VISUAL IMPACT ASSESSMENT FOR THE SOYUZ 3 WIND ENERGY FACILITY IN THE NORTHERN CAPE, SOUTH AFRICA

IMPACT ASSESSMENT PHASE

PREPARED BY:

Nuleaf Planning and Environmental (Pty) Ltd

PREPARED FOR:

Soyuz 3 (Pty) Ltd

DATE:

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Report number:	02

DECLARATION

I, **Tosca de Villiers**, as an independent consultant compiled this 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 de Villiers
Landscape Architect & Environmental Assessment Practitioner
SACLAP Reg nr: 20421
EAPASA Reg nr: 2019/1582

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1. INTRODUCTION

This visual impact assessment (VIA) report forms part of the scoping and environmental impact assessment for the Proposed **Soyuz 3 Wind Energy Facility** in the Northern Cape Province.

This VIA has been compiled for inclusion in the environmental impact report (EIR) following the approval of the Scoping report.

1.1. QUALIFICATION AND EXPERIENCE OF THE PROFESSIONAL TEAM

Nuleaf Planning and Environmental (Pty) Ltd, specialising in Visual Impact Assessments, undertook the visual assessment 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;
- Chief Directorate National (CDN) Geo-Spatial Information, varying dates. *1:50 000 Topographical Maps and Data.*
- DFFE, 2018/2020. *National Land-cover Database 2018/2020 (NLC2018/2020).*
- DFFE, 2022. *South African Protected Areas Database (SAPAD_OR_2022_Q2).*
- JAXA, 2021. Earth Observation Research Centre. *ALOS Global Digital Surface Model (AW3D30).*
- Google Earth Pro. *Up to date and recent satellite images.*
- Professional judgement based on experience gained from similar projects;
- Literature research on similar projects;
- Observations made and photographs taken during site visits;
- Procedures for the Assessment and Minimum Criteria for Reporting on identified Environmental Themes in terms of Sections 24(5)(a) and (h) and 44 of NEMA

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 and review. 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 and the Applicant is correct and relevant to the proposed project. This Visual Impact Assessment and all associated mapping has been undertaken according to the worst-case scenario.

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:

	Information on the project & experience of the practitioner			
		3	**2**	**1**

[1] Adapted from Oberholzer (2005).

Information on the study area	**3**	9	6	3
	2	6	4	2
	1	3	2	1

Table 1: Level of confidence

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

The study 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 topographical data provided by the Japan Aerospace Exploration Agency (JAXA), Earth Observation Research Centre, in the form of the ALOS Global Digital Surface Model "ALOS World 3D - 30m" (AW3D30) elevation model.

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 identification of sensitive environments upon which the proposed Soyuz 3 Wind Energy Facility (WEF) could have a potential visual impact;
- The creation of viewshed analyses from the proposed amended area in order to determine the visual exposure and the topography's potential to absorb the potential visual impact. The viewshed analyses take into account the dimensions of the proposed structures.
- A cumulative viewshed analysis in order to determine the potential cumulative exposure (visibility) of the proposed Soyuz 3 WEF together with any other WEF's proposed or already constructed in the region.

This report (visual impact assessment) sets out to identify and quantify the possible visual impacts related to the proposed **Soyuz 3 Wind Energy Facility (WEF)**, as well as offer potential mitigation measures, where required. The methodology as described below has been followed for the assessment of visual impact. 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.

UNDERTAKE A SITE VISIT

A site visit was undertaken in order to verify the results of the spatial analyses and to identify any additional site-specific issues that may need to be addressed in the VIA report. The season was not a consideration, nor had any effect on the carrying out of the visual assessment. A photographic survey was made of the site and surrounding potentially affected area from several selected viewpoints. The site visit was undertaken on the 02 April 2022.

DETERMINE THE POTENTIAL VISUAL EXPOSURE

The visibility or visual exposure of any development is the point of departure for the visual impact assessment. It stands to reason that if the proposed development were not visible, no impact would occur.

The viewshed analyses of the proposed facility and the related infrastructure are based on a 30m resolution AW3D30 digital terrain model of the study area.

The first step in determining the visual impact of the proposed facility is to identify the areas from which the structures would be visible. The type of structures, the dimensions, the extent of operations and their support infrastructure are taken into account.

DETERMINE THE VISUAL DISTANCE AND OBSERVER PROXIMITY

In order to refine the visual exposure of the development on surrounding areas/receptors, the principle of reduced impact over distance is applied in order to determine the core area of visual influence.

Proximity radii for the proposed WEF are created in order to indicate the scale and viewing distance of the development and to determine the prominence thereof in relation to their environment.

The visual distance theory and the observer's proximity to the development are closely related, and especially relevant, when considered from areas with a high viewer incidence and a predominantly negative visual perception of the proposed development.

DETERMINE VIEWER INCIDENCE, PERCEPTION AND SENSITIVITY

The number of observers and their perception of a development determine the concept of visual impact. If there are no observers, then there would be no visual impact. If the visual perception of a structure is favourable to all observers, then the visual impact would be positive.

It is therefore necessary to identify areas of high viewer incidence and to classify certain areas according to the observer's visual sensitivity towards the proposed development and its related infrastructure.

It would be impossible not to generalise the viewer incidence and sensitivity to some degree, as there are many variables when trying to determine the perception of the observer; regularity of sighting, cultural background, state of mind, and purpose of sighting which would create a myriad of options.

DETERMINE THE VISUAL ABSORPTION CAPACITY (VAC)

This is the capacity of the receiving environment to absorb the potential visual impact of the proposed development. The digital terrain model utilised in the calculation of the visual exposure of the development does not incorporate the potential visual absorption capacity (VAC) of the natural vegetation of the region. It is therefore necessary to determine the VAC by means of the interpretation of the vegetation cover and other landscape characteristics.

The VAC is primarily a function of the vegetation, and will be high if the vegetation is tall, dense and continuous. Conversely, low growing, sparse and patchy vegetation will have a low VAC.

The VAC would also be high where the environment can readily absorb the structure in terms of texture, colour, form and light / shade characteristics of the structure. On the other hand, the VAC for a structure contrasting markedly with one or more of the characteristics of the environment would be low.

The VAC also generally increases with distance, where discernible detail in visual characteristics of both environment and structure decreases.

DETERMINE THE CUMULATIVE VIEWSHED

A cumulative visual impact can be defined as the combined or incremental effects resulting from changes caused by a proposed development in conjunction with other existing or proposed activities. The visual assessment for this development will include a cumulative viewshed analysis in order to determine the visual exposure (visibility) of all the proposed WEFs making up the Proposed Britstown Wind Farm Cluster.

DETERMINE THE VISUAL IMPACT INDEX OF THE PROPOSED DEVELOPMENT

The results of the above analyses are merged in order to determine where the areas of likely visual impact would occur. These areas are further analysed in terms of the previously mentioned issues (related to the visual impact) and in order to judge the magnitude of each impact.

DETERMINE SHADOW FLICKER EFFECT

Shadow flicker only occurs when the sky is clear, and when the turbine rotor blades are between the sun and the receptor (i.e., when the sun is low). De Gryse in Scenic Landscape Architecture (2006) found that “most shadow impact is associated with 3-4 times the height of the object". Based on this research, a buffer around the turbines is identified as the zone within which there is a risk of shadow flicker occurring.

DETERMINE THE IMPACT SIGNIFICANCE

The potential visual impacts identified and described are quantified in their respective geographical locations in order to determine the significance of the anticipated impact. Significance is determined as a function of extent, duration, magnitude and probability.

GENERATE PHOTO SIMULATIONS

Photographs from strategic viewpoints will be undertaken in order to illustrate the potential realistic post construction views of the WEF within its receiving environment. This aids in visualising the perceived visual impact of the proposed WEFs and placing it in spatial context. The purpose of the photo simulation exercise is to support the findings of the VIA, and is not an exercise to illustrate what the facility will look like from all directions.

FORMULATION OF MITIGATION MEASURES

Recommendation of mitigation measures (if possible) to avoid or minimise potential negative visual impacts of the proposed development, for inclusion in the EMPr and authorisation conditions.

3. PROJECT DESCRIPTION

The Applicant, **Soyuz 3 (Pty) Ltd**, is proposing the development of a commercial Wind Energy Facility (WEF) and associated infrastructure on a site located approximately 35 km South of Britstown within the Emthanjeni 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 4 WEF, Soyuz 5 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 3 WEF** project site covers approximately 23 800 ha and comprises the following farm portions:

- Portion 4 of the Farm No. 143
- Remaining Extent of Portion 1 of the Farm No. 143
- Portion 9 of the Farm Combuisfontein No. 142.
- Portion 8 of the Farm Combuisfontein No. 142
- Portion 4 of the Farm Combuisfontein No. 142
- Portion 3 (a portion of Portion 1) of the Farm Combuisfontein No. 142
- Portion 6 (a portion of Portion 1 – Gemsbokdam) of the Farm Combuisfontein No. 142
- Portion 2 of the Farm Combuisfontein No. 142
- Portion 2 of the Farm No. 2
- Portion 0 of Farm No. 144.
- Portion 1 of the Farm No. 2
- Remaining Extent of the Farm No. 2
- Remaining Extent of Portion 13 of the Farm Welgedagt No. 3

The **Soyuz 3 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 160m and a rotor diameter of up to 200m;
- A transformer at the base of each turbine;
- Concrete turbine foundations of up to 1024m^2 each;

- Permanent Crane hardstand / blade and tower laydown area / crane boom erection area with a combined maximum footprint 5000m^2 at each WTG;
- Temporary concrete batch plants to be located at the construction camp area and the satellite laydown areas;
- Battery Energy Storage System (with a footprint of up to 5 ha);
- Internal up to 132kV overhead lines between substations. A 300m wide corridor (150m on either side of the proposed route) has been considered to allow for any technical and environmental sensitivity constraints identified during micro-siting prior to layout finalisation. Permanent service roads will be required for the construction and maintenance of the overhead lines. In areas where these overhead lines do not follow an existing or proposed road, additional roads of up to 3m in width will be required. Temporary construction areas beneath each overhead line tower position will also be required;
- Medium voltage (33kV) cables/powerlines running from wind turbines to the facility substations. The routing will follow existing/proposed access roads and will be buried where possible. If the use of overhead lines is required, the Avifaunal Specialist will be consulted timeously to ensure that a raptor friendly pole design are used, and that appropriate mitigation is implemented pro-actively.
- Up to six permanent met masts;
- Three substations and operation and maintenance facilities (up to 4 ha each) as well as a laydown area (8 000m^2) at each substation for the electrical contractor. Operation and maintenance facilities include a gate house, security building, control centre, offices, warehouses and workshops.
- Three temporary main construction camp areas (up to 12.25 ha each);
- Twelve temporary satellite laydown areas (5 000m^2 each).
- Access roads to the site and between project components inclusive of stormwater infrastructure. A 200m road corridor is being applied for to allow for slight realignments pending technical and environmental sensitivity constraints identified during micro-siting prior to layout finalisation. The final road will have maximum width of 12m (within the 200m corridor).

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 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 3 WEF as provided by the Applicant

Component	Info
Wind turbine unit size	Unspecified
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

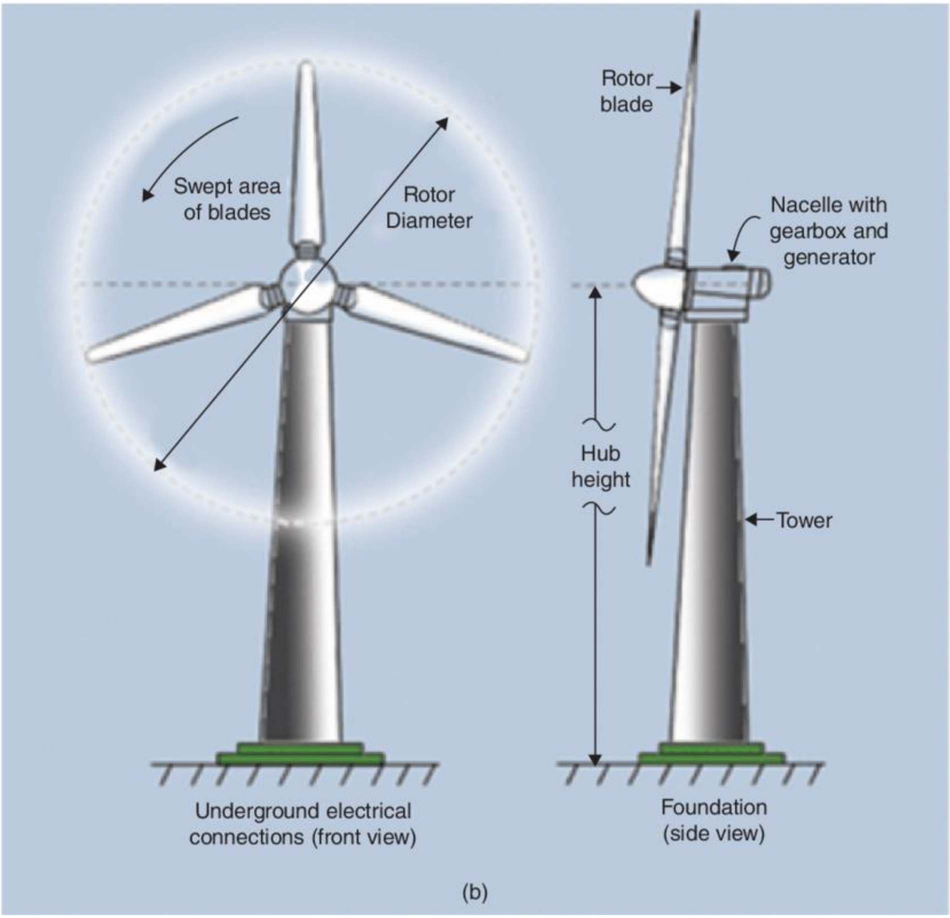


Figure 1: Illustration of the main components of a wind turbine[2]

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

During the Scoping Phase (i.e. first phase of the assessment) the scope of work included:

- Creation a detailed Digital Terrain Model (DTM) for the potentially affected environment. This constituted the study area and area of analysis for the subsequent VIA (this report).
- Sourcing of relevant spatial data. This included cadastral features, land use categories, natural and topographical features, site placement, design, etc.
- Identification of sensitive environments or areas upon which the activities/infrastructure could have a potential visual impact. Critical areas were highlighted during this phase. These would be identified through, mainly (but not restricted to), the inputs from interested and affected parties.
- Undertake viewshed analyses from proposed site placement or alternatives in order to determine the visual exposure. The viewshed analyses will take into account the dimensions of the relevant structures.
- 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.
- Stipulate the potential visual impacts of the project and identify issues related to the visual impact that should be addressed during the visual impact assessment phase.
- Make recommendations to inform the design process or alternative selection.
- Provide a Plan of Study for the VIA to be undertaken during the EIA phase of the project.

During the Impact Assessment Phase (i.e. second phase of the assessment) issues that weren't resolved during scoping phase and that require further investigation are taken forward. The determination of the potential visual impacts is undertaken in terms of nature, extent, duration, magnitude, probability and significance of the construction and operation of the proposed infrastructure.

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

The visual impact will be determined for the highest impact-operating scenario (worst-case scenario) and varying climatic conditions (i.e. different seasons, weather conditions, etc.) will not be considered.

The scope of work for this report includes the determination of the potential visual impacts in terms of nature, extent, duration, magnitude, probability and significance of the construction and operation of the proposed **Soyuz 3 WEF**. Mitigation measures are recommended where appropriate. Anticipated issues related to the potential visual impact of the proposed WEF include the following:

- Potential visual impacts associated with the construction phase on observers in close proximity to the proposed WEF.
- The Potential visual impact on sensitive visual receptors in close proximity to the proposed Soyuz 3 WEF.
- The Potential visual impact on sensitive visual receptors in the region.
- The potential visual impact of operational, safety and security lighting of the facility at night in terms of light glare, light trespass and sky glow.
- The visibility of the proposed Soyuz 3 WEF to, and potential visual impact on users of arterial and secondary roads.
- The potential visual impact of shadow flicker.
- The potential visual impact of the proposed infrastructure on the visual quality of the landscape and sense of place of the region.
- Potential residual visual impacts after the decommissioning of the proposed Soyuz 3 WEF.
- 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 process.

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

5. THE AFFECTED ENVIRONMENT

Regionally, the proposed site for the proposed Soyuz 3 WEF is located approximately 40km south of Britstown, 90km south west of De Aar and some 80km north west of Richmond in the Northern Cape Province.

The study area occurs on land that ranges in elevation from about 1200m above sea level (a.s.l.) to about 1300m a.s.l. The topography consists of flats and gently sloping plains interspersed with hills and rocky outcrops. This site is located below the slopes of the Kombuisfontein Mountains. Refer to **Map 1**.

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 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 with 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 Die Kalk, Swartkoppies, West Front, Fonteintjie, Gemsbokdam, Thomasgat, Mentoorskuilen, Nuwejaarsfontein and Ruitjiespoort farms which all occur within a 5km radius of the proposed Soyuz 3 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.

