EMVELO HOLDINGS (PTY) LTD (PTY) LTD

KAROSHOEK SOLAR VALLEY DEVELOPMENT
PROPOSED AREA OF DEVELOPMENT
SITE 7

VISUAL IMPACT ASSESSMENT REPORT

MAY 2016

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ACRONYMS

amsl	above mean sea level
CSP	Concentrating Solar Power
DEA	Department of Environmental Affairs
DoE	Department of Energy
DSG	Direct steam generation
EIA	Environmental Impact Assessment
GIS	Geographical Information System
LCAs	Landscape Character Areas
NEMA	National Environmental Management Act, Act No. 107 of 1998
REDZ7	Renewable Energy Development Zone 7
REIPPP	Renewable Energy Independent Power Producers Procurement Programme
USAA	US Aviation Authority
VAC	Visual Absorption Capacity
VIA	Visual Impact Assessment
ZTV	Zones of Theoretical Visibility

1 INTRODUCTION

1.1 GENERAL

This visual impact assessment (VIA) study forms part of the Scoping and Environmental Impact Assessment (EIA) that is being undertaken by Savannah Environmental (Pty) Ltd. on behalf of Emvelo Holdings (Pty) Ltd., for a proposed development of a Concentrating Solar Power (CSP) site, known as Ilanga CSP7, within the Karoshoek Solar Valley Development.

In terms of the EIA Regulations promulgated under the amended National Environmental Management Act (NEMA), Act No. 107 of 1998, the proposed development of the facility requires environmental authorisation from the National Department of Environmental Affairs (DEA). An impact to be assessed comprises the visual impact that the facility will have on surrounding areas.

This VIA report has been prepared for inclusion in the project EIA report following the approval of the Scoping report.

The site investigation was undertaken in March 2016. The key issue regarding the timing of the site investigation is that it is undertaken during clear weather. This enables key landscape features to be identified more easily over the greatest distance and for the assessor to consider the project under the worst case conditions in terms likely maximum impact.

1.2 PROJECT LOCATION AND EXTENT

Ilanga Site 7 is located on Portion 4 of Trooilaps Pan 53 and Portion 2 of Matjiesrivier 41 **(Map 1)**.

Geographic coordinates of the approximate centre point of the site are:

	DEGREES	**MINUTES**	**SECONDS**
(SITE 7)			
LATITUDE (S)	28°	35′	16.74″
LONGITUDE (E)	21°	30′	11.55″

No site alternatives are under consideration, due to the requirement for Ilanga Site 7, which is required immediately adjacent to the authorised sites within the Karoshoek Solar Valley Development.

1.3 BACKGROUND OF SPECIALIST

Jon Marshall (Pr. LArch, CMLI, EAPSA, Dip LA) qualified as a Landscape Architect in 1978 **(Appendix 1, Specialists brief CV)**. He is also a certified Environmental Impact Assessment Practitioner. He has been involved in Visual Impact Assessment over a period of approximately 30 years. He has developed the necessary computer skills to prepare viewshed analysis (zone of theoretical visibility) and three dimensional modelling to illustrate impact assessments. He has undertaken visual impact assessments for major buildings, mining, industrial development, mining and infrastructure projects and has been involved in the preparation of visual guidelines for large scale developments. Jon is responsible for report writing and visual impact assessment.

1.4 TERMS OF REFERENCE AND RELEVANT GUIDELINES

The brief is to assess the visual impact that the facility will have on surrounding areas.

Work was undertaken in accordance with the following guideline documents:

a. The Government of the Western Cape Guideline for Involving Visual and Aesthetic Specialists in EIA Processes (Western Cape Guideline) (Oberholzer, 2005). This is the only local relevant guideline available in South Africa, setting various levels of assessment subject to the nature of the proposed development and surrounding landscape **(Appendix II)**; and

b. The Landscape Institute and Institute of Environmental Management and Assessment (UK) Guidelines for Landscape and Visual Impact Assessment which provides detail of international best practice (UK Guidelines) (Landscape Institute and Institute of Environmental Assessment and Management, 2013).

Based on the predicted visual impacts described in the scoping report and on the basis that the proposed new facility will not add significantly to the visual impact of the already authorised projects, it is proposed that a site visit is undertaken and, if no additional significant impacts are likely, then Level 2 Assessments are undertaken. The site visit confirmed that the proposed project would have a similar or lesser level of impact as the existing and authorised CSP Tower projects and that lower level development around the proposed tower is likely to be difficult to see from public areas. The recommendation that a Level 2 Assessment should be undertaken remains valid, however due to the importance of clearly understanding the cumulative effects of the development 3D CAD modelling based on digital terrain information and accurate simulations have been undertaken. This in effect elevates the study to a Level 4 Assessment.

1.5 ISSUES IDENTIFIED

Anticipated issues related to the potential visual impact of the proposed project identified at the scoping stage include the following:

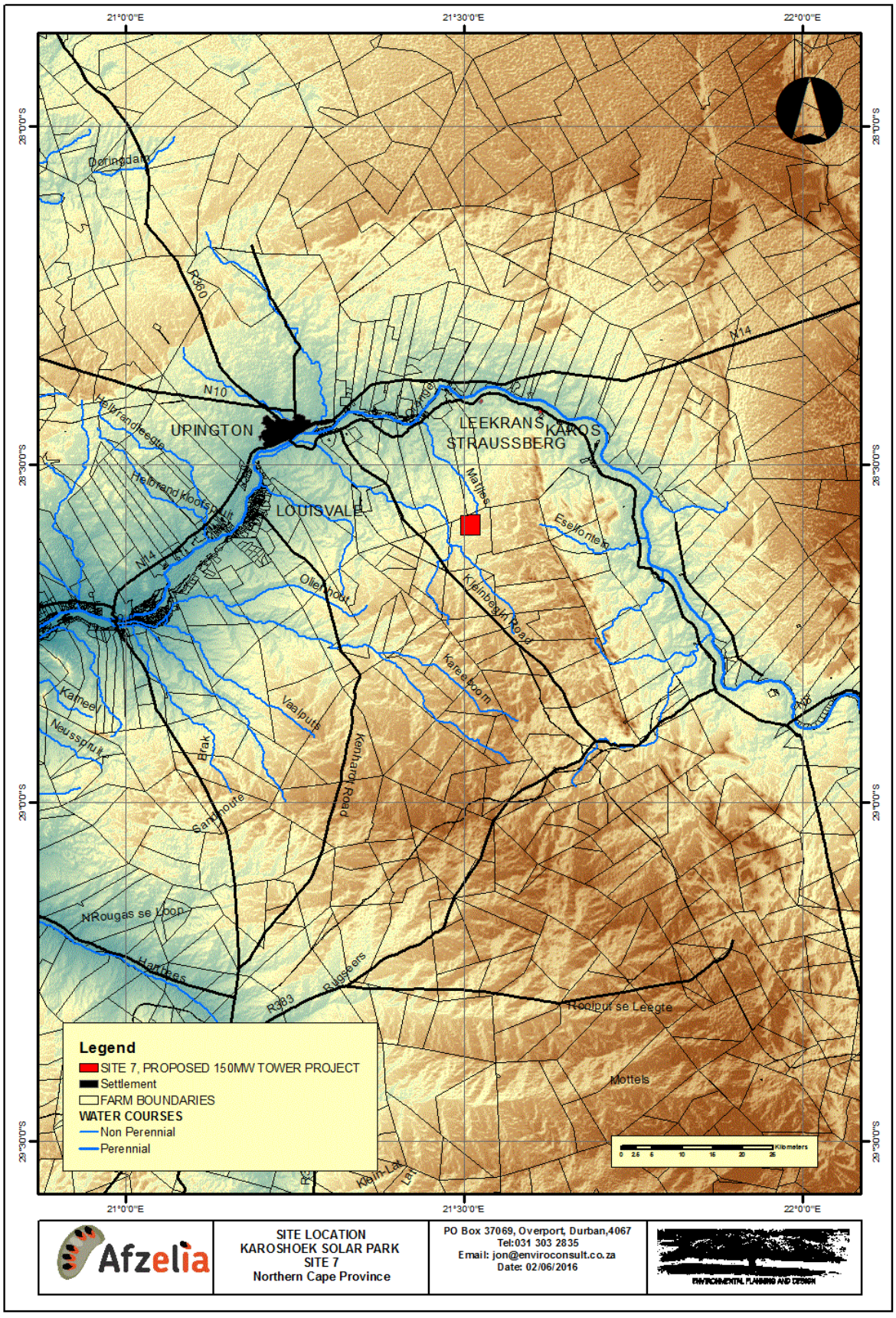
a) Potential visual impact on users of roads in close proximity to site 7;

b) Potential visual impact on residents of settlements and homesteads in close proximity to the proposed site 7;
c) Potential visual impact on sensitive visual receptors within the region;
d) Potential lighting impacts;
e) Potential impacts on general landscape character of the area; and
f) Ocular impacts associated with glint and glare.

These issues will be considered in the context of the Landscape Character Areas, visual effects identified and possible cumulative influence of other possible infrastructure projects that are planned in the vicinity.

Possible mitigation measures also need to be identified.

MAP 1: SITE LOCATION



2. PROJECT DESCRIPTION AND CONTEXT

2.1 MOTIVATION

The purpose of the proposed CSP facility on site 7 will be to evacuate the generated power into the Eskom electricity grid. The project is proposed to be bid into the Department of Energy's (DoE) Renewable Energy Independent Power Producer Procurement Programme (REIPPPP). Ultimately, the project will be a part of the renewable energy projects portfolio in South Africa.

2.2 PROJECT DESCRIPTION

Ilanga CSP 7 will comprise of heliostats and a molten salt tower system **(Plate 5**) with a generation capacity of 150 MW. An area of approximately 1526 ha is required for the facility. Infrastructure associated with the project includes:

- Molten salt tower (MST) up to 275 m in height with surrounding heliostat field, including a power block.
- Waste management infrastructure including evaporation dams and a wastewater treatment facility.
- On-site substation and associated 132 kV power-line linking the facility to the national electricity grid.
- Access roads and internal access roads.
- A water supply pipeline from the Orange River (including water treatment, storage reservoirs and evaporation ponds).
- Support buildings (control building and maintenance facilities)

Power Tower facilities include one or more central towers which are typically surrounded by a generally circular or semi-circular array of flat-plate reflectors called heliostats **(Plate 1 and 2**). The number of heliostats varies by facility, but can number in the thousands to hundreds of thousands.

The Power Tower heliostats reflect the sun to create heat, to Heat Transfer Fluid (HTF), so as to boil water. The light is focused onto a receiver unit that holds the HTF located close to the top of the central tower.

The heliostats track the sun during the course of the day to keep sunlight focused on the receiver.

Power Tower facilities have a power block, cooling system, and other ancillary structures similar to those of the other CSP systems.

The system requires a steam turbine that is housed in a power house and a cooling system that might be in the form of cooling towers or steam condensers (Dry Cooling). Refer to **Figure 1** for a generic layout.

The applicant has confirmed that dry cooling technology will be used for this project.

Because of the height of the Power Towers, it is likely that aviation warning lights are likely to be required.

It is also likely that security lighting will be required within the heliostat field and operational lighting will be required within and around ancillary buildings.

The applicant has confirmed that the Power Tower will be up to 270 m high.

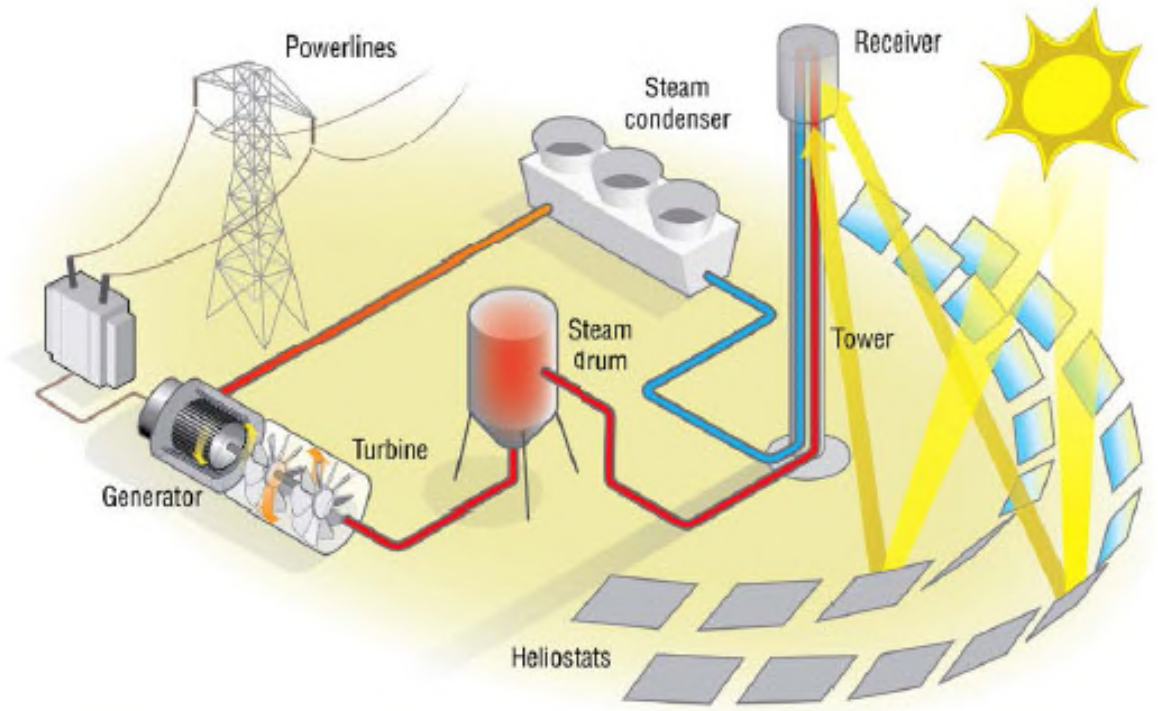


Figure 1, Generic Layout of a Power Tower CSP Project (extracted from CSP Website, http://www.cspworld.org/)

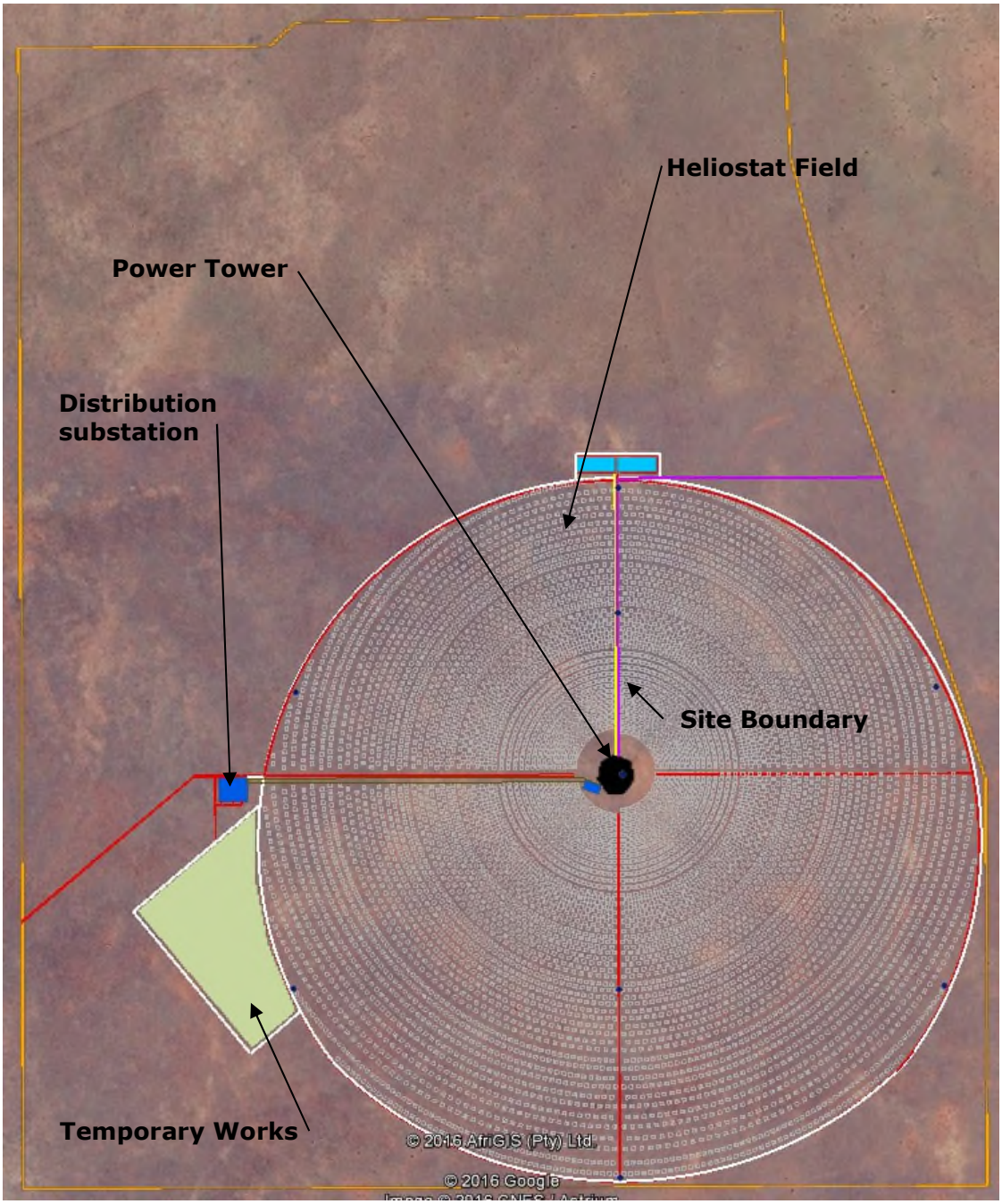


Figure 2, Ilanga Site 7, Proposed General Site Layout

Plate 1, Existing Power Tower Projects in Sanlucar la Mayor, near Seville, Spain. (photograph extracted from Desertec - UK web site, http://www.trec-uk.org.uk)

Plate 2, Existing Power Tower project. (photograph extracted from CSP World Web Site, http://www.csp-world.com).

