Proposed Loxton Wind Energy Facility 1
Northern Cape Province

for Loxton Wind Energy 1 (Pty) Ltd

Visual Impact Assessment

30 April 2023

Prepared for
Arcus Consultancy Services South Africa (Pty) Ltd

Prepared by
Quinton Lawson Architect
Bernard Oberholzer Landscape Architect

NEMA requirements for Specialist Reports		
	Specialist Report content as required by the NEMA 2014 EIA Regulations, as amended	**Section**
1 (1)(a)	(i) the specialist who prepared the report; and	Appendix A
	(ii) the expertise of that specialist to compile a specialist report including a curriculum vitae;	
(b)	a declaration that the specialist is independent in a form as may be specified by the competent authority;	Appendix D
(c)	an indication of the scope of, and the purpose for which, the report was prepared;	Sections 1 and 2
(cA)	an indication of the quality and age of the base data used for the specialist report;	Section 3
(cB)	a description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change;	Sections 9 and 12
(d)	the duration, date and season of the site investigation and the relevance of the season to the outcome of the assessment;	Section 3
(e)	a description of the methodology adopted in preparing the report or carrying out the specialised process, inclusive of equipment and modelling used;	Section 3
(f)	details of an assessment of the specific identified sensitivity of the site related to the proposed activity or activities and its associated structures and infrastructure, inclusive of a site plan identifying site alternative;	Sections 9, 10, 11 and maps
(g)	an identification of any areas to be avoided, including buffers;	Section 9
(h)	a map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers;	Maps 9-10
(i)	a description of any assumptions made and any uncertainties or gaps in knowledge;	Section 4
(j)	a description of the findings and potential implications of such findings on the impact of the proposed activity, or activities;	Section 14
(k)	any mitigation measures for inclusion in the EMPr;	Section 13
(l)	any conditions for inclusion in the environmental authorisation;	Sections 14
(m)	any monitoring requirements for inclusion in the EMPr or environmental authorisation;	Section 13
(n)	a reasoned opinion-	Section 14
	(i) whether the proposed activity or portions thereof should be authorised; and	
	(iA) regarding the acceptability of the proposed activity or activities; and	
	(ii) if the opinion is that the proposed activity or portions thereof should be authorised, any avoidance, management and mitigation measures that should be included in the EMPr, and where applicable, the closure plan;	
(o)	a description of any consultation process that was undertaken during the course of preparing the specialist report;	Refer to EAP
(p)	a summary and copies of any comments received during any consultation process and where applicable all responses thereto; and	Refer to EAP
(q)	any other information requested by the competent authority.	N/A
2	Where a government notice gazetted by the Minister provides for any protocol or minimum information requirement to be applied to a specialist report, the requirements as indicated in such notice will apply.	Verification map included in Appendix C.

Contents

Abbreviations and Glossary

List of Abbreviations

BESS	Battery Energy Storage System
DFFE	Department of Forestry, Fisheries and Environment
EIA	Environmental Impact Assessment
EMPr	Environmental Management Programme
GN	Government Notice
MTS	Main transmission station
NEMA	National Environmental Management Act
O&M	Operations and maintenance
OHPL	Overhead powerline
PPP	Public participation process
REDZ	Renewable Energy Development Zone
REEA	Renewable Energy EIA Application Database
VIA	Visual Impact Assessment
WEF	Wind energy facility

Glossary

Definitions	
Receptor	Individuals, groups or communities who are subject to the visual influence of a particular project.
Viewpoint	A selected point in the landscape from which views of the project are ascertained.
Viewshed	The outer boundary defining a view catchment area, used to determine the zone of visual influence.
View shadow	An area within the view catchment visually obscured from the project, usually by topography.
Visual absorption capacity	The ability of an area to visually absorb development by means of screening topography, vegetation or buildings.

1 Introduction

The applicant, Loxton Wind Facility 1 (Pty) Ltd, is proposing the development of a commercial Wind Energy Facility (WEF) and associated infrastructure on a site located approximately 18 km north-east of Loxton within the Ubuntu Local Municipality and the Pixley Ka Seme District Municipality in the Northern Cape Province. Two additional WEFs are concurrently being considered on the surrounding properties by the same developer, and are being assessed by way of separate impact assessment processes. These projects are known as Loxton WEF 2 and Loxton WEF 3.

A preferred project site with an extent of approximately 52 000 ha has been identified as a technically suitable area for the development of the three WEF projects. Loxton WEF 1 will comprise up to 42 turbines, Loxton WEF 2 up to 62 turbines and Loxton WEF 3 up to 38 turbines. Loxton WEF 1 and Loxton WEF 3 will each have a contracted capacity of up to 240 MW with a permanent footprint of up to 65ha whereas Loxton WEF 2 will comprise of up to 62 turbines with a contracted capacity of up to 480 MW and permanent footprint of up to 110ha. (Loxton Wind Energy 1 (Pty) Ltd, February 2023). A layout of the Loxton WEF 1 is indicated on **Map 6**.

The Visual Impact Assessment (VIA) involves the identification of visual / scenic features, potential sensitive receptors, and visual sensitivity mapping. Earlier visual screening and scoping studies, and fieldwork, were undertaken as part of the visual assessment.

2 Terms of Reference

The terms of reference for the visual specialist study includes the following:

- Site Visit
- Desktop Screening
- Sensitivity mapping and/or modelling
- Defining the legal, planning and policy context
- Description of the Baseline Environment
- Determination of potential impacts (direct, indirect, cumulative)
- Determination of residual risks
- Recommendation and input into project design
- Input into the Management Plan / Monitoring Programme
- Sensitivity Verification Reporting in terms of the Gazetted specialist protocols (GN R 320 and GN R 1150 of 2020).
- Incorporation of public comment following PPP
- Mitigation measures to avoid or minimise potential negative visual impacts.
- Cumulative visual impacts in relation to other existing and proposed wind energy facilities in the area.

Specialist Reports need to comply with the requirement of Government Notice (GN) 43110 of the National Environmental Management Act (NEMA), 1998 as amended.

3 Methodology

The visual assessment methodology included the following steps:

- A 3D digital terrain model of the study area was prepared in order to determine the viewshed of the project, based on the layout provided by Loxton Wind Energy 1 (Pty) Ltd.
- Potential sensitive receptors, such as farmsteads along the route, were identified using the viewshed map, Google Earth and a site visit.
- Landscape features and sensitive receptors were mapped together with recommended buffers for wind turbines, buildings, roads and powerlines.
- Field work was used to verify the existence and significance of landscape features and receptors in order to refine the visual mapping layers.
- A photographic record was made with the emphasis on views from potential sensitive receptors (mainly surrounding farmsteads and guest farms) at varying distances.

- Panoramic photographs, including their GPS positions, were used to create photomontages.
- Potential visual impacts relating to the proposed WEF for construction, operational and decommissioning phases of the project were assessed along with their relative significance.
- Mitigation measures to avoid or minimise potential negative visual impacts were formulated.
- Cumulative visual impacts in relation to other existing and proposed wind energy facilities and grids in the area were assessed.
- Impact significance ratings were determined based on the methodology provided by Arcus.

Field Work:

A site visit was carried out from 19 to 21 September 2022. The track used during the fieldwork is indicated on **Map 5**. The season was not a consideration for the visual assessment, but clear visibility was required for the photographic survey.

4 Assumptions and Limitations

Assumptions have been made regarding the footprint and height of the proposed substation (including the associated BESS facility) and operation and management (O&M) buildings, relating to the proposed project as detailed design of these would only become available at a later stage.

5 Legal Requirements and Guidelines

Legal and policy documents relating to visual and scenic resources are described below. These tend to fall under the National Heritage legislation, the natural heritage being part of the 'national estate', and therefore the VIA Report needs to be read in conjunction with the Heritage Impact Assessment (HIA).

National Heritage Resources Act (Act 25 of 1999 NHRA)	The Act includes protection of national and provincial heritage sites, as well as areas of environmental or cultural value, and proclaimed scenic routes. Natural heritage, including scenic resources, form part of the 'national estate'.
Provincial Government of the Western Cape 2005: Guideline for Involving Visual and Aesthetic Specialists in EIA Processes. B. Oberholzer.	A guideline document for specialist visual input with respect to determining potential visual impacts, along with criteria for rating the significance of impacts.
CSIR, 2018. Draft National Wind and Solar SEA Phase 2: Visual and Scenic Resources Chapter, B. Oberholzer and Q. Lawson.	Phase 2 Wind and Solar PV SEA provides a high-level visual assessment of focus areas, building on the previous Phase 1 Wind and Solar PV SEA, 2015.

6 Project Description

The Loxton WEF 1 project site covers approximately 7 600 ha and a permanent footprint of 65 ha, and is proposed to accommodate the following infrastructure, which will enable the wind farm to supply a contracted capacity of up to 240 MW:

- Up to 42 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 with a permanent footprint 5,5ha;
- Each turbine will have a crane hardstand of 70m x 45m. The permanent footprint for turbine hardstands will be up to 12ha.
- Each turbine will have a temporary blade hardstand of 80m x 45m. The temporary footprint for blade hardstands will be up to 14ha.
- Temporary laydown areas (with a combined footprint of up to 23ha) which will accommodate the boom erection, storage and assembly area;
- Battery Energy Storage System (with a footprint of up to 5ha);

- 33 kV cables/powerlines from the turbines to the facility substation, to follow existing/proposed access roads and laid underground where possible;
- An on-site substations of up to 2ha in extent to facilitate the connection between the wind farm and the electricity grid;
- Access roads to the site and between project components inclusive of stormwater infrastructure. A 15m road corridor may be temporarily impacted upon during construction and rehabilitated to 8m wide after construction. The WEF will have a total road network of up to 50km.
- A temporary site camp establishment and concrete batching plants (with a combined footprint of up to 2ha); and
- Operation and Maintenance buildings (with a combined footprint of up to 2ha) including a gate house, security building, control centre, offices, warehouses, a workshop and storage area.

Grid Connection:

The Electrical Grid Infrastructure (EGI) associated with the Loxton WEF considers a 300m wide corridor route from the Loxton Switching Station/Collector Station to the Gamma MTS. The EGI is located within the Central Strategic Powerline Corridor and therefore subject to a Basic Assessment process in accordance with GN 113 of 16 February 2018 listed under NEMA, 1998.

7 Description of the Study Area

A brief description of the landscape and scenic features of the study area is given below.

Landscape setting

The proposed wind energy facilities would be located in the Great Karoo to the north of the town of Loxton. The site lies east of the R63 Provincial Main Road, between Loxton and Carnarvon.

It is an expansive semi-arid landscape, with widely scattered farmsteads. The large farms mainly support merino sheep, and occasionally dorper sheep, goats and horses, as well as game, mainly small antelope.

Geology and landforms

The landscape in this part of the Great Karoo has been eroded over time, the once deeply buried Beaufort Group mudstones and sandstones and the dolerite intrusions having been exposed to form the present-day Karoo landscape (**Map 4**).

The regional plateau is characterised by horizontal sills and dykes of erosion-resistant dolerite forming steep slopes in places, boulder-strewn *mesas* and flat-topped *koppies* that are the main scenic features of the study area. The gentler, lower hillslopes and plains consist of more easily weathered mudstone, with occasional narrow ledges of harder sandstone. The flattish plains are at around 1400-1500 m elevation, and the dolerite ridges and mesas around 1600 m elevation in the study area (**Map 3**).

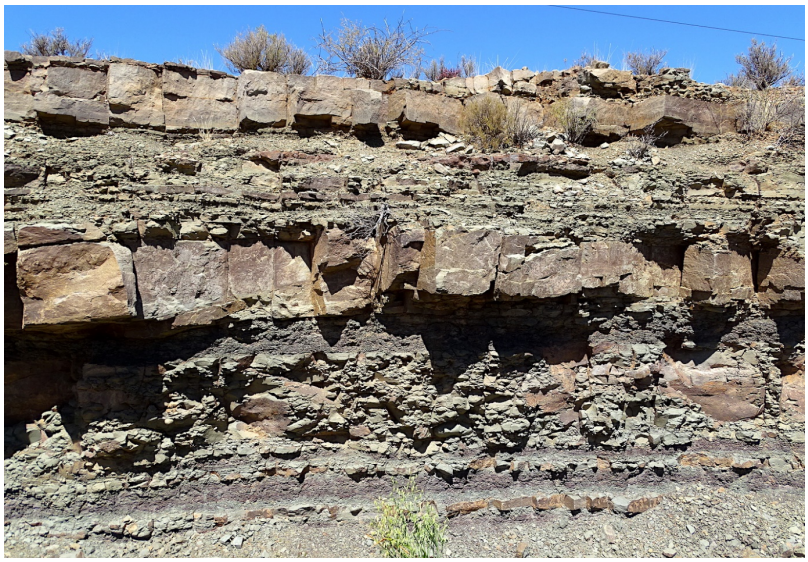


Figure 1: A road cut showing the sandstone, shale and mudstone of the Beaufort Group of rocks

Vegetation cover

The vegetation of the Upper Karoo Bioregion is a response to the geology and relatively low rainfall, which occurs mainly in summer. The *Eastern Upper Karoo (NKu4)* vegetation type on the Beaufort Group mudstones and sandstones covers most of the study area, and consists largely of dwarf shrubland, along with grasses and succulent shrubs in places.

The *Upper Karoo Hardeveld (NKu2)* vegetation type covers smaller areas, occurring on the dolerite crests and steep slopes, often among large boulders. It consists of a grassy dwarf Karoo shrubland (Mucina and Rutherford, 2006).

