britstown within the Ubuntu Local Municipality and the Pixley ka Seme District Municipality in the Northern Cape Province.

Five additional WEF's are concurrently being considered on the surrounding properties and are assessed by way of separate impact assessment processes contained in the 2014 Environmental Impact Assessment Regulations (GN No. R982, as amended) for listed activities contained in Listing Notices 1, 2 and 3 (GN R983, R984 and R985, as amended). These projects are known as Soyuz 1 WEF, Soyuz 2 WEF, Soyuz 3 WEF, Soyuz 4 WEF and Soyuz 6 WEF.

A preferred project site with an extent of approximately 125 000 ha has been identified as a technically suitable area for the development of the six WEF projects (collectively referred to in this report as the **Britstown Wind Farm Cluster**). It is proposed that each WEF will comprise of up to 75 turbines with a contracted capacity of up to 480 MW. It is anticipated that each WEF will have an actual (permanent) footprint of up to 150 ha.

The **Soyuz 5 WEF** project site covers approximately 16 800 ha and comprises the following farm portions:

- The Farm Lekkervlei No. 142
- Remaining Extent of the Farm Gediertesfontein No. 134.
- Portion 4 of the Farm Schram Fontein No. 21
- Portion 4 (Beschuid Kuil) of the Farm Schramfountain No. 23

- Remaining Extent (Portion 0) of the Farm Schram Fontein No. 21
- Portion 1 of the Farm Schram Fontein No. 21
- Remaining Extent of Portion 2 of the Farm Draayfountain No 24

The **Soyuz 5 WEF** project site is proposed to accommodate the following infrastructure, which will enable the wind farm to supply a contracted capacity of up to 480 MW:

- Up to 75 wind turbines with a maximum hub height of up to 160 m and a rotor diameter of up to 200 m;
- A transformer at the base of each turbine;
- Concrete turbine foundations;
- Turbine, crane and blade hardstands;
- Temporary laydown areas (with a combined footprint of up to 14 ha) which will accommodate the boom erection, storage and assembly area;
- Battery Energy Storage System (with a footprint of up to 5 ha);
- Cabling between the turbines, to be laid underground where practical;
- Two on-site substations with a combined footprint of up to 4 ha in extent to facilitate the connection between the wind farm and the electricity grid;
- Access roads to the site and between project components inclusive of stormwater infrastructure. A 12 m road corridor may be temporarily impacted upon during construction and rehabilitated to 6m wide after construction. The WEF will have a total road network of up to 125 km.
- A temporary site camp establishment and concrete batching plants (with a combined footprint of up to 2 ha); and
- Operation and Maintenance buildings (with a combined footprint of up to 2 ha) including a gate house, security building, control centre, offices, warehouses, a workshop and visitor's centre.

The project will also include self-build grid infrastructure to facilitate the connection of the WEFs to the national grid. This will include the construction of several 132kV/400kV overhead powerlines and the construction of a new Main Transmission Substation either to the North or South of the study area (awaiting confirmation from Eskom). The grid connections will be assessed in separate reports.

A WEF generates electricity by means of wind turbine generators (WTG) that harness the wind of the area as a renewable source of energy. Wind energy generation, or wind farming as it is commonly referred to, is a renewable electricity generation option. In order to optimise the use of the wind resource and the amount of power generated by the facility, the number of wind turbines erected in the area, as well as, the careful placement of the turbines in relation to the topography must be considered.

Each wind turbine is expected to consist of a concrete foundation, a steel tower, a hub and three turbine blades attached to the hub as illustrated in Figure 1. Each turbine is expected to have a hub height of 160m, with a rotor diameter of 200m, ultimately culminating in an overall height of 260m (maximum blade tip height). Refer to Table 2 below for a full breakdown. Variations of the above dimensions may occur, depending on the preferred supplier or commercial availability of wind turbines at the time of construction.

Table 2: Specifications of the proposed Soyuz 5 WEF as provided by the Applicant

Component	Info
Wind turbine unit size	Up to 8MW
Rotor diameter	Up to 200m
Hub height	Up to 160m
Blade tip height	Up to 260m
Number of wind turbines	75 max
Total WEF capacity	Up to 480MW

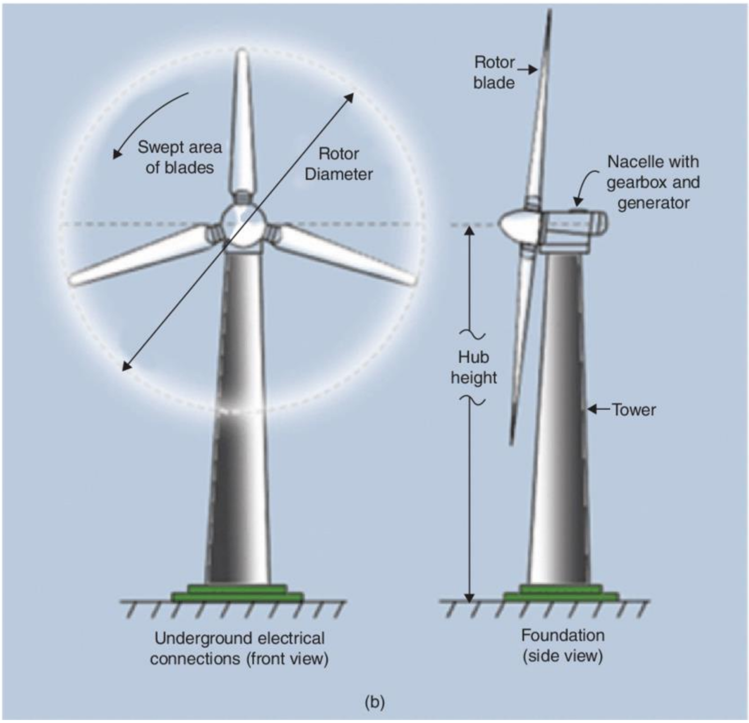


Figure 1: Illustration of the main components of a wind turbine[2]

The construction phase of the proposed facility is expected to be 18 months to 2 years, whilst the lifespan of the facility is approximated at 25 years.

4. SCOPE OF WORK

The Soyuz 5 WEF is proposed on a development area that covers approximately 16 800 ha. The extent of the broader site is larger than the space that will be required for the facility's actual development footprint. Therefore, the wind turbines and the associated infrastructure can be appropriately placed within the boundaries of the broader site while aiming to avoid any environmental sensitivities identified through the EIA process.

The scope of work for the proposed facility includes a scoping level visual impact assessment of the possible issues related to the potential visual impact. The scoping phase is the process of determining the spatial and temporal boundaries (i.e., extent) and key issues to be addressed in an impact assessment.

The main purpose is to focus the impact assessment on a manageable number of important questions on which decision-making is expected to focus and to ensure that only key issues are examined. Additionally, it is to inform the facility layout in order to avoid potential sensitive visual areas, if possible.

5. THE AFFECTED ENVIRONMENT

Regionally, the proposed site for the **Soyuz 5 WEF** is located approximately 60km south east of Britstown, 80km south west of De Aar and some 60km north west of Richmond in the Northern Cape Province.

The study area occurs on land that ranges in elevation from about 1300m above sea level (a.s.l.) to about 1400m a.s.l. The topography consists of flats and gently sloping plains interspersed with hills and rocky outcrops. Wolwekop located at 1374m a.s.l is one such hill located within the proposed development footprint of the **Soyuz 5 WEF**. Refer to **Map 1**.