2.4 PROJECT CONTEXT, EXISTING AND FUTURE

The descriptions of the associated authorised projects and their proposed additional areas within the Karoshoek Solar Valley Development are as follows:

NEW SITE REF. NO	OLD SITE REF. NO.	SITE AREA	PROJECT NAME & COMPONENTS
Site 1, CSP Tower	Site 3a	242 ha Authorised	Karoshoek Tower 1 (1 x 50 MW Tower) Karoshoek Tower 2 (1 x 50 MW Tower)
As above	As above	703 ha Additional area	1X100MW Tower replacing one of the approved 50MW Towers.
Site 2, CSP Parabolic Trough	Site 1.3	469 ha, Authorised	Karoshoek PT, 1X100 MW Parabolic Trough
As above	As above	200 ha Additional area	1X50 MW Parabolic Trough
Site 3, CSP Parabolic Trough	4	484 ha Authorised	Karoshoek LFTT 1, 1X100 MW Parabolic Trough
As above	As above	200 ha Additional area	1X50 MW Parabolic Trough
Site 4, CSP Parabolic Trough	5	484 ha Authorised	Karoshoek LFTT 2, 1X100 MW Parabolic Trough
As above	As above	200 ha Additional area	1X50 MW Parabolic Trough
Site 5, CSP Parabolic Trough	1.4	474 ha Authorised	Karoshoek LFT2, 1X 100 MW Parabolic Trough
As above	As above	200 ha Additional area	1X50 MW Parabolic Trough

There are three additional approved sites within the area which include:

SITE REF	PROJECT NAME, COMPONENTS AND DESCRIPTION
Site 2	Karoshoek CPVPD 1 (1 x 25 MW Concentrating photovoltaic or parabolic dish technology project)
	Karoshoek CPVPD 2 (1 x 25 MW Concentrating photovoltaic or parabolic dish technology project)
	Karoshoek CPVPD 3 (1 x 25 MW Concentrating photovoltaic or parabolic dish technology project)
	Karoshoek CPVPD 4 (1 x 25 MW Concentrating photovoltaic or parabolic dish technology project)
Site 1.1	Karoshoek LF 1 (1 x 100 MW Linear Fresnel)
Site 1.2	Ilanga CSP1 (1 x 100 MW Parabolic Trough) – currently under construction

SITE REF	PROJECT NAME, COMPONENTS AND DESCRIPTION
Grid connection	Electricity distribution line(s) which will connect to an on-site substation / switchyard

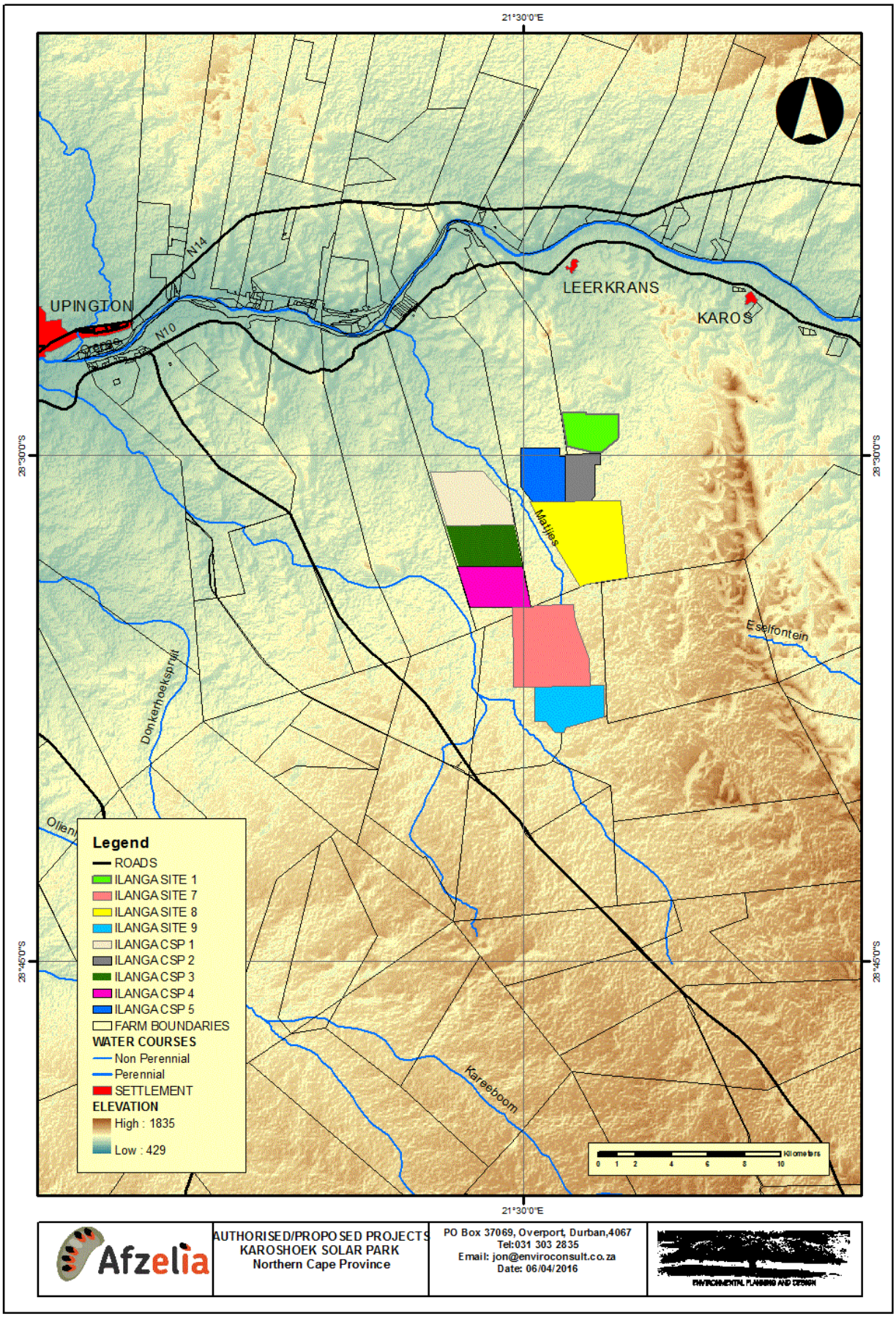
There are also two additional proposed sites within the area which include:

SITE REF	PROJECT NAME, COMPONENTS AND DESCRIPTION
Site 8, additional area for authorised CSP Tower	150 MW Power Tower Portion 3 of Matjesrivier 41 and Lot 944 Karos Settlement 944
Site 9, additional area for authorised CSP Trough	150 MW Power Tower Portion 4 and 20 of Trooilaps Pan 53

The location of all sites is shown on **Map 2, Authorised and proposed solar projects.**

This VIA report reviews visual implications for the proposed **Ilanga Site 7**. It is important however that the development area associated with this site is seen in the context of other authorised sites and proposed sites.

Authorised and proposed projects are likely to visually transform the area within which they are located. They will change sections of the rural landscape into developed, industrialised areas.


21°30'0"E
28°30'0"S
28°45'0"S
UPINGTON
N14
N10
LEERKRANS
KAROS
Matjies
Eselfontein
Donkerhoekspruit
Kareeboom
Legend
ROADS
ILANGA SITE 1
ILANGA SITE 7
ILANGA SITE 8
ILANGA SITE 9
ILANGA CSP 1
ILANGA CSP 2
ILANGA CSP 3
ILANGA CSP 4
ILANGA CSP 5
FARM BOUNDARIES
WATER COURSES
Non Perennial
Perennial
SETTLEMENT
ELEVATION
High : 1835
Low : 429
Kilometers
0 1 2 4 6 8 10
Afzelia
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ENVIRONMENTAL PLANNING AND DESIGN

3 DESCRIPTION OF RECEIVING ENVIRONMENT AND POSSIBLE RECEPTORS

3.1 LANDSCAPE CHARACTER

Landscape character is defined as "a distinct, recognisable and consistent pattern of elements in the landscape that makes one landscape different from another".

Landscape Character is a composite of a number of influencing factors including:

- Landform and drainage;
- Nature and density of development; and
- Vegetation patterns.

Landscape character was defined from available GIS datasets, online mapping and aerial photography. This will be ground-truthed during the assessment stage.

The region has a strong rural character, interspersed with intensive arable agriculture where water is available for irrigation and settlement.

The region to the north of the proposed site appears to have an agricultural character with large scale irrigated agriculture beside the Orange River. In this area settlement in the form of farmsteads is relatively dense. There are also two small settlements of Karos and Leerkrans.

To the south of the Orange River the landscape appears more natural. Low intensity grazing appears to be the main land use. There are also occasional isolated farmsteads located on the farms.

The other notable characteristic is landform with the majority of the area surrounding the site being relatively flat. To the north and east however, the terrain is more rugged with numerous steep ridgelines running in a general north/south direction through the landscape.

Whilst the major landscape characteristics are indicated above, it is also important to understand that a number of solar power projects are planned and authorised in the vicinity of the site. It is also understood that some of these projects have commenced. This is likely to change the character of the landscape in the vicinity of the projects.

Details of the main influencing factors are indicated below:

3.1.1 Landform and Drainage

The study area occurs on land that ranges in elevation from 800 amsl (above mean sea level) (at the Orange River) to 1180 amsl (at the top of the nearby koppies. The terrain surrounding the farm is predominantly flat with an even slope towards the Orange River valley that forms the most distinct hydrological feature in the region (MetroGIS, 2012).

Due to this flat topography, the area, particularly south of the river, is characterised by the occurrence of many non-perennial drainage lines and pans.

The dominant topographical unit or terrain type of the region is relatively homogenous and is described pre-dominantly as *lowlands with hills, dune hills* and *irregular or slightly irregular plains*.

Relatively prominent low hills and koppies occur in the south-east of the study area. Some isolated koppies also occur randomly in the north west of the study area. The Orange River meanders from the south east, and then curves toward the west (MetroGIS, 2012).

3.1.2 Nature of Development and Landuse

The river has, to a large degree, dictated the settlement pattern in this arid region by providing a source of permanent water for the cultivation of grapes. This and the associated production of wine is the primary agricultural activity of this district. Cattle and game farming practises also occur at a less intensive degree (MetroGIS, 2012).

The majority of the study area is sparsely populated (less than 10 people per km^2) and consists of a landscape of wide-open spaces and very little development. The scarcity of water and other natural resources has dictated the settlement patterns of this region.

Tourism is not well-developed within the study area, but some destinations exist along the river and in Upington.

The population distribution is primarily concentrated in and around small towns along the Orange River. Farming homesteads dot the countryside at irregular intervals.

The study area has a rural character with little development outside of Upington. Exceptions occur where power lines traverse the study area. These include the Garona-Gordonia No.1 132 kV line to the north east of the site and the Garona-Kleinbegin No.1 132kV line to the west of the site.

As indicated in Section 2.4, currently authorised projects will transform sections of this rural landscape into developed, industrialised areas.

3.1.3 Vegetation Patterns

Vegetation cover in this semi-desert region is primarily *shrubland, thicket, and bushland* with isolated pockets of *grassland*, and *agricultural fields* occurring along the Orange River where irrigation is possible. There are no formally protected areas within the study area.[1]

3.1.4 Landscape Character Areas and, Visual Absorption Capacity

Landscape Character Areas (LCAs) are defined by the UK Guidelines as, "single unique areas which are the discrete geographical areas of a particular landscape type".

Visual Absorption Capacity (VAC) is *defined* as, "the landscape's ability to absorb physical changes without transformation in its visual character and quality". Where elements that contrast with existing landscape character are proposed, VAC is dependent on elements such as landform, vegetation and other development to provide screening of a new element. The scale and texture of a landscape is also critical in

[1] Sources: DEAT (ENPAT Northern Cape), NBI (Vegetation Map of South Africa, Lesotho and Swaziland) and NLC2000 (ARC/CSIR).

providing VAC, for example; a new large-scale industrial development located within a rural small-scale field pattern is likely to be all the more obvious due to its scale.

The affected landscape can be broadly divided into the following LCAs that are largely defined by vegetation and landform **(Map 3, Landscape character areas)**.

- **The Orange River Corridor** which is generally comprised of open cultivated land that is surrounded in areas by tall woody vegetation. Woody vegetation within and on the edges of this area, often screens views from within the LCA as well as screening views from one side of the river to the other.
- **Undulating Valley Floor.** Gently undulating topography with low intensity grazing / game farming, low level grassland / shrub land, occasional non-perennial streams, occasional farmstead. Limited VAC is provided by gentle undulations and dark patches of woody vegetation which means that low / dark structures are likely to be assimilated into the landscape. However, anything greater than 2-3m high particularly if contrasting in colour could be highly obvious. The VAC for this LCA is dependent on both the undulating terrain and the low vegetation. Within the valleys and lower areas around the site, these elements combine to provide significant VAC. As soon as the viewer approaches the low ridgelines however, VAC is limited.
- **Steep Ridgelines and Koppies**. This area consists of steep rocky ridgelines that rise almost vertically from the valley floor. It is generally dryer than the valley floor, vegetation is therefore more stunted. This LCA also includes relatively rugged terrain to the south of the Orange River and to the east of the Karoshoek Solar Park. Land uses include low intensity grazing / game farming. There are also occasional farmsteads within the landscape. Ridgelines and koppies have an important screening effect to the degree that views over the site will not be possible past the first minor ridgeline. However, the same ridgeline also provides the possibility of elevating the viewer and increasing visibility over the site area which reduces VAC. The low vegetation that generally covers the area is unlikely to contribute significantly to the VAC of the landscape.

3.2 LANDSCAPE QUALITY AND IMPORTANCE

3.2.1 General

The importance of the study area lies both in its agricultural production capacity as well as its natural features and their ability to attract and provide a backdrop for tourism activities in the area. The latter point is attested by the use of sites along the Orange River for tourism activities.

The area around Upington is also becoming important for solar projects, with a number of projects in operation or already under development. This is due to national and provincial government initiatives promoting solar development in this area. This is likely to result in transformation of sections of the landscape in the near future. This development is of national importance given the need to produce energy from renewable sources. In order to maintain existing economic bases rather than replace them, it will be critical that this is done in a manner that minimises impact on existing uses.

3.2.2 Orange River Corridor

This landscape is of prime importance for productive agriculture. The main concern of the majority of users of the corridor is therefore likely to be related to the productivity of the area rather than aesthetic concerns. The area is also a focus for local recreational use and of secondary tourism importance; it is unlikely to be the main reason why visitors are attracted to Upington so there may be concern related to maintaining the quality of views from the corridor from local stakeholders, although this issue has not been raised through this process. Due to topography as well as dense tall woody vegetation within and on the edges of the corridor, views from within this LCA largely have an internal focus.

3.2.3 Undulating Valley Floor and Steep Ridgelines and Koppies

These LCAs are currently important for low intensity grazing. Existing natural features could also provide a backdrop for eco-tourism related activities. They are also part of the natural outlook from the national roads that carry a high degree of tourism related traffic to and through the area.