Figure 2: Grassland and dwarf shrubs of the Upper Karoo near Lushof.

Land use

There are a number of scattered farmsteads within the site and in the surroundings within the viewshed. The farmsteads are on average 5 to 10km+ apart, linked by narrow gravel roads. The farms are generally extensive in area and support mainly sheep farming and game. Game farms in the area offer farm stay and safaris, such as Osfontein north of the site. Loxton is the nearest town, being about 18 km from the nearest currently proposed wind turbines.

Sense of place

The flat-topped hills and dolerite ridges are a characteristic feature of the Great Karoo in an otherwise fairly featureless, parched landscape, an area noted mainly for its empty, uncluttered landscapes, stillness, red sunsets, dark nights and starry skies.

Springbok and many other smaller antelope roam free on game farms, the isolated farmsteads forming green oases in the semi-arid landscape.

Figure 3: Rondom farmstead looking west, 7,63 km from the proposed Loxton WEF 1. Wind turbines would be partly visible to the east.

Figure 4: Request farmstead looking west, 5,63 km from the proposed Loxton WEF 1. Wind turbines would be partly visible to the west.

Figure 5: Osfontein guest farm looking south, 5,78 km from the proposed Loxton WEF 1. The wind turbines would be partly visible to the south and south-east.

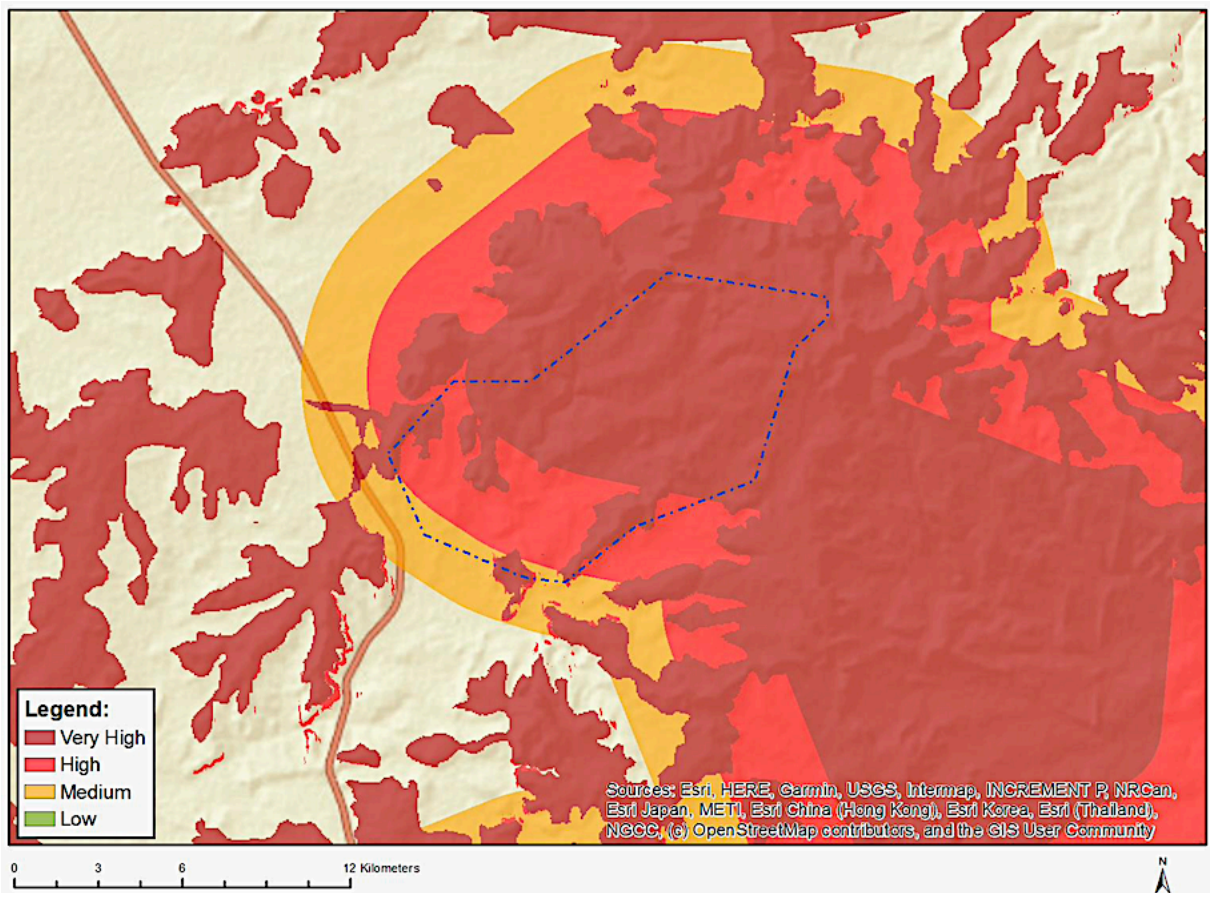
Figure 6: Elandsberg farmstead looking south, 5,67 km from the proposed Loxton WEF 1. Wind turbines would be partly visible to the south.

Figure 7: De Cypher farmstead looking east, 2,11 km from the proposed Loxton WEF 1. Wind turbines would be partly visible to the south and south-west.

8 Site Sensitivity Verification

The downloaded screening tool map of the study area, (DFFE, October 2022), includes a landscape / visual theme for the proposed site, with a landscape / visual specialist impact assessment being required as part of the EIA process.

The DFFE's Map of Relative Landscape Sensitivity for wind energy is indicated in Figure 8 below. As is often the case, the sensitivity mapping on which the screening tool is based is regional in scale and is therefore disputed based on the more detailed visual sensitivity mapping prepared by the visual specialists at the local project scale, as indicated on **Maps 9, 10** and 11.



Sensitivity	Feature(s)
High	Slope between 1:4 and 1:10
High	Between 2 and 5 km of a game farm
Low	Slope less than 1:10
Medium	Between 5 and 7 km of a game farm
Very High	Mountain tops and high ridges
Very High	Slope more than 1:4
Very High	Game farm
Very High	Within 2 km of a game farm

Figure 8: Map and legend of Relative Landscape (Wind) Theme Sensitivity (DFFE Screening Tool Map October 2022)

9 Visual Sensitivity Mapping

Visibility

Viewpoints visited during the field trip are listed in Table 1 below, and indicated on **Map 5**. These are based on potentially sensitive receptors, being mainly surrounding farmsteads and guest farms. In addition, the viewpoints were selected to represent a range of distances from the proposed WEF to give an idea of the relative visibility of the wind turbines.

Degrees of visibility would depend on the number of turbines in the view field and their position in the landscape, as well as on foreground screening provided by topography or trees. See Figure 9 for a comparison of visibility of turbines at various distances.

Table 1: Viewpoints: Farmsteads Outside the WEF Site

View-point	Name	Latitude	Longitude	Distance (kms)	Visibility
vp1	Altona	31.542473 S	22.510658 E	28.70	Not visible.
vp2	Erasmuskraal	31.545301 S	22.441822 E	26.62	Not visible.
vp3	Lushof	31.362754 S	22.312997 E	7.78	Moderate visibility.
vp4	Osfontein guesthouse	31.234215 S	22.337147 E	5.78	High to moderate visibility.
vp5	Bastardsfontein	31.220804 S	22.258350 E	12.28	Marginal visibility.
vp6	Rondom	31.259378 S	22.289054 E	7.63	Moderate visibility.
vp7	Meltonwold guesthouse	31.457597 S	22.746961 E	36.90	Not visible.
vp8	Bitterwater	31.434331 S	22.690137 E	31.01	Not visible.
vp9	Boshoek	31.442835 S	22.628570 E	27.23	Not visible.
vp10	Arizona	31.434046 S	22.583724 E	23.46	Not visible. In a view shadow.
vp11	Hebron	31.290174 S	22.570078 E	12.69	Marginal visibility.
vp12	Request	31.238830 S	22.507891 E	5.63	high to moderate visibility.
vp13	De Cypher	31.225878 S	22.437997 E	2.11	Very high visibility.
vp14	Elandsberg	31.200039 S	22.371785 E	5.67	High to moderate visibility.
vp15	Loxton	31.480535 S	22.354961 E	18.63	Not visible. In a view shadow.
vp16	Jakhalsdans guest farm	31.546633 S	22.344170 E	26.02	Not visible.
vp17	R63 East	31.420292 S	22.533006 E	18.97	Marginal visibility.
vp18	R63 West	31.424308 S	22.473934 E	15.70	Marginal visibility.

Table 2: Other Farmsteads within the 10km Viewshed

Name	Latitude	Longitude	distance (kms)	Visibility
Prinshof	31.168521 S	22.488080 E	9.00	Moderate visibility.
Kranspoort	31.158857 S	22.499090 E	8.46	Moderate visibility.
Soutpoort	31.355855 S	22.287121 E	9.29	Moderate visibility.
Rhenosterfontein	31.369219 S	22.298201 E	7.44	Moderate visibility.
Saaidam	31.319613 S	22.372607 E	4.45	Very high visibility.
Aarfontein	31.350174 S	22.388576 E	9.00	Moderate visibility, (part of Loxton WEF 2)

V. high visibility: Prominent feature within the observer's viewframe 0-2.5km
High visibility: Relatively prominent within observer's viewframe 2.5-5km
Moderate visibility: Only prominent with clear visibility as part of the wider landscape 5-10km
Marginal visibility: Seen in very clear visibility as a minor element in the landscape 10-20km

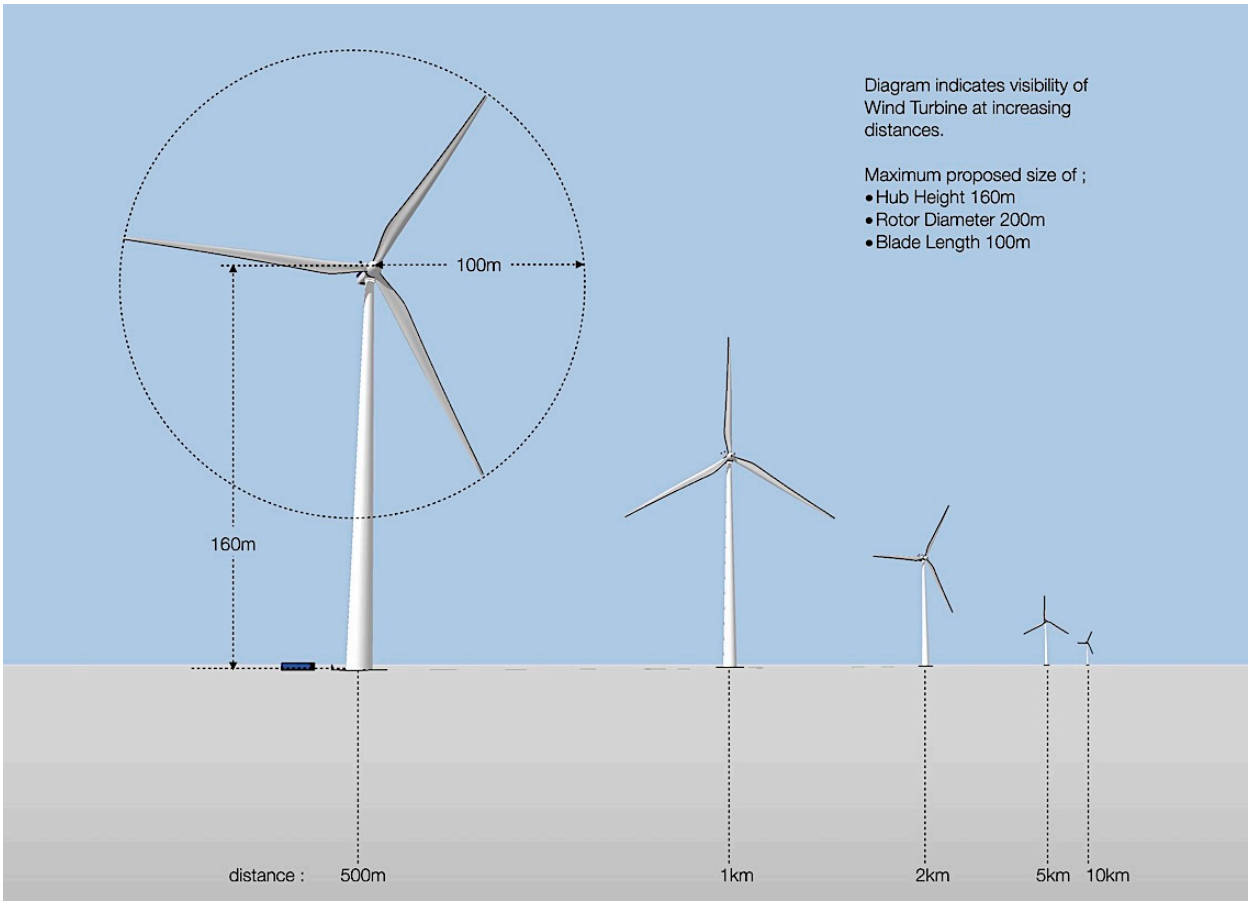


Figure 9: Comparative scale of wind turbines at a range of distances

Visual Exposure

The viewshed, or zone of visual influence, potentially extends for some 25 km, but is partly restricted by topography in some directions, where parts of the surrounding area would be in a view shadow, being the white areas on the map, and therefore not visually affected (see **Map 7**).