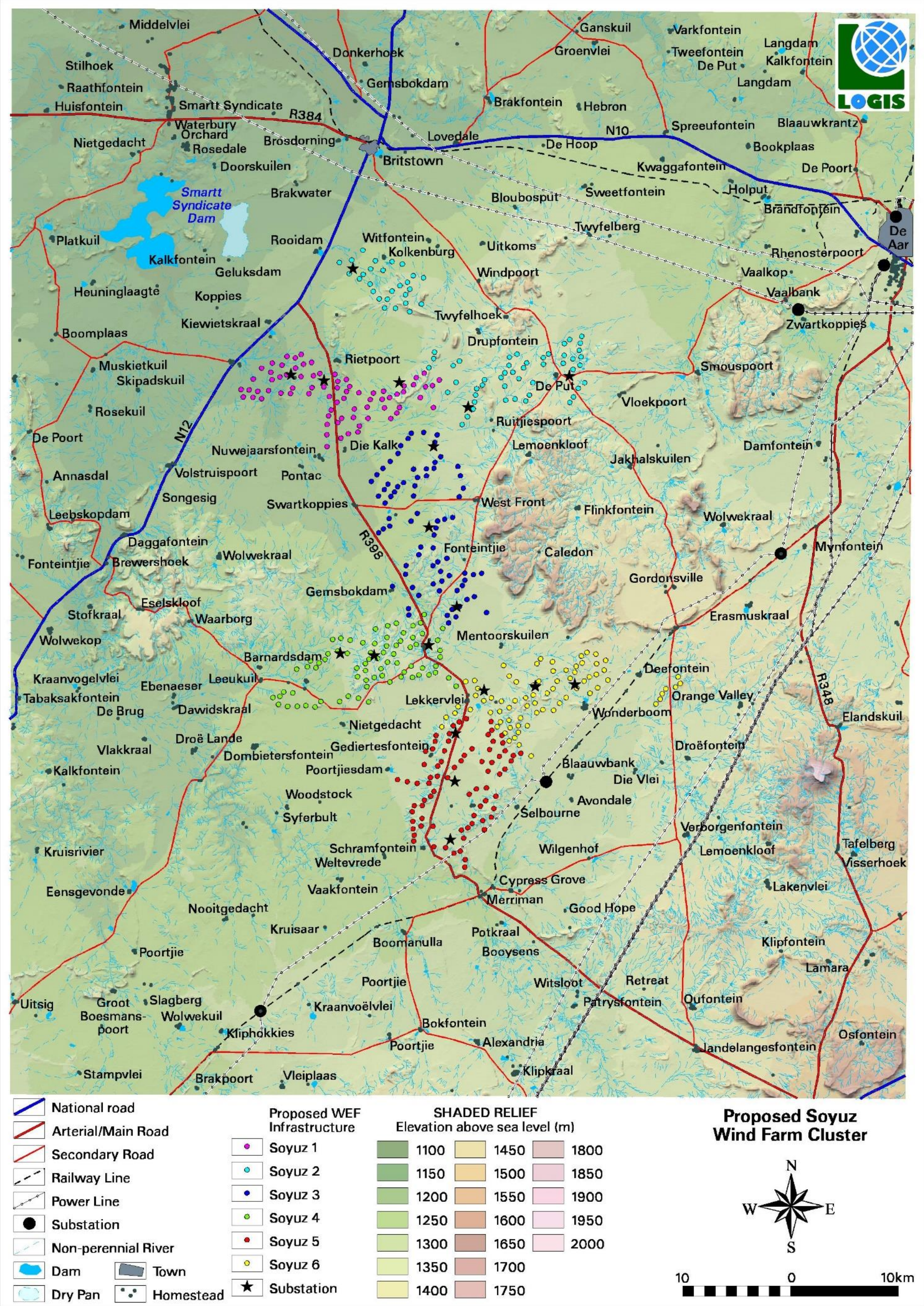
Figure 9: Example of the numerous secondary roads crisscrossing the study area

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.

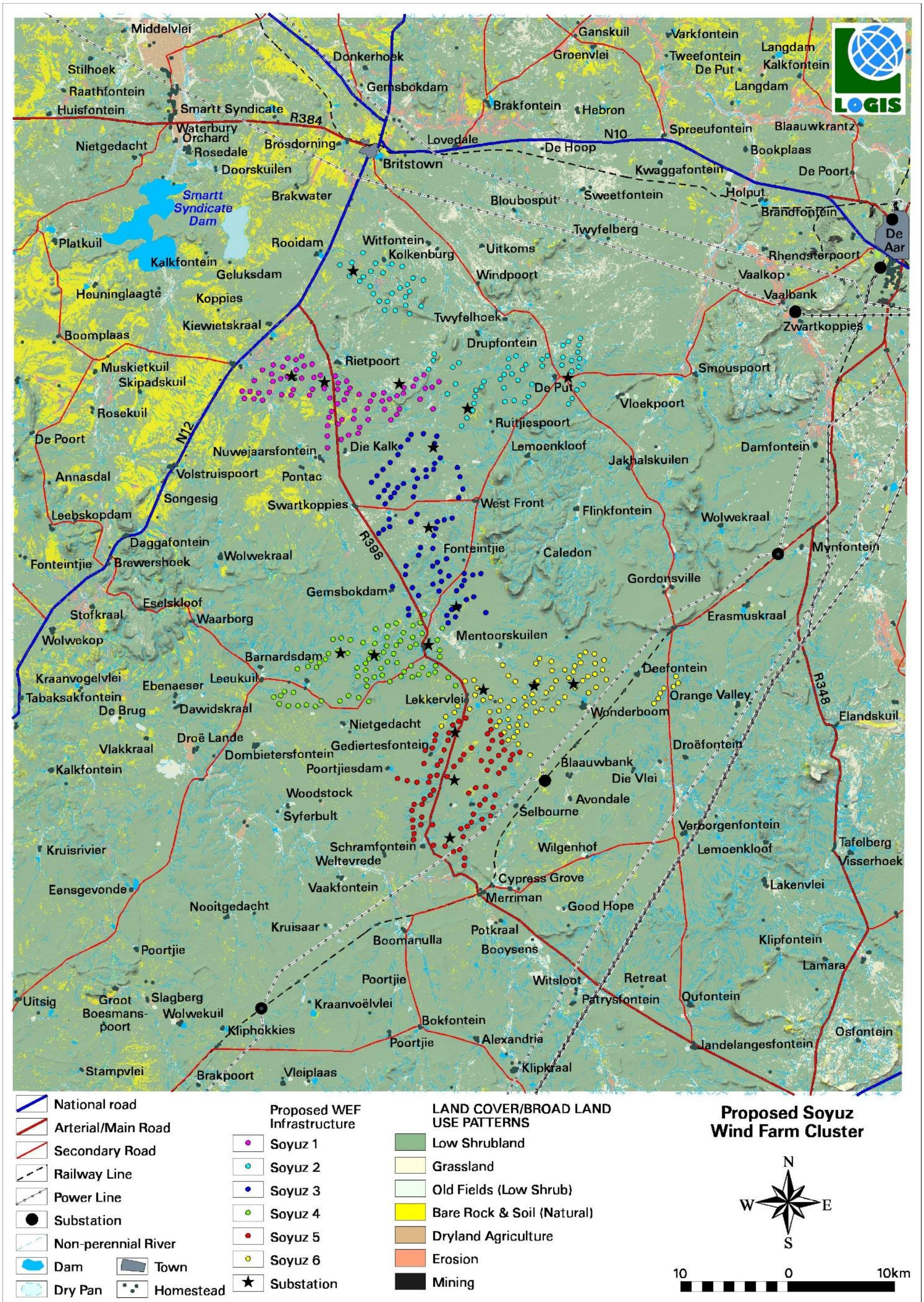
The greater environment with its wide open, undeveloped landscapes is considered to have a high visual quality.

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

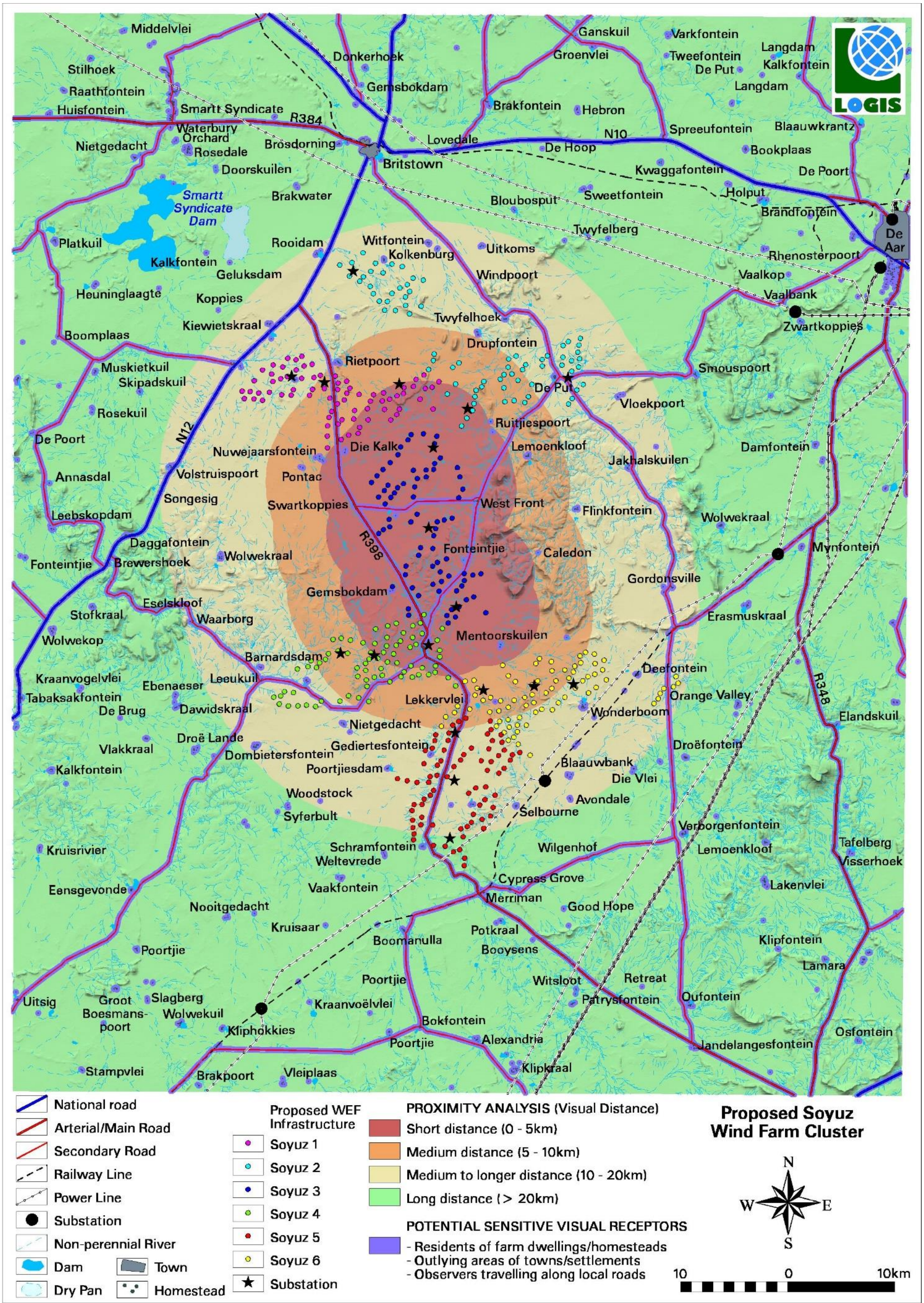
6. VIEWSHED ANALYSIS

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 WEFs. Therefore, for the purpose of this study, proximity offsets have been calculated from the expected boundary of the site, as indicated on

Figure 11: Visual experience of a 100m high wind turbine structure at a distance of 1km, 2km, 5km and 10km (represented from right to left)



Map 3 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.

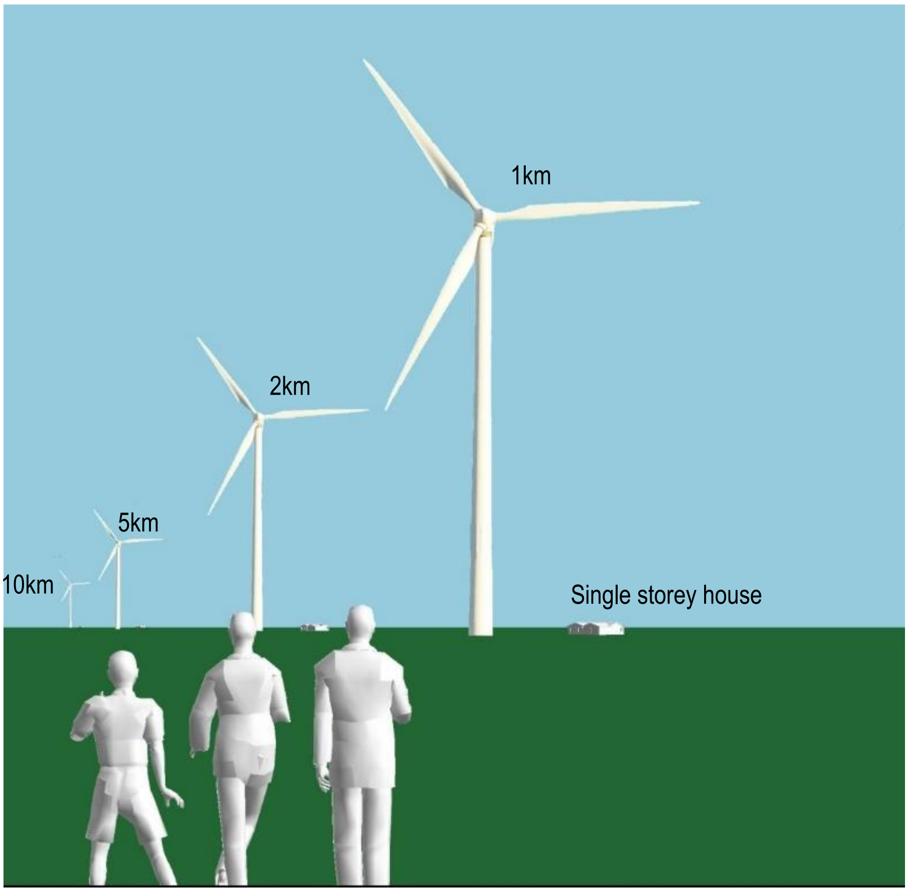
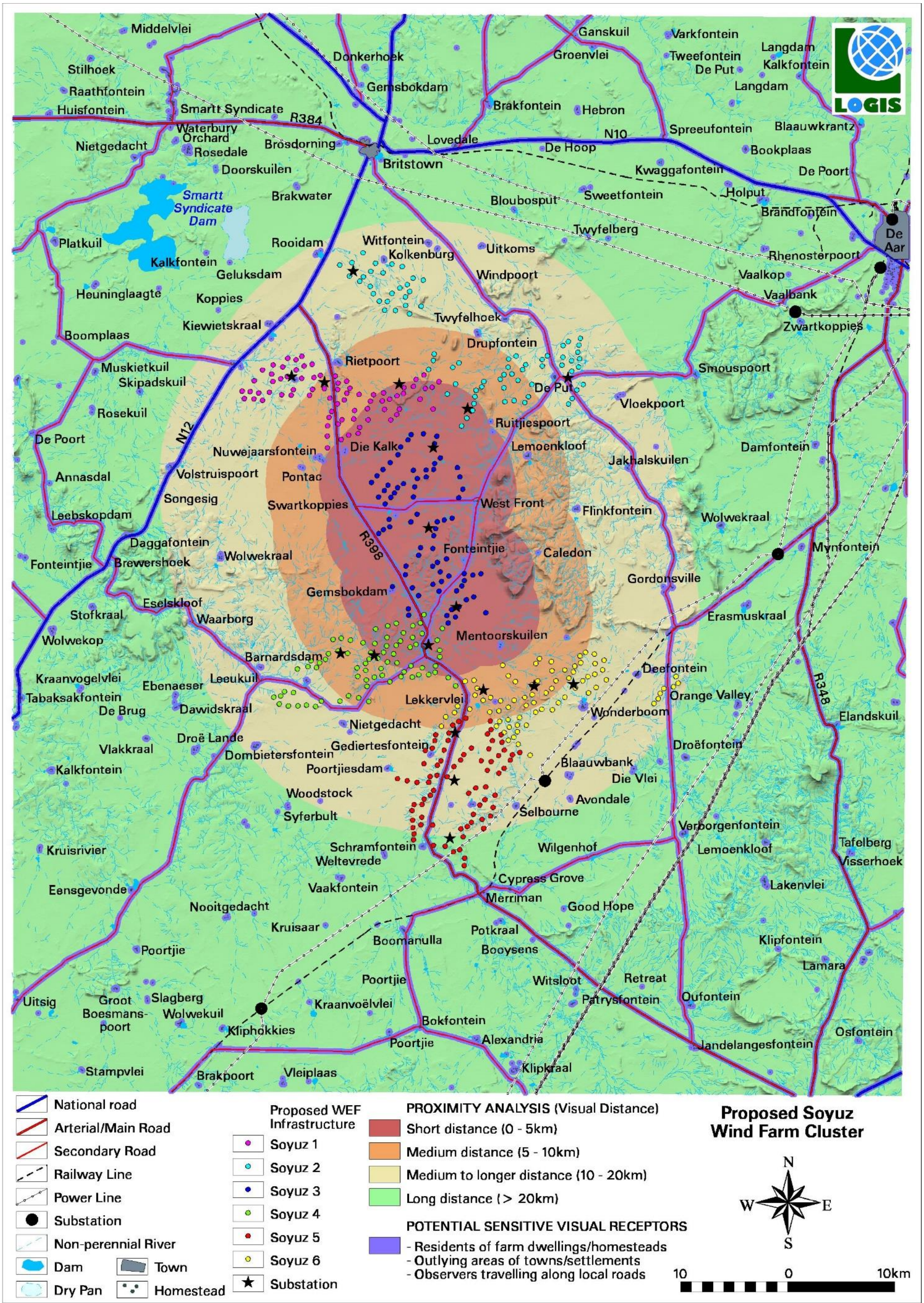


Figure 11: Visual experience of a 100m high wind turbine structure at a distance of 1km, 2km, 5km and 10km (represented from right to left)



Map 3: Visual proximity analysis, observer sensitivity and proximity of the proposed Soyuz 3 WEF

6.2. VIEWER INCIDENCE, PERCEPTION AND SENSITIVITY

Since the number of potential sensitive receptors and their perception of the development in question ultimately determines the concept of a visual impact (i.e. without receptors there would be no impact), the visual distance theory and the receptors' proximity to the development works hand in hand, and is especially relevant, when considered from areas with a high viewer incidence and a potentially negative visual perception of the proposed facility. It is, therefore, necessary to identify areas of high viewer incidence and to classify certain areas according to the observer's visual sensitivity towards the proposed Soyuz 3 WEF.