The Steep Ridgelines and Koppies provide a dramatic backdrop to the valley floor. They also compartmentalise the landscape providing screening from one area to another.

Figure 3 provides an overview of the development area as seen from the top of a koppie to the north west of the site. From this viewpoint it is obvious that the development occurs within the relatively natural valley floor and that is surrounded by high land to the north and east and that the area surrounding the development is largely unpopulated and because it is comprised of private farm land, there are limited public areas from which views of the development will be possible. It should be noted that the koppie from which this photograph was taken is also on a private farm.

3.3 VISUAL RECEPTORS

3.3.1 Definition

Visual Receptors are defined as "individuals and/ or defined groups of people who have the potential to be affected by the proposal".

It is also possible that an area might be sensitive due to an existing use. The nature of an outlook is generally more critical to areas that are associated with recreation, tourism and in areas where outlook is critical to land values.

3.3.2 Possible visual receptors and sensitivities

This section is intended to highlight possible visual receptors within the landscape which due to use could be sensitive to landscape change. They include:

Area Receptors
Include activity areas that could be sensitive to their outlook such as protected areas or areas that are important for tourism. These include all settlement areas as well as an ecotourism operation to the north of the Orange River (FM Safaris).

Linear Receptors
Include routes through the area which are comprised of two local gravel local roads (Kleinbegin Road and Kenhardt Roads) as well as one national routes (N10 and N14 to the north). All routes may be used to carry a proportion of tourism related traffic.

The N10 and N14 at their closest run approximately 15.4km and 23.5km to the north of the site respectively. These routes are likely to carry a large proportion of visitors to the Upington area as well as tourists on route from South Africa to Namibia and the Kalahari region.

The Kleinbegin and Kenhardt Roads at their closest run approximately 4.7km and 21.5km to the west of the proposed site respectively. These roads are likely to be most important for local traffic.

Point Receptors
Include isolated and small groups of homesteads that are generally associated with and located within the low undulating valley surrounding the development as well as the homesteads on the agricultural land in the Orange River Corridor. In excess of 200 of these receptors have been identified within the approximate visual limit (59.2km). The majority of these, however, are within the Orange River Corridor and are likely to be screened by landform from at least the lower sections of the development. Forty eight (48) homesteads have been identified within the Undulating Valley Floor LCA that have the potential to be affected.

Possible visual receptors or areas, places and routes that may be sensitive to landscape change are indicated on **Map3** indicating the Landscape Character Areas as well as **Maps 4 and 5** (included under Section 4 of this report) indicating the Zones of Theoretical Visibility of the proposed project.

LANDSCAPE CHARACTER AREAS

ORANGE RIVER CORRIDOR LCA

Plate 3, Orange River Corridor LCA. Settlements within the corridor are screened from the development area by steep ridgelines.

Plate 4, Orange River Corridor LCA. The focus within this LCA is on the river which is used for recreation / tourism activities as well as agricultural production.

STEEP RIDGELINES AND KOPPIES LCA

Plate 5, Steep Ridgelines and Koppies LCA. Steep ridgelines compartmentalise the landscape.

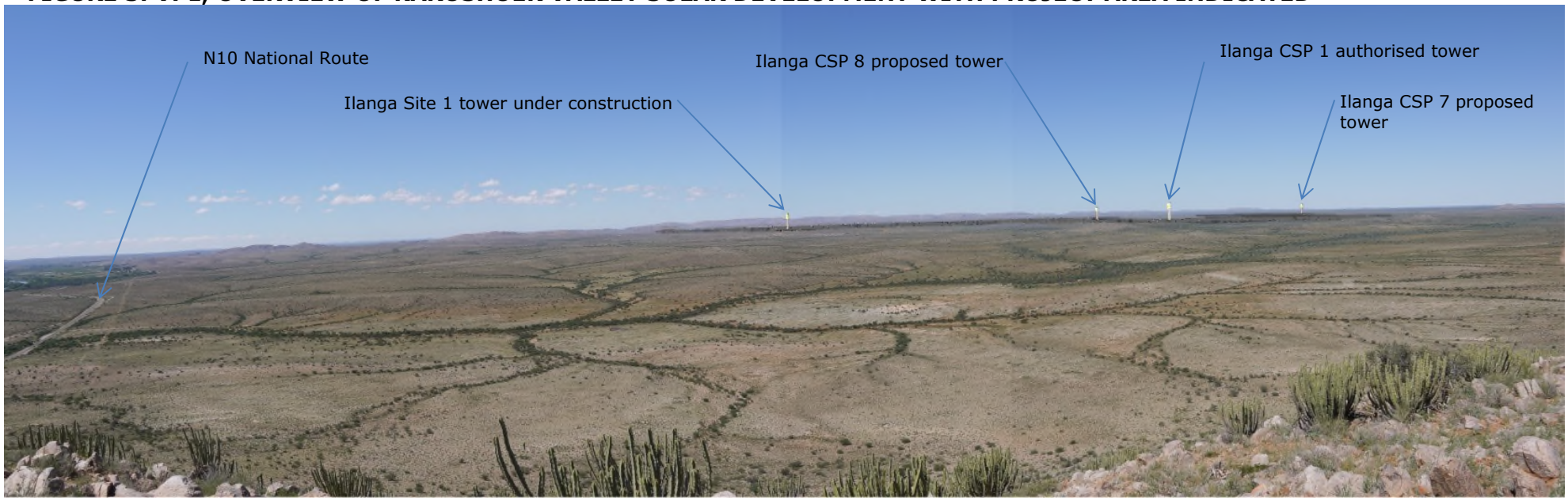
Plate 6, Steep Ridgelines and Koppies LCA. Steep ridgelines screen the N10 from the development area.

UNDULATING VALLEY FLOOR LCA

Plate 7, Undulating Valley Floor LCA. This is generally a flat landscape.

Plate 8, Undulating Valley Floor LCA. Minor ridgelines provide a degree of VAC

FIGURE 3: VP1, OVERVIEW OF KAROSHOEK VALLEY SOLAR DEVELOPMENT WITH PROJECT AREA INDICATED



Overview of the Karoshoek Valley from the North West Approximately 17km from Ilanga CSP 7

Note – Prior to 2016 the valley wa largely undeveloped and generally inaccessible to the public. At the time of reporting one CSP Tower project was under davelopment and another had been authorised. In addition four CSP parabolic trough developments have been authorised. This image locates the approximate extent of solar projects that are authorised and planned and indicates the location of CSP 7 in this context. Views into the valley are largely screened by steep ridgelines. Locations and extent of the site are displayed as accurately as possible based on visible landmarks, calculations based on the lens focal length / angle of view and CAD modelling.

POSSIBLE SENSITIVE RECEPTORS

HOMESTEADS

Plate 9: Homesteads located close to the development could be impacted. Homesteads have been identified within the approximate limit of visibility.

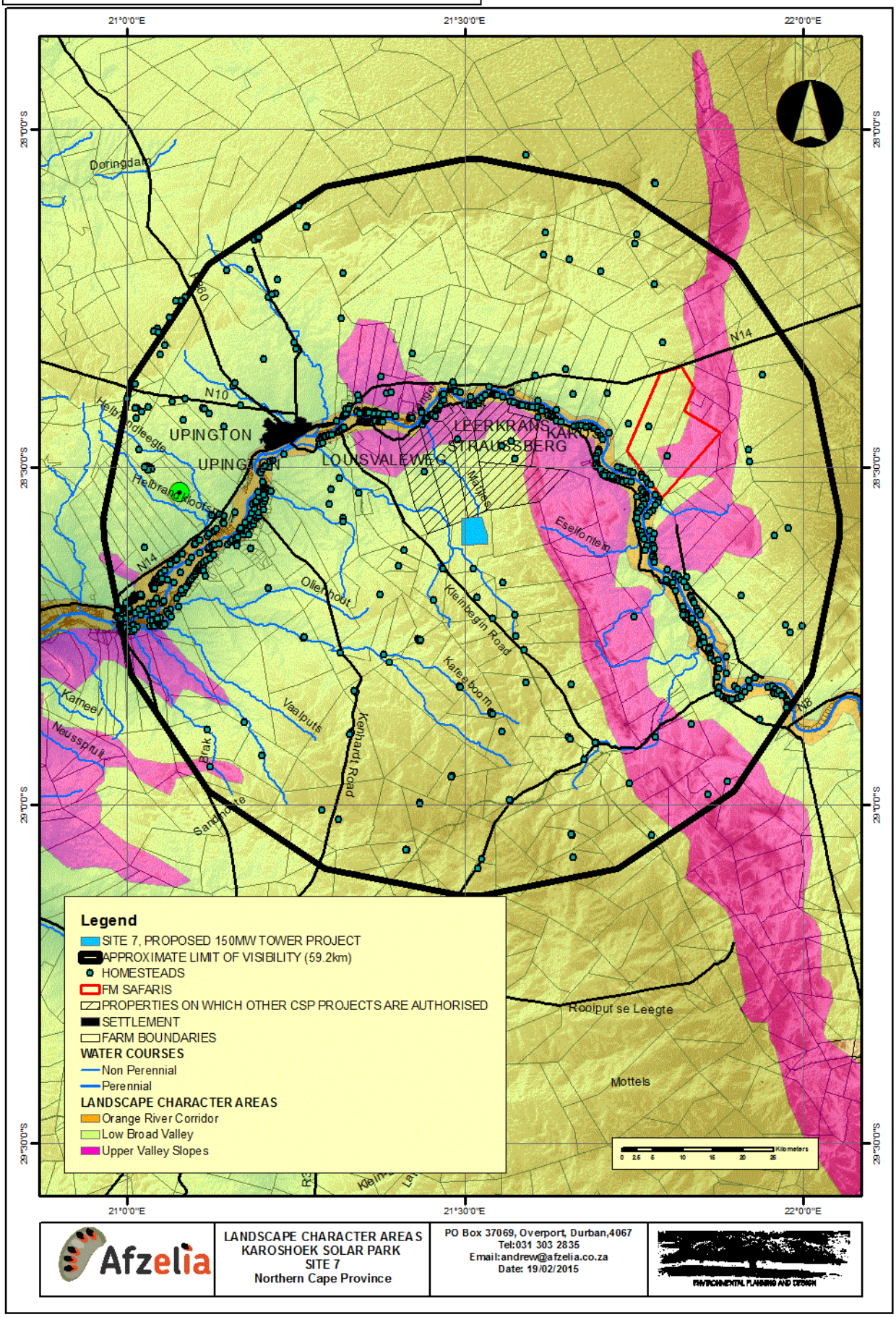
N10

Plate 10: The N10 runs to the north of the project area. Both the N10 and N14 could be impacted. These are busy national roads that have tourism importance.

KLEINBEGIN GRAVEL ROAD

Plate 11: The Kleinbegin Road (Gravel Road) runs to the west of the project area. Both the Kleinbegin and the Kenhardt Roads are local roads that run to the west of the site. They are used largely by local people. Consequently they appear to be lightly used.

MAP 3: LANDSCAPE CHARACTER AREAS



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4 THE NATURE OF POTENTIAL VISUAL IMPACTS

4.1 GENERAL

Impacts could include general degradation of LCAs due to the development that may detract from the existing character as well as change of view for affected people and/ or activities:

a. Generally, landscape change or degradation is particularly important in protected areas where the landscape character might be deemed to be exceptional or rare. However, it can also be important in non-protected areas particularly where landscape character is critical to a specific broad scale use such as tourism areas or for general enjoyment of an area. This is generally assessed by the breaking down of a landscape into components that make up the overall character and understanding how proposed elements may change the balance of the various elements. The height, mass, form and colour of new elements all help to make new elements more or less obvious as does the structure of an existing landscape which can provide screening ability or texture that helps to assimilate new elements. This effect is known as visual absorption capacity; and
b. Change in specific views within the affected area from which the character of a view may be important for a specific use or enjoyment of the area.
    - Visual intrusion is a change in a view of a landscape that reduces the quality of the view. This can be a highly subjective judgement. Subjectivity has however been removed as far as is possible by classifying the landscape character of each area and providing a description of the change in the landscape that will occur due to the proposed development. The subjective part of the assessment is to define whether the impact is negative or positive. Again to make the assessment as objective as possible, the judgement is based on the level of dependency of the use in question on existing landscape characteristics; and
    - Visual obstruction is the blocking of views or foreshortening of views. This can generally be measured in terms of extent.

    Due to the nature of the proposed development, visual impacts are expected to relate largely to intrusion.

4.2 POSSIBLE IMPLICATIONS FOR LANDSCAPE CHARACTER

Heliostats will be aligned radially around the power tower as indicated on Figure 2.

From views of the existing power tower installation to the west of Upington it is concluded that unless reflection, glint and glare make them more obvious, it is unlikely that the heliostats will be obvious in the flat landscape from greater than 4 – 5km distance.

Reflection, glint and glare could make the heliostats more obvious subject to the time of day and location of the viewer. When heliostats are aligned facing a viewpoint, light reflecting off the mirrored surfaces is likely to make the structures more obvious. In general therefore it is likely to be most obvious to the east in the morning, to the west in the afternoon and to the north during the middle of the day.

The heliostats can also reflect the colour of the sky or the surrounding landscape subject to their inclination. The colour of the facility is therefore likely to change as the angle of the sun changes.

Until the viewer sees the back face of the structure when the colour of the finish on the reverse side of the mirror is seen reflections of the sky or surrounding landscape are seen. This side is also likely to be viewed in at least partial shadow.

Where the development is seen from an elevated viewpoint, it is likely that the structures will visually combine providing an impression of an extensive industrial development. Judging from the topography within the approximate limit of visibility, it seems unlikely that this will occur, however views from upland areas to the east on the edge of the approximate limit of visibility could provide this impression.

The existing power tower development to the west of Upington is a dominant element in the landscape at 5km and at 30km the tower is obvious but not dominant.

Subject to time of day and weather conditions, it is likely that the structure will become less dominant at around 15-20km and not obvious at around 30-35km distance.

In addition to visual impacts from the tower structure, the sunlight focused on the tower's receiver by the heliostats during normal operations causes the surface of the receiver to appear to glow with sufficient intensity to be visible for long distances. It is likely therefore that this will make the tower more obvious to the south east, south and south west.

Refer to **Plates 12 to 18** inclusive which provide an indication of the likely impact of the proposed power tower on views from distances up to 35km. These images feature an existing power tower to the west of Upington.

4.3 POSSIBLE IMPLICATIONS FOR VISUAL RECEPTORS

Implications for visual receptors can be divided into;

1) Possible changes in views over the landscape that could affect sensitive users or general enjoyment of views; and
2) Glint and / or glare that could cause eye damage or nuisance to receivers. Power Tower projects are known to have the following effects[2];
   - Specular reflections[3] from the heliostats particularly from higher ground.
   - Diffuse[4] and specular reflections from the receiver.

4.4.1 Possible changes in views over the landscape that could affect sensitive users or general enjoyment of views

The review of possible sensitive receptors in the region highlighted:

[2] Journal of Solar Energy Engineering August 2011, Vol. 133. Clifford K. Ho of the Concentrating Solar Technologies Department, Sandia National Laboratories.

[3] Specular reflection is the mirror-like reflection of light (or of other kinds of wave) from a surface, in which light from a single incoming direction (a ray) is reflected into a single outgoing direction

[4] Diffuse reflection is the reflection of light from a surface such that an incident ray is reflected at many angles.

The N10 and N14 national roads. The N10 and N14 are located approximately 10 and 15km to the north of the proposed site respectively. Given that these roads are slightly lower than the proposed site and that they are to the north of a series of steep ridgelines and Koppies, because of this the heliostats will not be visible.

The power tower is likely to be obvious to extensive sections of these roads to the north. However, it is likely that from the north east, rugged terrain will help to at least part screen the structure.

Reflection from the receptor on the power tower may not be visible to a large proportion of these roads as they are located to the north of the project.

FM Safaris is an ecotourism operation that is located to the north of the Orange River approximately 25km from the proposed site. The major ridgelines that are located between the proposed site and the Orange River are likely to have a significant influence helping to screen the development.

The local unsurfaced roads to the west. These roads are located approximately 8 and 24 kilometres to the west of the western boundary of the site. These roads are likely to be used mainly by local people accessing the rural areas to the south and west of the site. The interest of this group is likely to be focused on the productivity of the land rather than aesthetics. The ZTV indicates that the development is likely to be visible over extensive sections of these roads. It is likely however, that the heliostats will not be obvious unless reflections are visible. The power tower is likely to be the most obvious element. The further south the viewer is on the roads, the more likely that diffuse reflection from the receptor will make the tower more obvious.