[2] *Illustration courtesy of Charlier, R & Thys, A. (2016). Wind Power—Aeole Turns Marine. 10.1002/9781119066354.ch7.*

Figure 2: General topography of the study area – plains interspersed with hills and rocky outcrops

The vegetation in the study area is relatively homogeneous. The broader study area is situated predominately within the Eastern Upper Karoo vegetation type. Therefore, land cover consists primarily of low shrubland, interspersed with naturally occurring bare rock and grassland. Visually, the plants comprise low growing, small arid shrubs and tufted grasses, with scattered slightly taller shrubs.

Figure 3: Representative vegetation cover in the area consisting of low shrubland, interspersed with naturally occurring bare rock and grassland

Clusters and rows of planted trees and plants (i.e., poplars, blue gums, sisal and willow trees) are also sometimes found in the landscape, close to roads, homesteads, windmills and water/feeding troughs.

Figure 4: Example of cluster and rows of planted trees sometimes found close to roads, homesteads, windmills and water/feeding troughs

Given the arid conditions of the region, as well as, the predominately rocky shallow soils occurring, the vegetation cover is sparse in some areas with rocks and open land between vegetation. The natural vegetation occurring, therefore, provides little to no visual cover for any built structures but the clusters or rows of trees (usually close to farm houses, roads or windmills) may provide height and effective visual screening for sensitive receptors at these sites. Refer to **Map 2**.

This semi-arid Central Karoo region receives approximately 168mm of precipitation per annum and is therefore greatly devoid of any rain fed agriculture or cultivation. The predominant land uses occurring throughout the region are livestock (sheep, goats and cattle) farming, together with hunting activities of free roaming game naturally occurring in the region. As a result of the low carrying capacity of the land, farms are large and there are generally vast distances between the farms. This ultimately results in the farming activities in the area have a low impact on the natural visual environment

Figure 5: Example of livestock farming taking place within the study area

The site location can be described as remote due to its considerable distance from any major metropolitan centres or populated areas. The study area is sparsely populated with the highest concentration of people living in towns such as Britstown, De Aar, Richmond and to a lesser extent Merriman.

Figure 6: Example of one of the populated towns within the study area - Britstown

Infrastructure present in the greater study area is closely associated and stems from the farming activities occurring in the region. Prominent visual features resulting from these farming activities typical include structures such as windmills, power lines, sheep kraals and fences, as well as, the occasional clusters of shade trees. Farm houses and buildings vary but tend to be located in the warmer valleys and are most often surrounded by gardens and sheltering trees. Additional noticeable infrastructure located within the region is closely associated with the various railway lines, this includes, buildings, tracks, overhead masts and lines etc.

Figure 7: Example of infrastructure associated with the farming activities already present in the study area

A number of homesteads and the settlement of Merriman are present within the study area. These include Lekkervlei, Gediertesfontein, Poortjiesdam, Schramfontein and Weltevrede which all occur within a 5km radius of the proposed Soyuz 5 WEF.

It is uncertain whether all of the potentially affected homesteads / farmsteads are inhabited or not. It stands to reason that the farmsteads that are not currently inhabited will not be visually impacted upon at present. These farmsteads do, however retain the potential to be affected visually should they ever become inhabited again in the future. For this reason, the author of this document operates under the assumption that they are all inhabited.

Figure 8: Existing powerlines in the study area

The N12 and N10 are the national roads in the study area, these roads are regional connector giving access to the area between Johannesburg, Bloemfontein, Kimberly, Cape Town and Gqeberha (formally known as Port Elizabeth). The R398 and R388, main arterial roads located in the study area, are local connectors between Britstown, De Aar and Richmond. Other than these main roads, a number of secondary and internal farm roads also cross the study area. It must be noted that the R398, R388, all secondary roads and internal farm roads are gravel roads unlikely to carry much traffic.

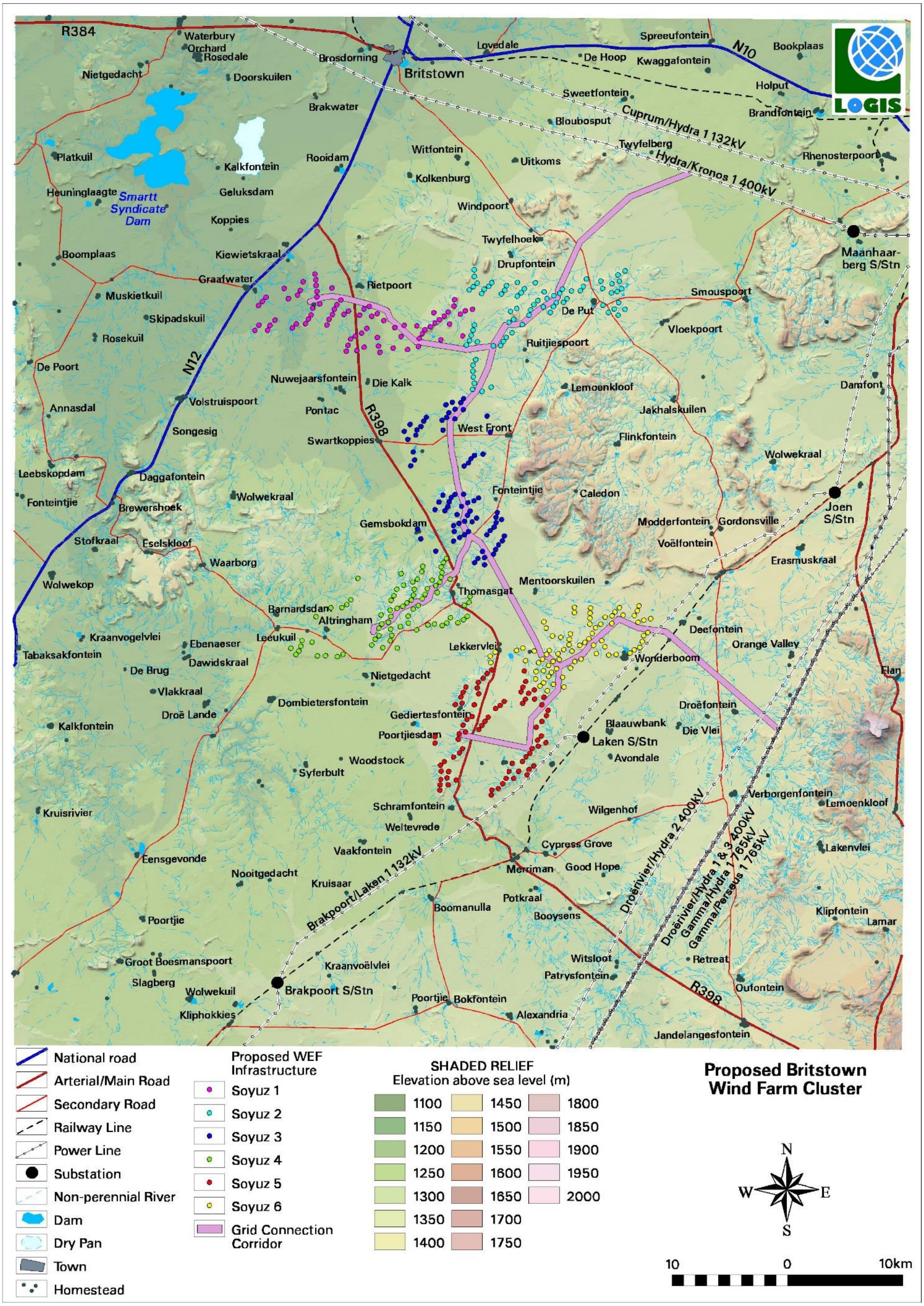
Figure 9: Example of the numerous secondary roads crisscrossing the study area

There are no formally protected or conservation areas present within the study area, but the greater environment has a vast, undeveloped and rugged character. Settlements, where these occur, are very limited in extent and domestic in scale.