Homesteads, by virtue of their visually exposed nature, are considered to be sensitive visual receptors. Viewer incidence is calculated to be the highest for homesteads within the areas closest to the facility. Second to these are the users along the provincial and secondary roads within the study area. Commuters and possible tourists using these roads may be negatively impacted upon by visual exposure to the proposed infrastructure should they find themselves in the region.

Residential receptors in natural contexts are more sensitive than those in more built-up contexts, due to the absence of visual clutter in these undeveloped and undisturbed areas. Receptors within built up areas are less sensitive to potential visual impact due to the presence of structures, infrastructure and general visual clutter. Those dwelling on the periphery may be more aware of visual intrusion and may thus be considered somewhat more sensitive.

No specific report can be made on viewer perception regarding the proposed Soyuz 3 WEF, as no stakeholder feedback regarding visual concerns has been received by the EAP during the scoping phase public participation. However, considering the proximity of the proposed facilities to various homesteads and the rural nature of the surrounding area, it is expected that any potential visual impact could be viewed in a negative light. Therefore, overall viewer perception of receptors within the study area will be assumed to be mostly negative.

It must be noted that while some sensitive receptors are identified based on homestead locations it is understood that the residents of these homesteads are not necessarily stationary at these identified points and that often these homesteads are associated with much larger properties or farms. Therefore, where these properties fall within the potential visual exposure it is assumed that the residents of these homesteads and any associated visitors to these homesteads will likely experience a visual impact as a result of the proposed development beyond the bounds of their homesteads. The potential sensitive visual receptors within a 5km, 10km and 20km radius as identified on

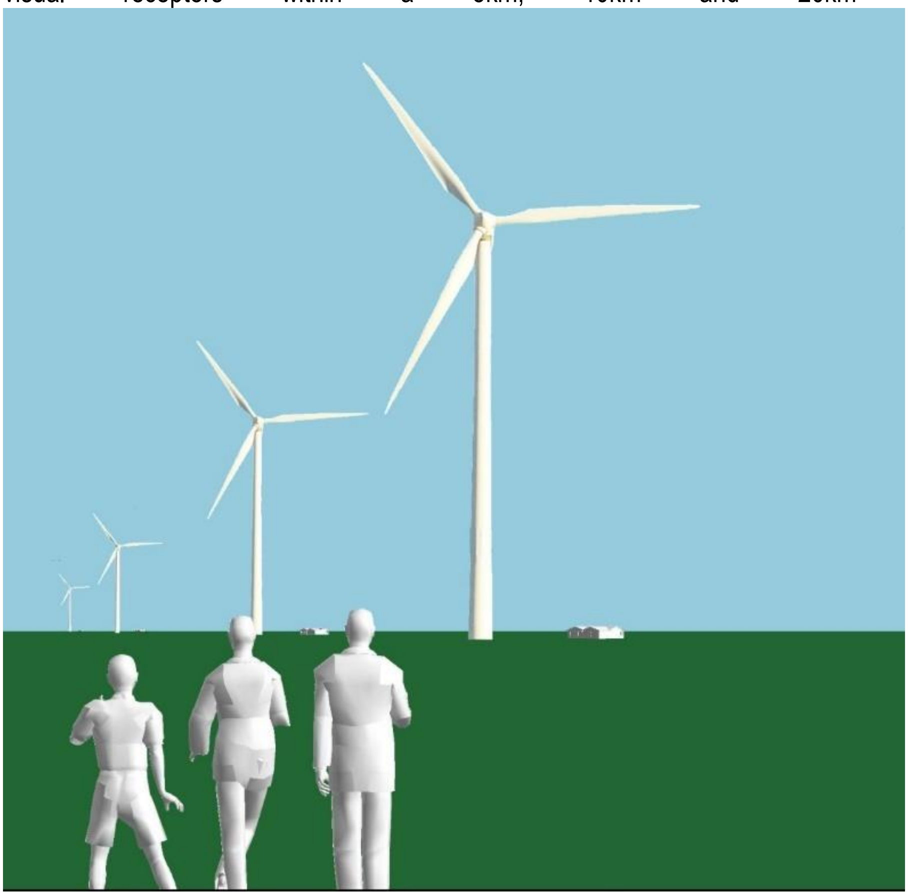
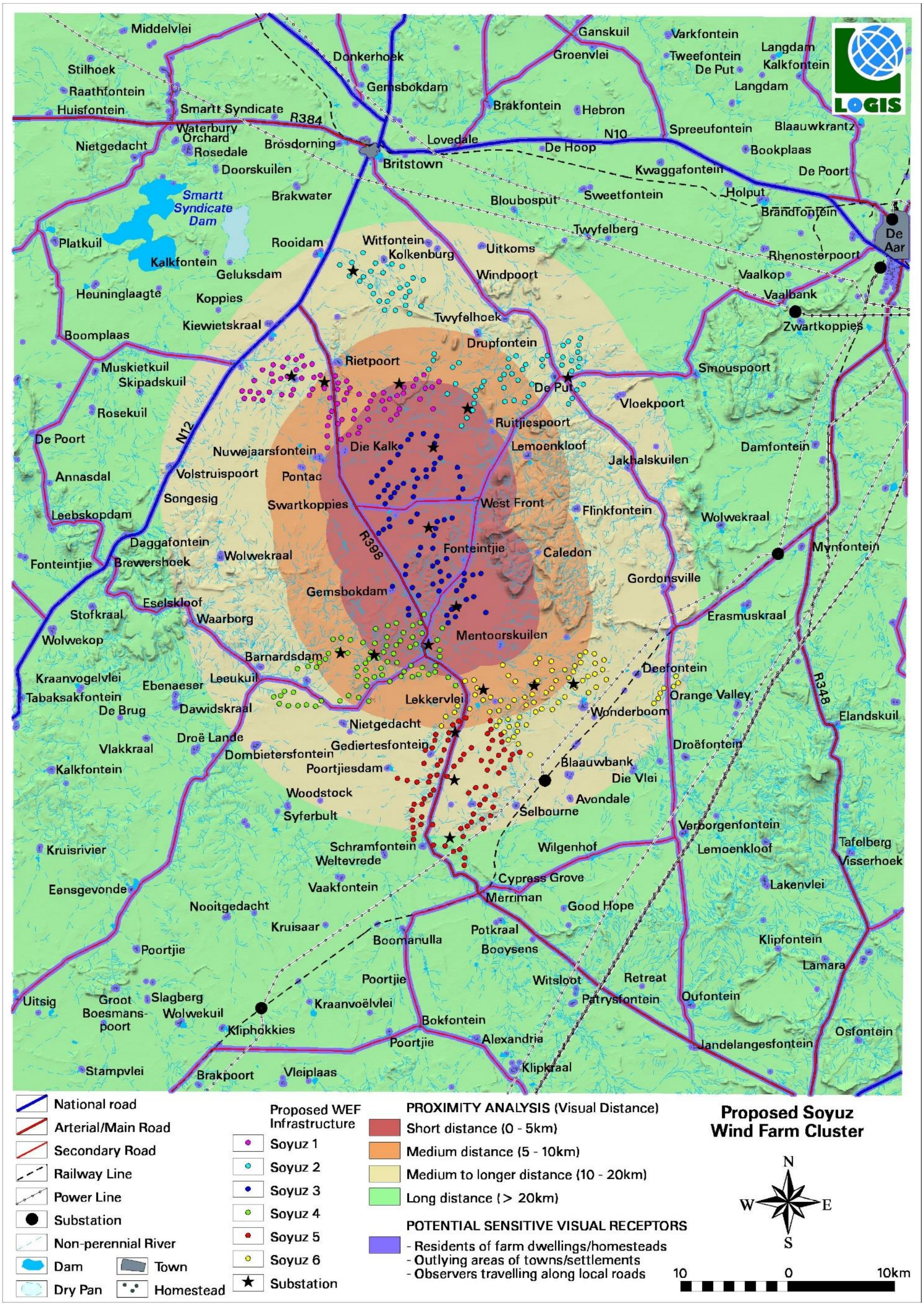


Figure 11: Visual experience of a 100m high wind turbine structure at a distance of 1km, 2km, 5km and 10km (represented from right to left)



Map 3. These potentially affected sensitive visual receptors are listed in **Section** Error! Reference source not found..

6.3. VISUAL ABSORPTION CAPACITY

Visual Absorption Capacity (VAC) is the capacity of the receiving environment to absorb the potential visual impact of the proposed development. VAC is primarily a function of the vegetation and will be high if the vegetation is tall, dense and continuous. Conversely, low growing sparse and patchy vegetation will have a low VAC.

Since the land cover within the study area consists primarily of low shrubland, interspersed with naturally occurring bare rock and grassland, overall, the VAC of the receiving environment of the Soyuz 3 WEF is deemed to be low by virtue of the low growing nature of the vegetation, as well as the generally rural nature of the study area.

The VAC would also be high where the environment can readily absorb the development in terms of texture, colour, form and light / shade characteristics. On the other hand, the VAC for a development contrasting markedly with one or more of the characteristics of the environment would be low. Since the significant height of turbines adds to the potential visual intrusion of the WEF in the landscape and against the background of the horizon, the scale and form of the structures mean that it is unlikely that the environment will visually absorb them in terms of texture, colour, form and light/shade characteristics, therefore VAC in this case would be considered low.

The VAC also generally increases with distance, where discernible detail in visual characteristics of both environment and development decreases.

As a result of the low growing nature of the vegetation and the high contrast of the turbines with the surrounding receiving environment, VAC will not be taken into account for the visual impact assessment of the Soyuz 3 WEF thereby representing the worst-case scenario.

6.4. POTENTIAL VISUAL EXPOSURE

The result of the viewshed analysis for the proposed Soyuz 3 WEF is shown on **Map 4** that follows. The analysis has been undertaken from each proposed turbine position as indicated within the proposed development area of **Soyuz 3 WEF** only in order to determine the general visual exposure (visibility) of the area under investigation. A height of 260m was used in order to illustrate the anticipated visual exposure of the wind turbines (i.e., the approximate maximum blade tip height of the proposed wind turbines). 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 outer most turbines) has been indicated at 20km. The extent of visual exposure within this zone is very high.

The result of the viewshed analysis displays the potential areas of visual exposure, as well as the potential frequency of exposure. The frequency of exposure indicates the number of turbines that may be exposed i.e. more turbines may be visible in the darker orange to red areas than in the yellow areas. Land that is more elevated is typically more exposed to the proposed WEF, whilst lower lying areas such as valleys are shielded, or not as exposed.

The viewshed analysis does not include the effect of vegetation cover or existing structures on the exposure of the proposed facility, therefore signifying a worst-case scenario. **Map 4** indicates areas from which any number of turbines could potentially be visible, as well as proximity offsets from the proposed development area. The following is an overview of the findings of the viewshed, 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. Small areas of scattered visually screened areas within this zone lie beyond the escarpment of the Kombuisfontein Mountains to the east and other hills to the north of the site.

  Potential sensitive visual receptors within this visually exposed zone include observers travelling along the R398, as well as various secondary and internal farm roads. Additionally, residents of the following homestead / farmsteads[3] are likely to be affected
    - Die Kalk
    - Swartkoppies
    - West Front
    - Fonteintjie
    - Gemsbokdam
    - Thomasgat
    - Mentoorskuilen

[3] The names listed here are of the homestead or farm dwelling as indicated on the SA 1: 50 000 topographical maps and do not refer to the registered farm name.

  - Nuwejaarsfontein
  - Ruitjiespoort

- Potential visual exposure remains high in the medium distance, **between 5 and 10km**, with visually screened areas predominantly associated with the lower lying areas beyond hills to the north and south west of the site, as well as beyond the escarpment of the Kombuisfontein Mountains to the east.

  Sensitive visual receptors include users of the R398 and various secondary roads in the area, as well as residents of a number of homesteads. Residents of the following homestead / farmsteads are likely to be affected:
  - Pontac
  - Rietpoort
  - Lemoenkloof
  - Lekkervlei
  - Allemansdam

- In the longer distance, **between 10 and 20km** offset, the extent of potential visual exposure is somewhat reduced, especially in the east beyond the escarpment of the Kombuisfontein Mountains and the north. Visually exposed areas tend to be concentrated in the north west and south western portions of the study area.

  Sensitive visual receptors comprise users of stretches of the N12 in the north west, as well as the R398 and various secondary roads located in and around the site. In addition, farm residents and homesteads, may be visually exposed. Residents of the following homesteads / farmsteads and settlements are likely to be affected:
  - Wolwekraal
  - Songesig
  - Volstruispoort
  - Graafwater
  - Kiewietskraal
  - Rooidam
  - Witfontein
  - Uitkoms
  - Windpoort
  - De Put
  - Deefontein
  - Wonderboom
  - Blaauwbank
  - Avondale
  - Beskuitkuil
  - Gediertesfontein
  - Poortjiesdam
  - Woodstock
  - Nietgedacht
  - Altringham
  - Leeukuil
  - Waarborg

- The frequency of visual exposure **beyond 20km** from the turbine structures remains largely unchanged but slightly more scattered, though it is expected that most turbines will only be partially visible. Visibility of the turbine structures will be scattered throughout this area with visually screened areas lying to the east, west, and north east.

  Sensitive visual receptors include users of stretches of the N12, N10, R384, as well as residents of the following homesteads / farmsteads which are likely to be affected:
  - Annasdal
  - De Poort
  - Rosekuil
  - Skipadskuil
  - Muskietkuil
  - Boomplaas

- Koppies
- Geluksdam
- Kalkfontein
- Waterbury
- Smart Syndicate
- Middelvlei
- Brakwater
- Brosdorning
- Gemsbokdam
- Donkerhoek
- Lovedale
- Bloubosput
- Tweefontein
- De Put
- Langdam
- Langdam
- Kapokpoort
- Blaauwkrantz
- Holput
- Klienbrandfontein
- Orange Valley
- Elandskuil
- Droëfontein
- Verborgenfontein
- Wilgenhof
- Cypress Grove
- Patrysfontein
- Jandelangesfontein
- Klipkraal
- Alexandria
- Bokfontein
- Poortjie
- Boomanulla
- Weltevrede
- Vaakfontein
- Kruisaar
- Kraanvoëlvlei
- Brakpoort
- Syferbult
- Nooitgedacht
- Poortjie
- Ebenaeser
- Dawidskraal
- Vlakkraal
- De Brug
- Kraanvogelvlei
- Tabaksakfontein
- Kalkfontein

It must be noted that some, not all, of the sensitive visual receptors of farms and homesteads listed above who could be affected visually by the proposed Soyuz 3 WEF are in fact located on properties involved in either this WEF or for the proposed WEF developments associated with the collective Britstown Wind Farm Cluster. This is particularly relevant to sensitive visual receptors located within 10km of the proposed site. 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 WEFs in general as a result of their involvement.

In general, the Soyuz 3 WEF may constitute a very high visual prominence, potentially resulting in a very high visual impact.

6.5. CUMULATIVE VISUAL ASSESSMENT

Cumulative visual impacts can be defined as the additional changes caused by a proposed development in conjunction with other similar developments or as the combined effect of a set of developments. In practice, the terms 'effects' and 'impacts' are used interchangeably. Cumulative visual impacts may be:

- Combined, where the wind turbines of several WEFs are within the observer's arc of vision at the same time;
- Successive, where the observer has to turn his or her head to see the various WEF's wind turbines; and
- Sequential, when the observer has to move to another viewpoint to see different developments, or different views of the same development (such as when travelling along a route).

The visual impact assessor is required (by the competent authority) to identify and quantify the cumulative visual impacts and to propose potential mitigating measures. This is often problematic as most regulatory bodies do not have specific rules, regulations or standards for completing a cumulative visual assessment, nor do they offer meaningful guidance regarding appropriate assessment methods. There are also not any authoritative thresholds or restrictions related to the capacity of certain landscapes to absorb the cumulative visual impacts of wind turbines.

To complicate matters even further, cumulative visual impact is not just the sum of the impacts of two developments. The combined effect of both may be much greater than the sum of the two individual effects, or even less.