Visual Absorption Capacity (VAC)

This relates to the potential of the landscape to screen the proposed WEFs from view. Wind turbines tend to be more exposed on ridgelines, particularly when seen in silhouette. The largely treeless landscape provides little screening effect. In most cases, clumps of trees around farmsteads tend to reduce visibility by receptors.

Landscape Integrity

Landscape integrity tends to be enhanced by scenic or rural quality and intactness of the landscape, as well as absence of other visual intrusions. Cultural landscapes, such as rural or farming scenes also have visual or scenic value. On the other hand, industrial activity and visual 'clutter', including substations and powerlines, detract from these scenes. Most of the site for the proposed WEF has an uncluttered, expansive landscape with pastoral scenes.

Visually Sensitive Resources

Natural and cultural landscapes, or scenic resources, form part of the 'National Estate' and may have local, regional or even national significance, usually, but not only, of tourism importance. **Map 8** indicates landscape features of interest.

Visual Impact Intensity

The overall potential visual impact intensity (or magnitude) is determined in Table 4 below by combining all the factors above, namely visual exposure, visibility, visual absorption capacity, landscape integrity and visually sensitive resources.

Table 4: Visual Impact Intensity (magnitude)

Visual Criteria	Comments	Wind turbines	Related infrastructure
Visual exposure	Extensive viewshed relating to scale of wind turbines.	High	Low
Visibility	Visible from the R63 Route and farmsteads.	High	Low
Visual absorption capacity (VAC)	Visually exposed hills, and therefore low VAC.	High	Medium
Landscape integrity / intactness	Effect on rural / pastoral farming character.	High	Low
Landscape / scenic sensitivity	Effect on scenic resources.	Medium	Low
Shadow flicker	Limited to receptors within 2km within the project site.	Low	n/a
Impact intensity	Summary	**Medium-high**	**Medium-low**

Shadow Flicker Effect

Receptors falling within the shadow flicker envelope could potentially be affected by shadow flicker from the rotating wind turbine blades when the sun is low in the sky. However, the blades would need to be orientated toward the receptor, they would need to be rotating and the weather would need to be clear with bright sunlight to cast shadows. The orientation of buildings, as well as topography and trees would all determine the potential flicker effect.

Only two farmsteads within 2 km of the proposed WEFs could potentially be affected (see **Map 12**), although these are both within the project boundary. Incidences of flicker are therefore expected to be minimal.

Landscape features that typically have visual or scenic value, along with potential sensitive receptors in the surroundings, are described in Table 5 below.

Table 5: Visual Sensitivity Mapping Features

Landscape features within or adjacent to the WEF	
Topographic features	Characteristic landforms predominantly consist of dolerite koppies and ridges, which contribute to the scenic value of the area.
Water Features	The larger drainage courses and dams provide scenic and amenity value in the arid landscape.
Cultural landscapes	Cultivated land and tree copses form part of the cultural landscape. Archaeological sites also form part of the cultural landscape, covered elsewhere in the Heritage Assessment.
Receptors adjacent to the WEF or in the local surroundings.	
Protected Areas	Visual significance is increased by the protection status of nature reserves. (There are no known proclaimed nature reserves or private reserves in the vicinity of the site).
Guest farms and resorts	Guest accommodation in the area is important for the local tourism economy, (e.g. Osfontein guest farm).
Human settlements	Nearby farmsteads. The nearest town is Loxton.
Scenic and arterial routes	The R63, known as the 'Karoo Highlands Route' as well as a number of local district roads have rural scenic value.

Recommended Buffers for Wind farms:

Guidelines prepared in the past on buffers for wind energy farms are indicated in Table 6 below. These are intended for regional scale mapping purposes and need to be adapted at the local project scale.

Table 6: Visual Guidelines for Wind Turbine Buffers

Landscape features	PGWC Guidelines [1]	SEA Visual Guidelines [2]	Comment
Project area boundary	-	-	Usually 1.5 times tip height of the proposed turbines.
Prominent topographic features	500m	500m	Includes prominent ridgelines, peaks and scarps.
Steep slopes	>1:4	>1:4	Generally avoid slopes >1:10, because of large assembly platforms.
Major perennial rivers	500m	1 km	Subject to specialist freshwater assessment.
Provincial / arterial roads	500m	1 km	Depends on local context, e.g. rural or urban areas.
Scenic routes and passes	2.5 km	1 km	Could be less if in a view shadow.
National parks/ protected areas	2 km	5 km	Could be less if in a view shadow.
Private reserves/ game farms	500m	2 km	Could be less if in a view shadow.
Farmsteads	400m (noise)	500m	General literature recommends 500m to 2 km.
Settlements	800m	2 km	Could be less if in a view shadow.
Cultural landscapes/ heritage	500m	Feature	Subject to heritage assessments.

[1] Provincial Government of the Western Cape, 2006. Recommended Criteria Thresholds for Regional and Site Level Assessment.
[2] CSIR, 2018. SEA for Wind and Solar Photovoltaic Energy in SA, Phase 2. Visual and Scenic Resources Chapter prepared by B. Oberholzer and Q. Lawson.

Scenic resources and sensitive receptors within the study area have been categorised into very high sensitivity (no-go), high, medium and low visual sensitivity zones, as indicated in Tables 7 to 10 below, for the proposed WEF and related infrastructure, such as the substation (including associated battery facility) and maintenance buildings.

Table 7: Visual Sensitivity Mapping Categories for Wind Turbines

Scenic Resources	Very high visual sensitivity (no-go areas)	High visual sensitivity	Medium visual sensitivity	Low visual sensitivity
Topographic feature: prominent scarps, peaks and ridges	within 150m	within 250m	within 500m	-
Topographic feature: minor ridges, scarps and outcrops	within 50m	within 150m	-	-
Steep slopes	Slopes > 1:5	Slopes 1:10 - 1:5	-	-
Scenic water features Minor water features	within 250m within 150m	within 500m within 250m	-	-
Cultural landscapes	(Refer to HIA)		-	-
Protected Landscapes / Sensitive Receptors				
Private reserves / game farms	within 2 km	within 4 km	within 6 km	-
Settlements/ towns (Loxton)	within 2 km	within 4 km	within 6 km	-
Farmsteads outside site	within 1 km	within 2 km	within 3 km	-
Farmsteads inside site	within 500m	within 1 km	within 2 km	-
Arterial routes (R63)	within 1 km	within 2 km	within 4 km	
Main district roads	within 250m	within 500m	within 1 km	-
Landing strips	within 3 km	-	-	-

Table 8: Visual Sensitivity Mapping for Buildings, Substation and Battery Facility

Scenic Resources	No-go areas	High visual sensitivity	Medium visual sensitivity	Low visual sensitivity
Topographic features	within 100m	within 150m	-	-
Minor ridges and outcrops	within 50m	within 100m	-	-
Steep slopes	Slopes > 1:4	Slopes > 1:10	-	-
Scenic water features	within 100m	within 150m	within 250m	-
Cultural landscapes	Refer to HIA		-	-
Protected Landscapes / Sensitive Receptors				
Private reserves / game farms	within 500m	within 1 km	within 1,5 km	-
Settlements, towns	within 500m	within 1 km	within 1,5 km	
Farmsteads outside	within 250m	within 500m	Within 1 km	-
Farmsteads inside	within 150m	within 250m	within 500m	-
Arterial routes (R63)	within 500m	within 1,5 km	within 2 km	-
Main district roads	within 250m	within 500m	Within 1 km	-

Table 9: Visual sensitivity mapping categories for internal overhead powerlines

Scenic Resources	No-go areas	High visual sensitivity	Medium visual sensitivity	Low visual sensitivity
Topographic features	Feature	within 100m	within 150m	-
Minor ridges and outcrops	Feature	within 50m	within 100m	-
Steep slopes	-	Slopes > 1:4	Slopes > 1:10	-
Scenic water features	within 100m	within 150m	-	-
Cultural landscapes	Refer to HIA			
Protected Landscapes / Sensitive Receptors				
Private reserves / game farms	within 150 m	within 250 m	-	-
Settlements / towns	within 100 m	within 150 m	-	
Farmsteads outside	within 150 m	within 250 m	-	-
farmsteads inside	within 100 m	within 150 m	-	-
Arterial routes (R63)	within 250m	within 500 m	-	-
Main district roads	within 50 m	within 100 m	-	-

Note: The internal powerlines are buried as far as possible, so no visual impacts have been mapped.

Table 10: Visual sensitivity mapping categories for internal access roads

Scenic Resources	No-go areas	High visual sensitivity	Medium visual sensitivity	Low visual sensitivity
Topographic features	Feature	within 50m	-	-
Minor ridges and outcrops	Feature	Feature	-	-
Steep slopes	Slopes > 1:4	Slopes > 1:10	-	-
Scenic water features	within 50m	within 100m	-	-
Cultural landscapes[1]	Refer to HIA			
Protected Landscapes / Sensitive Receptors				
Private reserves / game farms	-	-	-	-
Settlements / towns	-	-	-	
Farmsteads outside	within 100m	within 150m	within 200m	-
farmsteads inside	within 50m	within 100m	within 150m	-
Arterial routes (R63)	-	-	-	-
Main district roads	-	-	-	-

10 Visual Impact Assessment

Sensitivity categories are indicated in Table 11 below. The quantification of overall visual impact significance for the proposed WEF is based on the methodology provided by Arcus (2022), as used in Tables 12 to 16. The assessment criteria are included in Appendix B of this report.

The visual sensitivity mapping for wind turbines is indicated on **Map 9,** for buildings, substations and BESS on **Map 10**, and for internal access roads on **Map 11.**

Table 11: Sensitivity Categories

No Go	Areas or features considered of such sensitivity or importance that any adverse effects upon them may be regarded as a fatal flaw.
High	Development to be limited and remain within acceptable limits of change determined by the specialist, and comply with restrictions or mitigation measures identified by the specialist.
Medium	Areas considered to be developable, but to remain within acceptable limits of change as determined by the specialist, and comply with restrictions or mitigation measures identified by the specialist.
Low	Low sensitivity areas that are considered to be developable. However specialists may still wish to define acceptable limits of change where necessary.

Table 12: Visual Impact Assessment – Construction Phase

Impact Phase: Construction					
Nature of the impact: Visual effect of construction activities on scenic resources and sensitive receptors					
Description of Impact: Visual intrusion of cranes, heavy vehicles and construction activities required for the erection of wind turbines, and related infrastructure. Temporary construction areas e.g. camps and batching plants. Visual scarring from earthworks for assembly platforms. Soil/ rubble stockpiles from earthworks. Litter generated from construction site. Noise and dust from construction activity.					
Impact Status: Negative					
	E	**D**	**R**	**M**	**P**
Without Mitigation	Local	Short Term	Recoverable	Moderate	Definite
Score	2	2	3	3	5
With Mitigation	Local	Short Term	Recoverable	Moderate	Highly probable
Score	2	2	3	3	4
Significance Calculation	**Without Mitigation**		**With Mitigation**		
S=(E+D+R+M)*P	Moderate Negative Impact (50)		Moderate Negative Impact (40)		
Was public comment received?	NO. Public participation process not completed at this stage.				
Has public comment been included in mitigation measures?	NO. Public participation process not completed at this stage.				
Mitigation measures to reduce residual risk or enhance opportunities: Disturbed areas to be rehabilitated / revegetated as soon as possible during the construction phase. Temporary laydown areas and batching plants to be located away from arterial or district roads. Stockpiles to be located within approved construction footprints. Recycling and refuse bins to be provided to eliminate litter from the site.					
Residual impact	Visual disturbance caused by vehicles, cranes				

Table 13: Visual Impact Assessment – Operation Phase: Turbines

Impact Phase: Operation					
Nature of the impact: Visual effect of wind turbines on the rural landscape					
Description of Impact: Potential visual intrusion of tall wind turbines on the rural landscape, scenic resources and sensitive receptors. Change in the pastoral character and sense of place of the local area.					
Impact Status: Negative					
	E	**D**	**R**	**M**	**P**
Without Mitigation	Regional	Long Term	Recoverable	High	Definite
Score	3	4	3	4	5
With Mitigation	Regional	Long Term	Recoverable	High	Definite
Score	3	4	3	4	5
Significance Calculation	**Without Mitigation**		**With Mitigation**		
S=(E+D+R+M)*P	High Negative Impact (70)		High Negative Impact (70)		
Was public comment received?	NO. Public participation process not completed at this stage.				
Has public comment been included in mitigation measures?	NO. Public participation process not completed at this stage.				
Mitigation measures to reduce residual risk or enhance opportunities: Mitigation achieved in the revised layout by means of avoidance of high visual sensitivity areas and receptors in siting of turbines.					
Residual impact	Visual intrusion of wind turbines on the exposed landscape.				

Table 14: Visual Impact Assessment – Operation Phase: Substation, BESS and O&M Buildings

Impact Phase: Operation					
Nature of the impact: Visual effect of substation and BESS on the rural landscape					
Description of Impact: Visual effect of industrial-type substations and BESS on the rural landscape. Visual intrusion of internal overhead powerlines, including silhouette effect on skylines of ridges. Visual intrusion of internal access roads and hardstands in the local area.					
Impact Status: Negative					
	E	**D**	**R**	**M**	**P**
Without Mitigation	Local	Long Term	Recoverable	Moderate	Definite
Score	2	4	3	3	5
With Mitigation	Local	Long Term	Recoverable	Moderate	Highly probable
Score	2	4	3	3	4
Significance Calculation	**Without Mitigation**		**With Mitigation**		
S=(E+D+R+M)*P	Moderate Negative Impact (60)		Moderate Negative Impact (48)		
Was public comment received?	NO. Public participation process not completed at this stage.				
Has public comment been included in mitigation measures?	NO. Public participation process not completed at this stage.				
Mitigation measures to reduce residual risk or enhance opportunities: Substations, BESS and O&M Buildings have been located in unobtrusive low-lying area away from the R319 and district roads, as per recommended visual buffers, as currently indicated.					