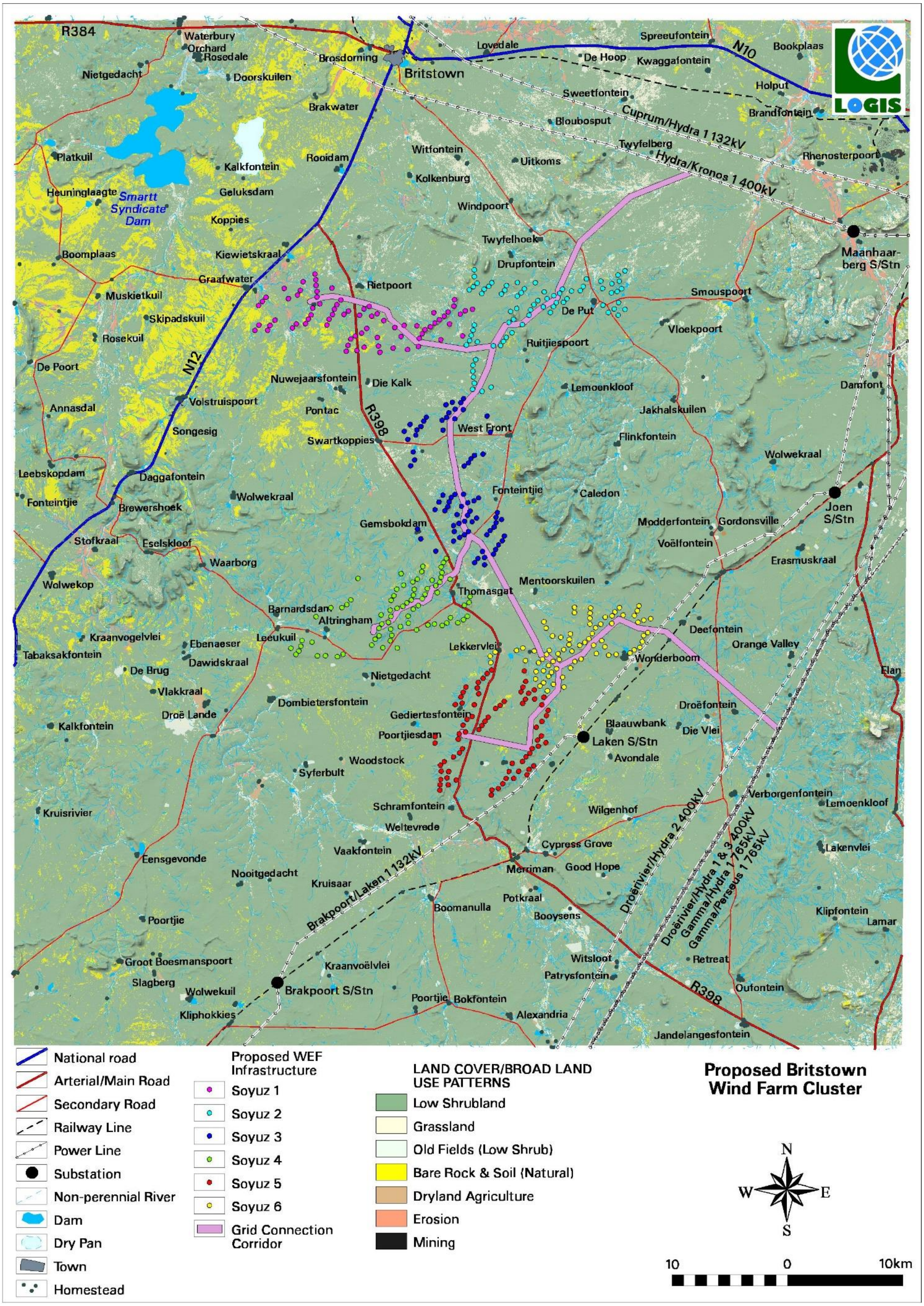
The greater environment with its wide open, undeveloped landscapes is considered to have a high visual quality.

Figure 10: Illustrating the high visual quality of the largely undeveloped landscape in the study area

This study area is not known as a tourist destination, but the various connectors discussed above do give access to the area between Johannesburg, Bloemfontein, Kimberly, Cape Town and Gqeberha, the area is also famously known as the major wool-producing area in South Africa.



Map 1: Shaded relief map of the study area



Map 2: Land cover / broad land use map of the study area

6. VIEWSHED ANALYSIS – SCOPING LEVEL ASSESSMENT

6.1. VISUAL DISTANCE AND OBSERVER PROXIMITY

Nuleaf Planning and Environmental determined proximity offsets based on the anticipated visual experience of the observer over varying distances. In general, the severity of the visual impact on visual receptors decreases with increased distance from the proposed infrastructure. Therefore, in order to refine the visual exposure of the facility on surrounding areas/receptors, the principle of reduced impact over distance is applied in order to determine the core area of visual influence for the WEF. Proximity offsets for the proposed development footprint are thus established in order to indicate the scale and viewing distance of the facility and to determine the prominence of the structures in relation to their environment.

These proximity offsets are based on the anticipated visual experience of the observer over varying distances. The distances are adjusted upwards for larger facilities and downwards for smaller facilities (i.e., depending on the size and nature of the proposed infrastructure). This rationale was developed in the absence of any known and/or acceptable standards for South African WEF's. Therefore, for the purpose of this study, proximity offsets have been calculated from the expected boundary of the site, as indicated on Error! Reference source not found. and as follows:

- 0 – 5km. Short distance view where the facility would dominate the frame of vision and constitute a very high visual prominence.
- 5 - 10km. Short to medium distance view where the structures would be easily and comfortably visible and constitute a high to moderate visual prominence.
- 10 - 20km. Medium to long distance view where the facility would become part of the visual environment, but would still be visible and recognisable. This zone constitutes a moderate visual prominence.
- > 20km. Long distance view of the facility where the structures are not expected to be immediately visible and not easily recognisable. This zone constitutes a lower visual prominence for the facility.

The figure below helps to place the above explanations in context, illustrating what scale a turbine structure will be perceived at different viewing distances.