The cumulative impact of the WEF development on the landscape and visual amenity is a product of:

- The distance between individual WEFs (or turbines);
- The distance over which the wind turbines are visible;
- The overall character of the landscape and its sensitivity to the structures;
- The siting and design of the WEFs themselves; and
- The way in which the landscape is experienced.

The specialist is required to conclude if the proposed development will result in any unacceptable loss of visual resource considering all the projects existing and proposed in the area.

Soyuz 3 WEF addressed in this report is only one component of a larger wind energy cluster consisting of up to six (6) different facilities known as the Britstown Wind Farm Cluster. For the purpose of this study, viewshed analyses were undertaken from all six (6) proposed WEFs as part of this development only. Visibility analyses of the six (6) proposed Britstown Wind Farm Cluster WEFs were undertaken individually from each of the WEF's wind turbine positions at an offset off 260m above ground level (the approximate/estimated blade tip-height). The results of these viewshed analyses were overlain in order to determine areas where all six WEFs may theoretically be visible.

Map 5 illustrates the anticipated cumulative visual impact of Britstown Wind Farm Cluster and specifically the anticipated frequency of visual exposure. Areas shaded in the following colours are likely to be exposed to the corresponding number of facilities making up the proposed Britstown Wind Farm Cluster as follows:

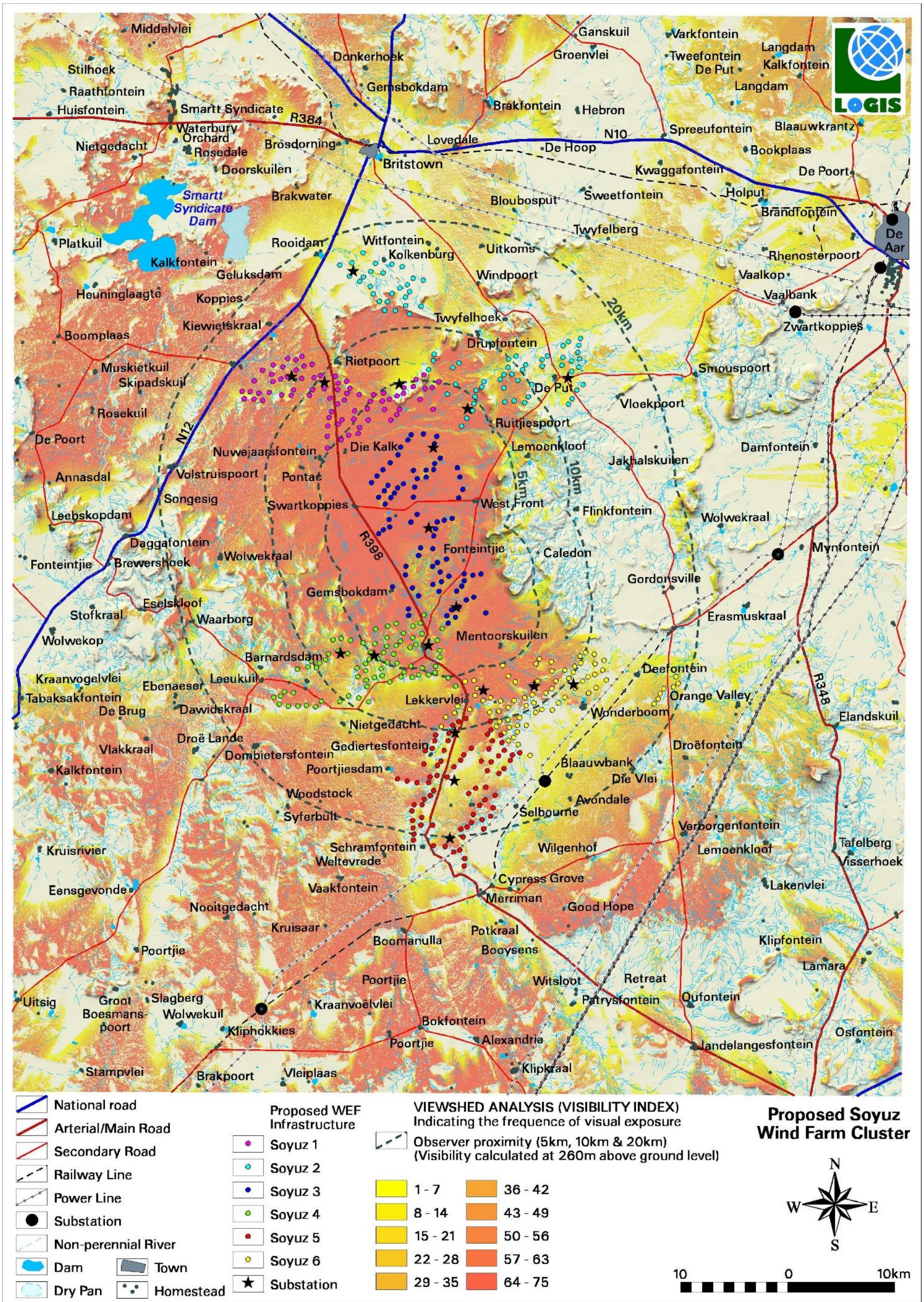
- Red - six (6) WEFs
- Orange - five (5) WEFs
- Yellow - four (4) WEFs
- Light green - three (3) WEFs
- Dark green – two (2) WEFs
- Blue – one (1) WEF

The approximate 450 wind turbine positions (excluding the already authorised WEFs located in the study area for which no layouts were available) are spread out across a very large surface area. The areas of highest potential cumulative visual exposure are located within and around the core area of the proposed Britstown Wind Farm Cluster site, within the plains. This is due to the unobstructed vistas brought about by the flat topography of the plains. Terrain located within the valleys of the more mountainous landscapes or located within lower lying drainage lines are generally more shielded from the cumulative visual exposure of the wind turbine structures. The opposite effect occurs along the more elevated ridges and hills where the terrain may be exposed to more turbines, i.e. along the western facing slopes of the Kombuisfontein Mountains.

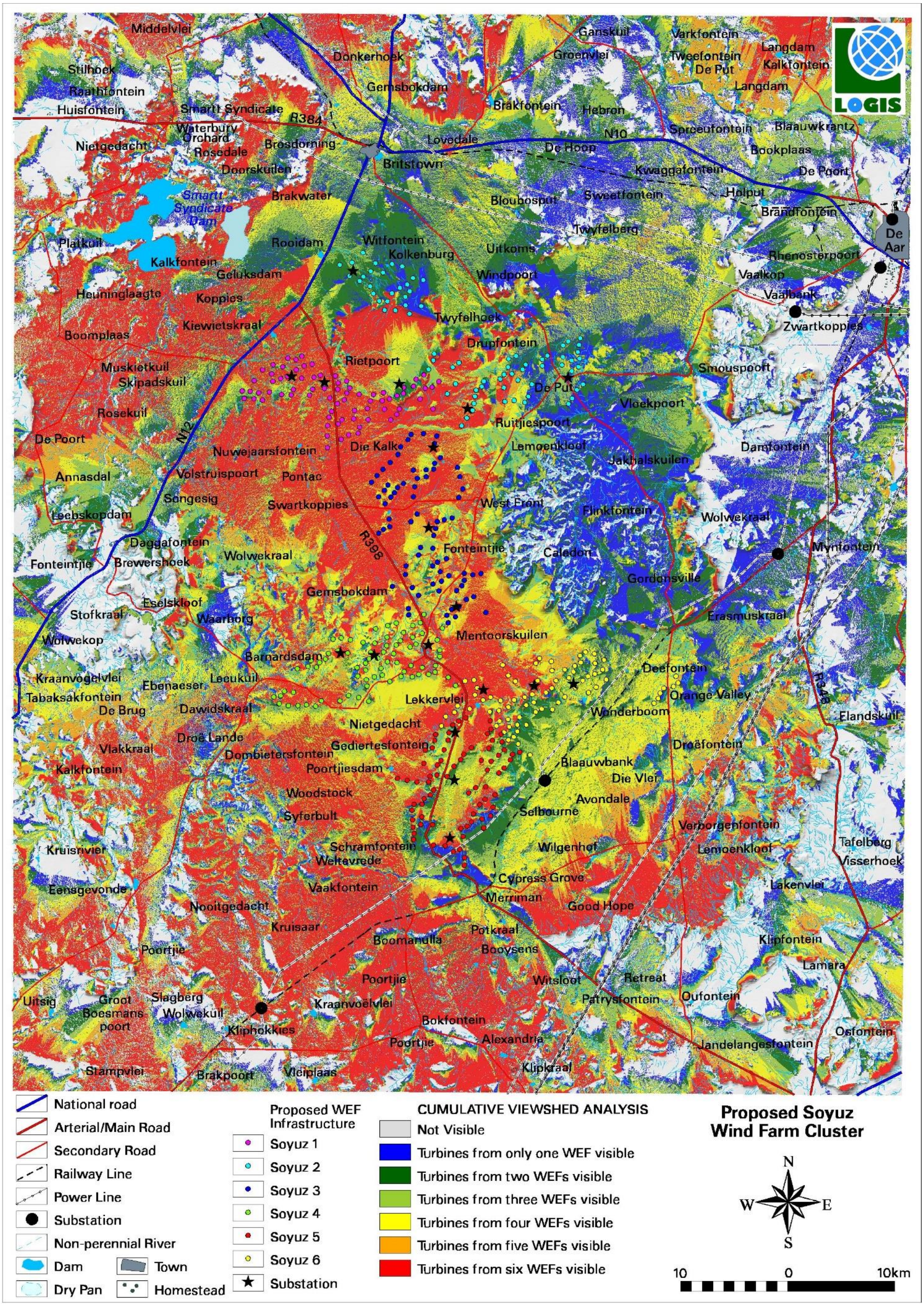
The areas of higher cumulative visual exposure (especially along the plains) contain sensitive visual receptors in the form of residents of homesteads and observers travelling along the national (N12), arterial (R398) and secondary roads traversing the plains. It is expected that should all 450 wind turbines of the Britstown Wind Farm Cluster be constructed; the potential cumulative visual impacts may range from moderate (where observers are absent i.e. vacant natural land) to high significance (where observers are present i.e. at homesteads and along roads).

Additionally, other authorised and in progress Renewable Energy Facilities (REF) consisting of both PV and WEFs within a 30km radius of the proposed Soyuz 3 WEF are indicated on **Map 6**. Since the layouts of these REFs are not available, they have not been included in the analyses. However, since only a limited number of facilities are located within the study area it is not expected that these smaller facilities will further contribute to the expected cumulative visual impact of the Britstown Wind Farm Cluster.

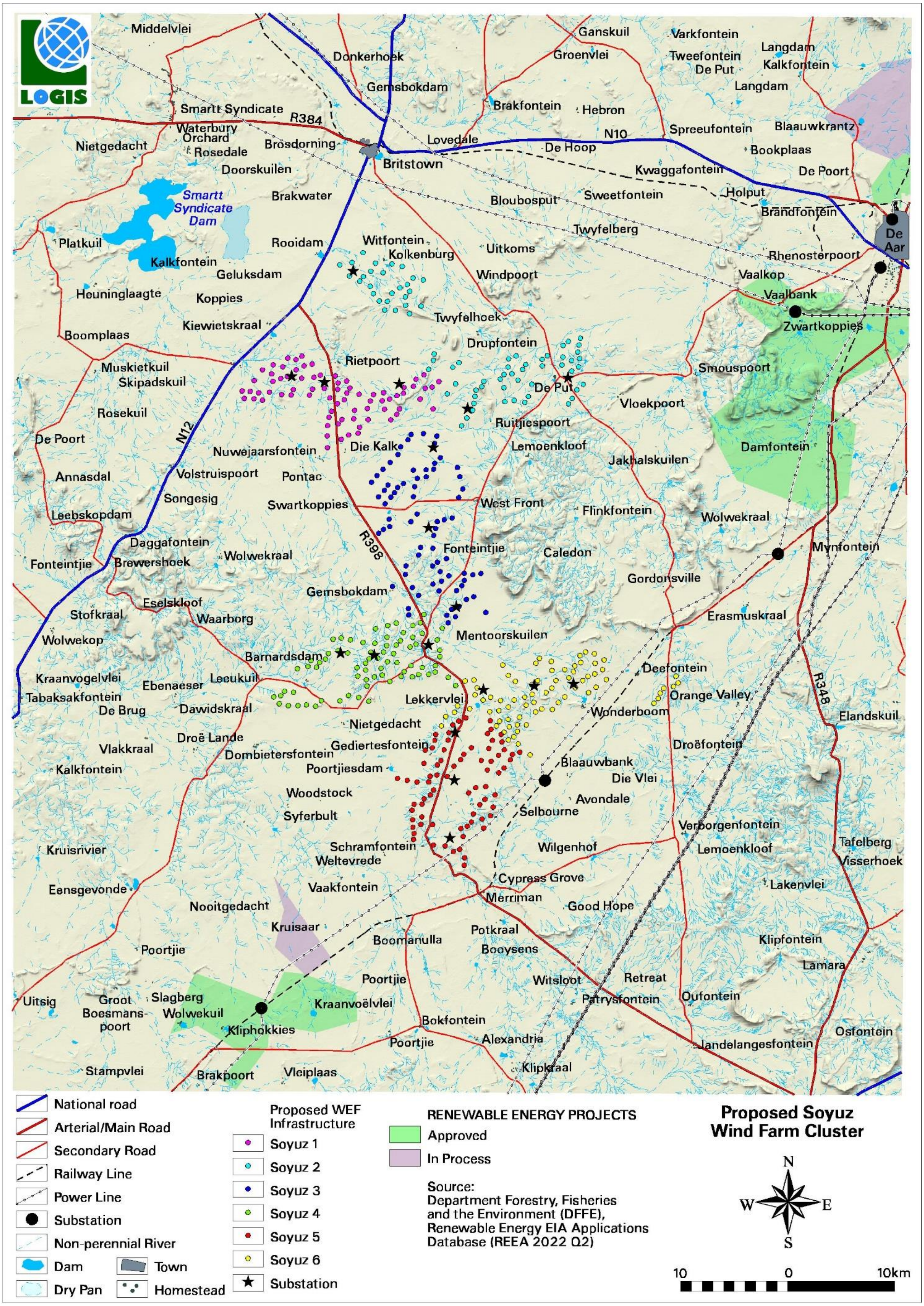
Should all these WEFs be constructed then these facilities will most likely be experienced as one facility by observers in the area. The overall cumulative visual impact of Britstown Wind Farm Cluster is ultimately expected to be of **high** significance on the region due to the very large surface area it covers, its remote location, as well as the sensitivity of the identified receptors to this kind of development.



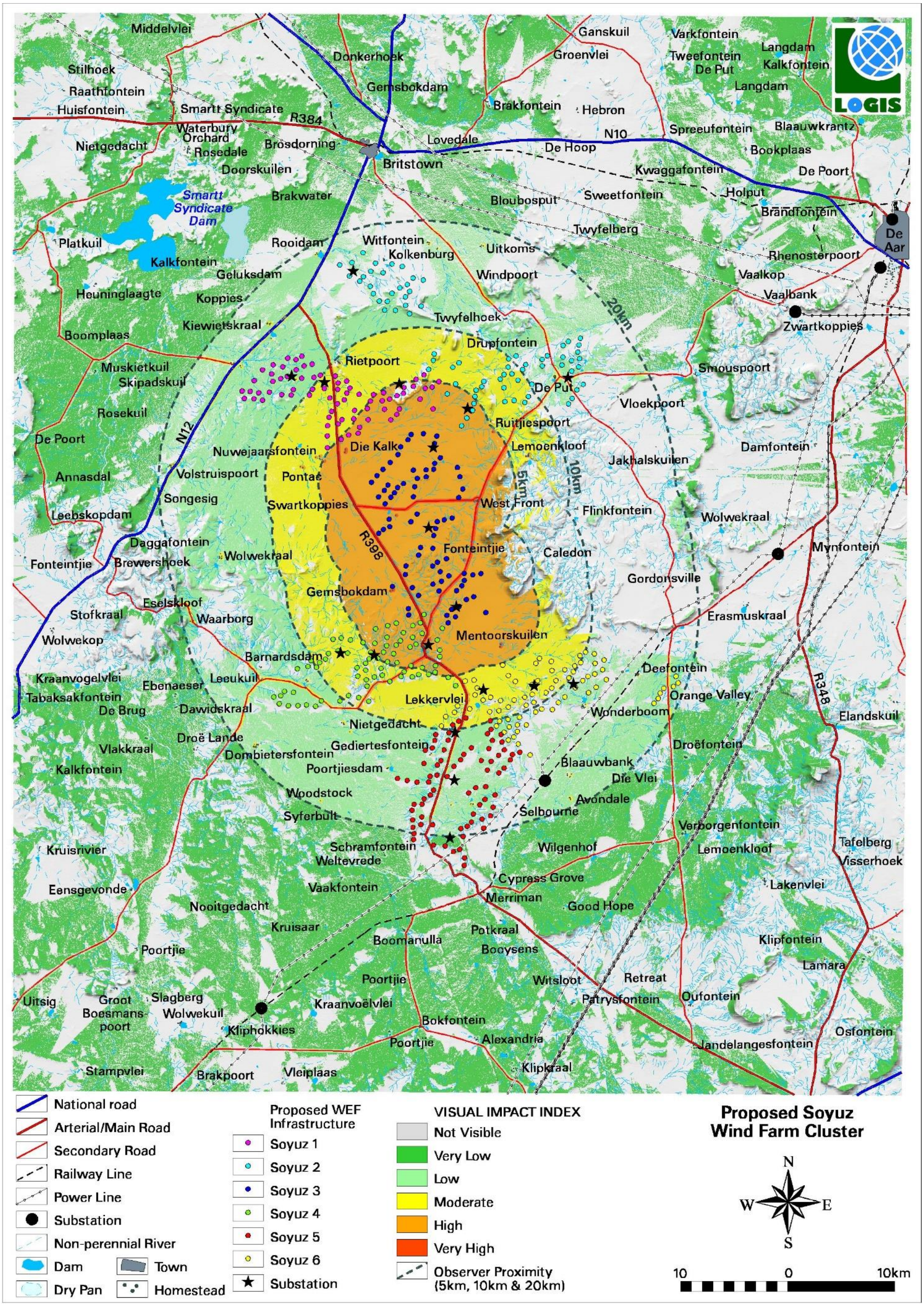
Map 4: Potential visual exposure (viewshed analysis) of the proposed Soyuz 3 WEF