On-site signage to be discrete, and billboards prohibited. Signage to be fixed against a backdrop to avoid intrusion on the skyline. Overhead powerlines, if applicable, to follow valleys and avoid peaks/ridges where possible. Security and other outdoor lighting to be fitted with reflectors to conceal light source and prevent light spillage.	
Residual impact	Visual intrusion of industrial facilities on the local landscape.

Table 15: Visual Impact Assessment – Operation Phase: Internal Access Roads

Impact Phase: Operation					
Nature of the impact: Visual effect of access roads on the rural landscape					
Description of Impact: Visual intrusion of internal access roads, including embankments, culverts and side drains.					
Impact Status: Negative					
	E	**D**	**R**	**M**	**P**
Without Mitigation	Local	Long Term	Recoverable	Low	Probable
Score	2	4	3	2	3
With Mitigation	Local	Long Term	Recoverable	Low	Low probability
Score	2	4	3	2	2
Significance Calculation	**Without Mitigation**		**With Mitigation**		
S=(E+D+R+M)*P	Moderate Negative Impact (33)		Low Negative Impact (22)		
Was public comment received?	NO. Public participation process not completed at this stage.				
Has public comment been included in mitigation measures?	NO. Public participation process not completed at this stage.				
Mitigation measures to reduce residual risk or enhance opportunities: Access roads have avoided steep slopes and drainage courses, as currently indicated. Road verges and cut/fill slopes to be rehabilitated as soon as possible after construction.					
Residual impact	Visual intrusion of gravel roads in the local landscape.				

Table 16: Visual Impact Assessment – Operation Phase: Lighting at Night

Impact Phase: Operation					
Nature of the impact: Visual intrusion of lighting at night.					
Description of Impact: Visual effect on the rural countryside created by lights on turbines for aircraft navigation. Visual intrusion of area and security lighting around the substations and O&M buildings.					
Impact Status: Negative					
	E	**D**	**R**	**M**	**P**
Without Mitigation	Local	Long Term	Recoverable	Moderate	Definite
Score	2	4	3	3	5
With Mitigation	Local	Long Term	Recoverable	Moderate	Highly probable
Score	2	4	3	3	4
Significance Calculation	**Without Mitigation**		**With Mitigation**		
S=(E+D+R+M)*P	Moderate Negative Impact (60)		Moderate Negative Impact (48)		
Was public comment received?	NO. Public participation process not completed at this stage.				

Has public comment been included in mitigation measures?	NO. Public participation process not completed at this stage.
Mitigation measures to reduce residual risk or enhance opportunities: Use of available technology to minimise the visual effect of navigation lights, conforming with CAA requirements. Use of reflectors on general area and security lighting to conceal light sources.	
Residual impact	Visual intrusion of light spillage on the local landscape.

Table 17: Visual Impact Assessment – Decommissioning Phase

Impact Phase: Decommissioning					
Nature of the impact: Visual intrusion of activities to remove infrastructure.					
Description of Impact: Visual effect of construction activities to remove infrastructure at the end of the life of the project, including wind turbines, substation, buildings, internal overhead powerlines and access roads.					
Impact Status: Negative					
	E	**D**	**R**	**M**	**P**
Without Mitigation	Local	Short Term	Recoverable	Moderate	Definite
Score	2	2	3	3	5
With Mitigation	Local	Short Term	Recoverable	Moderate	Highly probable
Score	2	2	3	3	4
Significance Calculation	**Without Mitigation**		**With Mitigation**		
S=(E+D+R+M)*P	Moderate Negative Impact (50)		Moderate Negative Impact (40)		
Was public comment received?	NO. Public participation process not completed at this stage.				
Has public comment been included in mitigation measures?	NO. Public participation process not completed at this stage.				
Mitigation measures to reduce residual risk or enhance opportunities: Disturbed areas to be rehabilitated / revegetated as soon as possible after the decommissioning phase. Wind turbines and building structures removed at the end of the life of the project. Hardstands and access roads no longer required to be ripped and regraded. Exposed or disturbed areas to be revegetated and returned to grazing pasture or natural veld to blend with the surroundings.					
Residual impact	Visual intrusion of remaining roads and slabs on the local landscape.				

11 Alternatives

An iterative design process has been followed to inform the Loxton WEF 1 project layout, where the integration of early screening and scoping studies, together with the various specialist studies was aimed at minimisation of impacts leading to refinements in the layout. This integrated approach negates the need for the assessment of alternatives in the EIA process.

The preferred WEF layout is assessed against the 'No-go' alternative of not constructing the project, in which case the status quo of the current farming activities on the site would prevail, and the significance of the No-go alternative would therefore be neutral.

12 Assessment of Cumulative Visual Impacts

Map 1 indicates the combination of the Loxton WEFs 1, 2 and 3, as well as other similar renewable energy projects, either existing or proposed, in order to assess cumulative visual impacts within a 35 km radius of the proposed project. The proposed Hoogland North WEF, and Nuweveld WEF by Redcap fall within this radius. Only parts of the Hoogland North WEF would potentially be seen in combination with the Loxton 1 WEF, although the nature of the topography

would result in some visual screening of the various WEF turbines. Cumulative Impacts have been assessed in the Cumulative Visual Impact summary, Table 18, below.

Table 18: Cumulative Visual Impact

Cumulative Impact: Visual					
Description of Cumulative Impact: Combined visual effect of existing and proposed WEFs on scenic resources and sensitive receptors.					
Impact Status: Negative					
	E	**D**	**R**	**M**	**P**
Without Enhancement	Regional	Long Term	Recoverable	Moderate	Highly probable
Score	3	4	3	3	4
With Enhancement	Regional	Long Term	Recoverable	Moderate	Highly probable
Score	3	4	3	3	4
Significance Calculation	**Without Enhancement**		**With Enhancement**		
S=(E+D+R+M)*P	Moderate Negative Impact (52)		Moderate Negative Impact (52)		
Can Impacts be Enhanced?	No. Little or no opportunity to visually screen turbines, except through avoidance.				
Enhancement: None					
Residual impact	Visual effect of existing and proposed WEFs on sense of place.				

13 Mitigation and EMPR Requirements

Mitigation measures have been recommended for the siting of wind turbines and related infrastructure in the tables above, in order to minimise visual impacts on scenic resources and sensitive receptors. Some mitigation, through avoidance, can be achieved in further iterations to the layout by either removing or micro-siting certain turbines.

Environmental Management Programme

Visual input into the Environmental Management Programme (EMPr) is discussed below. This should be included in the Environmental Authorisation for the project.

Construction Phase Monitoring:

Ensure that visual management measures are included as part of the EMPr, monitored by an Environmental Control Officer (ECO), including siting of any construction camps, stockpiles, temporary laydown areas and batching plants outside of identified no-go areas unless otherwise approved by the visual specialists, as well as the implementation of dust suppression and litter control measures. Rehabilitation efforts to commence immediately after construction activities are completed.

Responsibility: ECO / Contractor.
Timeframe: Preparation of EMPr during the planning phase. Monitoring during the construction phase.

Operation Phase Monitoring:

Ensure that visual mitigation measures are monitored by management on an on-going basis, including the maintenance of rehabilitated areas, as well as control of any signage, lighting and wastes at the proposed wind farm, with interim inspections by the environmental officer based on site.

Responsibility: Wind Farm Operator and ECO.
Timeframe: During the operational life of the project.

Decommissioning Phase Monitoring:

Ensure that procedures for the removal of wind turbines and building structures during decommissioning are implemented, including recycling of materials and rehabilitation of the site to a visually acceptable standard, and signed off by the delegated authority.

It is assumed that some access roads and concrete pads would remain. Those that are not required should be ripped and vegetation or cropland reinstated to match the surroundings.

The revegetation measures are not described here as they would fall under the auspices of the vegetation/ biodiversity specialist.

Responsibility: ECO / Contractor / qualified rehabilitation ecologist or horticulturist.
Timeframe: During the decommissioning contract phase, as well as a prescribed maintenance period thereafter (usually one year).

14 Summary and Conclusion

Summary of Findings

The visual assessment is based on the current turbine layout for the proposed Loxton 1 WEF. Mitigation measures have been recommended in Tables 12 to 16 of this Visual Impact Assessment and these have been included where possible in the WEF layout. Visual photomontages have been prepared to depict the current layout.

The preliminary visual assessment findings are the following:

- The viewshed is fairly extensive in all directions given the visually open nature of the treeless, hilly landscape.
- There are a number of visual receptors in close proximity to the proposed WEF (see Tables 1 and 2, and Map 5), these being mainly small farmsteads and guest farms in some cases.
- The overall visual impact significance for the wind turbines has been rated as high, both before and after mitigation, as there would be a significant change in character to the area. The high rating is a function of the scoring system although the actual rating is considered to be medium-high (see also 'magnitude' in Table 4). No turbines are in the 'very high' visual sensitivity category as avoidance has largely been achieved in the current layout.
- The visual impact significance for related infrastructure, (such as substations and O&M buildings) has been rated as medium, being in fairly remote locations.
- The visual impact significance of internal access roads has been rated as medium before mitigation and low significance after mitigation.
- The visual impact significance for navigation lights at night has been rated as medium, with some potential for mitigation depending on the technology used.
- The cumulative visual impact significance of the WEF, seen in combination with other renewable energy projects in the area has been rated as medium.
- Effective mitigation for the wind turbines is limited to 'avoidance', such as a reduction in the number of wind turbines, and/or relocating turbines further from nearby receptors.

Conclusion and Impact Statement

The layout of the WEF has been subject to an iterative planning process, based on the various specialist findings, including the mapping of scenic resources and sensitive receptors. The currently proposed layout largely succeeds in avoiding visually sensitive areas as indicated on the visual sensitivity maps.

The cumulative visual impact of the WEF and related infrastructure, such as the substations, associated battery facilities and internal access roads, could affect the rural quality, or sense of

place of the general area, particularly when seen in combination with other existing or planned wind farms within 35 km.

Specialist Recommendations for Inclusion in the EA

It is the opinion of the Visual Specialists that while the proposed Turbines could have a 'high' visual impact significance, the current layout has largely avoided the scenic resources and sensitive visual receptors of the area. The 'high' rating is a function of the scoring system. However, the rating is considered to be 'medium-high', and would therefore be acceptable from a visual perspective.

The visual impact significance for access roads is 'low' after mitigation, while other related infrastructure is 'moderate' significance.

Provided the recommended mitigation measures in Tables 12 to 17 are implemented, the project would not present a potential fatal flaw in visual terms and could be authorised from a visual perspective.

References

DFFE, October 2022. Screening Report for an Environmental Authorisation - Proposed Site Environmental Sensitivity, Loxton WEF 1.

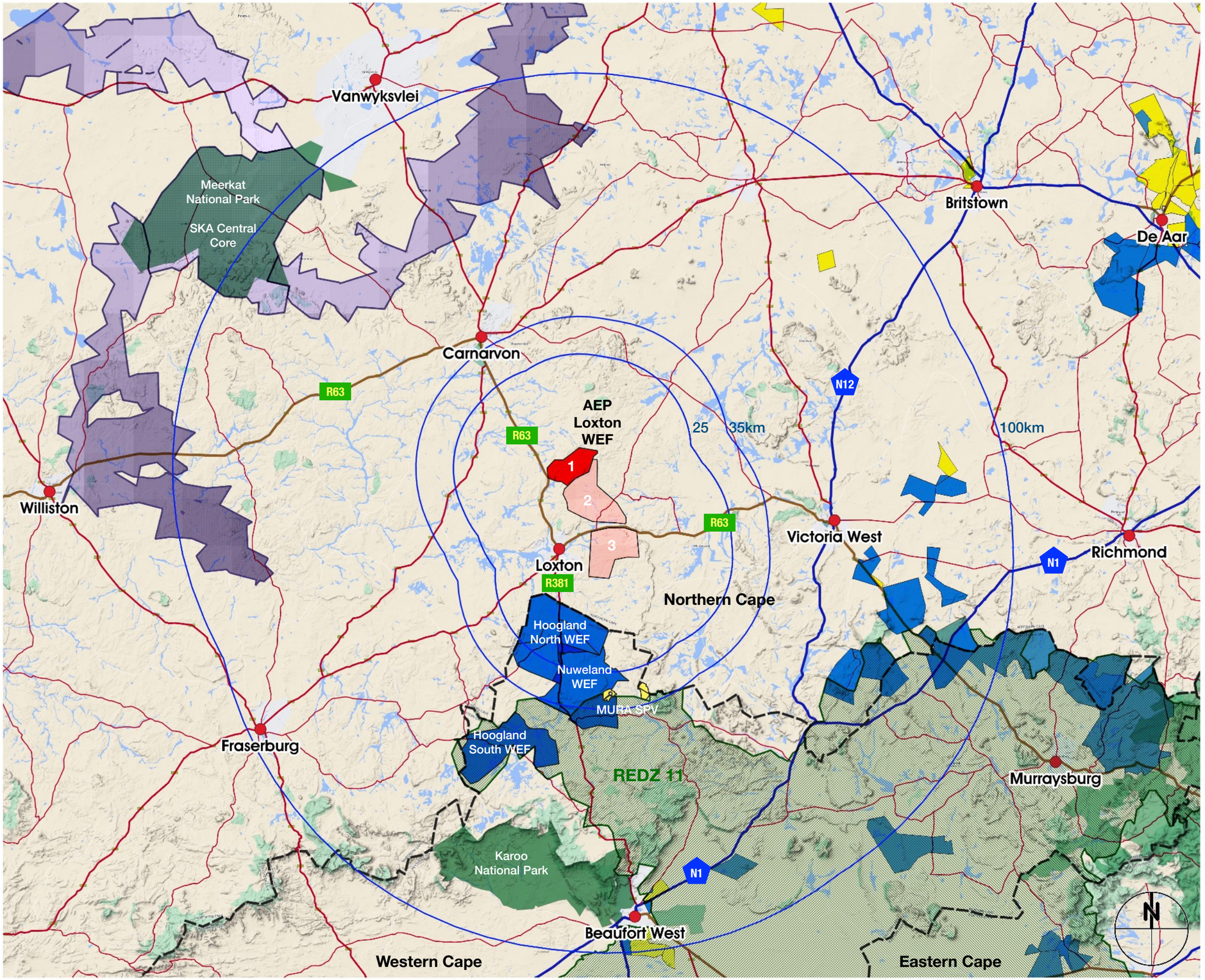
Loxton Wind facility 1 (Pty) Ltd. February 2023. Loxton Wind Energy Facility 1, Northern Cape Province – Project Description.