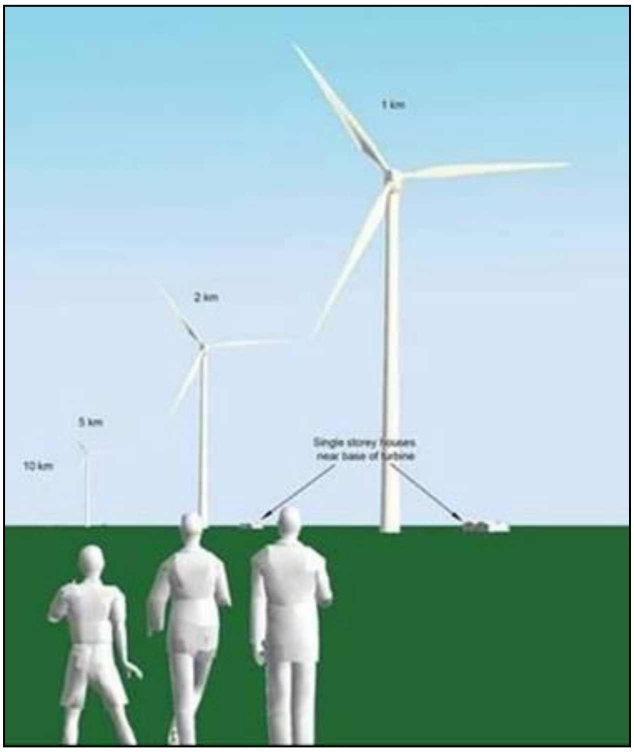
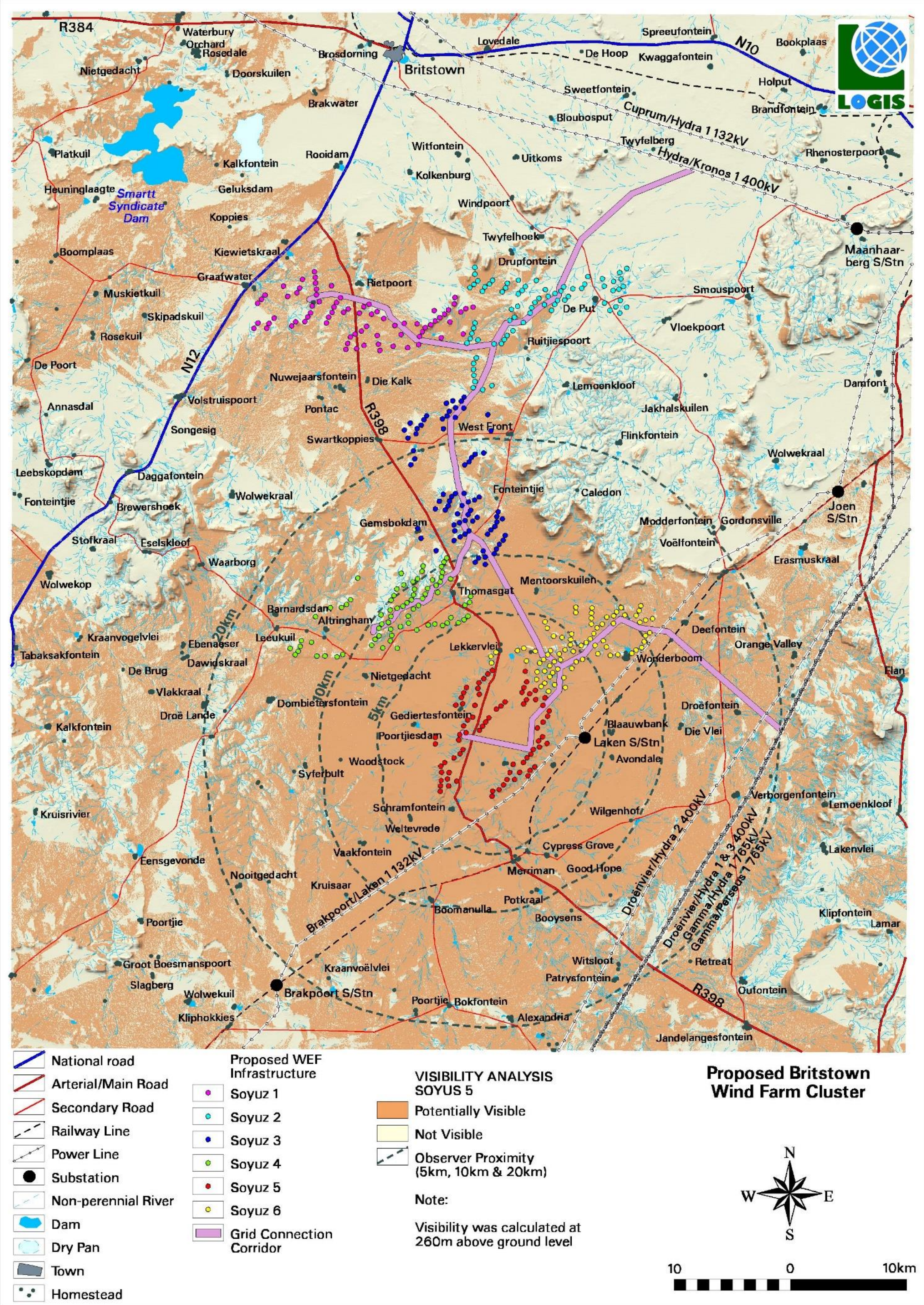


Figure 11: Visual experience of a 100m high wind turbine structure at a distance of 1km, 2km, 5km and 10km

6.2. POTENTIAL VISUAL EXPOSURE

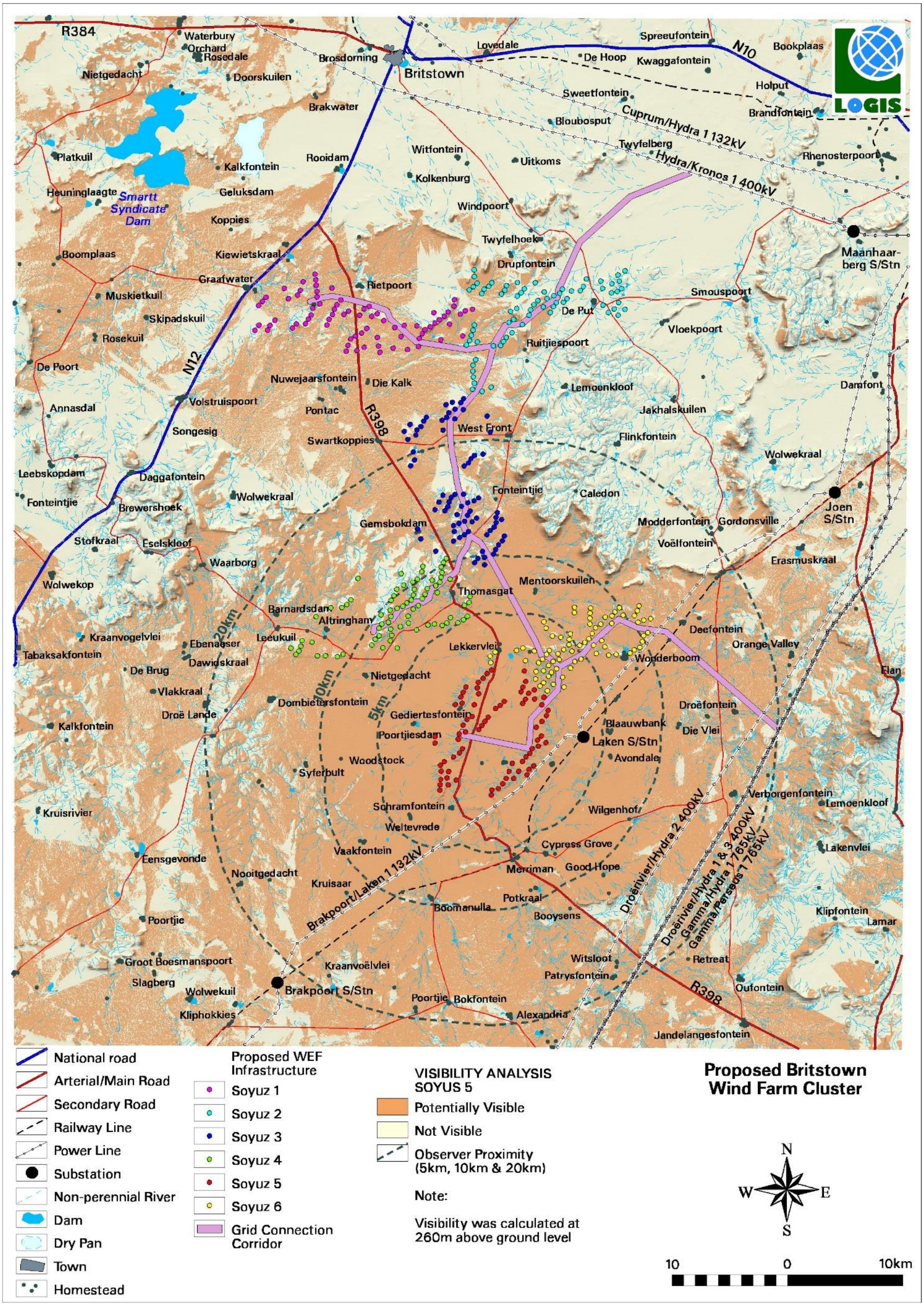
The result of the scoping viewshed analyses for the proposed **Soyuz 5 WEF** is shown on



Map 3 that follows.