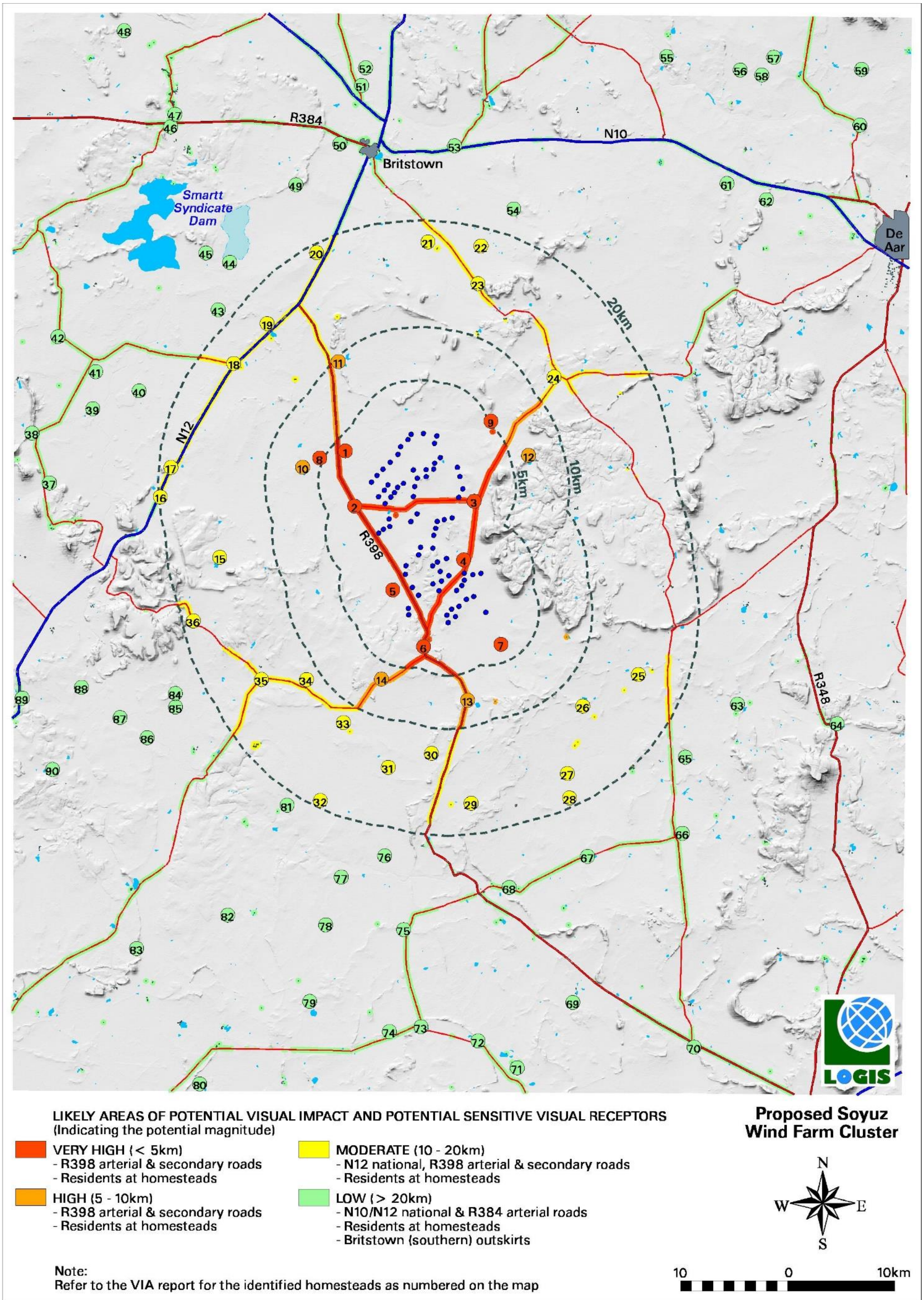
Map 5: Cumulative viewshed analysis for Britstown Wind Farm Cluster



Map 6: Authorized renewable energy projects within the region



Map 7: Visibility Index illustrating the frequency of exposure of the proposed Soyuz 3 WEF layout



Map 8: Likely areas of potential visual impact and potential sensitive visual receptors

6.6. VISUAL IMPACT INDEX

The combined results of visual exposure, viewer incidence / perception and visual distance of the proposed Soyuz 3 WEF are displayed on **Map 7**. Here the weighted impact and the likely areas of impact have been indicated as a visual impact index. Values have been assigned for each potential visual impact per data category and merged in order to calculate the visual impact index.

The criteria (previously discussed in this report) which inform the visual impact index are:

- Visibility or visual exposure of the structures
- Observer proximity or visual distance from the structures
- The presence of sensitive visual receptors
- The perceived negative perception or objections to the structures (if applicable)
- The visual absorption capacity of the vegetation cover or built structures (if applicable)

An area with short distance visual exposure to the proposed infrastructure, a high viewer incidence and a potentially negative perception (i.e. a sensitive visual receptor) would therefore have a **higher** value (greater impact) on the index. This helps in focussing the attention to the critical areas of potential impact and determining the potential **magnitude** of the visual impact.

The index indicates that **potentially sensitive visual receptors** within a 5km radius of the WEF may experience a **very high** visual impact. The magnitude of visual impact on sensitive visual receptors subsequently subsides with distance to; **high** within a 5 – 10km radius (where sensitive receptors are present) and **moderate** within a 10 – 20km radius (where sensitive receptors are present). Receptors beyond 20km are expected to have a **low** potential visual impact.

Likely areas of potential visual impact and potential sensitive visual receptors located the study area are displayed on **Map 8**. **The numbers assigned to the identified homestead as listed below coincide with the locations of the homesteads as numbered on Map 8.**

The visual impact index for the proposed facility is further described as follows.

- The visual impact index map indicates a core zone of **high** visual impact within 5km of the proposed facility. While the identified receptors within 5km of the proposed WEF, as listed below, are likely to experience **very high** visual impact, should mitigation not be possible or not be undertaken. Sensitive visual receptors within this zone comprise mainly of the following:
    - Observers travelling along the R398, as well as various secondary and internal farm roads
    - Residents of the following homesteads:
        1. Die Kalk
        2. Swartkoppies
        3. West Front
        4. Fonteintjie
        5. Gemsbokdam
        6. Thomasgat
        7. Mentoorskuilen
        8. Nuwejaarsfontein
        9. Ruitjiespoort

  Note: *The location of the homesteads Die Kalk, Swartkoppies, West Front, Fonteintjie, Gemsbokdam, Thomasgat, Mentoorskuilen, and Ruitjiespoort are on farm portions earmarked for the Britstown Wind Farm Cluster, thereby reducing the probability of this impact occurring (i.e. it is assumed that these landowners are supportive of WEF developments within the region).*

- Visual impact is prominently **moderate** between 5km and 10km of the proposed facility. The identified receptors between 5km and 10km of the proposed facility, as listed below, are likely to experience **high** visual impact, should mitigation not be possible or not be undertaken. Sensitive visual receptors within this zone comprise mainly of the following:
    - Users traveling along the R398 and various secondary roads in the area
    - Residents of the following homesteads:
        10. Pontac

11. Rietpoort
12. Lemoenkloof
13. Lekkervlei
14. Allemansdam

Note: *The location of the homesteads Rietpoort, Lemoenkloof, Lekkervlei, and Allemansdam are on farm portions earmarked for the Britstown Wind Farm Cluster, thereby reducing the probability of this impact occurring (i.e. it is assumed that these landowners are supportive of WEF developments within the region).*

- Visual impact is prominently **low** between 10 km and 20 km of the proposed facility. The identified receptors between 10km and 20km of the proposed facility, as listed below, are likely to experience **moderate** visual impact, should mitigation not be possible or not be undertaken. Sensitive visual receptors within this zone comprise mainly of the following:
  - Users traveling along portions of the N12, R398 and various secondary roads, potential visibility is however scattered along the length of these roads and visual intrusion where possible will be brief.
  - Residents of the following homesteads:

15. Wolwekraal
16. Songesig
17. Volstruispoort
18. Graafwater
19. Kiewietskraal
20. Rooidam
21. Witfontein
22. Uitkoms
23. Windpoort
24. De Put
25. Deefontein
26. Wonderboom
27. Blaauwbank
28. Avondale
29. Beskuitkuil
30. Gediertesfontein
31. Poortjiesdam
32. Woodstock
33. Nietgedacht
34. Altringham
35. Leeukuil
36. Waarborg

Note: *The location of Witfontein, Windpoort, De Put, Deefontein, Wonderboom, Blaauwbank, Beskuitkuil, Gediertesfontein and Altringham are on farm portions earmarked for the Britstown Wind Farm Cluster, thereby reducing the probability of this impact occurring (i.e. it is assumed that these landowners are supportive of WEF developments within the region).*

- Beyond the 20km of the proposed facility, the extent of potential visual impact is somewhat reduced, and the magnitude is predominantly **very low**. The identified receptors beyond 20km of the proposed facility, as listed below, are likely to experience **low** visual impact, should mitigation not be possible or not be undertaken. Sensitive visual receptors within this zone comprise mainly of the following:
  - Users traveling along portions of the N12, N10 and R384, potential visibility is however scattered along the length of these roads and visual intrusion where possible will be brief.
  - Residents of the following homesteads:

37. Annasdal
38. De Poort
39. Rosekuil
40. Skipadskuil
41. Muskietkuil
42. Boomplaas
43. Koppies
44. Geluksdam

45. Kalkfontein
46. Waterbury
47. Smart Syndicate
48. Middelvlei
49. Brakwater
50. Brosdorning
51. Gemsbokdam
52. Donkerhoek
53. Lovedale
54. Bloubosput
55. Tweefontein
56. De Put
57. Langdam
58. Langdam
59. Kapokpoort
60. Blaauwkrantz
61. Holput
62. Klienbrandfontein
63. Orange Valley
64. Elandskuil
65. Droëfontein
66. Verborgenfontein
67. Wilgenhof
68. Cypress Grove
69. Patrysfontein
70. Jandelangesfontein
71. Klipkraal
72. Alexandria
73. Bokfontein
74. Poortjie
75. Boomanulla
76. Weltevrede
77. Vaakfontein
78. Kruisaar
79. Kraanvoëlvlei
80. Brakpoort
81. Syferbult
82. Nooitgedacht
83. Poortjie
84. Ebenaeser
85. Dawidskraal
86. Vlakkraal
87. De Brug
88. Kraanvogelvlei
89. Tabaksakfontein
90. Kalkfontein

Note: *The location of De Put and Gemsbokdam are on farm portions earmarked for the Britstown Wind Farm Cluster, thereby reducing the probability of this impact occurring (i.e. it is assumed that these landowners are supportive of WEF developments within the region).*

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 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.

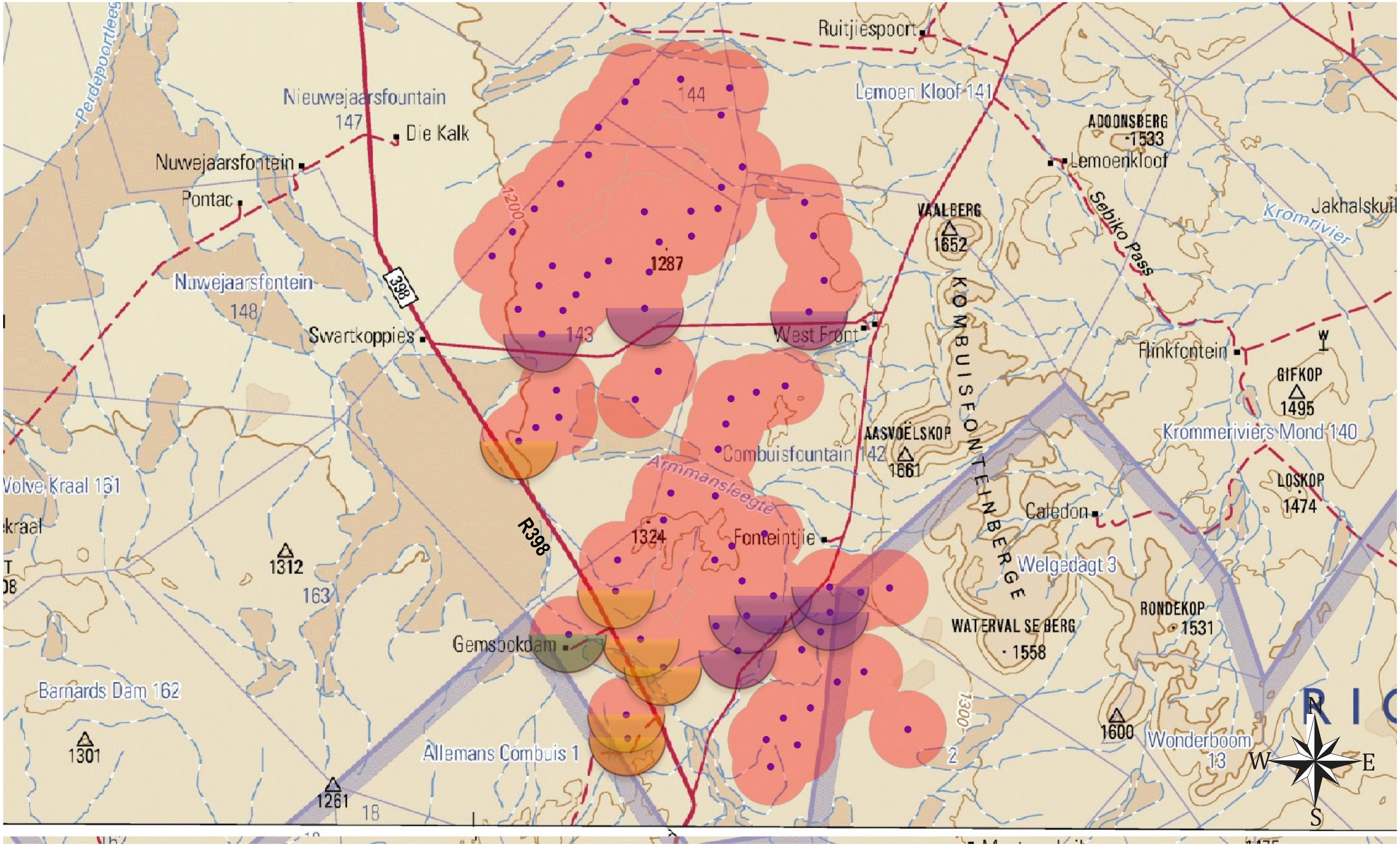
The impact of shadow flicker can be effectively mitigated by choosing the correct site and layout for the wind turbines, taking the orientation of the turbines relative to the nearby homesteads / roads and the latitude of the site into consideration. Tall structures and trees will also obstruct shadows 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 3 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 considered 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 9.**

This study found that six (6) turbines shaded in yellow**,** located on the south western portion of the **Soyuz 3 WEF** adjacent to the R398 are likely to have a shadow flicker impact on motorists using this portion of the R398. Other areas to potentially be impacted on by shadow flicker are loacted along the internal farm roads located in the designated development properties**.** These roads are likely to be affected by the eight (8) turbines shaded in purple. 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 homestead known as Gemsbokdam are also likely to experience shadow flicker from one (1) turbine shaded in green. Of note is that this homesteads are located on a property involved in this development.

It must also be noted that Gemsbokdam was identified during the scoping phase as the potential sensitive receptor likely to experience shadow flicker. As per the recommendations of the IFC Performance Standards, it was recommended that further consultation was undertaken as part of the Scoping Phase consultation process with this specific sensitive receptor in order to establish their understanding and concerns regarding this possible impact. Since no objections have been reported by the EAP or Applicant to the author of this report, it is assumed that the residents of this homestead are in fact aware of, and to a certain extent accepting, of the shadow flicker associated with these turbines.



Map 9: Potential sensitive receptors exposed to shadow flicker from the proposed Soyuz 3 WEF

8. PHOTO SIMULATIONS

Photo simulations were undertaken (in addition to the spatial analyses) in order to illustrate the potential visual impact of the proposed Soyuz 3 WEF only within the receiving environment. The purpose of the photo simulation exercise is to support the findings of the VIA, and is not an exercise to illustrate what the facility will look like from all directions.