Mucina, L. and Rutherford, M.C. (eds) 2006. The Vegetation of South Africa, Lesotho and Swaziland. *Strelizia 19*. South African National Biodiversity Institute, Pretoria.

Oberholzer, B. 2005. Guideline for Involving Visual and Aesthetic Specialists in EIA Processes. Edition 1. Provincial Government of the Western Cape.

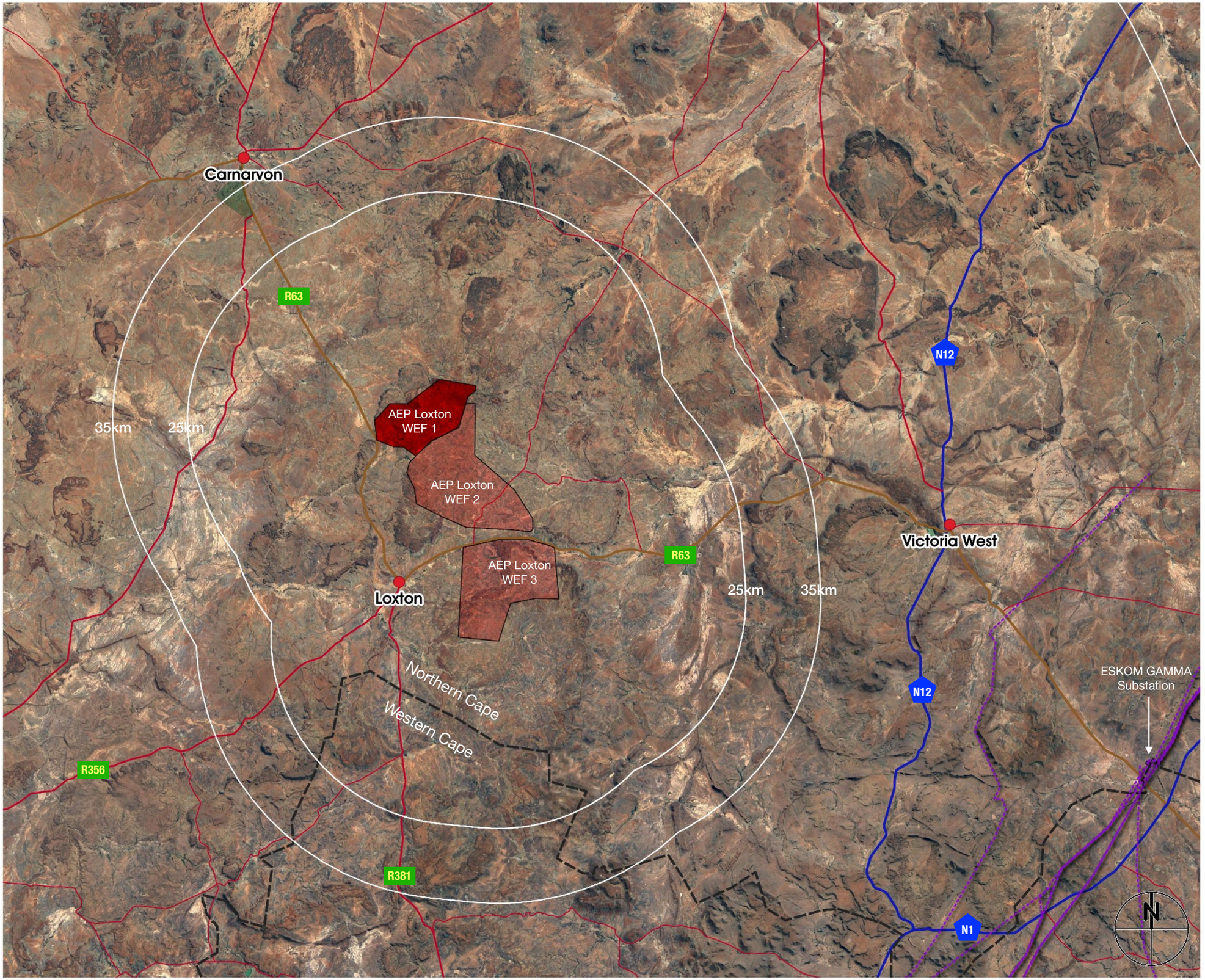
LEGEND :

- Loxton WEF Areas
- REEA Onshore Wind Energy Projects
- REEA Solar PV Projects
- SAPAD Protected Areas
- SKA 'Spiral Arms'



map 1 : Loxton WEF • Locality • REEA Projects Q4 2021

base map : Google Maps Terrain 2022

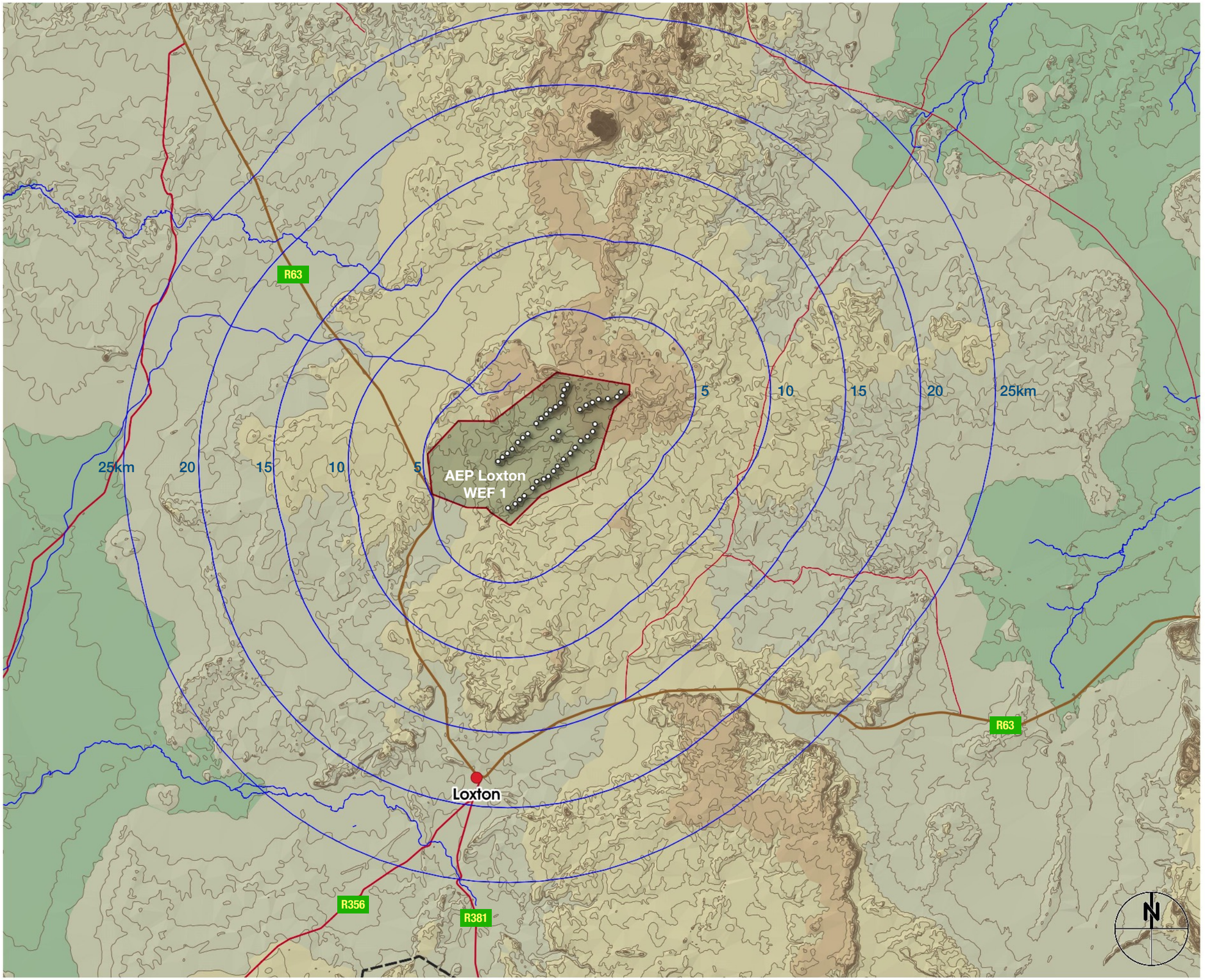


map 2 : Loxton WEF • Local Context

base map : Google Earth 2022

Elevation :

- 1200 - 1300m
- 1300 - 1400m
- 1400 - 1500 m
- 1500 - 1600 m
- 1600 - 1700 m



map 3 : Loxton WEF 1 • Physiography

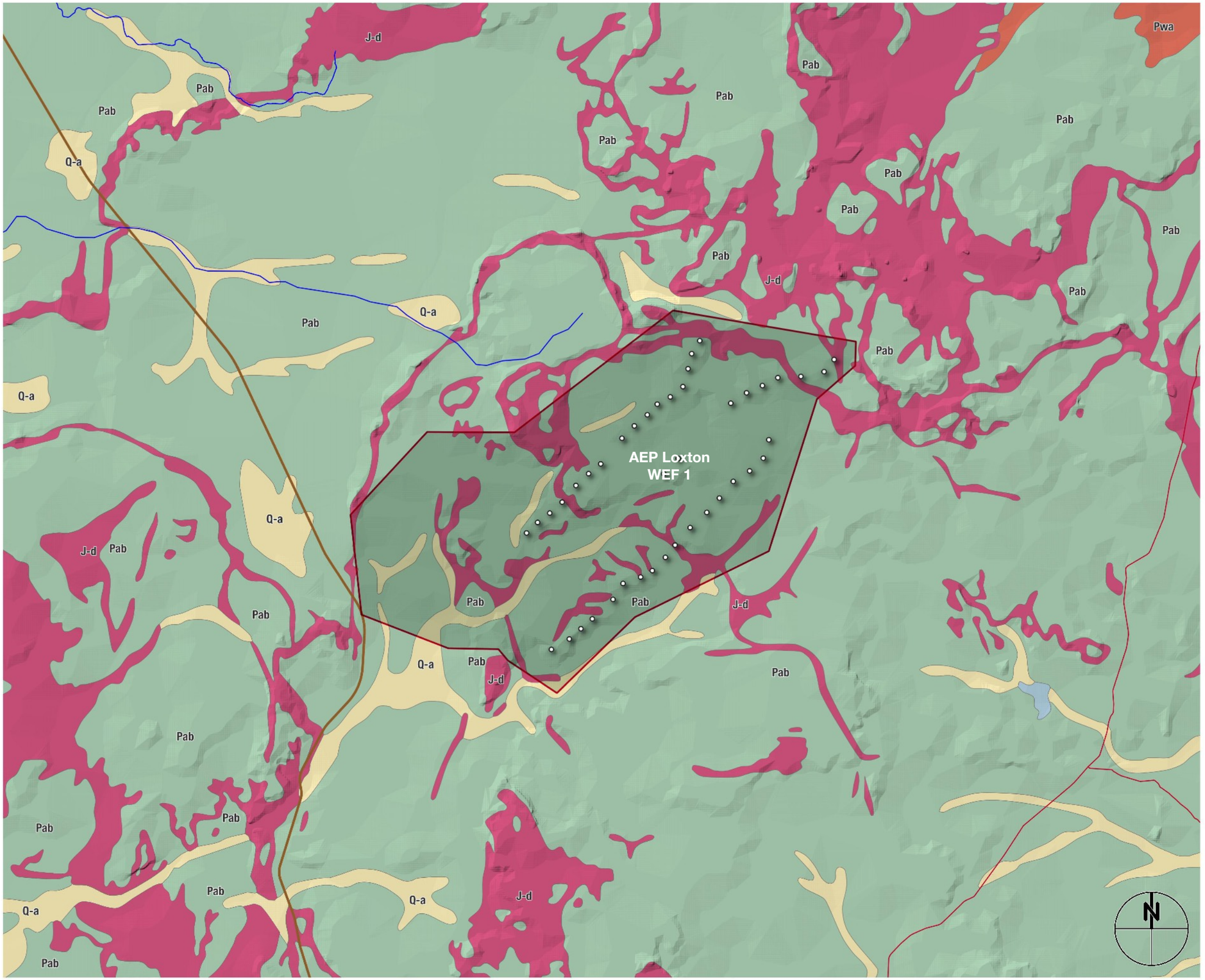
0 5 10 15 20 25 km

1:250,000

base map : NGI 50K Spatial Data

GEOLOGY LEGEND :