Homesteads located in the landscape surrounding the proposed project. The majority of homesteads are located within the Orange River Corridor and are set at a lower level than the proposed site. This means that they are likely to be largely screened from the heliostats although the power tower is likely to be obvious.

There is one homestead within 2km of the site boundary to the west north west, one homestead within 6km to the north west and three homesteads to the east from which the heliostats could be obvious, particularly if viewed from a higher level and due to reflected light. From review of levels however it appears that these homesteads are generally located at a lower level than the site. This means that landform and vegetation are likely to mitigate this impact.

4.4.2 Possible Glint and / or Glare

Glint is defined as a momentary flash of light, while glare is defined as a more continuous source of excessive brightness relative to the ambient lighting. Hazards from glint and glare from concentrating solar power plants include the potential for permanent eye injury (e.g., retinal burn in the worst case) and temporary disability or distractions (e.g., flash blindness), which may impact people working nearby, pilots flying overhead, or motorists driving alongside the site[5].

[5] Solar PACES, Berlin, September 15-18. 2009, conference paper by Clifford Ho, Cheryl Ghanbari, Richard Diver.

Research indicates that glint and glare problems are most likely to occur from the heliostats. It is possible that homesteads from which the heliostats are visible could be affected.

4.4.3 Possible Mitigation Measures

The US Bureau of Land Management highlights the following mitigation measures in their Best Practices Manual for Reducing Visual Impacts of Renewable Energy Facilities[6];

Vegetation Clearance

Often, vegetation beneath a solar field is completely stripped and the area may be levelled prior to construction; however, depending on the solar technology employed, these procedures may not be necessary. In some cases, grasses and some low shrubs can be left under the heliostat field, or shrubs can be trimmed to shorten them to an acceptable height. If vegetation can safely be left beneath the structures and does not interfere with facility construction, operation, or maintenance, strong colour contrasts associated with exposed or eroded soils can be reduced, as can texture contrasts caused by vegetation removal. The visual benefits of leaving vegetation underneath structures varies depending on the height and spacing between solar collectors; it is most effective at reducing visual impacts for more widely spaced and taller collector arrays because there is more space visible underneath and between the collectors. Leaving or replacing vegetation underneath the structures has non-visual benefits as well, such as reduced runoff and erosion, and reduced cost for revegetation at the time of decommissioning.

Colour

Colour-treated mirror backs and structural supports minimises reflection from these faces. Colour-treated mirror backs appear as a dark band. Untreated mirror backs appear blue. In this case, the colour treatment used has the added benefit of strengthening the mirrors, and it improves energy production efficiency during low-energy production conditions.

Depending on the component and treatment method, treatments could be subject to fading or flaking, and may require re-treatment to maintain proper coloration.

Fencing / Screening

Where significant offsite glare is unavoidable, fencing with privacy slats, earthen berms, or vegetative screening materials may be employed.

[6] Best Management Practices for Reducing Visual Impacts of Renewable Energy Facilities on BLM Administered Lands, United States Department of Interior, Bureau of Land Management (BLM), first edition, 2013.

VISUAL INFLUENCE OF POWER TOWER DEVELOPMENT

Plate 12, Existing Power Tower viewed from less than 5km.

Plate 13, Existing Power Tower viewed from approximately 15km.

Plate 14, Existing Power Tower viewed from approximately 20km.

Plate 15, Existing Power Tower viewed from approximately 25km.

Plate 16, Existing Power Tower viewed from approximately 30km.

Plate 17, Existing Power Tower viewed from approximately 35km.

Plate 18, Existing Power Tower visible over ridgeline.
Note, whilst only a small section of the upper tower is visible the diffuse reflection from the receptor makes the structure obvious. It is likely that similar views will be possible to the north of the Orange River Corridor.

5 VISIBILITY OF THE PROPOSED DEVELOPMENT

5.1 ZONES OF THEORETICAL VISIBILITY

Zones of Theoretical Visibility (ZTV) are defined by the UK Guidelines as "a map usually digitally produced showing areas of land within which a development is theoretically visible".

The ZTV analysis has been undertaken using Arc Spatial Analyst GIS. The assessment is based on terrain data that has been derived from satellite imagery. This data was originally prepared by NASA and is freely available on the CIAT-CCAFS website (http://www.cgiar-csi.org).

The Site Layout (Figure 2) locates the power tower and the heliostat field. Points have been placed and height attributes added to the points to represent the components of the proposed development and the viewshed facility in Arc Spatial Analyst has then been used to prepare each ZTV dataset.

5.2 ASSESSMENT LIMIT

The GIS based assessment of ZTV's does not take the curvature of the earth or reduction in scale due to distance into account. In order to provide an indication of the likely limit of visibility due to this effect a universally accepted navigational calculation (**Appendix III**) has been used to calculate the likely distance that the proposed structures might be visible over.

This indicates that in a flat landscape the proposed structures may be visible for the following distance;

ELEMENT	APPROXIMATE LIMIT OF VISIBILITY
Proposed Power Tower 275m high.	59.2km
Heliostats and low structures 10m high	11.5km

It is noted that the landscape within these distances from the proposed development is relatively flat and so this approximate limit of visibility is considered appropriate.

In reality visibility could be reduced by;

- Weather conditions that limit visibility. This would include hazy conditions during fine weather as well as mist and rain.
- Scale and colour of individual elements making it difficult to differentiate structures from background.

5.3 APPROACH TO THE ASSESSMENT

The project layout has been provided **(Figure 2)**. From this information, the Power Tower is located and it is obvious that the proposed heliostats extend practically to all four site boundaries with the Power Plant located in the north western quadrant of the site.

In order to generate the ZTV for the proposed development, it has been assumed that;

- The tower will be 275m high; and
- The entire area of development around the tower as indicated will be set at a uniform maximum height of 10m.

Points have been set to represent the tower and at each change in direction of the development footprint plus additional points within the development particularly at high points on the site for generation of the ZTV using the Viewshed option in Arc Spatial Analyst GIS.

5.4 VISIBILITY OF DEVELOPMENT

Map 4 indicates the ZTV of the originally proposed development of Ilanga CSP 7 Tower considering a 275m high power tower as anticipated. This shows that the proposed tower is likely to be visible over an extensive area within the approximate limit of visibility. It also indicates that areas to the east of the proposed development are likely to be screened by the ridgelines that run in an approximate north to south direction to the west of the Orange River. It also indicates that areas immediately adjacent to the Orange River to the north are likely to be screened and that views of the development become less continuous the closer to the limit of visibility that the viewer is located.

Map 5 indicates the ZTV of the proposed heliostat field and lower development surrounding the tower. The analysis indicates that the heliostats could be visible within a band centred on the site and extending for approximately 17km north to south and 9km east to west (approximately 153km^2). This is no doubt due to the orientation of the main landform features (non-perennial streams and minor ridgelines) that generally run in a south to north direction. Whilst undertaking the site visit it was difficult to gain a clear view of the site from public areas. It should be noted that Map 5 confirms that limited views of the lower sections of the development will be possible from public areas.

Map 6 indicates the cumulative area that will be affected by existing, authorised and proposed CSP Tower developments within the Upington area.

It is likely that close to the centre of the affected area, up to five towers could be visible if all are authorised. It should be noted however that landform will help to moderate the cumulative impact particularly for the north and east of the affected area.

5.5 VISUAL ABSORPTION CAPACITY (VAC) OF THE LANDSCAPE

The VAC for the area surrounding the site is dependent on the level of the viewer relative to the site. Close to the site, the VAC is largely provided by the vegetation cover and low ridgelines that bisect the valley floor.

From low levels the surrounding vegetation combines to provide screening ability for development up to an approximate height of approximately 2-3m. As the viewpoint is elevated above the plain on minor ridgelines and undulations, the screening effect of existing vegetation over short distances reduces drastically as the viewer sees over and between individual woody plants.

Given that the development will largely be viewed from a similar level as the site, the minor ridgelines combined with vegetation cover to provide significant VAC. This VAC results in general screening of lower sections of the proposed development, including heliostats, from public roads.

from further away, the more major ridgelines and koppies particularly to the east and north of the Karoshoek Valley will help to at least part screen most views of the towers and in areas, they are likely to completely screen individual towers.

5.6 KEY VIEWPOINTS

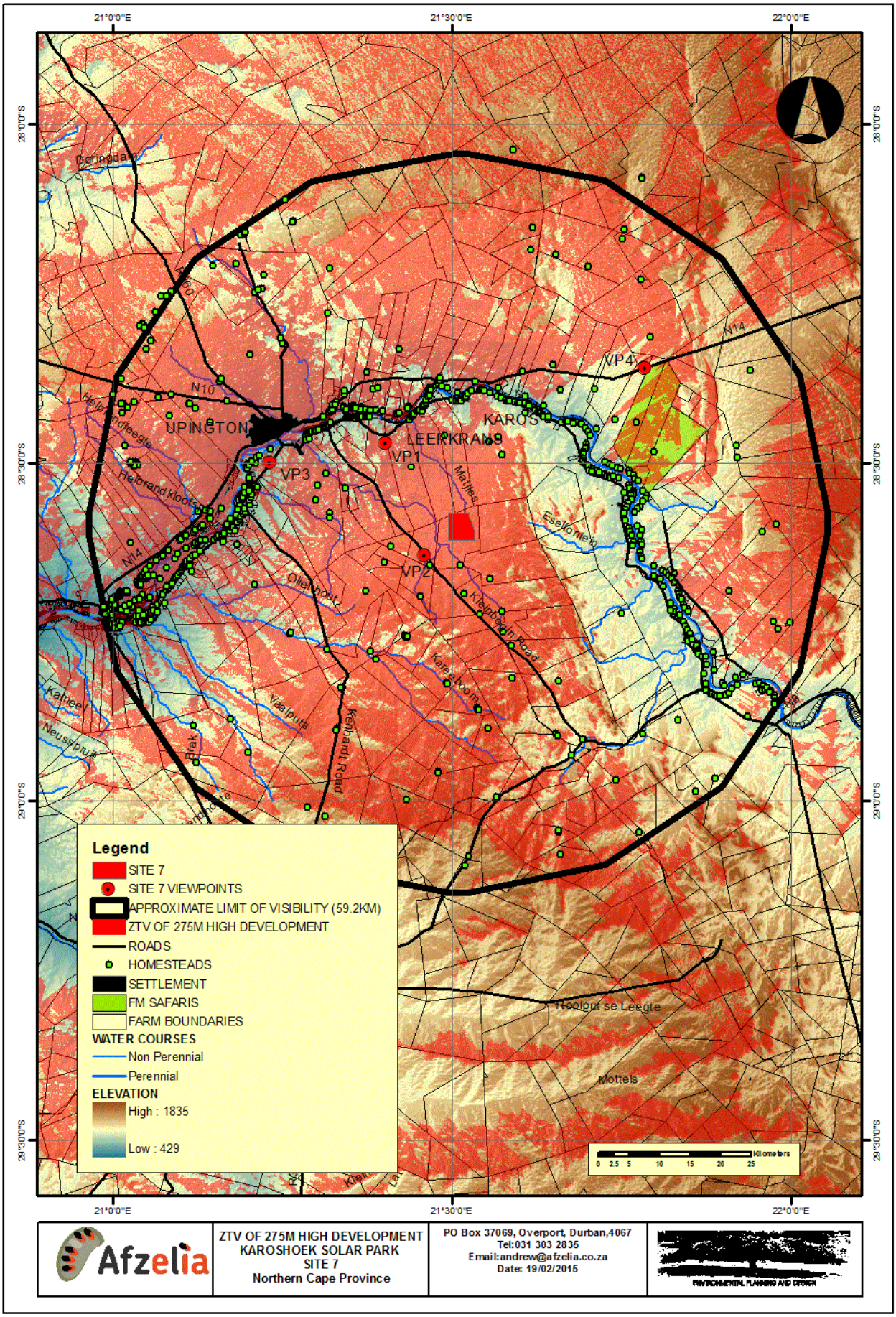
As indicated above, views into the site from public roads are likely to be difficult to see due to the VAC provided by low ridgelines and vegetation. This means that the power tower will be the main element that will impact the surrounding landscape.

A series of viewpoints have been selected to indicate;

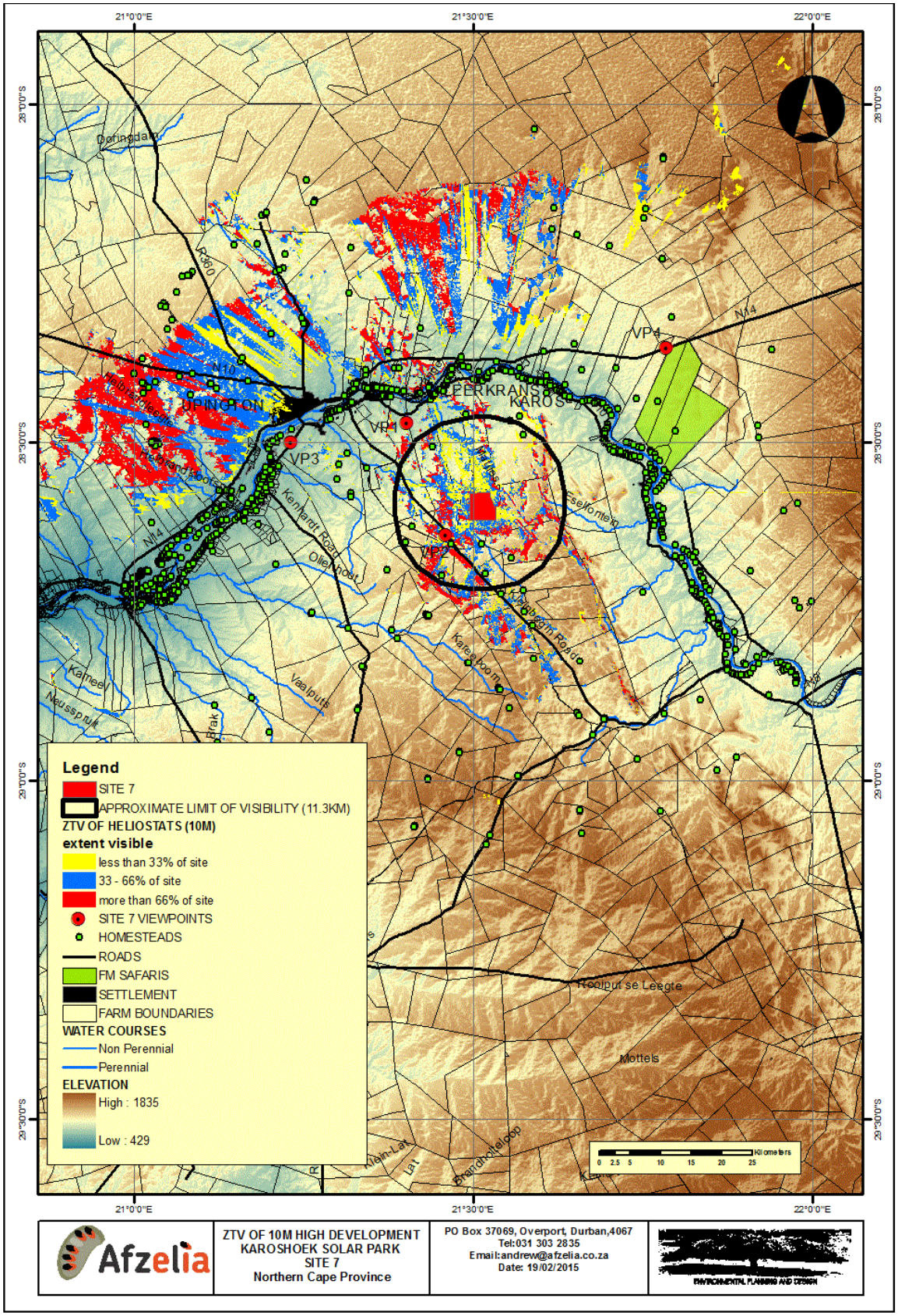
- An overview from higher surrounding ridgelines and Koppies (VP1)
- Close views from local roads (VP2)
- Views from settlement areas and particularly from southern edges of Upington (VP3)
- Views from the northern side of the Orange River including FM Safaris and the N14 (VP4)

In order to provide a realistic comparison of the impacts of this structure within the wide landscape area that it will affect, views of an existing power tower at known distances are presented (Plates 12 to 18 inclusive).