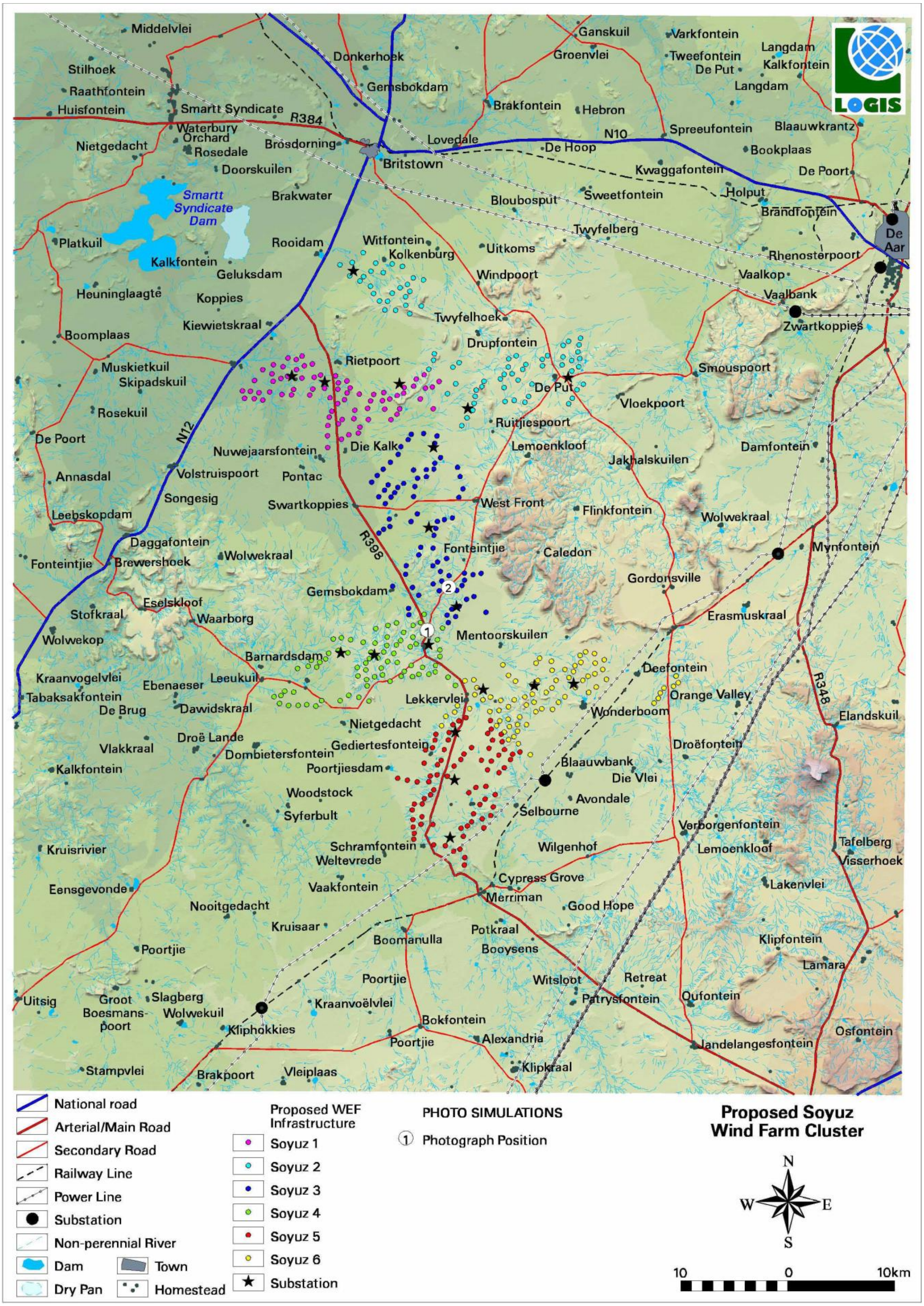
The photo simulations indicate the anticipated visual alteration of the landscape from various points located at different distances from the infrastructure. These points coincide with specific sensitive visual receptors noted during the site visit. The simulations are based on the turbines' actual dimensions and layout.

The photograph positions are indicated on **Map 10** below and should be referenced with the photo simulation being viewed in order to place the observer in spatial context.

It is assumed that the necessary post-construction phase rehabilitation and mitigation measures, as proposed by the various specialists in the environmental impact assessment report, have been undertaken. These photographs can therefore be seen as an ideal operational scenario (from a visual impact point of view) that should be aspired to. It is however crucial that the natural vegetation be restored to its present status in order for these simulations to be as realistic as possible. Additional infrastructure (e.g. access roads, substations, etc.) associated with the facility are not included in the photo simulations.

Each photographic simulation, as seen below, is preceded by a panoramic overview of the landscape (as it is presently), ultimately presenting a 'before' and 'after' scenario from the specified viewpoint being discussed.

The simulated Soyuz 3 WEF, as shown on the photographs, was adapted to the atmospheric conditions present when the original photographs were taken. This implies that factors such as haze and solar glare were also simulated in order to realistically represent the observer's potential view of the infrastructure.



Map 10: Photo simulation location points

8.1 PHOTO SIMULATION POINT 1

Photo simulation 1 has been generated from a viewpoint situated on R398 in the southern portion of the proposed Soyuz 3 WEF, looking north at the proposed site. The point from which the photo was taken is approximately 3km from the nearest turbine and is indicative of a close to medium-range view that locals and users of the R398 road will experience.

Figure 12: Photo simulation viewpoint 1 before construction

Figure 13: Photo simulation viewpoint 1 after construction

8.2 PHOTO SIMULATION POINT 2

Photo simulation 2 has been generated from a viewpoint situated on a secondary road in the southern portion of the proposed Soyuz 3 WEF, looking north east at the proposed site. The point from which the photo was taken is approximately 1km from the nearest turbine and is indicative of a close to medium-range view that locals and users of the secondary road will experience.

Figure 14: Photo simulation viewpoint 2 before construction

Figure 15: Photo simulation viewpoint 2 after construction

9. VISUAL IMPACT ASSESSMENT

9.1. METHODOLOGY

The previous section of the report identified specific areas where likely visual impacts would occur. This section 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 states 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 includes a table quantifying the potential visual impact according to the following criteria:

Extent – The distance the visual impact extends from the proposed development 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.

- (1) Very low: *Region*, long distance > 20km
- (2) Low: *District*, medium to long distance between 10 – 20km
- (3) Medium: *Local*, short distance between 5 – 10 km
- (4) High: *Neighbourhood*, very short distance < 5km
- (5) Very high: *Site* specific, within the development site only

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.

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

9.2. PRIMARY IMPACTS

The primary visual impacts of the proposed Soyuz 3 WEF are assessed as follows:

9.2.1. POTENTIAL VISUAL IMPACT OF CONSTRUCTION ON SENSITIVE VISUAL RECEPTORS IN CLOSE PROXIMITY TO THE FACILITY

During the construction period, there will be an increase in heavy vehicles utilising the roads to the construction sites that may cause, at the very least, a visual nuisance to other road users and landowners in the area in close proximity (within 5km). Within the region, dust as a result of construction activities may also be visible, as such it will result in a visual impact occurring during construction. Sensitive receptors in this zone consist of observers travelling along the R398, various secondary and internal farm roads, as well as residents of various homesteads (refer to Section 6.6 for a full list).

This impact is likely to be of **high** significance before mitigation and **moderate** significance post mitigation on the identified sensitive visual receptors within this zone.

Homesteads located on farm portions earmarked for the Britstown Wind Farm Cluster reduce the probability of this impact occurring on these specific receptors (i.e. it is assumed that these landowners are supportive of WEF developments and their associated visual impacts).

Mitigation entails proper planning, management and rehabilitation of all construction sites to forego the visual impacts of the construction activities only.

Table 3: Impact table summarising the significance of visual impact of construction on visual receptors in close proximity to the proposed WEF

Nature of Impact: Visual impact of construction on sensitive visual receptors in close proximity (< 5km) to the proposed development		
	No mitigation	***Mitigation considered***
Extent	Neighbourhood **(4)**	Neighbourhood **(4)**
Duration	Short term **(2)**	Short term **(2)**
Magnitude	Very High **(10)**	High **(8)**
Probability	Definite **(5)**	Highly probable **(4)**
Significance	High **(80)**	Moderate **(56)**
Status (positive or negative)	Negative	Negative
Reversibility	Reversible **(1)**	Reversible **(1)**
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes, to a certain extent	
Mitigation potential	Achievable	

Mitigation / Management: Construction: ➢ Ensure that vegetation is not unnecessarily removed during the construction period. ➢ Reduce the construction period through careful logistical planning and productive implementation of resources. ➢ Plan the placement of lay-down areas and temporary construction equipment camps in order to minimise vegetation clearing (i.e., in already disturbed areas) wherever possible. ➢ Restrict the activities and movement of construction workers and vehicles to the immediate construction site and existing access roads. ➢ Ensure that rubble, litter, and disused construction materials are appropriately stored (if not removed daily) and then disposed regularly at licensed waste facilities. ➢ Reduce and control construction dust using approved dust suppression techniques as and when required (i.e., whenever dust becomes apparent). ➢ Restrict construction activities to daylight hours whenever possible in order to reduce lighting impacts. ➢ Rehabilitate all disturbed areas immediately after the completion of construction works.
Cumulative impacts: No cumulative impacts as a result of the construction activities are expected.
Residual impacts: None, provided that rehabilitation works are carried out as specified.

9.2.2. POTENTIAL VISUAL IMPACT OF FACILITY OPERATIONS ON SENSITIVE VISUAL RECEPTORS IN CLOSE PROXIMITY (< 5KM) TO THE PROPOSED DEVELOPMENT

The visual impacts of facility operations on sensitive visual receptors in close proximity to the proposed Soyuz 3 WEF (within 5km) is expected to be of **very high** significance. Sensitive receptors in this zone consist of observers travelling along the R398, various secondary and internal farm roads, as well as residents of various homesteads (refer to Section 6.6 for a full list).

Homesteads located on farm portions earmarked for the Britstown Wind Farm Cluster reduce the probability of this impact occurring on these specific receptors (i.e. it is assumed that these landowners are supportive of WEF developments and their associated visual impacts).

No mitigation is possible for a facility of this scale, but measures have been included as best practice guidelines. The table below illustrates this impact assessment.

Table 4: Impact table summarising the significance of facility operations on sensitive visual receptors in close proximity (within 5km) to the proposed WEF

Nature of Impact: Visual impact on sensitive receptors within 5km (residents of homesteads, as well as observers travelling along the various secondary roads), in close proximity to the proposed development.		
	No mitigation	***Mitigation considered***
Extent	Neighbourhood **(4)**	Neighbourhood **(4)**
Duration	Long **(4)**	Long **(4)**
Magnitude	Very High **(10)**	Very High **(10)**
Probability	Definite **(5)**	Definite **(5)**
Significance	Very High **(90)**	Very High **(90)**
Status (positive or negative)	Negative	Negative
Reversibility	Reversible **(1)**	Reversible **(1)**
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	No	
Mitigation potential	Very difficult	
Mitigation / Management: Operations: ➢ Retain / re-establish and maintain natural vegetation in all areas outside of the development footprint. ➢ Maintain the general neat and tidy appearance of the facility as a whole. ➢ Monitor rehabilitated areas, and implement remedial action as and when required. Decommissioning: ➢ Remove infrastructure not required for the post-decommissioning use of the site. ➢ Rehabilitate all areas. Consult an ecologist regarding rehabilitation specifications. ➢ Monitor rehabilitated areas post-decommissioning and implement remedial actions.		

Cumulative impacts: The construction of the Soyuz 3 WEF (75 turbines) together with the other five proposed facilities that form part of the Britstown Wind Farm Cluster is expected to contribute to the increased cumulative visual impact of renewable energy facilities in the region.
Residual impacts: The visual impact will be removed after decommissioning, provided the facility and ancillary infrastructure is removed. Failing this, the visual impact will remain.

9.2.3. POTENTIAL VISUAL IMPACT OF FACILITY OPERATIONS ON SENSITIVE VISUAL RECEPTORS WITHIN THE LOCAL AREA (BETWEEN 5 - 10KM) SURROUNDING THE PROPOSED DEVELOPMENT

The visual impact of facility operations on sensitive visual receptors (i.e. users of the various roads and residents of homesteads) within the local area (between 5 - 10km offset) is expected to be of **high** significance. Sensitive visual receptors within this zone include users traveling along the R398 and various secondary roads in the area, as well as residents of various homesteads (refer to Section 6.6 for a full list).

Homesteads located on farm portions earmarked for the Britstown Wind Farm Cluster reduce the probability of this impact occurring on these specific receptors (i.e. it is assumed that these landowners are supportive of WEF developments and their associated visual impacts).

No mitigation is possible within this environment and for a facility of this scale, but measures have been included as best practice guidelines. The table below illustrates this impact assessment.

Table 5: Impact table summarising the significance of visual impacts of the facility operations on sensitive visual receptors within the local area (between the 5 - 10km offset)

Nature of Impact: Visual impact on the users of various secondary roads, residents of homesteads and visitors to the local area (between 5 - 10km offset) surrounding the proposed development.		
	No mitigation	***Mitigation considered***
Extent	Local **(3)**	Local **(3)**
Duration	Long **(4)**	Long **(4)**
Magnitude	High **(8)**	High **(8)**
Probability	Definite **(5)**	Definite **(5)**
Significance	High **(75)**	High **(75)**
Status (positive or negative)	Negative	Negative
Reversibility	Reversible **(1)**	Reversible **(1)**
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	No	
Mitigation potential	Very difficult	

Mitigation / Management:

Site development & Operation:

- Retain / re-establish and maintain large trees, natural features and noteworthy natural vegetation in all areas outside of the activity footprint.
- Retain natural pockets (wetland, river and other sensitive vegetation zones) as buffers within the property and along the perimeter.
- Dust suppression techniques should be in place at all times during the site development and operational phases.
- Access roads will require an effective dust suppression management programme, such as regular wetting and/or the use of non-polluting chemicals that will retain moisture in the road surface.
- Keeping infrastructure at minimum heights.
- Introducing landscaping measures such as vegetating berms.
- Avoid the use of highly reflective material.
- Metal surfaces, where they occur, should be painted in natural soft colours that would blend in with the environment.
- Maintain the general neat and tidy appearance of the site as a whole.

Lighting

- Lighting should be kept to a minimum wherever possible.
- Install light fixtures that provide precisely directed illumination to reduce light "spillage" beyond the immediate surrounds of the activity – this is especially relevant where the edge of the activity is exposed to residential properties.
- Wherever possible, lights should be directed downwards to avoid illuminating the sky.
- Avoid high pole top security lighting along the periphery of the site and use only lights that are activated on movement.

Decommissioning: ➢ Remove infrastructure not required for the post-decommissioning use of the site. ➢ Rehabilitate all areas as per the rehabilitation plan undertaken. Consult an ecologist regarding rehabilitation specifications. ➢ Monitor rehabilitated areas post-decommissioning and implement remedial actions as required.
Cumulative impacts: The construction of the Soyuz 3 WEF (75 turbines) together with the other five proposed facilities that form part of the Britstown Wind Farm Cluster is expected to contribute to the increased cumulative visual impact of renewable energy facilities in the region.
Residual impacts: The visual impact will be removed after decommissioning, provided the facility and ancillary infrastructure is removed. Failing this, the visual impact will remain.

9.2.4. POTENTIAL VISUAL IMPACT OF FACILITY OPERATIONS ON SENSITIVE VISUAL RECEPTORS WITHIN THE DISTRICT (BETWEEN 10 - 20KM) SURROUNDING THE PROPOSED DEVELOPMENT

The visual impact of facility operations on sensitive visual receptors within the district (between 10 - 20km offset) is expected to be of **moderate** significance. Sensitive visual receptors within this zone include users traveling along portions of the N12, R398 and various secondary roads, as well as residents of various homesteads (refer to Section 6.6 for a full list).

Homesteads located on farm portions earmarked for the Britstown Wind Farm Cluster reduce the probability of this impact occurring on these specific receptors (i.e. it is assumed that these landowners are supportive of WEF developments and their associated visual impacts).

No mitigation is possible within this environment and for a facility of this scale, but measures have been included as best practice guidelines. The table below illustrates this impact assessment.

Table 6: Impact table summarising the significance of visual impacts of the facility operations on sensitive visual receptors within the district (between the 10 – 20km offset)

Nature of Impact: Visual impact on the users of the various roads, residents of towns, visitors to the district and residents of homesteads (between 10 - 20km offset) surrounding the proposed development.		
	No mitigation	***Mitigation considered***
Extent	District **(2)**	District **(2)**
Duration	Long **(4)**	Long **(4)**
Magnitude	Moderate **(6)**	Moderate **(6)**
Probability	Highly Probable **(4)**	Highly Probable **(4)**
Significance	Moderate **(48)**	Moderate **(48)**
Status (positive or negative)	Negative	Negative
Reversibility	Reversible **(1)**	Reversible **(1)**
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	No	
Mitigation potential	Very difficult	
Mitigation / Management: Site development & Operation: ➢ Retain / re-establish and maintain large trees, natural features and noteworthy natural vegetation in all areas outside of the activity footprint. ➢ Retain natural pockets (wetland, river and other sensitive vegetation zones) as buffers within the property and along the perimeter. ➢ Dust suppression techniques should be in place at all times during the site development and operational phases. ➢ Access roads will require an effective dust suppression management programme, such as regular wetting and/or the use of non-polluting chemicals that will retain moisture in the road surface. ➢ Keeping infrastructure at minimum heights. ➢ Introducing landscaping measures such as vegetating berms. ➢ Avoid the use of highly reflective material. ➢ Metal surfaces, where they occur, should be painted in natural soft colours that would blend in with the environment. ➢ Maintain the general neat and tidy appearance of the site as a whole. Lighting ➢ Lighting should be kept to a minimum wherever possible.		