Q-a	Alluvium
J-d	Karoo Dolerite sills and dykes
Ppo	Middleton Formation, Beaufort Group Sandstone and interbedded mudstone



map 4 : Loxton WEF 1 • Geology

0 5 10 km

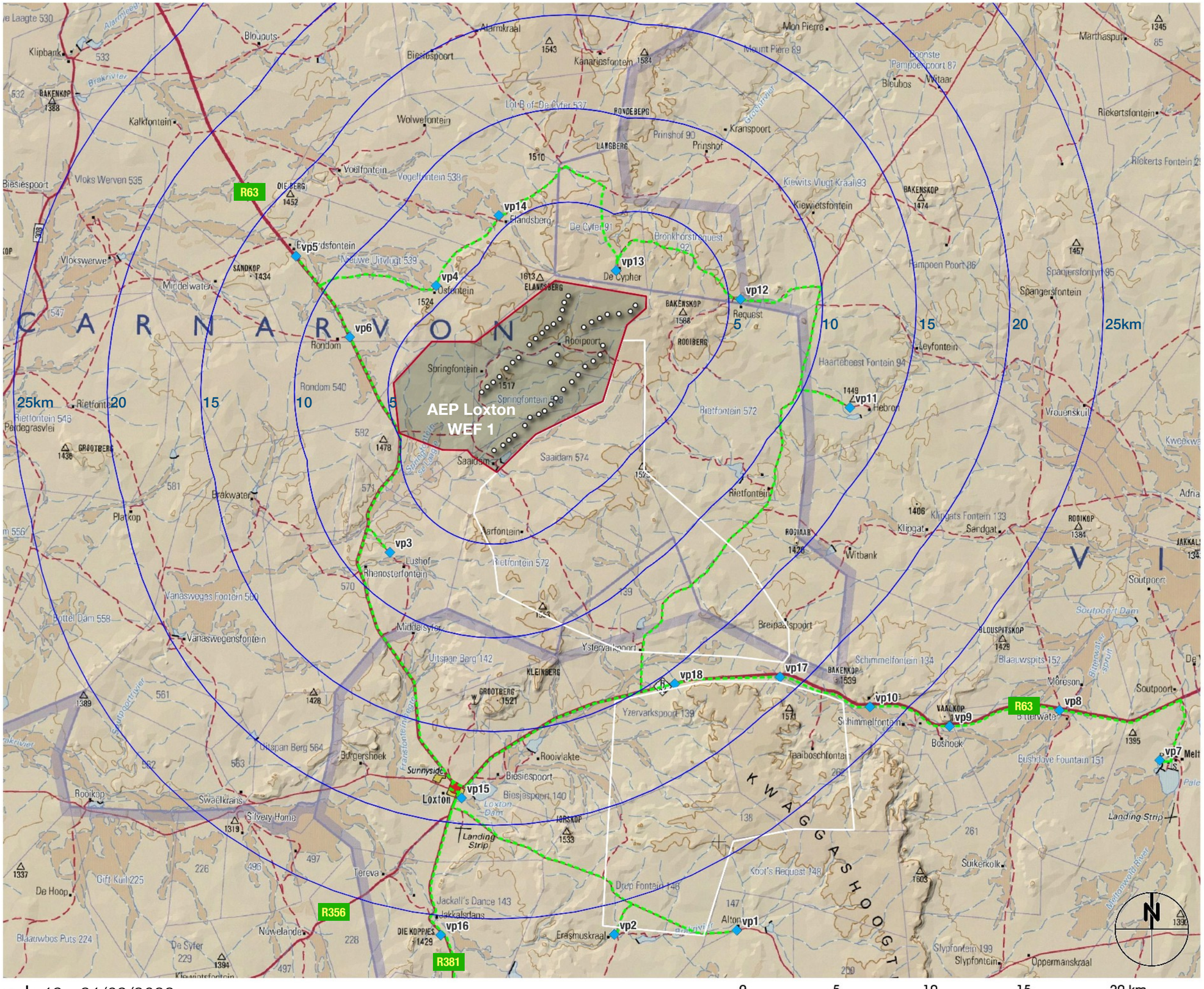
1:100,000

base map : CGS : Victoria West 3122 Geology 250K

Legend :

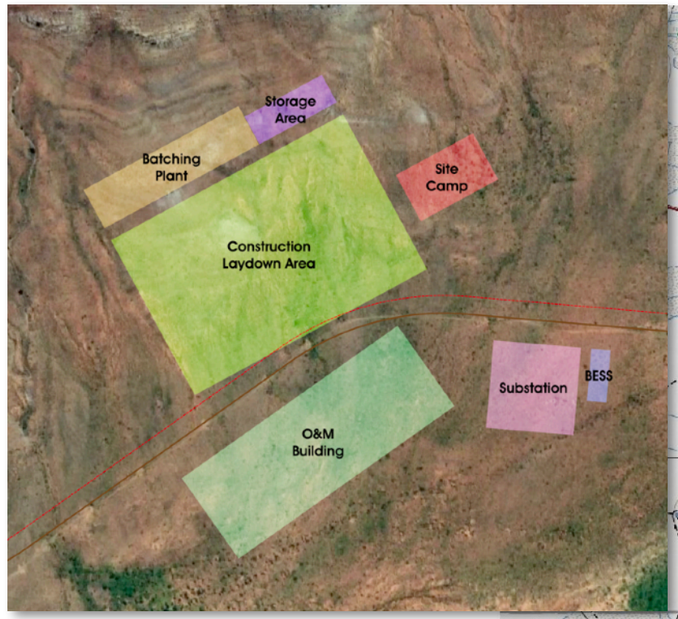
Field Track

Viewpoints



map 5 : Loxton WEF 1 • Fieldwork *19 - 21/09/2022*

base map : NGI 250K Topo-Cadastral Series Current Mosaic



Numbered WTG Locations

Supporting Infrastructure (see Inset above)

Internal Access Roads and MV Cabling

map 6 : Loxton WEF 1 • Facilities Layout

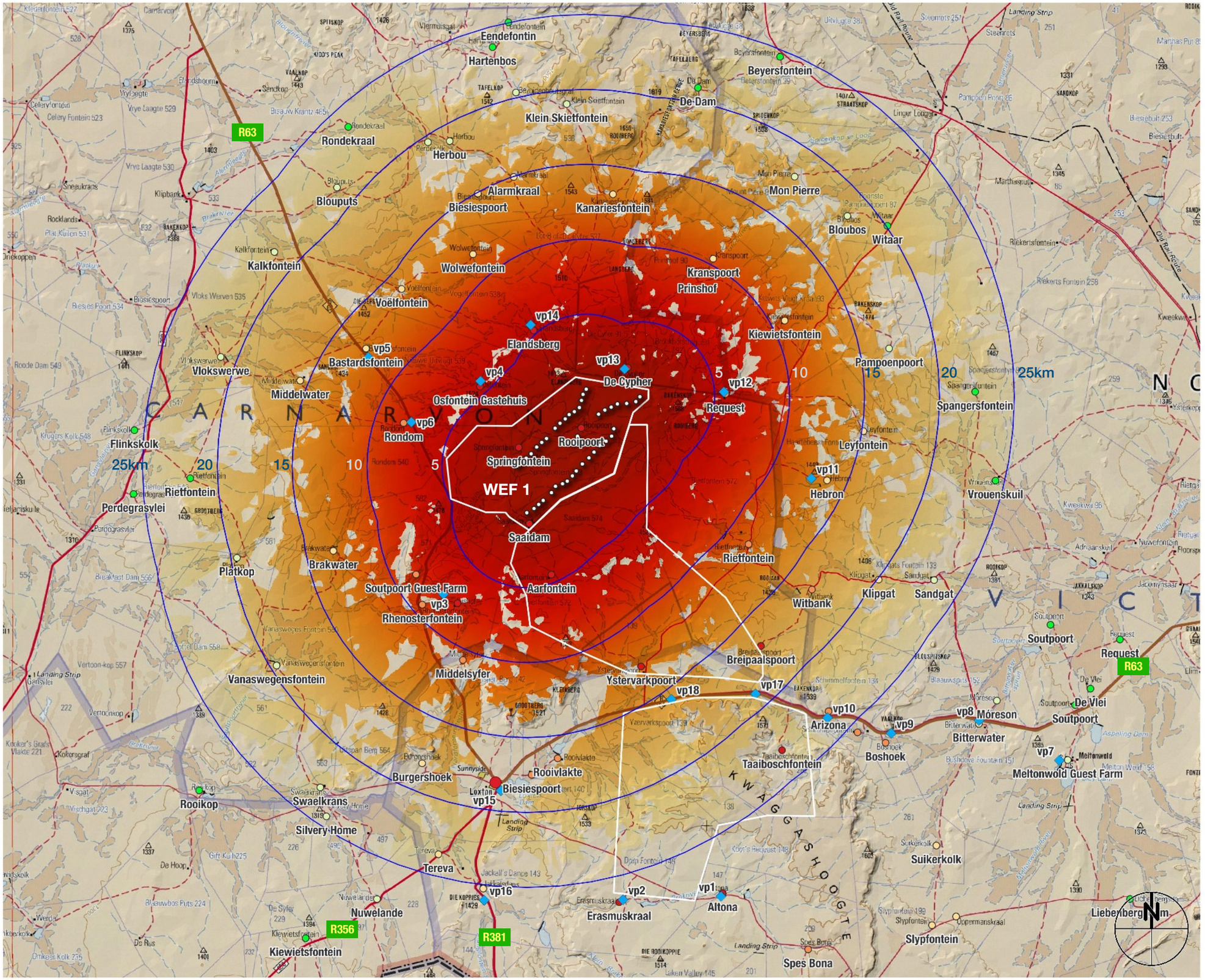
base map : NGI 50K Topographic Series Current Mosaic

0 1 2 3 4 5 km

1:50,000

Viewshed Legend :

- High Visibility
- Medium Visibility
- Low Visibility
- No Visibility (View Shadow)



map 7 : Loxton WEF 1 • Nominal Viewshed • *WTG Tip Height 260m*

0 5 10 15 20 25 km

1:250,000

base map : NGI 250K Topo-Cadastral Series Current Mosaic

LEGEND :

Topographic Features

Dolerite Dykes

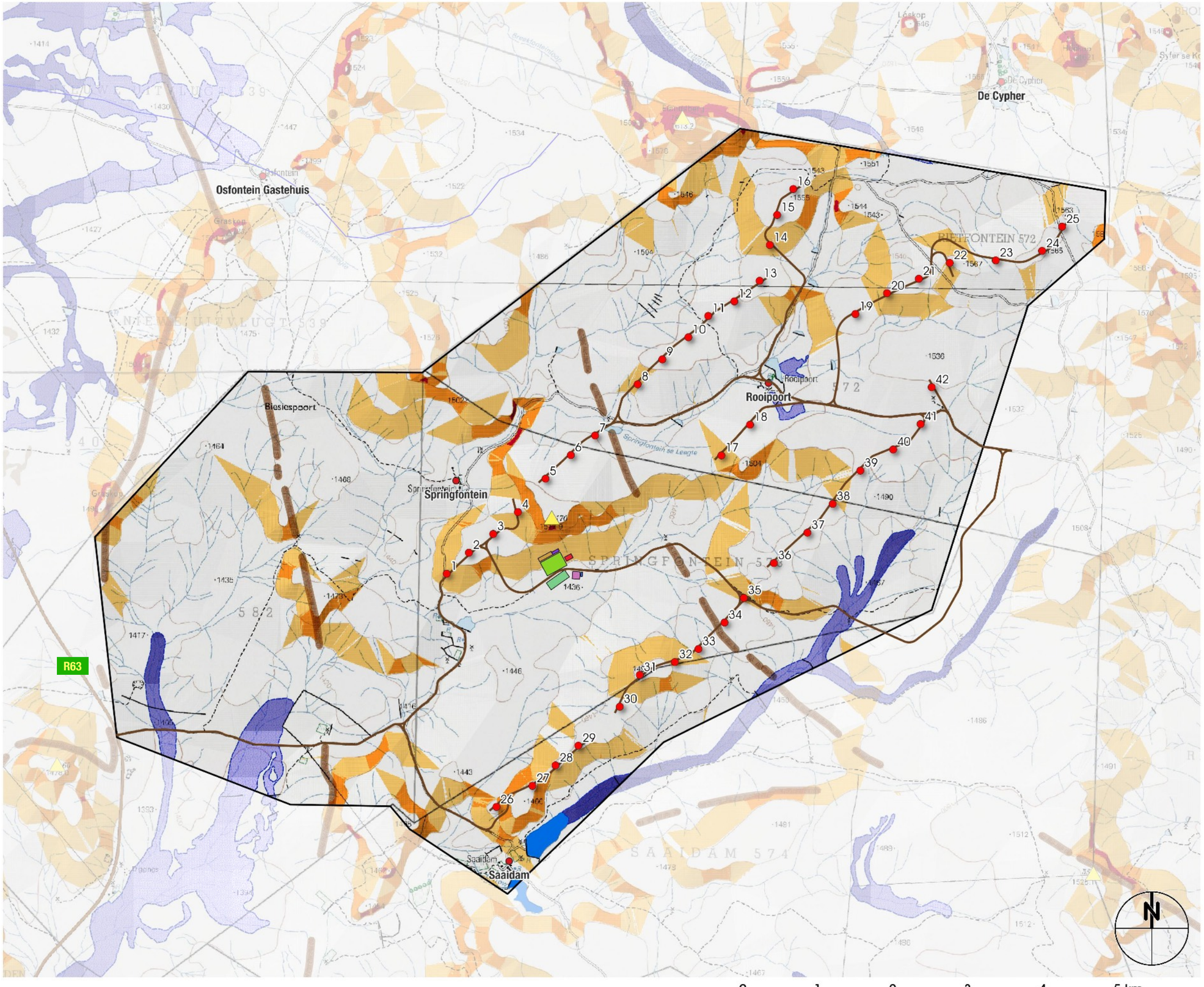
YELLOW <1:10 slopes
ORANGE 1:10 - 1:5 slopes,
RED >1:5 slopes