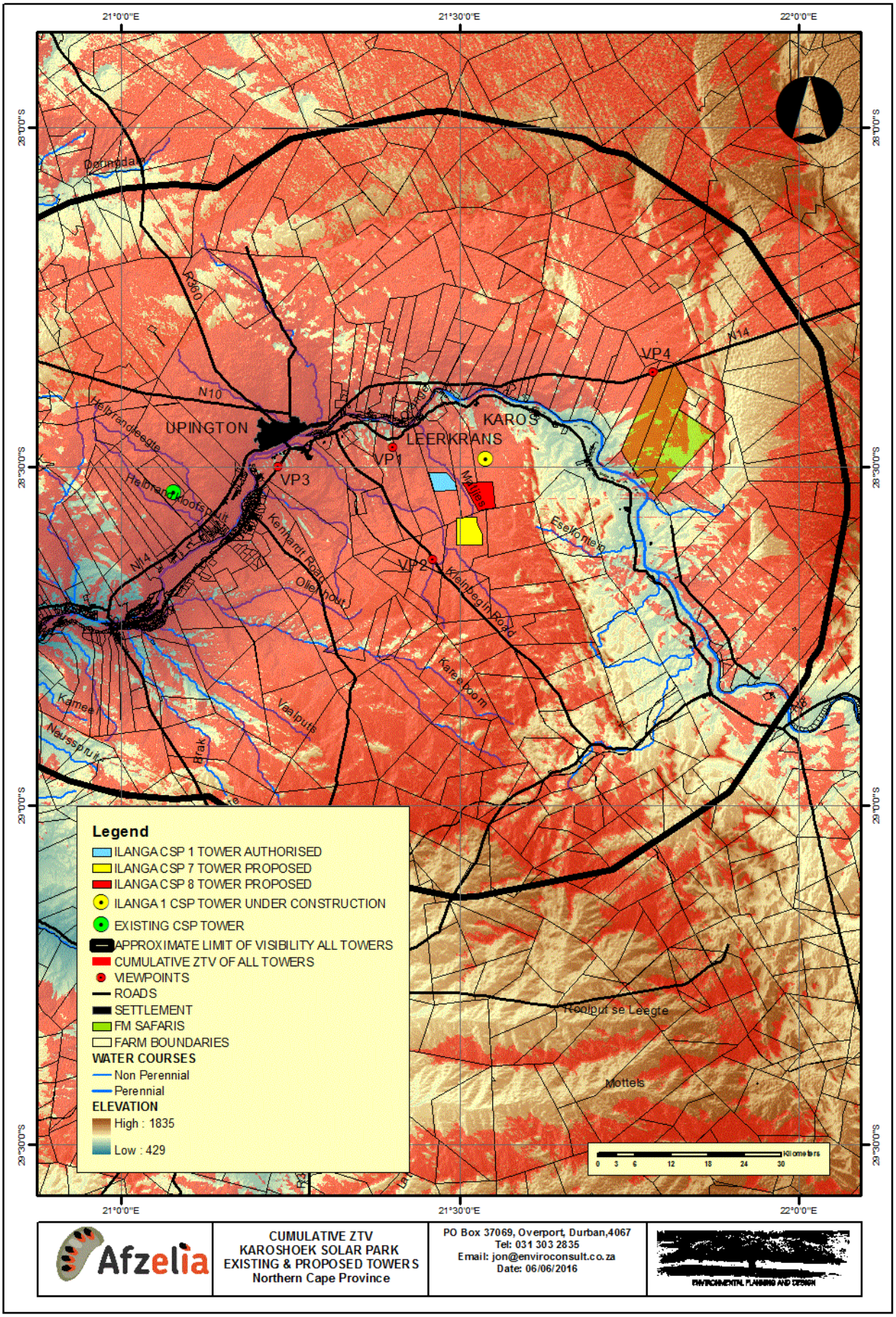
MAP 4: ZTV OF 275M HIGH DEVELOPMENT, ILANGA CSP 7



MAP 5: ZTV OF 10M HIGH DEVELOPMENT, ILANGA CSP 7



MAP 6: CUMULATIVE ZTV OF CSP TOWER PROJECTS



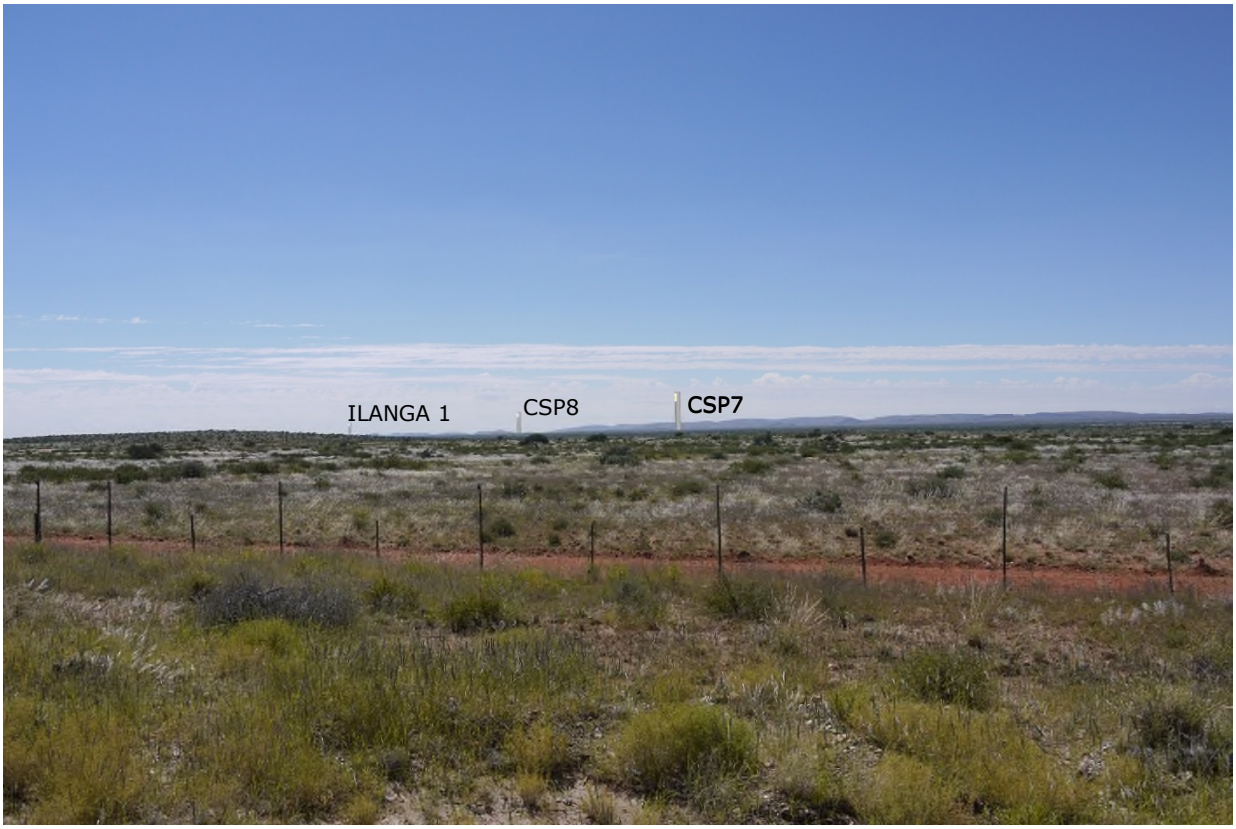


Figure 4, VP2 View from the Kleinbegin Road approximately 7.0km from CSP7 Tower. In view are CSP7 Tower (closest), CSP8 Tower (proposed) and Ilanga 1 Tower (under construction).

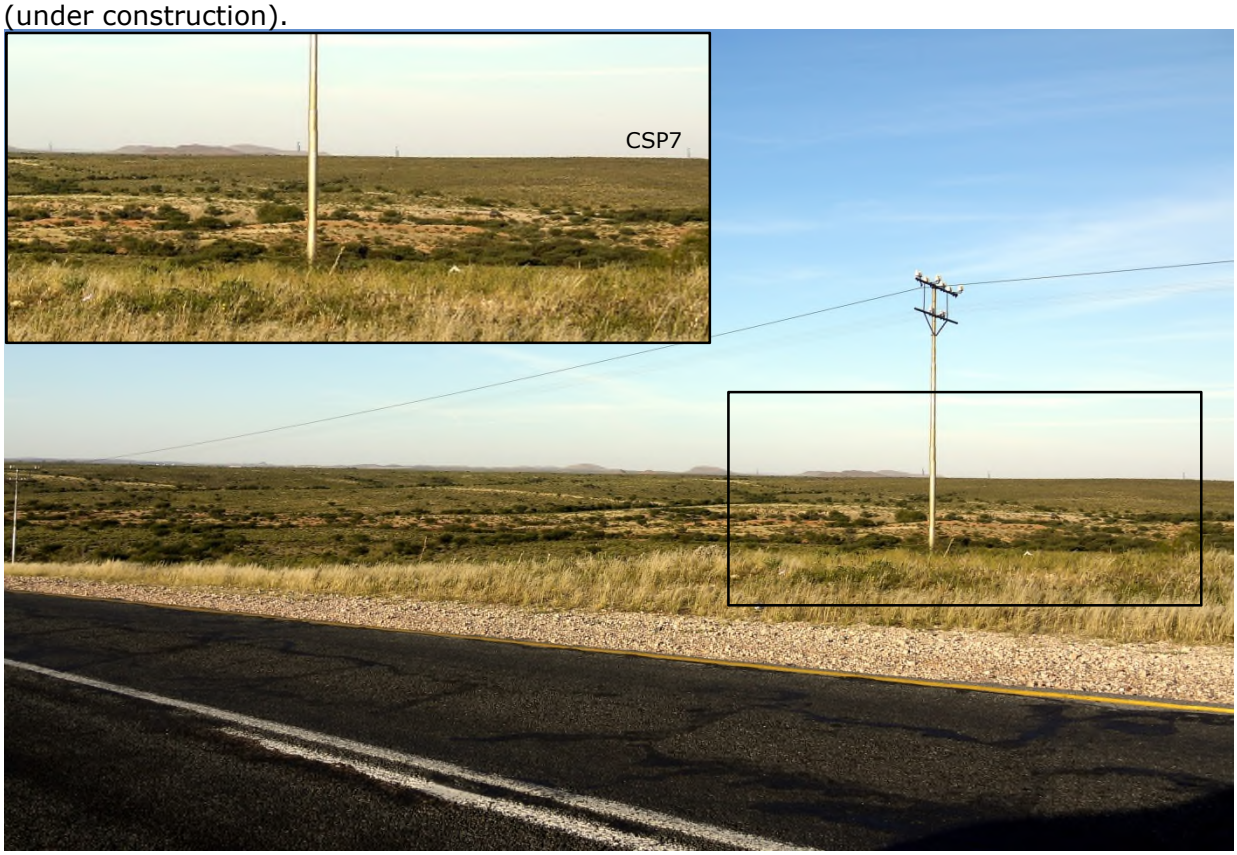


Figure 5, VP3 - View from the Louisvale Road approximately 28.2km from CSP7 Tower. In view from right to left are CSP7 Tower, CSP8 Tower (proposed), CSP1 Tower (authorised) and Ilanga 1 Tower (under construction).

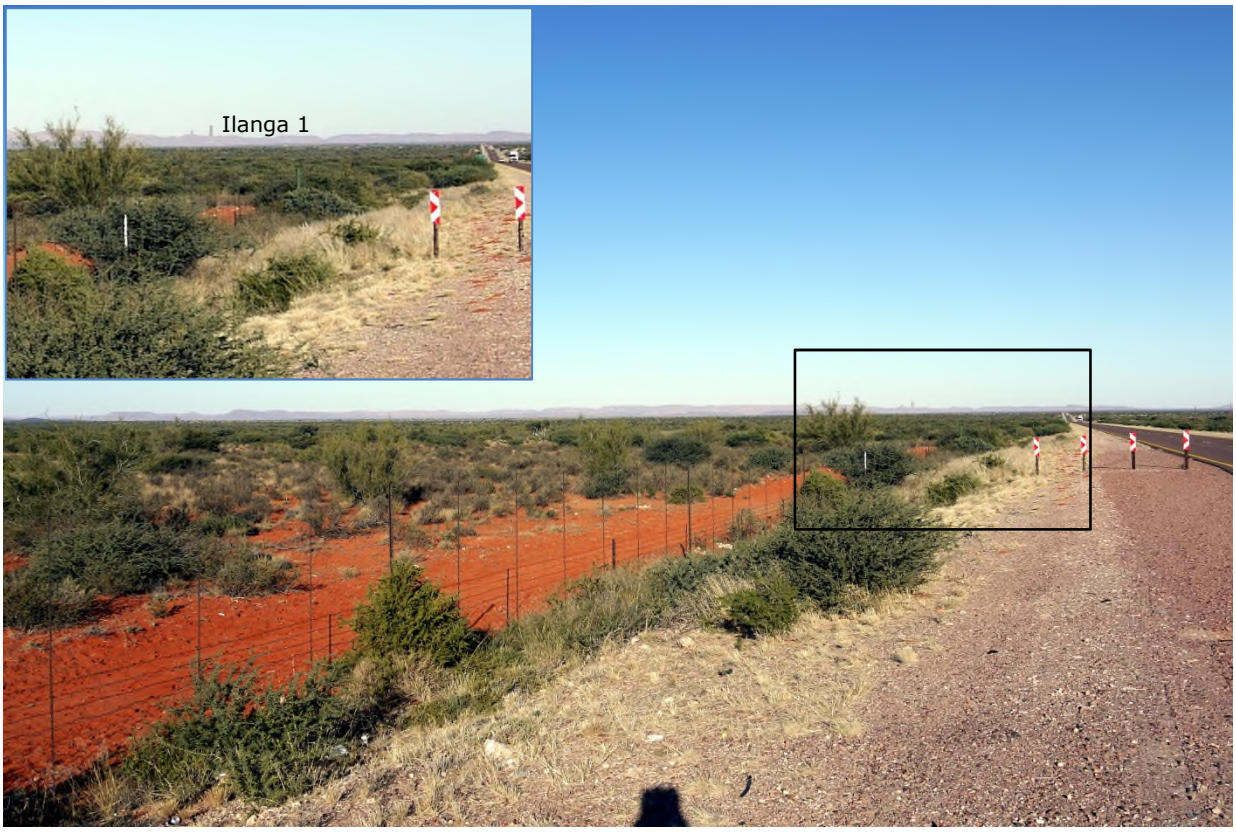


Figure 6, VP4 - View from the N14 close to FM Safaris approximately 34.0km from CSP7 Tower. In view from right to left are Ilanga 1 Tower (under construction)and CSP1 Tower (authorised). The ZTV analysis indicates that the CSP 7 and CSP8 Towers may be visible from this viewpoint however, the model does not indicate that they will be obvious. It may be that the very tops of the towers will be visible over the ridgeline. It should be noted that the receptor on the top of the towers will be on the opposite side of the structures. The diffuse reflection from these plates therefore should not make the towers more obvious.

6 VISUAL IMPACT ASSESSMENT

6.1 ASSESSMENT METHODOLOGY

The previous section of the report identified specific areas where visual impacts may occur. This section will quantify these impacts in their respective geographical locations and in terms of the identified issues (see Section 1.5).

The methodology for the assessment of potential visual impacts includes:

- The **nature**, which shall include a description of what causes the effect, what will be affected and how it will be affected.
- The **extent**, wherein it will be indicated whether the impact will be local (limited to the immediate area or site of development) or regional:
    - local extending only as far as the development site area – assigned a score of 1;
    - limited to the site and its immediate surroundings (up to 10 km) – assigned a score of 2;
    - will have an impact on the region – assigned a score of 3;
    - will have an impact on a national scale – assigned a score of 4; or
    - will have an impact across international borders – assigned a score of 5.
- The **duration**, wherein it will be indicated whether:
    - the lifetime of the impact will be of a very short duration (0–1 years) – assigned a score of 1;
    - the lifetime of the impact will be of a short duration (2-5 years) - assigned a score of 2;
    - medium-term (5–15 years) – assigned a score of 3;
    - long term (> 15 years) - assigned a score of 4; or
    - permanent - assigned a score of 5.
- The **magnitude**, quantified on a scale from 0-10, where a score is assigned:
    - 0 is small and will have no effect on the environment;
    - 2 is minor and will not result in an impact on processes;
    - 4 is low and will cause a slight impact on processes;
    - 6 is moderate and will result in processes continuing but in a modified way;
    - 8 is high (processes are altered to the extent that they temporarily cease); and
    - 10 is very high and results in complete destruction of patterns and permanent cessation of processes.
- The **probability** *of occurrence*, which shall describe the likelihood of the impact actually occurring. Probability will be estimated on a scale, and a score assigned:
    - Assigned a score of 1–5, where 1 is very improbable (probably will not happen);
    - Assigned a score of 2 is improbable (some possibility, but low likelihood);
    - Assigned a score of 3 is probable (distinct possibility);
    - Assigned a score of 4 is highly probable (most likely); and
    - Assigned a score of 5 is definite (impact will occur regardless of any prevention measures).
- The **significance**, which shall be determined through a synthesis of the characteristics described above (refer formula below) and can be assessed as low, medium or high.
- The **status**, which will be described as either positive, negative or neutral.
- The degree to which the impact can be reversed.