➢ Install light fixtures that provide precisely directed illumination to reduce light "spillage" beyond the immediate surrounds of the activity – this is especially relevant where the edge of the activity is exposed to residential properties. ➢ Wherever possible, lights should be directed downwards to avoid illuminating the sky. ➢ Avoid high pole top security lighting along the periphery of the site and use only lights that are activated on movement. Decommissioning: ➢ Remove infrastructure not required for the post-decommissioning use of the site. ➢ Rehabilitate all areas as per the rehabilitation plan undertaken. Consult an ecologist regarding rehabilitation specifications. ➢ Monitor rehabilitated areas post-decommissioning and implement remedial actions as required.
Cumulative impacts: The construction of the Soyuz 3 WEF (75 turbines) together with the other five proposed facilities that form part of the Britstown Wind Farm Cluster is expected to contribute to the increased cumulative visual impact of renewable energy facilities in the region.
Residual impacts: The visual impact will be removed after decommissioning, provided the facility and ancillary infrastructure is removed. Failing this, the visual impact will remain.

9.2.5. POTENTIAL VISUAL IMPACT OF FACILITY OPERATIONS ON SENSITIVE VISUAL RECEPTORS WITHIN THE REGION (> 20KM)

The visual impact of facility operations on sensitive visual receptors within the region (beyond the 20km offset) is expected to be of **low** significance. Sensitive visual receptors within this zone include users traveling along portions of the N12, N10, and R384, as well as residents of various homesteads (refer to Section 6.6 for a full list).

Homesteads located on farm portions earmarked for the Britstown Wind Farm Cluster reduce the probability of this impact occurring on these specific receptors (i.e. it is assumed that these landowners are supportive of WEF developments and their associated visual impacts).

No mitigation is possible within this environment and for a facility of this scale, but measures have been included as best practice guidelines. The table below illustrates this impact assessment.

Table 7: Impact table summarising the significance of visual impacts of the facility operations on sensitive visual receptors within the region (beyond the 20km offset)

Nature of Impact: Visual impact on the users of the various roads, visitors to the region, and residents of homesteads within the region (beyond the 20km offset)		
	No mitigation	***Mitigation considered***
Extent	Region **(1)**	Region **(1)**
Duration	Long **(4)**	Long **(4)**
Magnitude	Low **(4)**	Low **(4)**
Probability	Probable **(3)**	Probable **(3)**
Significance	Low **(27)**	Low **(27)**
Status (positive or negative)	Negative	Negative
Reversibility	Reversible **(1)**	Reversible **(1)**
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	No	
Mitigation potential	Very difficult	
Mitigation / Management: Site development & Operation: ➢ Retain / re-establish and maintain large trees, natural features and noteworthy natural vegetation in all areas outside of the activity footprint. ➢ Retain natural pockets (wetland, river and other sensitive vegetation zones) as buffers within the property and along the perimeter. ➢ Dust suppression techniques should be in place at all times during the site development and operational phases. ➢ Access roads will require an effective dust suppression management programme, such as regular wetting and/or the use of non-polluting chemicals that will retain moisture in the road surface. ➢ Keeping infrastructure at minimum heights. ➢ Introducing landscaping measures such as vegetating berms. ➢ Avoid the use of highly reflective material.		

➢ Metal surfaces, where they occur, should be painted in natural soft colours that would blend in with the environment. ➢ Maintain the general neat and tidy appearance of the site as a whole. Lighting ➢ Lighting should be kept to a minimum wherever possible. ➢ Install light fixtures that provide precisely directed illumination to reduce light "spillage" beyond the immediate surrounds of the activity – this is especially relevant where the edge of the activity is exposed to residential properties. ➢ Wherever possible, lights should be directed downwards to avoid illuminating the sky. ➢ Avoid high pole top security lighting along the periphery of the site and use only lights that are activated on movement. Decommissioning: ➢ Remove infrastructure not required for the post-decommissioning use of the site. ➢ Rehabilitate all areas as per the rehabilitation plan undertaken. Consult an ecologist regarding rehabilitation specifications. ➢ Monitor rehabilitated areas post-decommissioning and implement remedial actions as required.
Cumulative impacts: The construction of the Soyuz 3 WEF (75 turbines) together with the other five proposed facilities that form part of the Britstown Wind Farm Cluster is expected to contribute to the increased cumulative visual impact of renewable energy facilities in the region.
Residual impacts: The visual impact will be removed after decommissioning, provided the facility and ancillary infrastructure is removed. Failing this, the visual impact will remain.

9.2.6. POTENTIAL VISUAL IMPACT OF OPERATIONAL LIGHTING AT NIGHT ON SENSITIVE VISUAL RECEPTORS IN THE REGION

The receiving environment has a relatively small number of populated places, and it can be expected that any light trespass and glare from the security and after-hours operational lighting for the facility will have some significance. In addition, the remote sense of place and rural ambiance of the local area increases its sensitivity to such lighting intrusions.

Another source of glare light is the aircraft warning lights mounted on top of the hub of the wind turbines. While these lights are less aggravating due to the toned-down red colour, they do have the potential to be visible from a greater distance than general operational lighting, especially due to the strobing effect of the lights, a function specially designed to attract the viewers' attention. The Civil Aviation Authority (CAA) prescribes these warning lights and the potential to mitigate their visual impacts is low. The possibility of limiting aircraft warning lights to the turbines on the perimeter according to CAA requirements, thereby reducing the overall impact, is recommended to be investigated.

Figure 16: Example of aircraft warning lights fitted to the turbines as prescribed by the CAA[4]

[4] Image Source: https://kythira-windturbines.com/en/wind-turbines-remain-visible-all-night/

Some ground breaking new technology in the development of strobing lights that only activate when an aircraft is detected nearby. This may aid in restricting light pollution at night and should be investigated and implemented by the project proponent, if available and permissible by the CAA. This new technology is referred to as *needs-based night lights*, which basically deactivates a wind turbine's night lights when there is no flying object within the airspace of the WEF. The system relies on the active detection of aircraft by radar sensors, which relay a switch-on signal to the central wind farm control to activate the obstacle lights.

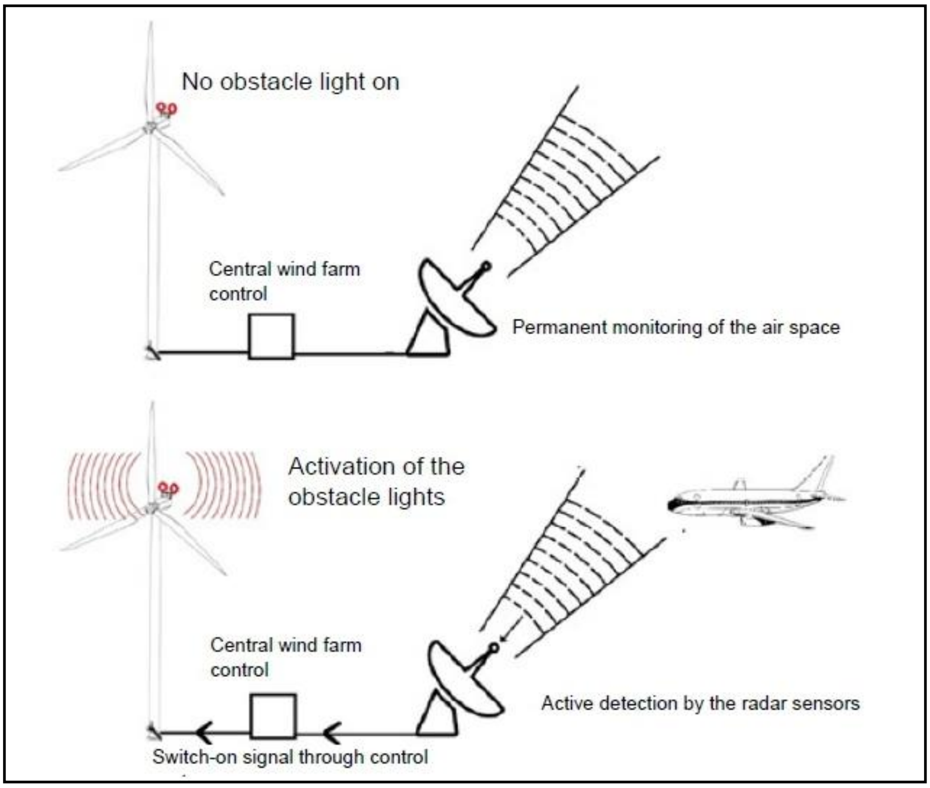


Figure 17: Diagram of the functional principle of the needs-based night lights.

Last is the potential lighting impact is known as sky glow. Sky glow is the condition where the night sky is illuminated when light reflects off particles in the atmosphere such as moisture, dust or smog. The sky glow intensifies with the increase in the number of light sources. Each new light source, especially upwardly directed lighting, contributes to the increase in sky glow. The general lighting of the facility may contribute to the effect of sky glow in an otherwise dark environment.

The visual impacts as a result of operational lighting at night on sensitive visual receptors in the region is likely to be of **high** significance and may be mitigated to **moderate** should the required CAA lighting be approved to be installed on the perimeter and/or the installation of *needs-based night lights* be allowed. Best practice guidelines for other general site lighting that may occur on the site have also been taken into consideration. The table below illustrates this impact assessment.

Table 8: Impact table summarising the significance of visual impact of operational lighting at night on visual receptors in close proximity to the proposed facility

Nature of Impact: Visual impact of lighting at night on sensitive visual receptors in the region		
	No mitigation	***Mitigation considered***
Extent	Region **(1)**	Region **(1)**
Duration	Long term **(4)**	Long term **(4)**
Magnitude	Very High **(10)**	High **(8)**
Probability	Definite **(5)**	Highly Probable **(3)**
Significance	High **(75)**	Moderate **(52)**
Status (positive or negative)	Negative	Negative
Reversibility	Reversible **(1)**	Reversible **(1)**
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	
Mitigation potential	Difficult	

Mitigation: Planning & operation: ➢ Aviation standards and CAA Regulations for turbine lighting must be followed. ➢ The possibility of limiting aircraft warning lights to the turbines on the perimeter according to CAA requirements, thereby reducing the overall impact, must be investigated. ➢ Install aircraft warning lights that only activate when the presence of an aircraft is detected, if permitted by CAA. ➢ Shield the sources of light by physical barriers (walls, vegetation, or the structure itself). ➢ Limit mounting heights of lighting fixtures, or alternatively use foot-lights or bollard level lights. ➢ Make use of minimum lumen or wattage in fixtures. ➢ Make use of down-lighters, or shielded fixtures. ➢ Make use of Low-Pressure Sodium lighting or other types of low impact lighting. ➢ Make use of motion detectors on security lighting. This will allow the site to remain in relative darkness, until lighting is required for security or maintenance purposes.
Cumulative impacts: The operation of the Soyuz 3 WEF (75 turbines) together with the other five proposed facilities that form part of the Britstown Wind Farm Cluster is expected to contribute to the increased lighting and light pollution in an otherwise natural area increasing the cumulative visual impact of renewable energy facilities in the region.
Residual impacts: The visual impact will be removed after decommissioning, provided the facility and ancillary infrastructure is removed. Failing this, the visual impact will remain.

9.2.7. POTENTIAL VISUAL IMPACT OF SHADOW FLICKER ON SENSITIVE VISUAL RECEPTORS IN CLOSE PROXIMITY TO THE PROPOSED DEVELOPMENT

Shadow flicker only occurs when the sky is clear, and when the turbine rotor blades are between the sun and the receptor (i.e. when the sun is low). De Gryse in Scenic Landscape Architecture (2006) found that "most shadow impact is associated with 3-4 times the height of the object". Based on this research, a 1km zone around each turbine has been identified as the zone within which there is a risk of shadow flicker occurring.

One homestead, Gemsbokdam, is located within the 1km buffer. Of note is that this homestead is located on a property involved in this development, thereby reducing the probability of this impact occurring. It is expected that motorists travelling along roads within the 1km zone of a turbine could potentially experience shadow flicker, however the shadow flicker experienced by these motorists will be fleeting and not constitute a shadow flicker visual impact of concern.

The significance of shadow flicker is therefore anticipated to be **high** before mitigation and **moderate** post mitigation.

Table 9: Impact table summarising the significance of shadow flicker on sensitive receptors in close proximity to the proposed development

Nature of Impact: Visual impact of shadow flicker on sensitive receptors in close proximity to the proposed development		
	No mitigation	***Mitigation considered***
Extent	Neighbourhood **(4)**	Neighbourhood **(4)**
Duration	Long **(4)**	Long **(4)**
Magnitude	High **(8)**	Moderate **(6)**
Probability	Highly Probable **(4)**	Probable **(3)**
Significance	High **(64)**	Moderate **(42)**
Status (positive or negative)	Negative	Negative
Reversibility	Recoverable **(3)**	Recoverable **(3)**
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	No	
Mitigation potential	Difficult	
Mitigation / Management: Planning & operation: ➢ Adjust wind turbine locations to reduce the number of receptors likely to experience shadow flicker. ➢ Consult with participating landowners or identified receptors who may experience shadow flicker impacts to identify feasible and reasonable management and mitigation measures, should they be required. ➢ Installation of screening structures and/ or planting of trees to block shadows cast by the turbines on the identified affected receptors. Investigate the use of turbine control strategies which shut down the offending turbines when shadow flicker is likely to occur on identified receptors is investigated.		
Residual impacts: The visual impact will be removed after decommissioning, provided the facility and ancillary infrastructure is removed. Failing this, the visual impact will remain.		

9.2.8. ANCILLARY INFRASTRUCTURE

On-site ancillary infrastructure associated with the Soyuz 3 WEF includes a permanent laydown area, Battery Energy Storage System (BESS), internal overhead lines between the substations, permanent met masts, three on-site substations, access roads to and between project components inclusive of stormwater infrastructure, as well as operation and maintenance buildings, including a gate house, security building, control centre, offices, warehouses and workshops, etc. No dedicated viewshed analyses have been generated for the ancillary infrastructure, as the range of visual exposure will fall within (and be overshadowed by) that of the turbines.

The anticipated visual impact resulting from this infrastructure is likely to be of **moderate** significance both before and after mitigation.

Table 10: Impact table summarising the visual impact of the ancillary infrastructure

Nature of Impact: Visual impact of ancillary infrastructure on observers in close proximity to the proposed development		
	No mitigation	***Mitigation considered***
Extent	Neighbourhood **(4)**	Neighbourhood **(4)**
Duration	Long **(4)**	Long **(4)**
Magnitude	Moderate **(6)**	Moderate **(6)**
Probability	Probable **(3)**	Probable **(3)**
Significance	Moderate **(42)**	Moderate **(42)**
Status (positive or negative)	Negative	Negative
Reversibility	Recoverable **(3)**	Recoverable **(3)**
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	No	
Mitigation potential	Difficult	
Mitigation / Management: Planning: ➢ Retain/re-establish and maintain natural vegetation in all areas outside of the development footprint/servitude, but within the project site. Operations: ➢ Maintain the general neat and tidy appearance of the infrastructure. Decommissioning: ➢ Remove infrastructure not required for the post-decommissioning use. Rehabilitate all areas. Consult an ecologist regarding rehabilitation specifications.		
Residual impacts: The visual impact will be removed after decommissioning, provided the facility and ancillary infrastructure is removed. Failing this, the visual impact will remain.		

9.3. SECONDARY IMPACTS

9.3.1. POTENTIAL VISUAL IMPACT OF FACILITY OPERATIONS ON THE VISUAL CHARACTER OF THE LANDSCAPE AND SENSE OF PLACE OF THE REGION

Sense of place refers to a unique experience of an environment by a user, based on his or her cognitive experience of the place. Visual criteria and specifically the visual character of an area (informed by a combination of aspects such as topography, level of development, vegetation, noteworthy features, cultural / historical features, etc.) play a significant role.

A visual impact on the sense of place is one that alters the visual landscape to such an extent that the user experiences the environment differently, and more specifically, in a less appealing or less positive light.

In general, the landscape character of the greater study area and site itself presents as rural in character with wide open, undeveloped landscapes. The visual quality of the region is generally high with tracts of intact vegetation as well as, hills and rocky outcrops characterising most of the visual environment. As such, the entire study area is considered sensitive to visual impacts due to its generally low levels of transformation.

The anticipated visual impact on the visual character and sense of place of the study area is expected to be of **high** significance. No mitigation is possible within this environment and for a facility of this scale, but measures have been included as best practice guidelines. The table below illustrates the assessment of this anticipated impact.