The analysis has been undertaken from each proposed turbine position as indicated within the proposed development area of **Soyuz 5 WEF** only in order to determine the general visual exposure (visibility) of the area under investigation. It is expected, from a visual impact perspective, that the wind turbines themselves would constitute the highest potential visual impact of the WEF's, therefore, the viewshed analysis for the facility was undertaken at an offset of maximum 260m above average ground level (i.e., the proposed blade tip height of the turbines).

It must be noted that the viewshed analysis does not include the effect of vegetation cover or existing structures on the exposure of the proposed wind turbines, therefore signifying a worst-case scenario.



Map 3 indicates areas from which the proposed Soyuz 5 WEF could potentially be visible, as well as, proximity offsets (5km, 10km and 20km) from the proposed development area. Typically, structures of this height (i.e., 260m) may be visible from up to 20km away. In this respect, the anticipated Zone of Visual Influence for this facility as calculated from the development footprint (i.e., determined from the edge of the proposed development areas) has been indicated at 20km. The extent of visual exposure within this zone is expected to be very high.

The following is an overview of the findings of the viewshed of the **Soyuz 5 WEF** only, based on the layout illustrated on the Map provided:

- The proposed facility will have a large core area of potential visual exposure on the project site itself, and within a 5km radius thereof. There are no screened areas within this zone.

  Potential sensitive visual receptors within this visually exposed zone include observers travelling along the R398 various secondary roads and farm roads, as well as, users of the railway line. Additionally, residents of the following homestead / farmsteads are likely to be affected:
  - Lekkervlei
  - Gediertesfontein
  - Poortjiesdam
  - Schramfontein
  - Weltevrede

- Potential visual exposure remains high in the medium distance (i.e. between 5 and 10km), with visually screened areas predominantly associated with the lower river valleys associated with the hills to the north of the site.

  Sensitive visual receptors comprise users of the main road R398, various secondary roads in the area, the railway line, as well as, residents of Merriman and various homesteads. Residents of the following homestead / farmsteads and settlements are likely to be affected:
  - Residents on the outskirts of the town of Merriman
  - Potkraal
  - Cypress Grove
  - Wilgehof
  - Avondale
  - Blaauwbank
  - Wonderboom
  - Mentoorskuilen
  - Thomasgat
  - Nietgedacht
  - Woodstock
  - Vaakfontein
  - Boomanulla

- In the longer distance (i.e. between 10 and 20km offset), the extent of potential visual exposure is significantly reduced, especially in the north eastern portion of the study area beyond the escarpment of the Kombuisfontein Mountains. Scattered visually screened areas associated with lower river valleys lie in the north west, west and south east. Visually exposed areas tend to be concentrated on areas of higher elevation located in the south, east and western portions of the study area.

  Sensitive visual receptors include users of stretches of the R398 in the north and potentially in the south east, as well as, various secondary roads located to the north west, south, south east and east of the site. In addition, users of the railway line, as well as, residents of farm and homesteads, particularly within the southern portion of the study area, may be visually exposed. Residents of the following homestead / farmsteads and settlements are likely to be affected:
  - Booysens
  - Witsloot
  - Patrysfontein
  - Good Hope
  - Verborgenfontein
  - Die Vlei
  - Droëfontein
  - Deefontein

- Fonteintjie
- Gemsbokdam
- Barnardsdam
- Altringham
- Leeukuil
- Dombietersfontein
- Syferbult
- Nooitgedacht
- Kruisaar
- Kraanvoëlvlei
- Poortjie
- Bokfontein
- Alexandria

- Beyond the 20km offset from the proposed site, potential sensitive visual receptors are not likely to be visually exposed to the proposed facility, despite lying within the viewshed.

In general, despite the scattered and lower population density of the study area, the proposed **Soyuz 5 WEF** may constitute a high visual prominence, potentially resulting in a high to very high visual impact.

However, it must be noted that some of the sensitive visual receptors of farm and homesteads listed above who could be affected visually by the proposed **Soyuz 5 WEF** are in fact located on properties involved in either this or the overall proposed **Britstown Wind Farm Cluster** development. It is therefore assumed that these sensitive receptors are in fact aware of and to a certain extent accepting of the visual intrusion associated with WEF's in general as a result of their involvement.

7. SHADOW FLICKER ASSESSMENT

Shadow flicker is an effect which is caused when the shadow of an object repeatedly passes or pulsates over the same point in the landscape. Shadow flicker can be caused by the wind turbines when the sun passes behind the hub or rotor blades of a wind turbine and casts a shadow that continually passes over the same point as the rotor blades of the wind turbine rotate. Shadow flicker only occurs when the sky is clear, and when the turbine rotor blades are between the sun and the receptor.

De Gryse in Scenic Landscape Architecture (2006) notes that "*shadow flickering associated with the rotation of the rotor blades has the potential to alter the viewed landscape, and to detract from the experience of people …*". Therefore, the effect of shadow flicker is likely to be experienced by people situated directly within the shadow cast by the rotor blades of the wind turbine. As such, shadow flicker is expected to have an impact on people residing in homesteads located within close proximity of a wind turbine and at a specific orientation, particularly in areas where there is little screening present.

Since this proposed WEF is located in the Southern Hemisphere it can be expected that shadow flicker will be experienced by sensitive receptors who are predominately located on the southern half of the potential flicker zones, namely to the west, south west, south, south east and east following the traction of the sun from east to west. It is also expected that the shadow flicker zone of influence will be its greatest early in the mornings and later afternoons when the sun is at its lowest casting a longer shadow.

Shadow flicker may also be experienced by, and impact on, motorists if a wind turbine is located in close proximity to an existing road. It is however expected that the shadow flicker experienced by motorist traveling along roads will be fleeting and not constitute a shadow flicker visual impact of concern.