- The degree to which the impact may cause irreplaceable loss of resources.
- The *degree* to which the impact can be *mitigated.*
- The **significance** is determined by combining the criteria in the following formula:
    - S=(E+D+M)P; where S = Significance weighting, E = Extent, D = Duration, M = Magnitude, P = Probability

The **significance weightings** for each potential impact are as follows:

- < 30 points: Low (i.e. where this impact would not have a direct influence on the decision to develop in the area),
- 30-60 points: Medium (i.e. where the impact could influence the decision to develop in the area unless it is effectively mitigated),
- > 60 points: High (i.e. where the impact must have an influence on the decision process to develop in the area).

6.2 ASSESSMENT

The following assessment focuses first on general landscape change that will occur due to the proposed development which provides context for the assessment of impacts on identified sensitive receptors.

6.2.1 Impact of the Proposed Development on General Landscape Character

Nature of impact:
Industrialisation of general landscape character.

The assessment indicates that the proposed CSP tower development is likely to be visible and therefore influence landscape character over a wide area. However this impact areas is either likely to be partially moderated by landform.

The heliostat field is also likely to result in a relatively local impact influencing the character of its immediate surrounding area of the Karoshoek Solar Valley Development area only. It will largely influence areas that are likely to be affected by other adjacent CSP projects and over areas of private land that is generally inaccessible to the public. It is therefore unlikely to significantly influence general perception of the landscape character of the area.

The main influencing element is therefore likely to be the main tower structure.

Given that the impact of the authorised tower developments were originally assessed as moderate. Using the same criteria, it is unlikely that the impact of the proposed power tower will increase this impact.

Impacts on character can also be divided into areas to the north and east of the Orange River where they will be moderated by larger landform and areas within the Karoshoek Valley where there will be minimal moderation due to landform

	Without mitigation	**With mitigation**
Extent	Regional, **(3)**	Regional, **(3)**
Duration	Long term, **(4)**	Long term, **(4)**
Magnitude	**<u>North and East of the Orange River</u>** Minor, **(2)** **<u>Karoshoek Valley</u>** Low, **(4)**	Minor, **(2)** Low, **(4)**
Probability	**<u>North and East of the Orange River</u>** Probable, **(3)**	Probable, **(3)**

	<u>Karoshoek Valley</u> Highly Probable, **(4)**	Highly Probable, **(4)**
Significance	**<u>North and East of the Orange River</u>** Low, **(27)** **<u>Karoshoek Valley</u>** Medium, **(44)**	Low, **(27)** Medium, **(44)**
Status	The character of the rural landscape will be modified by authorised and existing development and the proposed development will be in keeping with this character change. For those people that are attracted to the area for its natural attributes and those travelling through the area for recreational and tourism reasons, it is likely that development of natural areas will be seen as a **negative impact**.	**Negative**
Irreplaceable loss	The proposed development can be dismantled and removed at the end of the operational phase. There will therefore be **no irreplaceable loss**. However, given the likely long-term nature of the project, it is possible that a proportion of stakeholders will view the loss of view as irreplaceable.	**No irreplaceable loss**
Can impacts be mitigated?	**Yes,** however, only impacts associated with the lower elements can realistically be mitigated. This will not change the larger impacts associated with the tower structure.	

Mitigation / Management:

Mitigation of views of the power tower is not possible due to its scale.

Mitigation of the impact of the heliostat field on the landscape of the Karoshoek Solar Valley Development area is possible although this is unlikely to be highly visible from public access areas.

Planning:

- Plan levels to minimise earthworks to ensure that levels are not elevated;
- Plan to maintain the height of structures as low as possible;
- Minimise disturbance of the surrounding landscape and maintain existing vegetation around the development;

Operations:

- Reinstate any areas of vegetation that have been disturbed during construction;
- Remove all temporary works;
- Monitor rehabilitated areas post-decommissioning and implement remedial actions;
- Minimise disturbance and maintain existing vegetation as far as is possible both within and surrounding the development area;
- Colouring of mirror backs;

Decommissioning:

- Remove infrastructure not required for the post-decommissioning use of the site;
- Return all affected areas to productive agricultural use;
- Monitor rehabilitated areas post-decommissioning and implement remedial actions.

Cumulative Impacts:

The area around Upington has been identified by the Department of Environmental Affairs as a Renewable Energy Development Zone (REDZ 7). These zones have been put forward in order to focus development and inform planning. In the Upington area this has resulted in numerous renewable energy project applications. This focus is likely to transform the landscape character of the area.

The development of the proposed project is unlikely to significantly extend the impact of authorized sites. It will however intensify impacts within the Karoshoek Valley.

Residual Risks:
The residual risk relates to loss of natural vegetation cover being obvious on decommissioning of the proposed project. It is therefore critical that existing vegetation is maintained and protected and that effective rehabilitation is undertaken during and after construction as well as on closure of the plant.

6.2.2 Impact of the Proposed Development on Identified Sensitive Receptors

Potential visual impacts on sensitive receptors that have been identified through scoping and the site visit include:

a) Potential visual impact on users of roads in close proximity to CSP 7;
b) Potential visual impact on residents of settlements and homesteads in close proximity to the proposed CSP 7;
c) Potential visual impact on sensitive visual receptors within the region;
d) Potential lighting impacts;
e) Ocular impacts associated with glint and glare; and
f) Construction impacts.

a) The visibility of the facility to, and potential visual impact on users of roads in close proximity.

Nature of impact:
Industrialisation of a natural landscape as seen from local and national roads.

The assessment indicates that short sections of both the N10 (18km to the north) and the N14 (22km to the north) could be affected. To the north east, high ground between the development and the above mentioned roads will largely screen views to these roads and where views of the tower are possible, it is likely to only be the top of the tower that will be seen.

Due to distance and topography, heliostats will not be obvious from these areas.

The local roads to the west (Kleinbegin and Kenhardt Roads) are located, at their closest point, approximately 4km and 20km to the west of the site.

Due to distance and topography, heliostats are unlikely to be obvious from the Kleinbegin Road and will not be visible from the Kenhardt Road. The Power Tower however will be an obvious element in the landscape from both roads. It is likely that diffuse reflection from the receiver will make the tower more obvious.

The N10 and N14 carry significant amounts of traffic, a proportion of which is likely to be tourism related. The local roads carry infrequent traffic that is mainly of a local nature.

The N10 and N14 are therefore more likely to be sensitive to landscape character change.		
	Without mitigation	**With mitigation**
Extent	Regional, **(3)**	Regional, **(3)**
Duration	Long term, **(4)**	Long term, **(4)**
Magnitude	**N10 & N14** Minor, **(2)** Due to the mitigating effects of distance and landform. **Kenhardt and Kleinbegin Roads** Minor, **(2)** Due to the low amount of traffic and nature of travellers.	Minor, **(2)** Minor, **(2)**
Probability	**N10 & N14** Probable, **(3)** **Kenhardt and Kleinbegin Roads** Highly Probable, **(4)**	Probable, **(3)** Highly Probable, **(4)**
Significance	**N10 & N14** Low, **(27)** **Kenhardt and Kleinbegin Roads** Medium, **(36)**	Low, **(27)** Medium, **(36)**
Status	The character of the rural landscape will be modified. For those people that are attracted to the area for its natural attributes and those travelling through the area for recreational and tourism reasons, it is likely that development of natural areas will be seen as a **negative impact**.	**Negative**
Irreplaceable loss	The proposed development can be dismantled and removed at the end of the operational phase. There will therefore be **no irreplaceable loss**. However, given the likely long-term nature of the project, it is possible that a proportion of stakeholders will view the loss of view as irreplaceable.	**No irreplaceable loss**
Can impacts be mitigated	**Yes,** however, only impacts associated with the lower elements can realistically be mitigated. This will not change the larger impacts associated with the tower structure.	

Mitigation:

Planning:

- Plan levels to minimise earthworks to ensure that levels are not elevated;
- Plan to maintain the height of structures as low as possible;
- Minimise disturbance of the surrounding landscape and maintain existing vegetation around the development;

Operations:

- Reinstate any areas of vegetation that have been disturbed during construction;
- Remove all temporary works;

- Monitor rehabilitated areas post-decommissioning and implement remedial actions;
- Minimise disturbance and maintain existing vegetation as far as is possible both within and surrounding the development area;

Decommissioning:

- Remove infrastructure not required for the post-decommissioning use of the site; and
- Return all affected areas to productive agricultural use;

Monitor rehabilitated areas post-decommissioning and implement remedial actions.

Cumulative Impacts:

The assessment indicates that CSP 7 is unlikely to have any significant impact on either the N10 or N14.

The local roads to the west (Kleinbegin and Kenhardt Roads) are located, relatively close to the site. It is likely that the development will generally be visible from this area. Due to distance and topography, heliostats are unlikely to be obvious to the Kleinbegin Road or visible to the Kenhardt Road.

The Power Tower will add an obvious element in the view from these roads. It is likely that diffuse reflection from the receiver will make the tower more obvious.

Residual Risks:

The residual risk relates to loss of natural vegetation cover being obvious on decommissioning of the proposed project. It is therefore critical that effective rehabilitation is undertaken.

b) Potential visual impact on Settlements and Homesteads.

Nature of impact:

Industrialisation of a natural landscape as seen from local homesteads.

The assessment indicates that there are a large number of homesteads and the urban area of Upington and smaller settlements of Leerkrans, Karos and Louisvale within the approximate limit of visibility of the proposed development.

The Orange River Corridor has the largest concentration of homesteads within the study area but a range of small hills separates the site from this area. This means that varying extents of upper sections of the power tower only are likely to be visible from these areas. Given the relative distance, views of the proposed CSP 7 tower are likely to be significantly lower in impact than to those of currently authorised development.

Within urban areas, it is also likely that vegetation or buildings will provide a moderating influence.

The greatest concern lies with homesteads that are in relatively close proximity to the proposed development from which the heliostat field as well as the tower could be obvious.

From these areas the tower will be highly obvious, however it will be viewed in the context of other similar development.

The main intrusion could possibly result from reflection from the heliostat field making the facility highly obvious.

If the heliostat field should be visible, views from elevated areas appear unlikely. This means that the facility is likely to be viewed largely in elevation and that minor undulations in landform and VAC provided by vegetation should help to soften / screen views of the structures.

Three homesteads have been identified to the south and south west of the development that are most likely to be affected and within 7km of the site. However from the site visit these are all located in low points in the landscape and are likely to be screened by minor ridgelines.

It is possible that mirror backs could be obvious in the landscape due to colour changes in early to mid-morning from the west and late to mid-afternoon from the east.

Views into the site from local homesteads therefore will be very limited and where possible the proposed development will largely be seen in elevation. This means that whilst the character of the landscape surrounding the proposed development will undoubtedly change, the degree of change associated with the proposed project is unlikely to be significant as glimpses of the edge of the development only will be possible.

	Without mitigation	**With mitigation**
Extent	Regional, **(3)**	Regional, **(3)**
Duration	Long term, **(4)**	Long term, **(4)**
Magnitude	Minor, **(2)**	Minor, **(2)**
Probability	Probable **(3)**	Probable **(3)**
Significance	Low, **(27)**	Low, **(27)**
Status	The character of the rural landscape will be modified. For those people that are attracted to the area for its natural attributes and those travelling through the area for recreational and tourism reasons, it is likely that development of natural areas will be seen as a **negative impact**.	**Negative**
Irreplaceable loss	The proposed development can be dismantled and removed at the end of the operational phase. There will therefore be **no irreplaceable loss**. However, given the likely long-term nature of the project, it is possible that a proportion of stakeholders will view the loss of view as irreplaceable.	**No irreplaceable loss**
Can impacts be mitigated?	**Yes,** however, only impacts associated with the lower elements can realistically be mitigated. This will not change the larger impacts associated with the tower structure.	

Mitigation / Management:
Mitigation of the impact area of the power tower is not possible due to its scale.

Mitigation of the impact of the heliostat field on the landscape of the Karoshoek Valley is possible. This is likely to benefit homesteads within the approximate limit of visibility.

Planning:

- Plan levels to minimise earthworks to ensure that levels are not elevated;
- Plan to maintain the height of structures as low as possible;

- Minimise disturbance of the surrounding landscape and maintain existing vegetation around the development;

Operations:

- Reinstate any areas of vegetation that have been disturbed during construction;
- Remove all temporary works;
- Monitor rehabilitated areas post-decommissioning and implement remedial actions;
- Minimise disturbance and maintain existing vegetation as far as is possible both within and surrounding the development area;
- Colouring of mirror backs;

Decommissioning:

- Remove infrastructure not required for the post-decommissioning use of the site;
- Return all affected areas to productive agricultural use;
- Monitor rehabilitated areas post-decommissioning and implement remedial actions.

Cumulative Impacts:

The area around Upington has been identified by the Department of Environmental Affairs as a Renewable Energy Development Zone (REDZ 7). These zones have been put forward in order to focus development and inform planning. In the Upington area this has resulted in numerous renewable energy project applications. This focus is likely to transform the landscape character of the area.

In cumulative terms this project is likely to intensify the impact associated with authorised projects within the Karoshoek Valley.

Residual Risks:

The residual risk relates to loss of natural vegetation cover being obvious on decommissioning of the proposed project. It is therefore critical that effective rehabilitation is undertaken.

c) The visibility of the facility to, and potential visual impact on other sensitive receptors within the region

Nature of impact:

Industrialisation of a natural landscape as seen from sensitive uses.

Other sensitive receptors that have been identified within the region include the FM Safaris ecotourism operation to the north east and on the northern side of the Orange River.

The assessment indicates that the proposed tower is likely to be visible to a portion of FM Safaris operation. Whilst a view of the development may be possible, it is likely that it will not be obvious as only the top of the tower is likely to be visible over a ridgeline at a minimum distance of 25.5km.

The impact of CSP 7 on FM Safaris is therefore likely to be low.

	Without mitigation	**With mitigation**
Extent	Regional **(3)**	NA
Duration	Long term **(4)**	NA
Magnitude	Small **(0)**	NA
Probability	Improbable **(2)**	NA
Significance	**Low (14)**	NA
Status	**Negative**	NA
Irreplaceable loss	No irreplaceable loss.	NA

Can impacts be mitigated?	**No**
Mitigation: No mitigation possible	
Cumulative Impacts: The area around Upington has been identified by the Department of Environmental Affairs as a Renewable Energy Development Zone (REDZ 7). These zones have been put forward in order to focus development and inform planning. In the Upington area this has resulted in numerous renewable energy project applications. This focus is likely to transform the landscape character of the area. The impact of CSP 7 on FM Safaris is likely to be low but may add slightly to impacts associated with closer projects particularly Ilanga 1 and CSP 1.	
Residual Risks: No residual risk.	

d) The possible impact of lighting associated with night time operation, and security lights.

Nature of impact:
Industrialisation of a natural landscape as seen at night.

Aviation warning lights are likely to be required on the top of the CSP tower.

It is also likely that operational lighting will be required at buildings and security lighting may be required within the heliostat field.

Lighting associated with the proposed project will be seen in the context of lighting that will occur due to authorised development.

Authorised projects within the greater Karoshoek Valley are extensive and pose a more major risk to the transformation of the night time landscape. The extent of this transformation is not known.

If flood lighting is deemed necessary for each plant throughout the hours of darkness then general impacts are likely to be significant. However if low level operational lighting is required at buildings then it is likely that each plant will not appear significantly different than the farmsteads that are scattered through the landscape.

If the former approach is adopted then floodlighting of the proposed site could be noticeable. If however only low level lighting around buildings is required then the proposed site is likely to have negligible impact on the night time landscape.