Drainage Courses

Peaks

Altona Farmsteads

District Roads



map 8 : Loxton WEF 1 • Visual Features

0 1 2 3 4 5 km

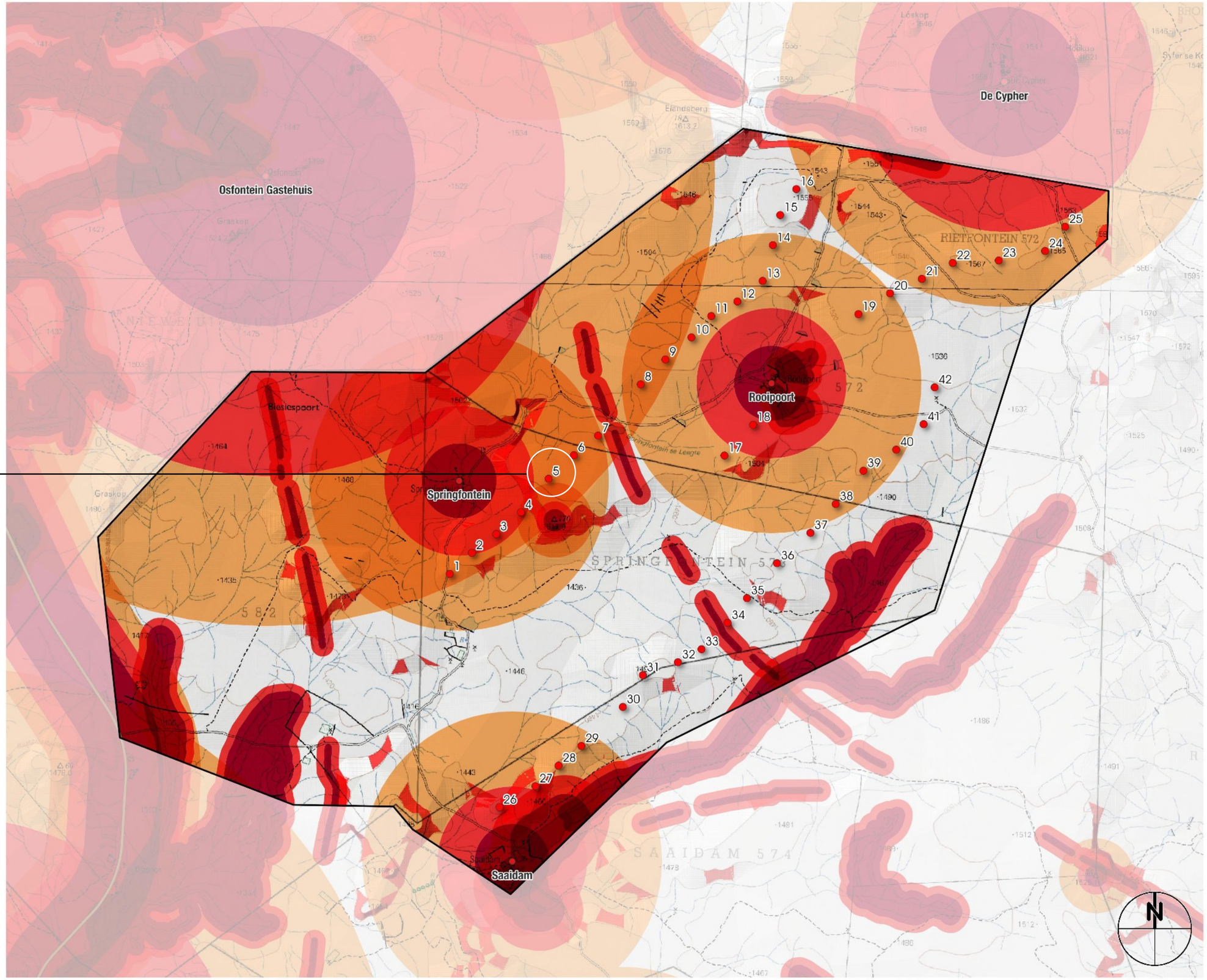
1:50,000

base map : NGI 50K Topographic Series Current Mosaic

SENSITIVITY LEGEND :

- Very High Visual Sensitivity
- High Visual Sensitivity
- Medium Visual Sensitivity
- Low Visual Sensitivity

Numbered WTG Locations



map 9 : Loxton WEF 1 • Visual Sensitivity • Wind Turbines

0 1 2 3 4 5 km

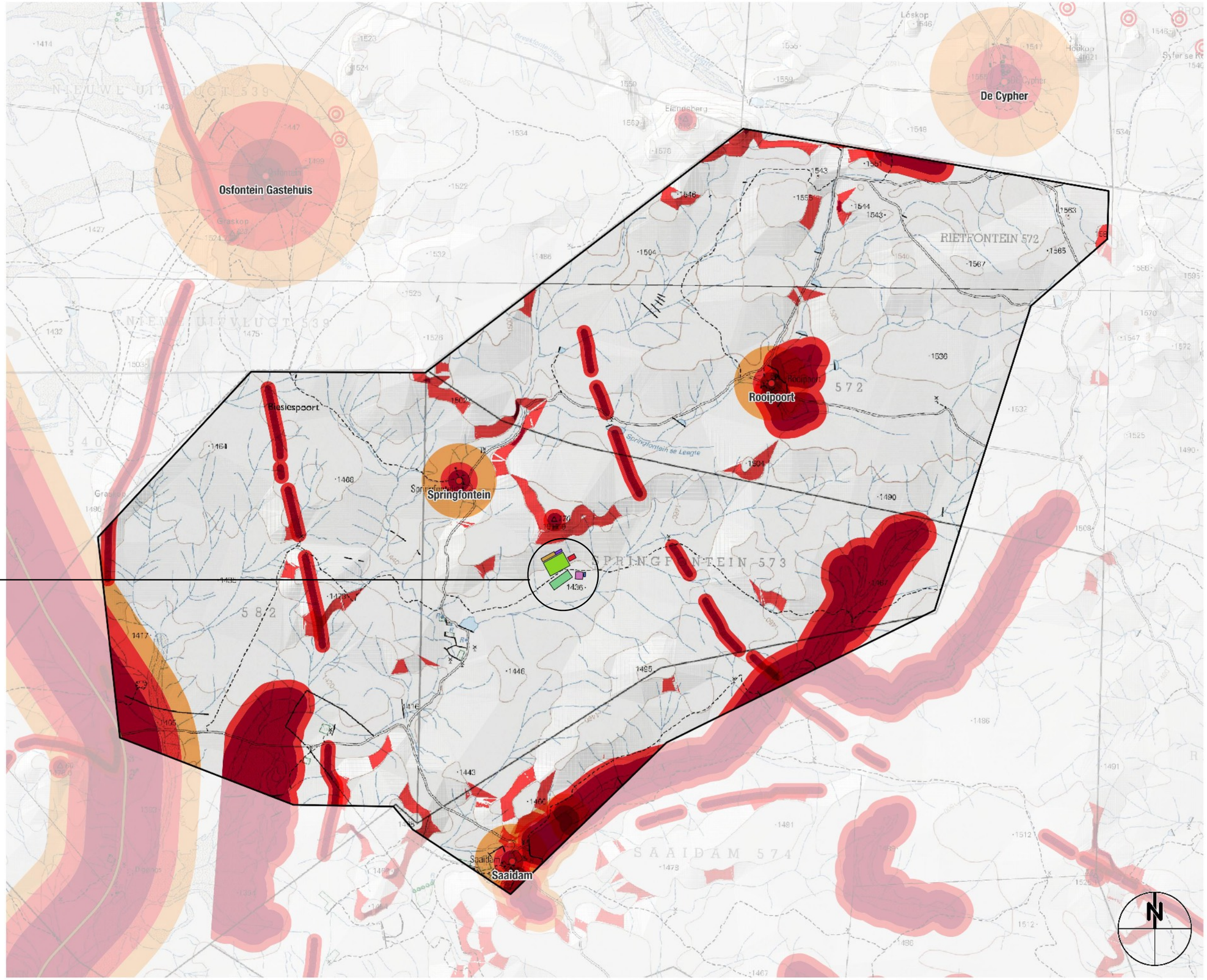
1:50,000

base map : NGI 50K Topographic Series Current Mosaic

SENSITIVITY LEGEND :

- Very High Visual Sensitivity
- High Visual Sensitivity
- Medium Visual Sensitivity
- Low Visual Sensitivity

Supporting Infrastructure



map 10 : Loxton WEF 1 • Visual Sensitivity • Supporting Infrastructure

0 1 2 3 4 5 km

1:50,000

base map : NGI 50K Topographic Series Current Mosaic

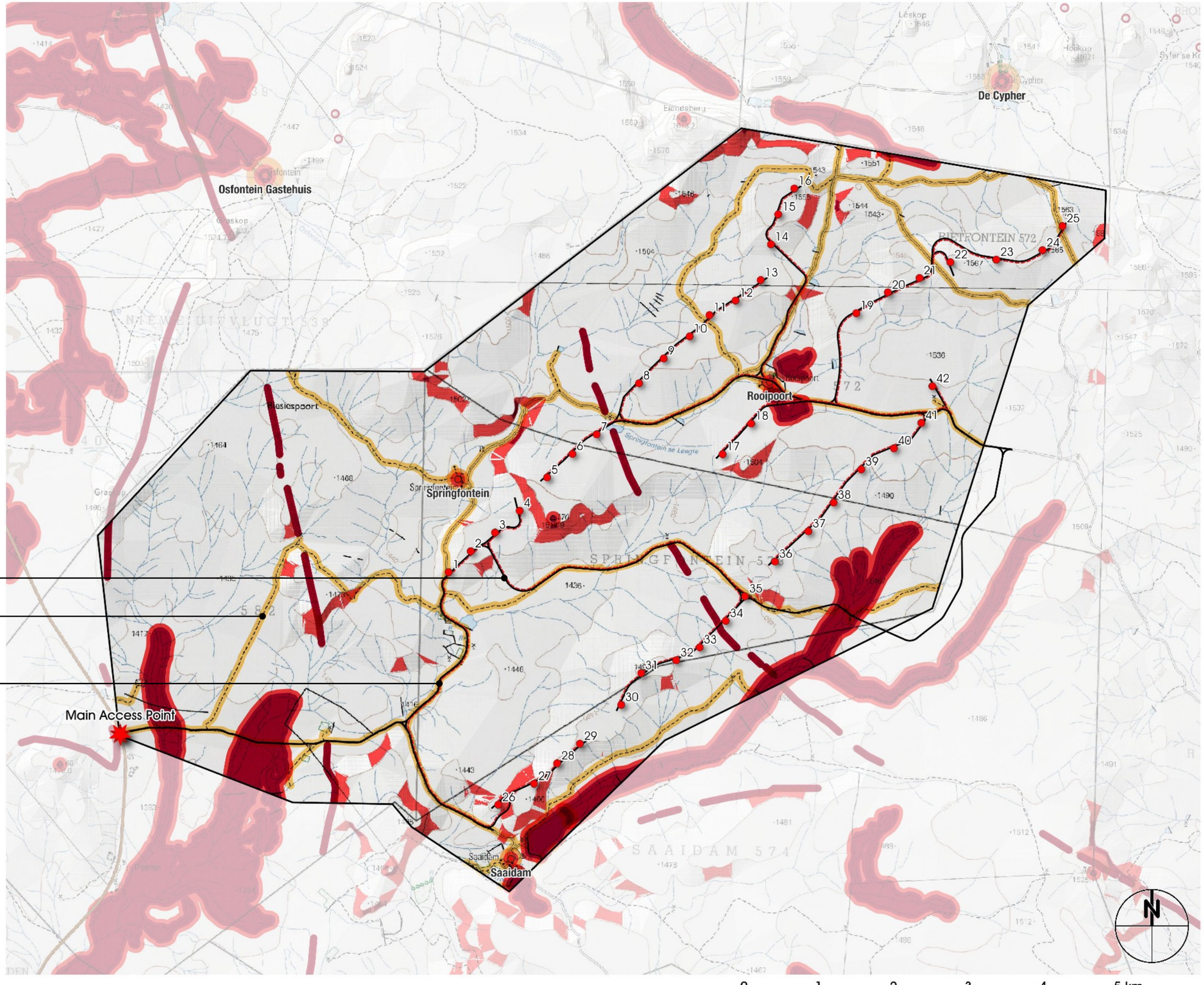
SENSITIVITY LEGEND :