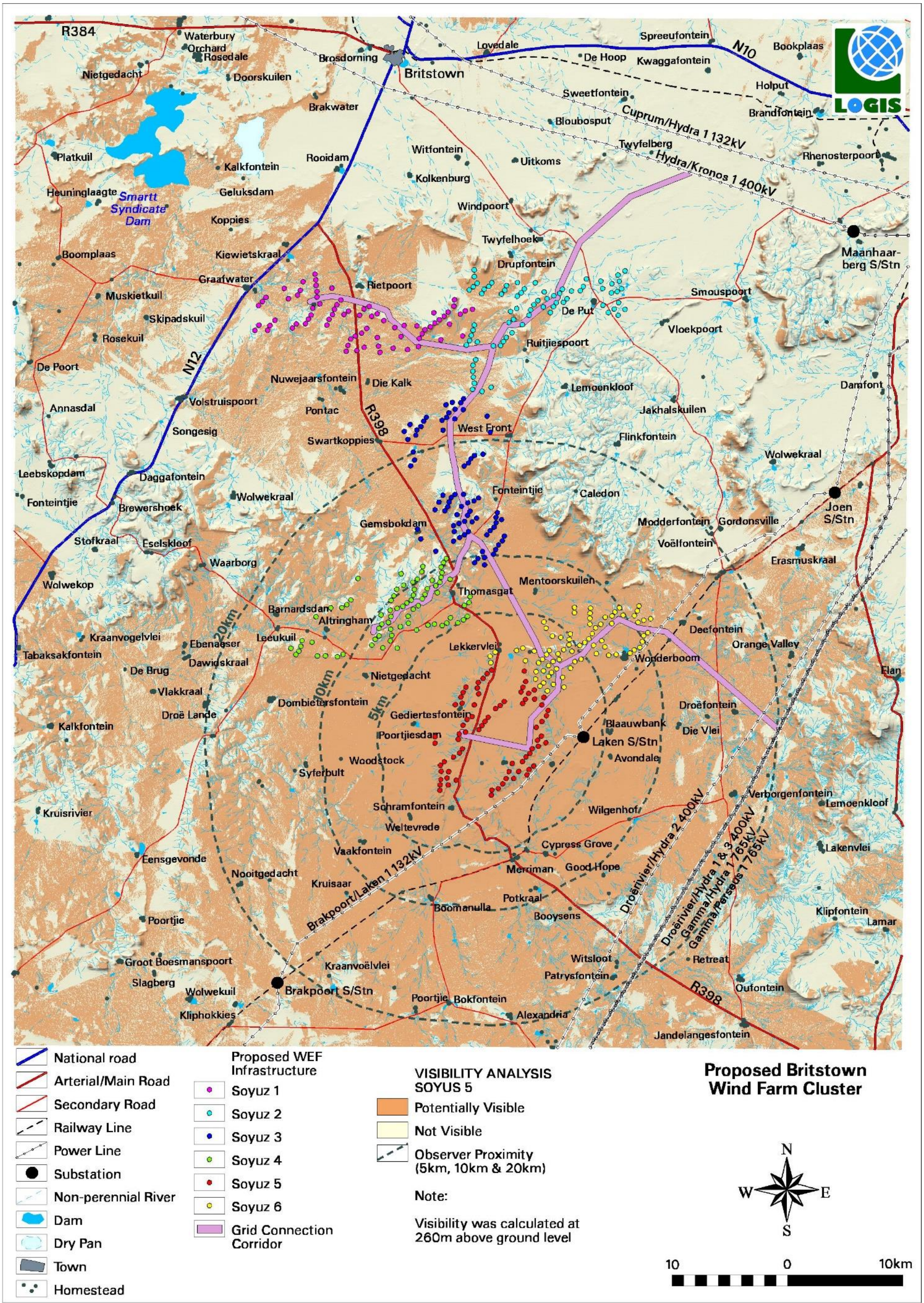
The impact of shadow flicker can be effectively mitigated by choosing the correct site and layout for the wind turbines, taking the orientation of the turbines relative to the nearby homesteads / roads and the latitude of the site into consideration. Tall structures and trees will also obstruct shadows and prevent the effect of shadow flicker from impacting on surrounding sensitive receptors, however, since this is not a consistent factor or given to occur around any of the structures within the study area it will not be considered in this assessment.

De Gryse found that "*most shadow impact is associated with 3-4 times the height of the object While shadows may extend further than this, they become insignificant in their visual intrusion because of the reduced intensity of the shadow at such distances*". Based on this research, the shadow flicker assessment for the proposed **Soyuz 5 WEF** was undertaken on a likely 75 turbine layout using a 260m blade tip height (hub height of 160m and rotor diamter of 200m). As such, sensitive receptors are consideres to be affected where shadows are predicted to occur within 1km of a turbine. Therefore, a 1km zone around each turbine has been identified as the zone within which there is a risk of shadow flicker occurring. These zones and turbines loacted near sensitive receptors have been labelled on **Map 4.**

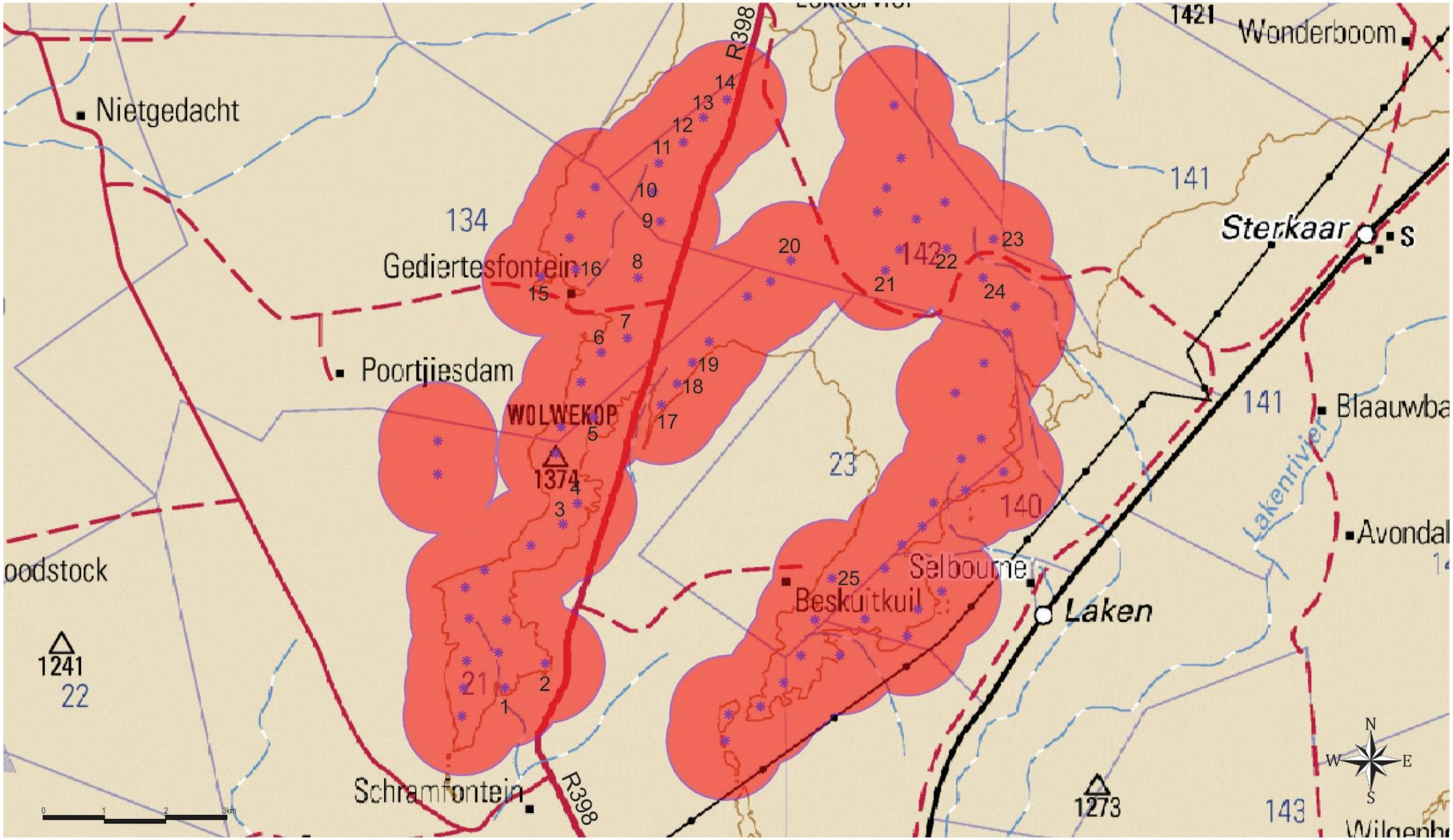
This study found that seventeen (17) turbines 1-14 and 17-19, located on the western portion of the **Soyuz 5 WEF** adjacent to the R398 are likely to have a shadow flicker impact on motorists using this portion of the R398. This will especially be the case early in the morning or towards the late afternoon, depeding on the specific location of the turbine, when the sun is at its lowest casting a longer shadow towards the road. Other areas of potential shadow flicker impact are loacted along the internal farm roads loacted within the designated development. These roads are likely to be affected by turbines 8, 15, 16, 20 – 24 It is, however, expected that the number of motorists travelling on these roads will be very limited and the level of exposure will be brief, thereby, not constituting a shadow flicker visual impact of concern for these receptors.