	Without mitigation	**With mitigation**
Extent	Site and immediate surroundings **(2)**	Local, **(1)**
Duration	Long term **(4)**	**(4)**
Magnitude	Minor **(2)**	Small, **(0)**
Probability	Probable **(3)**	Very improbable **(1)**
Significance	Low **(24)**	**Low (5)**
Status	The appearance of a large lit area in an otherwise dark, natural landscape is likely to be seen as a **negative** factor	If the lights are generally not visible then the occasional

	particularly by people wanting to experience the natural landscape.	light is unlikely to be seen as negative.
Irreplaceable loss	It would be possible to change the lighting / camera system so the impact cannot be seen as an irreplaceable loss.	No irreplaceable loss
Can impacts be mitigated?	Yes	

Mitigation / Management:

Planning:

- Plan to utilise infra-red security systems or motion sensor triggered lighting;
- Ensure that lighting is focused on the development with no light spillage outside the site; and
- Keep lighting low, no tall mast lighting should be used.

Cumulative Impact:

The area around Upington has been identified by the Department of Environmental Affairs as a Renewable Energy Development Zone (REDZ 7). These zones have been put forward in order to focus development and inform planning. In the Upington area this has resulted in numerous renewable energy project applications. This focus is likely to transform the landscape character of the area.

If floodlighting is required CSP 7 will add slightly to cumulative impacts associated with authorised projects. If this is not required then the cumulative impact will be negligible.

Residual Risks:

No residual risk has been identified.

e) Possible impact of glint and glare.

Nature of impact:

All large scale solar facilities are capable of causing offsite glare that may cause annoyance and visual discomfort.

Typically the main risk of glint and glare associated with Power Tower developments include;

1. Viewed from certain angles, specular reflection from heliostats might result in glint or glare from these surfaces, particularly from elevated viewpoints. Power tower facilities usually have the heliostats arrayed in a circle around the central tower. Where this heliostat configuration is used, some portion of the heliostat field would face viewers regardless of their direction of view, which could increase the potential for glinting and glare from the heliostats.
2. Observations of reflections from power tower receivers have shown the sunlight focused on the tower's receiver by the heliostats during normal operations causes the surface of the receiver to appear to glow with sufficient intensity to be visible for long distances; however, the apparent glow is actually diffuse reflected sunlight. The tower receivers can appear brilliantly white at close distances, and the light from relatively small-scale existing facilities has been observed at distances of 25 miles (40km)[7]. Whilst visible over a long distance, this effect is likely to be less intense than glare observed from other CSP facilities such as parabolic troughs.

[7] Best Management Practices for Reducing Visual Impacts of Renewable Energy Facilities on BLM Administered Lands, United States Department of Interior, Bureau of Land Management (BLM), first edition, 2013.

In order for there to be a problem it is necessary for the facility to be visible to receivers. From the review of visibility undertaken in assessment of other impacts, it is obvious that the only identified receivers that have the potential to be impacted are;

- The Kleinbegin Road from which the heliostats may be visible .

Given the distance, the screening effect of vegetation and minor land form which largely serves to hide the lower levels of CSP 7, it is highly unlikely that the proposed project will have the potential for glint and glare impacts. However if it should prove problematic, due to the extent and relative level of the road, mitigation in the form of localised screening should be possible.

	Without mitigation	**With mitigation**
Extent	Site and immediate surroundings**, (2)**	Local, **(1)**
Duration	Long term **(4)**	Long term **(4)**
Magnitude	Small **(0)**	Small **(0)**
Probability	Very improbable **(1)**	Very improbable **(1)**
Significance	Low **(6)**	Low **(5)**
Status	Negative	Negative
Irreplaceable loss	There will be no irreplaceable loss.	There will be no irreplaceable loss.
Can impacts be mitigated?	Yes.	

Mitigation:

- Screening with opaque fencing / earth berms; and
- Careful siting and operation of solar collectors turning mirrors away from the sun during time periods when glare impacts are significantly adverse may substantially reduce or avoid visual impacts from offsite glare.

Cumulative Impact:

The development of the proposed Ilanga CSP 7 within the Karoshoek Solar Valley Development will not significantly alter the risk of glint and glare associated with the already authorized sites.

Residual Risks:

No residual risk has been identified.

f) Visual impacts associated with construction of the proposed project.

Nature of impact:

Construction will be comprised of:

- Clearance of site;
- Construction of associated infrastructure;
- laying of concrete bases for the tower, heliostats and power plant;
- Erection and fixing of structures; and
- Laying of cable / pipe runs and connections.

This work is likely to be completed in 24 to 36 months.

As the site and surrounding area is relatively flat, an overview of the construction work is unlikely. Activity on site is likely to be obvious from vehicles and plant. Once ground work and concrete bases are complete, the structures are likely to progress rapidly.

Interim impacts are likely to include dust from site operations once the site has been cleared, storage areas which may be as high as the heliostat development and delivery trucks using local roads.

It is also possible that waste-blow could be problematic.

From the assessment of impacts of the final development as experienced by local receptors, it is obvious that the site and lower development is unlikely to be obvious. Waste blow, delivery vehicles on local roads and dust could make the development obvious during construction.

	Without mitigation	**With mitigation**
Extent	Site and immediate surroundings, **(2)**	Site **(1)**
Duration	Very short duration, **(1)**	Very short duration **(1)**
Magnitude	Minor **(2)**	None **(0)**
Probability	Probable, **(3)**	Possible, **(2)**
Significance	Low, **(15)**	Low **(4)**
Status	Negative	Negative
Irreplaceable loss	There will be no irreplaceable loss.	There will be no irreplaceable loss.
Can impacts be mitigated?	Yes	

Mitigation:

- Minimise clearance of vegetation;
- undertake dust prevention measures;
- Maintain stockpiles to less than 3 m high; and
- Manage waste effectively and prevent waste blowing around and off site.

Cumulative Impact:

It is possible that a number of construction projects could occur at any one time. This could create the impression that extensive areas of natural landscape are subject to development. Dust and plant may be visible; however, it is not likely to be highly obvious.

The proposed project could slightly increase the cumulative visual impact of construction of projects in the Karoshoek Valley.

Residual Risks:

The residual risk relates to loss of natural vegetation cover being obvious on decommissioning of the proposed project. It is therefore critical that effective rehabilitation is undertaken.

The detailed Cumulative Impact Assessment is attached as **Appendix IV**.

7 IMPACT STATEMENT

7.1 LANDSCAPE CHARACTER AND IMPORTANCE

The importance of the study area lies both in its agricultural production capacity as well as its natural features and their ability to attract and provide a backdrop for tourism activities in the area. The latter point is attested by the use of sites along the Orange River for tourism activities.

The area around Upington is also becoming important for solar projects, with a number of projects already under development. This is due to a government initiative that will see the development of strategic infrastructure to link solar power projects into the National Grid. This is likely to result in transformation of sections of the landscape in the near future. This development is of national importance given the need to produce energy from renewable resources. In order to maintain existing economic bases rather than replace them, it will be critical that this is done in a manner that minimises impact on existing uses.

The landscape is compartmentalised to a large degree by a series of steep ridgelines and koppies. These upland areas effectively separate the Orange River corridor from the rural agricultural valley floor on which the Karoshoek Solar facilities are being developed. The undulating valley floor is sparsely populated and appears largely natural. Minor ridgelines and valleys bisect the valley floor providing a degree of visual absorption capacity particularly for relatively low development such as the heliostats and low elements that will surround the proposed CSP tower.

7.2 FUTURE DEVELOPMENT

There are a number of solar projects authorised within the Karoshoek Valley as indicated in section 2.4. These will transform this area by introducing an industrial character into the area. However, from review of these projects as well as a site visit, a substantial area of relatively natural landscape will remain between public access areas such as local and national roads and the developed areas. This will soften the impact of the industrial elements. The steep ridgelines and koppies surrounding the Valley will also help to contain the impact ensuring that surrounding areas are relatively unaffected whilst the minor ridgelines and vegetation within the undulating valley floor will also help to mitigate impacts of low elements within the valley.

7.3 AREAS AND NATURE OF VISUAL IMPACT

Possible visual receptors that have been identified include:

- A small number of homesteads that occur within the approximate limit of visibility of the heliostat field;
- A large number of homesteads and urban areas that could be affected by the power tower;
- Local road to the west (Kleinbegin and Kenhardt Roads) that could be affected by the heliostat field and the power tower;
- The N10 and N14 National roads to the north that could be affected by the power tower; and
- The FM Safaris ecotourism operation on the northern side of the Orange River.

The assessment indicates that the proposed heliostat field and low development surrounding the tower is likely to be largely screened from identified homesteads and

local roads by the VAC of the surrounding landscape. This is due to the extent of visual absorption capacity of the surrounding landscape and the fact that homesteads appear to be largely located within the minor valleys bisecting the area.

From within the Karoshoek Valley, views of the power tower are likely to be similar to those of other authorised development within the area. However, because it is further south than other authorised CSP tower developments, its impact on areas to the north of the Karoshoek Valley including the Orange River Corridor where the majority of homesteads are located, settlement areas, the N10, the N14 and FM Safaris is likely to be significantly lower than authorised developments.

7.4 CUMULATIVE IMPACT

The assessment indicated that the proposed development of Ilanga CSP 7 will generally marginally increase cumulative visual impacts associated with currently authorised projects. This is due to the fact that it is located further from possible sensitive receptors than other already authorised development.

7.5 MITIGATION POTENTIAL

The affected landscape has a degree of visual absorption capacity due to occasional head height shrubs particularly in valley lines as well as the minor ridgelines that bisect the valley floor. This will help to mitigate visibility of the lower levels of the development, including the heliostat field, from the closest receptors.

Where visible, the lower elements associated with the development will almost always be viewed from a similar level as the development meaning that they will largely be seen in elevation. This will mean that overviews of the full extent of development will not be possible from public access areas.

Mitigation should therefore be focused on maintaining natural vegetation which will provide a degree of screening and ensuring that development levels are not elevated above the natural landform.

It will not be possible to mitigate visual impact associated with the proposed CSP tower.

7.7 CONCLUSION

The proposed project will have greatest impact on the Karoshoek Valley which is under development for similar projects. Outside the Karoshoek Valley where the majority of sensitive receivers are located impacts are likely to be low.

Within the Karoshoek Valley, the most critical sensitive receivers are likely to be residents of local homesteads. A small number of people are likely to be affected. Views over the development are unlikely to be possible due to the relative elevation of receivers. This means that the main impact will be a view of the tower set within a relatively natural landscape. Because of the relative elevation of receivers and the VAC of the surrounding landscape nuisance impacts such as glint and glare are unlikely and should be easily mitigated.

Given the changing character of the setting in which the development is proposed, the distances from the majority of sensitive receptors and the way in which surrounding landform helps to mitigate broader impacts, there is no reason on landscape and visual impact grounds why the proposed project should not be authorised.

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APPENDIX I

SPECIALIST'S BRIEF CV

Name JONATHAN MARSHALL
Nationality British
Year of Birth 1956
Specialisation Landscape Architecture / Landscape & Visual Impact Assessment / Environmental Planning / Environmental Impact Assessment.

Qualifications

Education
Diploma in Landscape Architecture, Gloucestershire College of Art and Design, UK (1979)
Environmental Law, University of KZN (1997)

Professional
Registered Professional Landscape Architect (South Africa)
Chartered Member of the Landscape Institute (UK)
Certified Environmental Assessment Practitioner of South Africa.
Member of the International Association of Impact Assessment, South Africa

Languages

English	-	Speaking	-	Excellent
	-	Reading	-	Excellent
	-	Writing	-	Excellent

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Key Experience

Jon qualified as a Landscape Architect (Dip LA) at Cheltenham (UK) in 1979. He has also been a Certified Environmental Assessment Practitioner of South Africa since 2009.

During the early part of his career (1981 - 1990) He worked with Clouston (now RPS) in Hong Kong and Australia. During this period he was called on to undertake visual impact assessment (VIA) input to numerous environmental assessment processes for major infrastructure projects. This work was generally based on photography with line drawing superimposed to illustrate the extent of development visible.

He has worked in the United Kingdom (1990 - 1995) for a major supermarket chain and prepared CAD based visual impact assessments for public enquiries for new green field store development. He also prepared the VIA input to the environmental statement for the Cardiff Bay Barrage for consideration by the UK Parliament in the passing of the Barrage Bill.

His more recent VIA work (1995 to present) includes a combination of CAD and GIS based work for a new international airport to the north of Durban, new heavy industrial operations, overhead electrical transmission lines, mining operations in West Africa and numerous commercial and residential developments.

VIA work undertaken during the last eighteen months includes assessments for proposed new mine developments in Ghana and Guinea, numerous solar plant projects for Eskom and private clients, proposed wind farm development and a proposed tourism development within the Isimangaliso Wetland Park World Heritage Site.

Jon has also had direct experience of working with UNESCO representatives on a candidate World Heritage Site and has undertaken VIAs within and adjacent to other World Heritage Sites.

Relevant Visual Impact Assessment Projects

1. **Isundu Sub- Station Development -** Visual impact assessment for a new major sub – station in KwaZulu-Natal for Eskom.
2. **Bhangazi Lake Tourism Development** – Visual impact assessment for a proposed lodge development within the Isimangaliso Wetland Park World Heritage Site. This work is ongoing.
3. **Quarry Development for the Upgrade of Sani Pass –** Visual Impact Assessments for two proposed quarry developments on the edge of the uKhalamba-Drakensburg World Heritage Site.
4. **Mtubatuba to St Lucia Overhead Power Line** – Visual Impact Assessment for a proposed power line bordering on the Isimangaliiso Wetland Park World Heritage Site for Eskom.
5. **St Faiths 400/132 kV Sub-Station and Associated Power Lines** - Visual Impact Assessment for a proposed new major sub-station and approximately 15 km of overhead power line for Eskom.
6. **Clocolan to Ficksburg Overhead Power Line** – Visual Impact Assessment for a proposed power line for Eskom.
7. **Solar Plant Projects including Photovoltaic and Concentrating Solar Power Plants** – Numerous projects for Eskom and private clients in the Northern Cape, Limpopo, Mpumalanga and the Free State.
8. **Moorreesburg Wind Farm.** Visual impact assessment for a proposed new wind farm in the Western Cape.
9. **AngloGold Ashanti, Dokyiwa (Ghana)** – Visual Impact Assessment for proposed new Tailings Storage Facility at a mine site working with SGS as part of their EIA team.
10. **Camperdown Industrial Development** - Visual Impact Assessment for proposed new light industrial area to the north o Camperdown for a private client.
11. **Wild Coast N2 Toll Highway** – Peer review of VIA undertaken by another consultant.
12. **Gamma to Grass Ridge 765kv transmission line** – Peer review of VIA undertaken by another consultant.
13. **Gateway Shopping Centre Extension (Durban)** – Visual Impact Assessment for a proposed shopping centre extension in Umhlanga, Durban.
14. **Kouroussa Gold Mine (Guinea)** – Visual impact assessment for a proposed new mine in Guinea working with SGS as part of their EIA team.
15. **Mampon Gold Mine (Ghana)** - Visual impact assessment for a proposed new mine in Ghana working with SGS as part of their EIA team.
16. **Telkom Towers** – Visual impact assessments for numerous Telkom masts in KwaZulu-Natal
17. **Dube Trade Port, Durban International Airport** – Visual Impact Assessment for a new international airport.
18. **Sibaya Precinct Plan** – Visual Impact Assessment as part of Environmental Impact Assessment for a major new development area to the north of Durban.