Table 11: Impact table summarising the significance of visual impacts of facility operations on landscape character and sense of place within the region

Nature of Impact: Visual impact of the proposed development on the visual quality of the landscape and sense of place of the region		
	No mitigation	***Mitigation considered***
Extent	Region **(1)**	Region **(1)**
Duration	Long **(4)**	Long **(4)**
Magnitude	Very high **(10)**	Very high **(10)**
Probability	Definite **(5)**	Definite **(5)**
Significance	High **(75)**	High **(75)**
Status (positive or negative)	Negative	Negative
Reversibility	Reversible **(1)**	Reversible **(1)**
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	No	
Mitigation potential	Very Difficult	
Mitigation / Management: Planning: ➢ Retain / re-establish and maintain natural vegetation in all areas outside of the development footprint. ➢ Plan ancillary infrastructure in such a way and in such a location that clearing of vegetation is minimised. ➢ Use existing roads wherever possible. Where new roads are required to be constructed, these should be planned carefully, taking due cognisance of the local topography. Roads should be laid out along the contour wherever possible, and should never traverse slopes at 90 degrees. Construction of roads should be undertaken properly, with adequate drainage structures in place to forego potential erosion problems. Construction: ➢ Rehabilitate all construction areas. ➢ Ensure that vegetation is not cleared unnecessarily to make way for infrastructure. Operations: ➢ Maintain the general neat and tidy appearance of the facility as a whole. ➢ Monitor rehabilitated areas, and implement remedial action as and when required. Decommissioning: ➢ Remove infrastructure not required for the post-decommissioning use of the site. ➢ Rehabilitate all areas. Consult an ecologist regarding rehabilitation specifications. ➢ Monitor rehabilitated areas post-decommissioning and implement remedial actions.		
Cumulative impacts: The construction and operation of the Soyuz 3 WEF (75 turbines) together with the other five proposed facilities that form part of the Britstown Wind Farm Cluster is expected to contribute to the increased cumulative visual impact of renewable energy facilities in the region.		
Residual impacts: The visual impact will be removed after decommissioning, provided the facility and ancillary infrastructure is removed. Failing this, the visual impact will remain.		

9.3.2. POTENTIAL CUMULATIVE VISUAL IMPACT OF WIND ENERGY FACILITIES WITHIN THE REGION

It is a requirement that a visual specialist identify and quantify the cumulative visual impacts of a proposed development, propose potential mitigating measures and conclude if the proposed development will result in any acceptable loss of visual resources taking into consideration the other proposed and operational projects in the area. A cumulative visual impact can be defined as the combined or incremental effects resulting from changes caused by a proposed development in conjunction with other existing or proposed activities. The cumulative impact assessed in the table below will consist of the combined impact of the proposed Soyuz 3 WEF and the five other proposed facilities that form part of the Britstown Wind Farm Cluster.

Cumulative visual impacts may be experienced as a result of where a combination of several WEF's turbines is within a receptors line of sight at the same time, where the receptor has to turn their head to see several of the turbines of the different WEF's or when the receptor has to move from one viewpoint to another to either see different developments or different views of the same development (such as when travelling along a road).

The cumulative visual impact is not just the totality of the impacts of two developments. The combined impact may be greater than the sum of the two individual developments, or in rare cases even less. The cumulative visual impact is assessed as the product of the distance between the individual WEFs (or turbines), the total distance over which the turbines are visible, the general character of the landscape and its sensitivity to that specific typology of development, the location and design of the WEFs themselves and lastly the way in which the landscape is experienced by the sensitive receptors.

The table below illustrates the assessment of the anticipated cumulative visual impact of infrastructure on sensitive visual receptors within the region. The cumulative visual impacts are likely to be of **high** significance when the proposed Soyuz 3 WEF and the five other proposed facilities that form part of the Britstown Wind Farm Cluster are in operation.

Table 12: Impact table summarising the significance of the cumulative visual impact of the proposed Soyuz 3 WEF and the other proposed facilities of the Britstown Wind Farm Cluster on sensitive visual receptors within the region

Nature of Impact: The potential cumulative visual impact of the proposed Soyuz 3 WEF and the five other proposed facilities that form part of the Britstown Wind Farm Cluster on sensitive visual receptors within the region		
	Overall impact of the proposed project considered in isolation	***Cumulative impact of the project and other projects in the area***
Extent	Region **(1)**	Region **(1)**
Duration	Long **(4)**	Long **(4)**
Magnitude	High **(8)**	Very High **(10)**
Probability	Highly Probable **(4)**	Definite **(5)**
Significance	Moderate **(52)**	High **(75)**
Status (positive or negative)	Negative	Negative
Reversibility	Reversible **(1)**	Reversible **(1)**
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	No	
Mitigation potential	Very Difficult	
Mitigation / Management: Not Applicable		
Residual impacts: The visual impact will be removed after decommissioning, provided the facility and ancillary infrastructure is removed. Failing this, the visual impact will remain.		

9.4. THE POTENTIAL TO MITIGATE VISUAL IMPACTS

The primary visual impact, namely the appearance of the Wind Energy Facility (the wind turbines) is not possible to mitigate. The functional design of the turbines cannot be changed in order to reduce visual impacts.

Alternative colour schemes (i.e., painting the turbines sky-blue, grey or darker shades of white) are not permissible as the CAA's *Marking of Obstacles* expressly states, "*Wind turbines shall be painted bright white to provide the maximum daytime conspicuousness*". Failure to adhere to the prescribed colour specifications will result in the fitting of supplementary daytime lighting to the wind turbines, once again aggravating the visual impact.

The overall potential for mitigation is therefore generally low or non-existent. The following mitigations are however possible:

- Retain / re-establish and maintain natural vegetation in all areas outside of the development footprint.
- Plan ancillary infrastructure (i.e., substation and workshop) in such a way and in such a location that clearing of vegetation is minimised. Consolidate existing infrastructure as much as possible, and make use of already disturbed areas rather than pristine sites wherever possible.
- Use existing roads wherever possible. Where new roads are required to be constructed, these should be planned carefully, taking due cognisance of the local topography. Roads should be laid out along the contour wherever possible, and should never traverse slopes at 90 degrees. Construction of roads should be undertaken properly, with adequate drainage structures in place to forego potential erosion problems.
- Access roads, which are not required post-construction, should be ripped and rehabilitated.
- The Civil Aviation Authority (CAA) prescribes that aircraft warning lights be mounted on the turbines. However, it is possible to obtain permission to mount these lights on the turbines representing the outer perimeter of the facility. In this manner, fewer warning lights can be utilised to delineate the facility as one large obstruction, thereby lessening the potential visual impact. It is therefore recommended that the possibility of this be investigated.
- Install aircraft warning lights that only activate when the presence of an aircraft is detected, if permitted by CAA.

- Mitigation of visual impacts associated with the construction phase, albeit temporary, entails proper planning, management and rehabilitation of all construction sites. Construction should be managed according to the following principles:

  - Ensure that vegetation is not unnecessarily cleared or removed during the construction period.
  - Reduce the construction period through careful logistical planning and productive implementation of resources.

- Plan the placement of lay-down areas and temporary construction equipment camps in order to minimise vegetation clearing (i.e., in already disturbed areas) wherever possible.
- Restrict the activities and movement of construction workers and vehicles to the immediate construction site and existing access roads.
- Ensure that rubble, litter, and disused construction materials are appropriately stored (if not removed daily) and then disposed regularly at licensed waste facilities.
- Reduce and control construction dust through the use of approved dust suppression techniques as and when required (i.e., whenever dust becomes apparent).
- Restrict construction activities to daylight hours in order to negate or reduce the visual impacts associated with lighting.
- Ensure that all infrastructure and the site and general surrounds are maintained and kept neat.
- Rehabilitate all disturbed areas, construction areas, roads, slopes etc. immediately after the completion of construction works. If necessary, an ecologist should be consulted to assist or give input into rehabilitation specifications.
- Monitor all rehabilitated areas for at least a year for rehabilitation failure and implement remedial action as required. If necessary, an ecologist should be consulted to assist or give input into rehabilitation specifications.

- Mitigation of other lighting impacts includes the pro-active design, planning and specification lighting for the facility. The correct specification and placement of lighting and light fixtures will go far to contain rather than spread the light. Additional measures include the following:

  - Shielding the sources of light by physical barriers (walls, vegetation, or the structure itself);
  - Limiting mounting heights of lighting fixtures, or alternatively using foot-lights or bollard level lights;
  - Making use of minimum lumen or wattage in fixtures;
  - Making use of down-lighters, or shielded fixtures;
  - Making use of Low-Pressure Sodium lighting or other types of low impact lighting.
  - Making use of motion detectors on security lighting. This will allow the site to remain in relative darkness, until lighting is required for security or maintenance purposes.

- Mitigation of show flicker impacts of concern:

  - Adjust wind turbine locations to reduce the number of receptors likely to experience shadow flicker.
  - Consult with participating landowners or identified receptors who may experience shadow flicker impacts to identify feasible and reasonable management and mitigation measures, should they be required.
  - Installation of screening structures and/ or planting of trees to block shadows cast by the turbines on the identified affected receptors.
  - Investigate the use of turbine control strategies which shut down the offending turbines when shadow flicker is likely to occur on identified receptors is investigated.

- During Operations, monitor the general appearance of the facility as a whole, as well as all rehabilitated areas.
  - The maintenance of the turbines and ancillary structures and infrastructure will ensure that the facility does not degrade, thus aggravating visual impact. Implement remedial action where required.
  - Where sensitive visual receptors are likely to affected, it is recommended that the developer enter into negotiations regarding the potential screening of visual impacts at the receptor site. This may entail the planting of vegetation, trees or even the construction of screens. Ultimately, visual screening is most effective when placed at the receptor itself.
  - Roads must be maintained to forego erosion and to suppress dust, and rehabilitated areas must be monitored for rehabilitation failure. Remedial actions must be implemented as a when required.

- After decommissioning, all infrastructure should be removed and all disturbed areas appropriately rehabilitated. Monitor rehabilitated areas post-decommissioning and implement remedial actions and consult an ecologist regarding rehabilitation specifications if necessary.

The possible mitigation of both primary and secondary visual impacts as listed above should be implemented and maintained on an on-going basis.

10. SUMMARY OF VISUAL IMPACTS ASSESSED

In light of the results and findings of the Visual Impact Assessment undertaken for the Soyuz 3 WEF proposed, it is acknowledged that the receiving environment will be significantly visually transformed for the entire operational lifespan of the facility.

The following is a summary of the impacts assessed:

- The potential visual impact of construction on sensitive visual receptors in close proximity to the facility is likely to be of **high** significance before mitigation and **moderate** significance post mitigation.
- The potential visual impact of facility operations on sensitive visual receptors in close proximity (within 5km) to the proposed facility is likely to be of **very high** significance. No mitigation is possible for a facility of this scale.
- The potential visual impact of facility operations on sensitive visual receptors within the local area (between 5 - 10km offset) to the proposed facility is likely to be of **high** significance. No mitigation is possible for a facility of this scale.
- The potential visual impact of facility operations on sensitive visual receptors within the district (between 10 - 20km offset) to the proposed facility is likely to be of **moderate** significance. No mitigation is possible for a facility of this scale.
- The potential visual impact of facility operations on sensitive visual receptors within the region (beyond the 20km offset) to the proposed facility is likely to be of **low** significance. No mitigation is possible for a facility of this scale.
- The anticipated visual impact of operational lighting at night on sensitive visual receptors within the study area is likely to be of **high** significance and may be mitigated to **moderate** should the possible best practice mitigation measures be implemented and approval for changes to the CAA lighting is approved.
- The expected visual impact of shadow flicker on sensitive receptors in close proximity to the proposed development is likely to be of **high** significance before mitigation and **moderate** significance post mitigation.
- The expected visual impact of ancillary infrastructure on sensitive receptors in close proximity to the proposed development is likely to be of **moderate** significance.
- The potential visual impact of the proposed facility operations on the visual quality of the landscape and sense of place of the region is likely to be of **high** significance. No mitigation is possible for a facility of this scale.
- The cumulative visual impacts are likely to be of **high** significance when the proposed Soyuz 3 WEF and the five other proposed facilities that form part of the Britstown Wind Farm Cluster within the study area are in operation.

11. CONCLUSION AND RECOMMENDATIONS

The visual assessment indicates that the construction and operation of the proposed **Soyuz 3 WEF** will have an overall high visual effect on both the rural landscape and on sensitive receptors in the study area. The visual impact will differ amongst places, depending on the distance from the facility, but it is expected to be of the highest significance within (but not restricted to) a 5km radius of the proposed facility. Within this distance it will generally be restricted to residents of homesteads, as well as observers travelling along the various roads in the area (i.e. N12 and R398). This is largely due to the relatively close distance between the observers and the wind turbines, as well as the generally flat topography.

Overall, the significance of the visual impacts is predominately **moderate** to **high,** as a result of the generally rural character of the landscape and the fair number of homesteads located within the study area (increasing the number of sensitive receptors affected). A significance of **very high** is expected on sensitive receptors in close proximity (within 5km) of the proposed facility during the operational phase. Some impacts, post mitigations (if applicable), are expected to of **high** significant (visual impacts on sensitive receptors within the local area between 5 - 10km offset, visual quality of the landscape and the cumulative impact), **moderate** significance (visual impacts of construction, on sensitive receptors within the within the district between 10 - 20km offset, lighting at nights, shadow flicker and ancillary infrastructure) and others **low** significance (visual impacts on sensitive receptors within the region beyond the 20km offset). The facility would be visible within an area that contains certain sensitive visual receptors who would consider visual exposure to this type of infrastructure to be intrusive. Such visual receptors include people travelling along roads and residents of the homesteads scattered throughout the region.

The areas of higher cumulative visual exposure (especially along the plains) contain sensitive visual receptors in the form of residents of homesteads and observers travelling along the national (N12), arterial (R398) and secondary roads traversing the plains. It is expected that should all 450 wind turbines of the Britstown Wind Farm Cluster be constructed; the potential cumulative visual impacts may range from moderate (where observers are absent i.e. vacant natural land) to high significance (where observers are present i.e. at homesteads and along roads).Additionally, since only a limited number of other REFs are located within the study area it is not expected that these smaller facilities will further contribute to the expected cumulative visual impact of the Britstown Wind Farm Cluster. Should the Britstown Wind Farm Cluster be constructed then these facilities will most likely be experienced as one facility by observers in the area. The overall cumulative visual impact of Britstown Wind

Farm Cluster is therefore ultimately expected to be of **high** significance on the region due to the very large surface area it covers, its remote location, as well as the sensitivity of the identified receptors to this kind of development.

This study found that fifteen (15) turbines, located on the central portion of the **Soyuz 1 WEF** adjacent to the R398 are likely to have a shadow flicker impact on motorists using this portion of the R398. Other areas to potentially be impacted on by shadow flicker are loacted along the internal farm roads located in the designated development properties. These roads are likely to be affected by the six (6) turbines shaded in purple. 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.

Conventional mitigation (e.g., such as screening of the structures) of the potential visual impacts is highly unlikely to succeed due to the nature of this type of development (tip height exceeding 260m) and the receiving environment. However, a number of best practice mitigation measures have been proposed (Section 9.4) in order to limit the impacts that can be mitigated. Additionally, irrespective of whether or not mitigation measures will reduce the significance of the anticipated visual impacts, they are considered to be best practice and should all be implemented and maintained throughout the construction, operation and decommissioning phases of the proposed facility, should it be authorized. Impacts deemed possible to mitigate are general lighting of the facility and the construction activities on sensitive receptors in close proximity of the proposed facility.

In order to ensure that all the spatial analyses and mapping undertaken in this report is as accurate as possible, a transparent and scientifically defensible approach, in line with best practice methodology for this type of assessment, has been utilised. The objective of this process is to quantify the potential visual impacts associated with the proposed Soyuz 3 WEF, using visibility analyses, proximity analyses and the identification of sensitive receptors. However, it must be noted that visual impact is a very subjective concept, personal to each individuals' backgrounds, opinions and perceptions. The subjects in this case are the identified sensitive receptors such as the residents of the homesteads, observers travelling along public roads and visitors to the region.

According to the Provincial Government of the Western Cape, Department of Environmental Affairs and Development Planning (DEA&DP) Guideline for Involving Visual and Aesthetic Specialists in the EIA Process (Oberholzer, 2005), the criteria that determine whether or not a visual impact constitutes a potential fatal flaw are categorised as follows:

1. Non-compliance with Acts, Ordinances, By-laws and adopted policies relating to visual pollution, scenic routes, special areas or proclaimed heritage sites.
2. Non-compliance with conditions of existing Records of Decision.
3. Impacts that may be evaluated to be of high significance and that are considered by the majority of the stakeholders and decision-makers to be unacceptable.

In terms of the above and to the knowledge of the author the proposed development is compliant with all Acts, Ordinances, By-laws and adopted policies relating to visual pollution, scenic routes, special areas or proclaimed heritage sites, as well as conditions of existing Records of Decisions.

Since no reported objections from stakeholders or decision-makers within the region regarding the visual impacts have been received by the EAP (during the scoping phase), this assessment has adopted a risk averse approach by assuming that the perception of most (if not all) of the sensitive visual receptors (bar the landowners of the properties earmarked for the development), would be predominantly negative towards the development of a WEF in the region. While still keeping in mind that there are also likely to be supporters of the Soyuz 3 WEF (as renewable energy generation is a global priority) amongst the population of the larger region, they are largely expected to be indifferent to the construction of the WEF and not as vocal in their support for the wind farm as the detractors thereof.

In spite of the predominantly high residual ratings (as assessed in Section 9) and the likelihood that the proposed development could be met with concern and objections from some of the affected sensitive receptors and landowners in the region, this report cannot categorically state that any of the above conditions were transgressed. Therefore, the visual impacts are not considered to be a fatal flaw for a development of this nature. It is recommended that the proposed Soyuz 3 WEF, as per the assessed layout be supported from a visual perspective, subject to the implementation of the suggested best practice mitigation measures, as provided in this report.

12. REFERENCES

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