Additionally, the residents of the homesteads Gediertesfontein and Beskuitkuil are also likely to experience shadow flicker from various turbines. Gediertesfontein from two turbines labelled 15 and 16 on Map 4, when the sun is north west and north east of the turbines respectively. While Beskuitkuil will be in the shadow flicker zone of turbine 24 early in the mornings when the sun is in the east.

Of note is that these homesteads are located on properties involved in this development. It is assumed that they are in fact aware of and to a certain extent accepting of the shadow flicker associated with these turbines, thereby not constituting a shadow flicker visual impact of concern for these receptors. However, as per the recommendations of the IFC Performance Standards, it is recommended that further consultation is undertaken as part of the EIA consultation process with these specific sensitive receptors of the above identified homesteads, in order to establish their understanding and concerns regarding this possible impact. Should it be found during the consultation process that these specific receptors are concerned with the impact associated with shadow flicker, it is then recommended that the positioning of these specific turbines be revised or removed.



Map 3: Potential visual exposure (viewshed analysis) of the proposed Soyuz 5 WEF



Map 4: Potential sensitive receptors exposed to shadow flicker from the proposed Soyuz 5 WEF turbines

8. ANTICIAPATED ISSUES RELATED TO VISUAL IMPACT

Anticipated issues related to the potential visual impact of the proposed **Soyuz 5 WEF** include the following:

- The potential visual impact of the construction of the facility and ancillary infrastructure on sensitive visual receptors in close proximity.
- The visibility of the operational facility and ancillary infrastructure to, and potential visual impact on observers (homesteads and farmsteads) in close proximity.
- The visibility of the operational facility and ancillary infrastructure to, and potential visual impact on observers within the region.
- The visibility of the facility and ancillary infrastructure to, and potential visual impact on observers travelling along the national, main roads (i.e., the N12 and R398), as well as, secondary roads within the study area.
- The potential visual impact of operational, safety and security lighting of the facility and ancillary infrastructure at night on sensitive visual receptors residing in the region.
- The potential visual impacts of shadow flicker on sensitive and potentially sensitive visual receptors in close proximity.
- The potential visual impact of the facility and ancillary infrastructure on the visual character of the landscape and sense of place of the region.
- The potential cumulative visual impacts of the facility and ancillary infrastructure within the study area.
- The potential to mitigate visual impacts and inform the design phase.

It is envisaged that the issues listed above may constitute a visual impact at a local and/or regional scale.

9. PROPOSED IMPACT ASSESSMENT METHODOLOGY

The above potential impacts will be assessed using the below methodology. The methodology will attempt to quantify these potential visual impacts in their respective geographical locations and in terms of the identified issues related to the visual impact.

The methodology for the assessment of potential visual impacts will state the nature of the potential visual impact (e.g., the visual impact on users of major roads in the vicinity of the proposed infrastructure) and will include a table quantifying the potential visual impact according to the following criteria:

Extent - How far the visual impact is going to extend and to what extent it will have the highest impact. In the case of this type of development the extent of the visual impact is most likely to have a higher impact on receptors closer to the development and decrease as the distance increases [3].

- (1) Very low: Long distance
- (2) Low: Medium to longer distance
- (3) Medium: Short distance
- (4) High: Very short distance

Duration - The timeframe over which the effects of the impact will be felt.

- (1) Very short: 0-1 years
- (2) Short: 2-5 years
- (3) Medium: 5-15 years
- (4) Long: >15 years
- (5) Permanent

Magnitude - The severity or size of the impact. This value is read off the Visual Impact Index maps [4].

- (0) None
- (2) Minor
- (4) Low
- (6) Moderate

[3] The extent is based on the proximity radius as read on the map: Long distance = > 20km. Medium to longer distance = 10 – 20km. Short distance = 5 – 10km. Very short distance = < 5km

[4] This value is read from the visual impact index. Where more than one value is applicable, the higher of these will be used as a worst-case scenario.

- (8) High
- (10) Very High

Probability - The likelihood of the impact actually occurring.
- (1) Very improbable: Less than 20% sure of the likelihood of an impact occurring
- (2) Improbable: 20-40% sure of the likelihood of an impact occurring
- (3) Probable: 40-60% sure of the likelihood of an impact occurring
- (4) Highly probable: 60-80% sure of the likelihood of that impact occurring
- (5) Definite: More than 80% sure of the likelihood of that impact occurring

Significance - The significance weighting for each potential visual impact (as calculated above) is as follows:
- (0-12) Negligible:
  Where the impact would have no direct influence on the decision to develop in the area. The impact would be of a very low order. In the case of negative impacts, almost no mitigation and or remedial activity would be needed, and any minor steps, which might be needed, would be easy, cheap, and simple.
- (13-30) Low:
  Where the impact would have a very limited direct influence on the decision to develop in the area. The impact would be of a low order and with little real effect. In the case of negative impacts, mitigation and / or remedial activity would be either easily achieved or little would be required, or both.
- (31-60) Moderate:
  Where the impact could influence the decision to develop in the area. The impact would be real but not substantial. In the case of negative impacts, mitigation and / or remedial activity would be both feasible and fairly easily possible.
- (61-80) High:
  Where the impact must have an influence on the decision to develop in the area. The impacts are of a substantial order. In the case of negative impacts, mitigation and / or remedial activity would be feasible but difficult, expensive, time-consuming or some combination of these.
- (81-100) Very High:
  Where the impact will definitely have an influence on the decision to develop in the area. The impacts are of the highest order possible. In the case of negative impacts, there would be no possible mitigation and / or remedial activity possible.

The **significance** of the potential visual impact is equal to the **consequence** multiplied by the **probability** of the impact occurring, where the consequence is determined by the sum of the individual scores for magnitude, duration and extent (i.e., **significance = consequence (magnitude + duration + extent) x probability**).

Status – The perception of Interested and Affected Parties towards the proposed development.
- Positive
- Negative
- Neutral

Reversibility – The possibility of visual recovery of the impact following the decommissioning of the proposed development
- (1) Reversible
- (3) Recoverable
- (5) Irreversible

This methodology complies to the International Finance Corporation (IFC) Performance Standards on Environmental and Social Sustainability, 2012 and Environmental, Health, and Safety Guidelines for Wind Energy, 2015.

10. TERMS OF REFERENCE FOR THE ENVIRONMENTAL IMPACT ASSESSMENT PHASE

Following the establishment of the baseline information pertinent to the development in the Scoping Phase VIA (as undertaken in this report), the primary goal of the Environmental Impact Assessment (EIA) Phase VIA report will be to ensure that visual impacts are adequately assessed and considered, so that the relevant authorities can decide if the proposed WEF has unreasonable or undue visual impacts. The secondary aim is to identify effective and practical mitigation measures, if possible.