- Very High Visual Sensitivity
- High Visual Sensitivity
- Medium Visual Sensitivity
- Low Visual Sensitivity

New Internal Access Road and MV Cabling

Existing Roads / Tracks

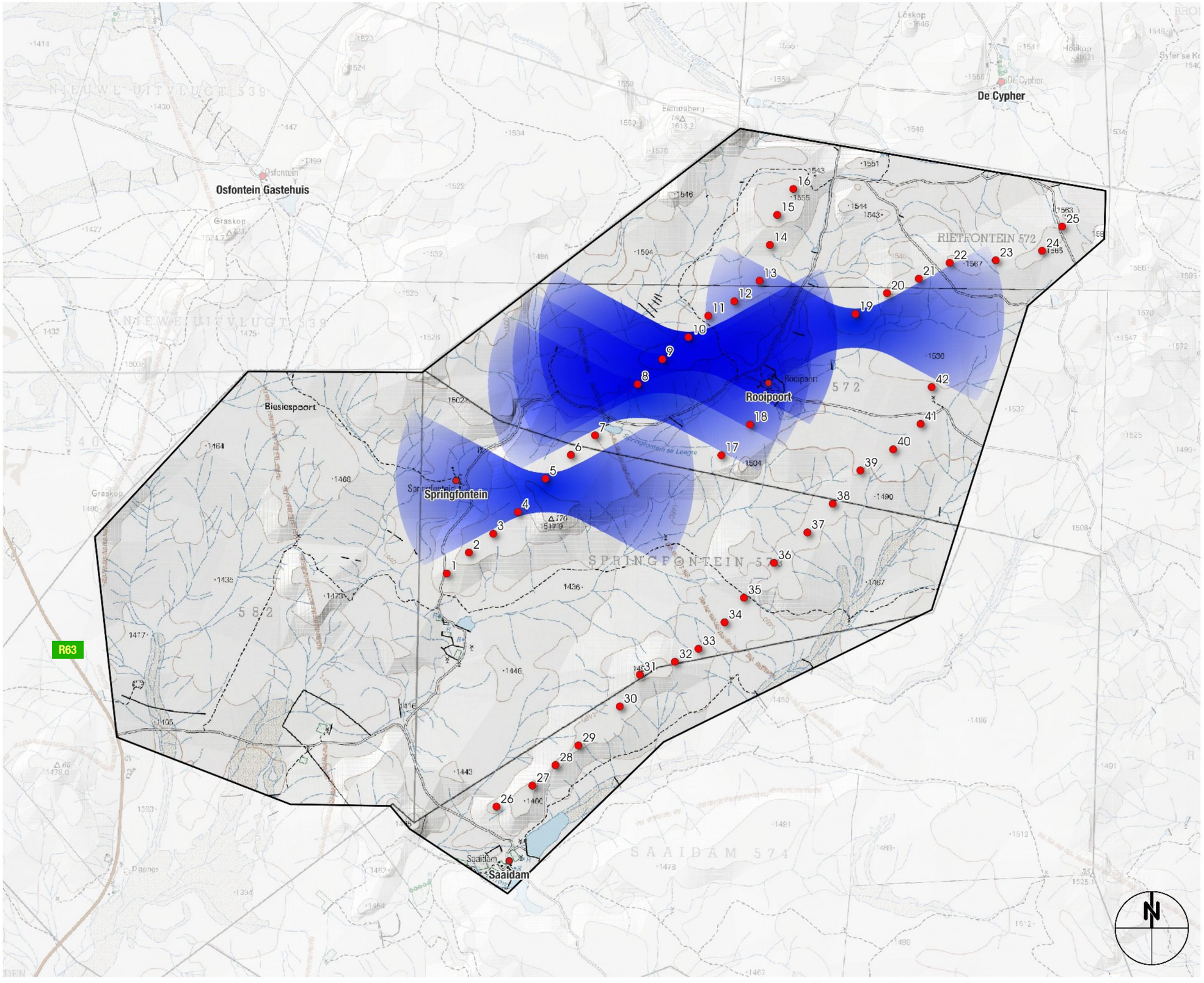
New Internal Access Road and MV Cabling on existing road / track alignment



map 11 : Loxton WEF 1 • Visual Sensitivity • Internal Access Roads

base map : NGI 50K Topographic Series Current Mosaic

- Farm Springfontein potentially affected by shadow flicker from WTG 5.
- Farm Rooipoort potentially affected by shadow flicker from WTGs 8, 9, 10 and 19.



NOTE : This method determines the potential shadow flicker 'envelope' for a specific geographic location and Wind Turbine parameters.

Shadow flicker may also be affected by weather conditions, wind direction and speed, as well as location and orientation of the receptor.

Beyond a distance of approximately 2km the blade shadows become too diffuse to create the shadow flicker effect.

map 12 : Loxton WEF 1 • Potential Shadow Flicker Effect

0 1 2 3 4 5 km

1:50,000

base map : NGI 50K Topographic Series Current Mosaic

Viewpoint 13 • looking South from De Cypher Farmyard

Location : 31.225878S, 22.437997E distance : 2.11km

Viewpoint 12 • looking West from Request Farm Road

Location : 31.238830S, 22.507891E distance : 5.63km

Viewpoint Photomontages

Appendix A: Visual Specialists

Bernard Oberholzer, Landscape Architect
PO Box 471, Stanford, Western Cape, 7210
Email: bernard.bola@gmail.com

Quinton Lawson, Architect
8 Blackwood Drive, Hout Bay 7806
Email: quinton@openmail.co.za

Expertise

Bernard Oberholzer has a Bachelor of Architecture (UCT) and Master of Landscape Architecture (U. of Pennsylvania), and has more than 25 years' experience in undertaking visual impact assessments. He has presented papers on *Visual and Aesthetic Assessment Techniques*, and is the author of *Guideline for Involving Visual and Aesthetic Specialists in EIA Processes,* prepared in association with the CSIR for the Dept. of Environmental Affairs and Development Planning, Provincial Government of the Western Cape, 2005.

Quinton Lawson has a Bachelor of Architecture Degree (Natal) and has more than 15 years' experience in visual assessments, specializing in 3D modelling and visual simulations. He has previously lectured on visual simulation techniques in the Master of Landscape Architecture Programme at UCT.

The authors have been involved in visual assessments for a wide range of residential, industrial and renewable energy projects. They prepared the 'Landscape/Visual Assessment' chapter in the report for the *National Wind and Solar PV Strategic Environmental Assessment (SEA)*, as well as the *National Electricity Grid Infrastructure SEA* in association with the CSIR, for the then Department of Environmental Affairs in 2014-2015.

Appendix B: Impact Assessment Methodology

The purpose of the assessment of impacts in an EIA is to evaluate the likely extent and overall significance that a potential impact may have on an identified receptor or resource. Another important aspect of the assessment of impacts is to quantify those impacts that are not scientific-based or evidence-based and include the opinions of others (i.e., the involvement and comment from I&APs).

A successful assessment of the potential significance of impacts will include the description and development of measures that will be taken to avoid, minimise or compensate for any adverse environmental impacts, to enhance positive impacts, and to report the significance of residual impacts that occur following mitigation.

A 7-step approach for the determination of significance of potential impacts was developed by Arcus to align with the requirements of Appendix 3 of the EIA Regulations, 2014 (as amended). The approach is both objective and scientific based to allow appointed specialists and EAPs to retain independence throughout the assessment process.

Arcus has adapted this 7-step approach from standard ranking metrics such as the Hacking Method, Crawford Method etc. The Arcus 7-step approach complies with the method provided in the EIA guideline document (GN 654 of 2010) and considers international EIA Regulatory reporting standards such as the newly amended European Environmental Impact Assessment (EIA) Directive (2014/52/EU).

The 7-Step approach for determining the significance of impacts pre, and post mitigation, is described below:

- **Step 1:** Predict potential impacts by means of an appraisal of:
    - Site Surveys,
    - Project-related components and infrastructure,
    - Activities related with the project life-cycle,
    - The nature and profile of the receiving environment and potential sensitive environmental features and attributes,
    - Input received during public participation from all stakeholders, and
    - The relevant legal framework applicable to the proposed development
- **Step 2**: Determination of whether the potential impacts identified in **Step 1** will be *direct* (caused by construction, operation, decommissioning or maintenance activities on the proposed development site or immediate surroundings of the site), *indirect* (not immediately observable or do not occur on the proposed development site or immediate surroundings of the site), *residual* (those impacts which remain after post mitigation) and *cumulative* (the combined impact of the project when considered in conjunction with similar projects in proximity).
- **Step 3:** Description and determination of the significance of the predicted impacts in terms of the criteria below to ensure a consistent and systematic basis for the decision-making process. Significance is numerically quantified on the basis score of the following impact parameters:
    1. ***Extent*** **(E)** of the impact: The geographical extent of the impact on a given environmental receptor.
    2. ***Duration*** **(D)** of the impact: The length of permanence of the impact on the environmental receptor.
    3. ***Reversibility*** **(R) of the impact**: The ability of the environmental receptor to rehabilitate or restore after the activity has caused environmental change
    4. ***Magnitude*** **(M)** of the impact: The degree of alteration of the affected environmental receptor.
    5. ***Probability*** **(P)** of the impact: The likelihood of the impact actually occurring.

A widely accepted numerical quantification of significance is the formula: **S=(E+D+R+M)*P**

Where: *Significance=(Extent+Duration+Reversibility+Magnitude) * Probability*

The following has also been considered when determining the significance of a potential impact.

6. **Nature (N)** of the impact: A description of what causes the effect, what will be affected, and how it will be affected.
7. **Status (S)** of the impact: described as either positive, negative or neutral

8. **Cumulative impacts**.
9. Inclusion of **Public comment.**

The significance of environmental impacts is determined and ranked by considering the criteria presented in **Table 1** below. All criteria are rank according to 'Very Low', 'Low', 'Moderate', 'High' and 'Very High' and are assigned scores of 1 to 5 respectively.

Table 1: Defining the significant in terms of the impact criteria

Impact Criteria	Definition	Score	Criteria Description
Extent (E)	Site	1	Impact is on the site only
	Local	2	Impact is localized inside the activity area
	Regional	3	Impact is localized outside the activity area
	National	4	Widespread impact beyond site boundary. May be defined in various ways, e.g. cadastral, catchment, topographic
	International	5	Impact widespread far beyond site boundary. Nationally or beyond
Duration (D)	Immediate	1	On impact only
	Short term	2	Quickly reversible, less than project life. Usually up to 5 years.
	Medium term	3	Reversible over time. Usually between 5 and 15 years.
	Long term	4	Longer than 10 years. Usually for the project life.
	Permanent	5	Indefinite
Magnitude (M)	Very Low	1	No impact on processes
	Low	2	Qualitative: Minor deterioration, nuisance or irritation, minor change in species/habitat/diversity or resource, no or very little quality deterioration. Quantitative: No measurable change; Recommended level will never be exceeded.
	Moderate	3	Qualitative: Moderate deterioration, discomfort, Partial loss of habitat /biodiversity /resource or slight or alteration. Quantitative: Measurable deterioration; Recommended level will occasionally be exceeded.
	High	4	Qualitative: Substantial deterioration death, illness or injury, loss of habitat /diversity or resource, severe alteration or disturbance of important processes. Quantitative: Measurable deterioration; Recommended level will often be exceeded (e.g. pollution)
	Very High	5	Permanent cessation of processes
Reversibility (R)	Reversible	1	Recovery which does not require rehabilitation and/or mitigation.
	Recoverable	3	Recovery which does require rehabilitation and/or mitigation.
	Irreversible	5	Not possible, despite action. The impact will still persist, and no mitigation will remedy or reverse the impact.
Probability (P)	Improbable	1	Not likely at all. No known risk or vulnerability to natural or induced hazards
	Low Probability	2	Unlikely; low likelihood; Seldom; low risk or vulnerability to natural or induced hazards
	Probable	3	Possible, distinct possibility, frequent; medium risk or vulnerability to natural or induced hazards.
	Highly Probable	4	Highly likely that there will be a continuous impact. High risk or vulnerability to natural or induced hazards
	Definite	5	Definite, regardless of prevention measures.

The *significance* (s) of potential impacts identified according to the criteria above has been colour-coded for the purpose of comparison. This colour coding will be used in impact tables.

Significance is deemed Negative (-)			Significance is deemed Positive (+)		
0 - 30	**31 - 60**	**61 - 100**	**0 - 30**	**31 - 60**	**61 - 100**
Low	**Moderate**	**High**	**Low**	**Moderate**	**High**

- **Step 4:** Determination of practical and reasonable mitigation measures based on specialists' inputs and field observations following the mitigation hierarchy (avoid, minimise, manage, mitigate, or rehabilitate).
- **Step 5:** Evaluation of predicted residual impacts after implementation of mitigation measures.
- **Step 6:** Determination of the significance of the impact taking into consideration the predicted residual impacts after implementation of mitigation measures.
- **Step 7:** Based on an acceptable significance of the impact, determination of the need and desirability of the proposed development and an opinion as to whether the development should proceed or not.

The Assessment of the significance of potential impacts is then populated in an Impact Summary Table.