Since the purpose of a VIA is not to predict whether specific individuals or entities will find this type of development (renewable wind energy facility) pleasing or not, but instead to identify the important visual features of the surrounding landscape, especially the features and characteristics that contribute to scenic quality, as the basis for determining how and to what degree a particular project will impact on those scenic values. The study will include the following:

1. Refinement of the baseline study, description of the visual character of the sites and zone of visual influence, if required.
2. Adjust the list of identified visual impacts resulting from the proposed development (with consideration of any public and/or relevant authorities' comments), if required.
3. Assessment of visual impacts based on the following VIA rating criteria, namely:
    a. Quality of the affected environment (landscape) – the aesthetic excellence and significance of the visual resources and scenery;
    b. Viewer incidence, perception and sensitivity – the level of acceptable visual impact is influenced by the type of visual receptors.
    c. Determine the Visual Absorption Capacity (VAC) – the capacity of the receiving environment to absorb the potential visual impact of the proposed development;
    d. Refine the potential visual exposure (visibility) - the geographic area from which the project may be visible based on any layout changes undertaken between the Scoping and EIA Phase;
    e. Refine the Shadow Flicker Assessment – based on any layout changes undertaken between the Scoping and EIA Phase, determine the affected zone caused when the shadow of an object repeatedly passes or pulsates over the same point in the landscape;
    f. Determine the cumulative visual exposure - the combined or incremental effects resulting from changes caused by a proposed development in conjunction with other existing or proposed activities;
    g. Visual Impact Index - the combined results of visual exposure, viewer incidence / perception and visual distance of the proposed facility. Values are assigned for each potential visual impact per data category and merged in order to calculate the visual impact index;
4. Assessment of the significance of the visual impacts, rated according to methodology outlined in Section 9 above, which includes:
    a. Extent, duration, magnitude and probability to determine significance; and
    b. Significance considered with status (positive, negative or neutral) and reversibility (reversible, recoverable or irreversible) following decommissioning of the proposed facility.
5. Impacts will be rated before mitigation and after, assuming mitigation is possible.
6. Development of mitigation measures to reduce visual impacts and enhance any positive visual benefits, where possible.
7. Undertaking of photo simulations (in addition to the spatial analyses) in order to illustrate the potential visual impact of the proposed facility within the receiving environment.

11. CONCLUSION AND RECOMMENDATIONS

The construction and operation of the proposed **Soyuz 5 WEF** will have a visual impact on potentially sensitive visual receptors especially within (but not restricted to) a 20km radius of the proposed project development sites.

Such visual receptors include people travelling along national, main, secondary and internal farm roads, as well as, those residing within the farming homesteads in the study area.

The following findings are pertinent and applicable to the proposed **Soyuz 5 WEF**:

- The greater environment with its wide open, undeveloped landscapes is considered to have a high visual quality
- There are few visual intrusions in the natural landscape, but it is visually compromised in sections by existing transmission lines, railway lines, farm houses, planted trees and windmills.
- The natural vegetation occurring provides little to no visual cover for any built structures but the clusters or rows of trees (usually close to farm houses, roads or windmills) may provide height and effective visual screening for sensitive receptors at these sites.
- There are no formally protected or conservation areas present within the study area, but the greater environment has a vast, undeveloped and rugged character.

- The area is not densely populated and as a result of the low carrying capacity of the land the farms in the area are large and there are generally vast distances between homesteads / farmsteads (some of which may potentially uninhabited).
- Settlements, where these occur, are mostly located beyond the visibility extent of the proposed **Soyuz 5 WEF** and are limited in extent and domestic in scale. The highest concentration of people in the study area are residents of the towns of Britstown, De Aar, Richmond and to a lesser extent Merriman.
- It is uncertain whether all of the potentially affected homesteads / farmsteads are inhabited or not. It stands to reason that the farmsteads that are not currently inhabited will not be visually impacted upon at present. These farmsteads do, however retain the potential to be affected visually should they ever become inhabited again in the future. For this reason, the author of this document operates under the assumption that they are all inhabited.
- This area itself is not known as a tourist destination, but the various connectors (i.e., N12 and N10) do give access to the area between Johannesburg, Bloemfontein, Kimberly, Cape Town and Gqeberha (formally known as Port Elizabeth), which are known as popular tourist destinations.
- The R398 and R388 are local connectors between Britstown, De Aar and Richmond. A number of secondary and internal farm roads also cross the study area. It must be noted that the R398, R388, all secondary roads and internal farm roads are gravel roads unlikely to carry much traffic.
- The Zone of Visual Influence for wind turbines was defined as a 0 - 20km radius, with 20km being the outer limit of analysis.
- Identified sensitive visual receptors include people travelling along the various main, secondary and internal farm roads (i.e., R398) as well as, those residing within the farming homesteads in the study area.
- It was noted that some of the sensitive visual receptors of farm and homesteads identified who could be affected visually by the proposed **Soyuz 5 WEF** are in fact located on properties involved in either this or the overall proposed **Britstown Wind Farm Cluster** development. It is therefore assumed that these sensitive receptors are in fact aware of and to a certain extent accepting of the visual intrusion associated with WEF's in general as a result of their involvement.
- Only a preliminary 'screening' assessment has been made of the proposed **Soyuz 5 WEF** in this report. A more detailed visual assessment of the wind turbines and related infrastructure will be made in the EIA Phase of the project.
- Turbines, as indicated on **Map 4,** likely to result in a potential shadow flicker impact on sensitive receptors within their shadow flicker zone are as follows:
    - Seventeen (17) turbines **1-14** and **17-19**, located on the western portion of the **Soyuz 5 WEF** adjacent to the R398 are likely to have a shadow flicker impact on motorists using this portion of the R398. This will especially be the case early in the morning or towards the late afternoon, depeding on the specific location of the turbine, when the sun is at its lowest casting a longer shadow towards the road. Other areas of potential shadow flicker impact are loacted along the internal farm roads loacted within the designated development. These roads are likely to be affected by turbines **8, 15, 16, 20 – 24**. It is, however, expected that the number of motorists travelling on these roads will be very limited and the level of exposure will be brief, thereby, not constituting a shadow flicker visual impact of concern for these receptors.
    - The residents of the homesteads Gediertesfontein and Beskuitkuil are also likely to experience shadow flicker from various turbines. Gediertesfontein from two turbines **15** and **16**, when the sun is north west and north east of the turbines respectively. While Beskuitkuil will be in the shadow flicker zone of turbine **25** early in the mornings when the sun is in the east.

Considering the above conclusions, the following recommendations are relevant to the proposed **Soyuz 5 WEF**:

- Detailed viewsheds and analysis of visual impacts is required in the EIA Phase of the project.
- Given their height, effective mitigation measures for the visual impact of the proposed wind turbines is not possible. However, impacts can be minimised to some extent in terms of where the turbines are positioned.
- With regards to the shadow flicker likely to be experienced by homesteads that are located on properties involved in this development, it is assumed that they are in fact aware of and to a certain extent accepting of the shadow flicker associated with these turbines, thereby not constituting a shadow flicker visual impact of concern for these receptors. However, as per the recommendations of the IFC Performance Standards, it is recommended that further consultation is undertaken as part of the EIA consultation process with these specific sensitive receptors of the identified homesteads, in order to establish their understanding and concerns regarding this possible impact. Should it be found during the consultation process that these specific receptors are concerned with the impact

associated with shadow flicker, it is then recommended that the positioning of these specific turbines be revised or removed.

- Detailed mitigation measures for visual impacts as a result of associated infrastructure must be developed in the next phase of the EIA process.

12. REFERENCES

Council for Scientific and Industrial Research (CSIR), 2015. *The Strategic Environmental Assessment for wind and solar photovoltaic energy in South Africa.*

DEADP, Provincial Government of the Western Cape, 2011. Guideline on Generic Terms of Reference for EAPS and Project Schedules.

Oberholzer, B. (2005). Guideline for involving visual and aesthetic specialists in EIA processes: Edition 1.

DEA, 2021. *South African Renewable Energy EIA Application (REEA) Database.*

Charlier, R & Thys, A. 2016. *Wind Power—Aeole Turns Marine. 10.1002/9781119066354.ch7.*

International Finance Corporation (IFC) World Bank Group, 2012. *IFC Performance Standards on Environmental and Social Sustainability.*

International Finance Corporation (IFC) World Bank Group, 2015. *IFC Environmental, Health, and Safety Guidelines for Wind Energy.*