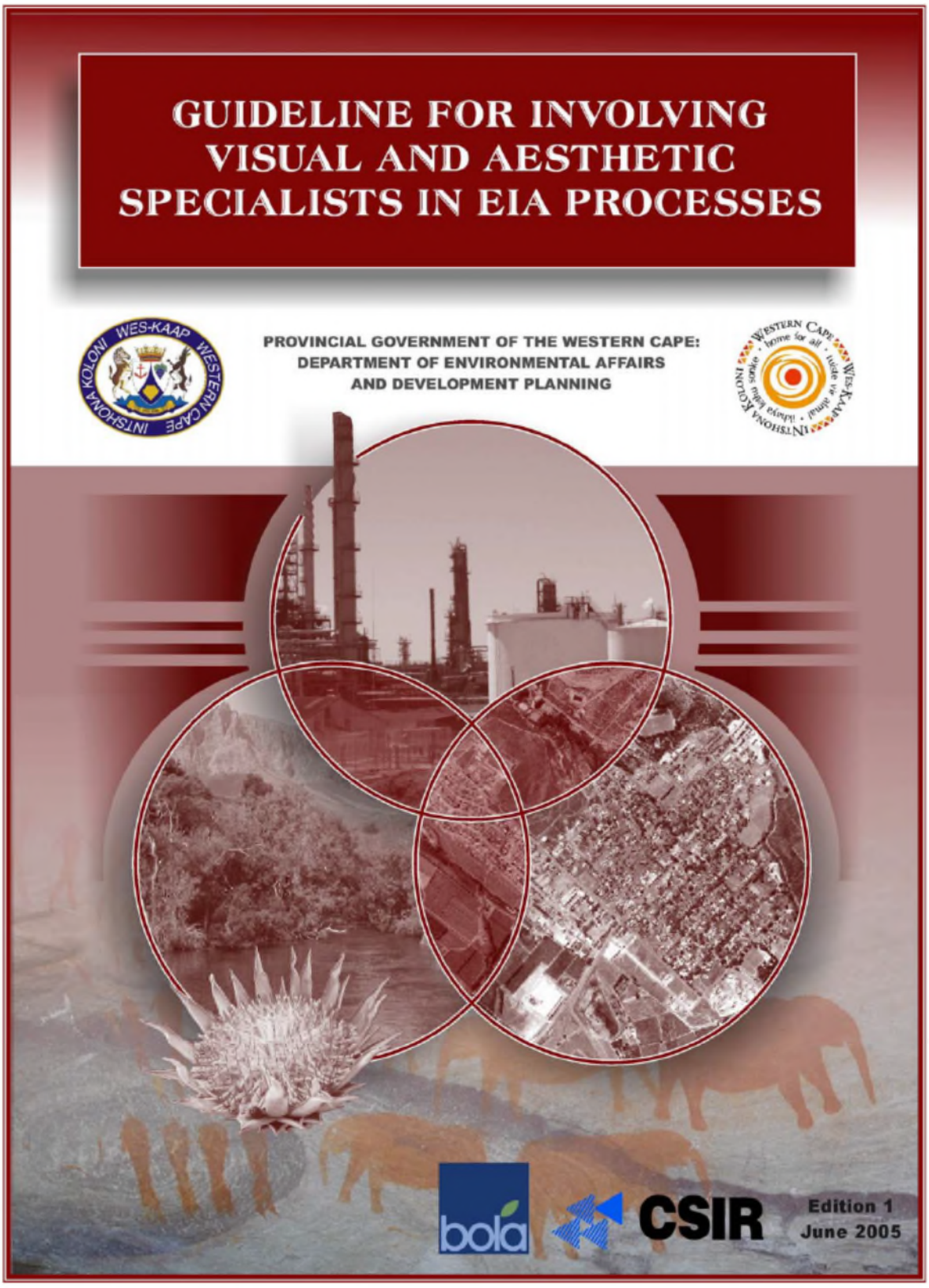
19. **Umdloti Housing** – Visual Impact Assessment as part of Environmental Impact Assessment for a residential development beside the Umdloti Lagoon to the north of Durban.
20. **Tata Steel Ferrochrome Smelter** - Visual impact assessment of proposed new Ferrochrome Smelter in Richards Bay as part of EIA undertaken by the CSIR.
21. **Diamond Mine at Rooipoort Nature Reserve near Kimberley** – Visual impact assessment for a proposed diamond mine within an existing nature reserve for De Beers.
22. **Durban Solid Waste Large Landfill Sites –** Visual Impact Assessment of proposed development sites to the North and South of the Durban Metropolitan Area. The project utilised 3d computer visualisation techniques.
23. **Hillside Aluminium Smelter, Richards Bay -** Visual Impact Assessment of proposed extension of the existing smelter. The project utilised 3d computer visualisation techniques.
24. **Estuaries of KwaZulu Natal Phase 1 and Phase 2 –** Visual character assessment and GIS mapping as part of a review of the condition and development capacity of eight estuary landscapes for the Town and Regional Planning Commission. The project was extended to include all estuaries in KwaZulu Natal.
25. **Signage Assessments** – Numerous impact assessments for proposed signage developments for Blast Media.
26. **Signage Strategy** – Preparation of an environmental strategy report for a national advertising campaign on National Roads for Visual Image Placements.
27. **Zeekoegatt, Durban** - Computer aided visual impact assessment. Acted as advisor to the Province of KwaZulu Natal in an appeal brought about by a developer to extend a light industrial development within a 60 metre building line from the National N3 Highway.
28. **La Lucia Mall Extension** - Visual impact assessment using three dimensional computer modelling / photo realistic rendering and montage techniques for proposed extension to shopping mall for public consultation exercise.
29. **Redhill Industrial Development** - Visual impact assessment using three dimensional computer modelling / photo realistic rendering and montage techniques for proposed new industrial area for public consultation exercise.
30. **Avondale Reservoir** - Visual impact assessment using three dimensional computer modelling / photo realistic rendering and montage techniques for proposed hilltop reservoir as part of Environmental Impact Assessment for Umgeni Water.
31. **Hammersdale Reservoir** - Visual impact assessment using three dimensional computer modelling / photo realistic rendering and montage techniques for proposed hilltop reservoir as part of Environmental Impact Assessment for Umgeni Water.
32. **Southgate Industrial Park, Durban** - Computer Aided Visual Impact Assessment and Landscape Design for AECI.
33. **Sainsbury's Bryn Rhos (UK)** - Computer Aided Visual Impact Assessment/ Planning Application for the development of a new store within the Green Wedge North of Swansea.
34. **Ynyston Farm Access (UK)** - Computer Aided Impact Assessment of visual intrusion of access road to proposed development in Cardiff for the Land Authority for Wales.

35. **Cardiff Bay Barrage (UK)** - Concept Design, Detail Design, Documentation, and Visual Input to Environmental Statement for consideration by Parliament in the debate prior to the passing of the Cardiff Bay Barrage Bill. The work was undertaken for Cardiff Bay Development Corporation.
36. **A470, Cefn Coed to Pentrebach (UK)** - Preparation of frameworks for the assessment of the impact of the proposed alignment on the landscape for The Welsh Office.
37. **Sparkford to Illchester Bye Pass (UK)** - The preparation of the landscape framework and the draft landscape plan for the Department of Transport.
38. **Green Island Reclamation Study (Hong Kong)** - Visual Impact Assessment of building massing, Urban Design Guidelines and Masterplanning for a New Town extension to Hong Kong Island.
39. **Route 3 (Hong Kong)** - Visual Impact Assessment for alternative road alignments between Hong Kong Island and the Chinese Border.
40. **China Border Link (Hong Kong)** - Visual Impact Assessment and initial Landscape Design for a new border crossing at Lok Ma Chau.
41. **Route 81, Aberdeen Tunnel to Stanley (Hong Kong)** - Visual Impact Assessment for alternative highway alignments on the South side of Hong Kong Island.

APPENDIX II

GUIDELINES FOR INVOLVING VISUAL AND AESTHETIC SPECIALISTS IN EIA PROCESSES

(Preface, Summary and Contents for full document go to the Provincial Government of the Western Cape, Department of Environmental Affairs and Development Planning web site, http://eadp.westerncape.gov.za/your-resource-library/policies-guidelines)


GUIDELINE FOR INVOLVING VISUAL AND AESTHETIC SPECIALISTS IN EIA PROCESSES
PROVINCIAL GOVERNMENT OF THE WESTERN CAPE:
DEPARTMENT OF ENVIRONMENTAL AFFAIRS
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GUIDELINE FOR INVOLVING VISUAL AND AESTHETIC SPECIALISTS IN EIA PROCESSES

Edition 1

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Stakeholders engaged in the guideline development process:

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In particular, thanks are due to Jan Glazewski (University of Cape Town), Keith Wiseman (City of Cape Town), Paul Britton (SANPARKS), Graham Young (University of Pretoria), Lisa Parkes (Ninham Shand) and Paul Claassen (Environomics) for providing useful information and in-depth comments.

Finalisation of report figures and formatting:

Magdel van der Merwe and Elna Logie, DTP Solutions

PREFACE

The purpose of an Environmental Impact Assessment (EIA) is to provide decision-makers (be they government authorities, the project proponent or financial institutions) with adequate and appropriate information about the potential positive and negative impacts of a proposed development and associated management actions in order to make an informed decision whether or not to approve, proceed with or finance the development.

For EIA processes to retain their role and usefulness in supporting decision-making, the involvement of specialists in EIA needs to be improved in order to:

- Add greater value to project planning and design;
- Adequately evaluate reasonable alternatives;
- Accurately predict and assess potential project benefits and negative impacts;
- Provide practical recommendations for avoiding or adequately managing negative impacts and enhancing benefits;
- Supply enough relevant information at the most appropriate stage of the EIA process to address adequately the key issues and concerns, and effectively inform decision-making in support of sustainable development.

It is important to note that not all EIA processes require specialist input; broadly speaking, specialist involvement is needed when the environment could be significantly affected by the proposed activity, where that environment is valued by or important to society, and/or where there is insufficient information to determine whether or not unavoidable impacts would be significant.

The purpose of this series of guidelines is to improve the efficiency, effectiveness and quality of specialist involvement in EIA processes. The guidelines aim to improve the capacity of roleplayers to anticipate, request, plan, review and discuss specialist involvement in EIA processes. Specifically, they aim to improve the capacity of EIA practitioners to draft appropriate terms of reference for specialist input and assist all roleplayers in evaluating whether or not specialist input to the EIA process is appropriate for the type of development and environmental context. Furthermore, they aim to ensure that specialist inputs support the development of effective, practical Environmental Management Plans where projects are authorised to proceed (refer to *Guideline for Environmental Management Plans*).

The guidelines draw on best practice in EIA in general, and within specialist fields of expertise in particular, to address the following issues related to the timing, scope and quality of specialist input. The terms "specialist involvement" and "input" have been used in preference to "specialist assessment" and "studies" to indicate that the scope of specialists' contribution (if required) depends on the nature of the project, the environmental context and the amount of available information and does not always entail detailed studies or assessment of impacts.

The guidelines draw on best practice in EIA in general, and within specialist fields of expertise in particular, to address the following issues related to the timing, scope and quality of specialist input. The terms "specialist involvement" and "input" have been used in preference to "specialist

assessment" and "studies" to indicate that the scope of specialists' contribution depends on the nature of the project, the environmental context and the amount of available information.

	ISSUES
TIMING	▪ When should specialists be involved in the EIA process; i.e. at what stage in the EIA process should specialists be involved (if at all) and what triggers the need for their input?
SCOPE	▪ Which aspects must be addressed through specialist involvement; i.e. what is the purpose and scope of specialist involvement? ▪ What are appropriate approaches that specialists can employ? ▪ What qualifications, skills and experience are required?
QUALITY	▪ What triggers the review of specialist studies by different roleplayers? ▪ What are the review criteria against which specialist inputs can be evaluated to ensure that they meet minimum requirements, are reasonable, objective and professionally sound?

The following guidelines form part of this first series of guidelines for involving specialists in EIA processes:

- Guideline for determining the scope of specialist involvement in EIA processes
- Guideline for the review of specialist input in EIA processes
- Guideline for involving biodiversity specialists in EIA processes
- Guideline for involving hydrogeologists in EIA processes
- Guideline for involving visual and aesthetic specialists in EIA processes
- Guideline for involving heritage specialists in EIA processes
- Guideline for involving economists in EIA processes

The *Guideline for determining the scope of specialist involvement in EIA processes* and the *Guideline for the review of specialist input in EIA processes* provide generic guidance applicable to any specialist input to the EIA process and clarify the roles and responsibilities of the different roleplayers involved in the scoping and review of specialist input. It is recommended that these two guidelines are read first to introduce the generic concepts underpinning the guidelines which are focused on specific specialist disciplines.

Who is the target audience for these guidelines?

The guidelines are directed at authorities, EIA practitioners, specialists, proponents, financial institutions and other interested and affected parties involved in EIA processes. Although the guidelines have been developed with specific reference to the Western Cape province of South Africa, their core elements are more widely applicable.

What type of environmental assessment processes and developments are these guidelines applicable to?

The guidelines have been developed to support project-level EIA processes regardless of whether they are used during the early project planning phase to inform planning and design decisions (i.e. during pre-application planning) or as part of a legally defined EIA process to obtain statutory approval for a proposed project (i.e. during screening, scoping and/or impact assessment). Where specialist input may be required the guidelines promote early, focused and appropriate involvement of specialists in EIA processes in order to encourage proactive consideration of potentially significant impacts, so that negative impacts may be avoided or

effectively managed and benefits enhanced through due consideration of alternatives and changes to the project.

The guidelines aim to be applicable to a range of types and scales of development, as well as different biophysical, social, economic and governance contexts.

What will these guidelines not do?

In order to retain their relevance in the context of changing legislation, the guidelines promote the principles of EIA best practice without being tied to specific legislated national or provincial EIA terms and requirements. They therefore do not clarify the specific administrative, procedural or reporting requirements and timeframes for applications to obtain statutory approval. They should, therefore, be read in conjunction with the applicable legislation, regulations and procedural guidelines to ensure that mandatory requirements are met.

It is widely recognized that no amount of theoretical information on how best to plan and coordinate specialist inputs, or to provide or review specialist input, can replace the value of practical experience of coordinating, being responsible for and/or reviewing specialist inputs. Only such experience can develop sound judgment on such issues as the level of detail needed or expected from specialists to inform decision-makers adequately. For this reason, the guidelines should not be viewed as prescriptive and inflexible documents. Their intention is to provide best practice guidance to improve the quality of specialist input.

Furthermore, the guidelines do not intend to create experts out of non-specialists. Although the guidelines outline broad approaches that are available to the specialist discipline (e.g. field survey, desktop review, consultation, modeling), specific methods (e.g. the type of model or sampling technique to be used) cannot be prescribed. The guidelines should therefore not be used indiscriminately without due consideration of the particular context and circumstances within which an EIA is undertaken, as this influences both the approach and the methods available and used by specialists.

How are these guidelines structured?

The specialist guidelines have been structured to make them user-friendly. They are divided into six parts, as follows:

- **Part A**: Background;
- **Part B**: Triggers and key issues potentially requiring specialist input;
- **Part C**: Planning and coordination of specialist inputs (drawing up terms of reference);
- **Part D**: Providing specialist input;
- **Part E**: Review of specialist input; and
- **Part F**: References.

Part A provides grounding in the specialist subject matter for all users. It is expected that authorities and peer reviewers will make most use of Parts B and E; EIA practitioners and project proponents Parts B, C and E; specialists Part C and D; and other stakeholders Parts B, D and E. Part F gives useful sources of information for those who wish to explore the specialist topic.

SUMMARY

This guideline document, which deals with specialist visual input into the EIA process, is organised into a sequence of interleading sections. These follow a logical order covering the following:

- the background and context for specialist visual input;
- the triggers and issues that determine the need for visual input;
- the type of skills and scope of visual inputs required in the EIA process;
- the methodology, along with information and steps required for visual input;
- finally, the review or evaluation of the visual assessment process.

Part A is concerned with defining the visual and aesthetic component of the environment, and with principles and concepts relating to the visual assessment process. The importance of the process being logical, holistic, transparent and consistent is stressed in order for the input to be useful and credible.

The legal and planning context within which visual assessments take place indicate that there are already a number of laws and bylaws that protect visual and scenic resources. These resources within the Western Cape context have importance for the economy of the region, along with the proclaimed World Heritage Sites in the Province.

The role and timing of specialist visual inputs into the EIA process are outlined, with the emphasis being on timely, and on appropriate level of input, from the early planning stage of a project, through to detailed mitigation measures and management controls at the implementation stage.

Part B deals with typical factors that trigger the need for specialist visual input to a particular project. These factors typically relate to:

(a) the nature of the receiving environment, in particular its visual sensitivity or protection status;
(b) the nature of the project, in particular the scale or intensity of the project, which would result in change to the landscape or townscape.

The correlation between these two aspects are shown in a table, in order to determine the varying levels of visual impact that can be expected, i.e. from little or no impact, to very high visual impact potential.

Part C deals with the choice of an appropriate visual specialist, and the preparation of the terms of reference (TOR) for the visual input. Three types of visual assessment are put forward, each requiring different expertise, namely:
Type A: assessments involving large areas of natural or rural landscape;
Type B: assessments involving local areas of mainly built environment;
Type C: assessments involving smaller scale sites with buildings, or groups of buildings.

The scope of the visual input would in summary relate to the following:

- the issues raised during the scoping process;
- the time and space boundaries, i.e. the extent or zone of visual influence;

- the types of development alternatives that are to be considered;
- the variables and scenarios that could affect the visual assessment;
- the inclusion of direct, indirect and cumulative effects.

Approaches to the visual input relate to the level of potential impact and range from minimal specialist input, to a full visual impact assessment (VIA). A list of the typical components of a visual assessment is given, and the integration with other studies forming part of the EIA process is discussed.

Part D provides guidance for specialist visual input, and on the information required by specialists. Notes on predicting potential visual impacts are given, along with suggested criteria for describing and rating visual impacts. The assessment of the overall significance of impacts, as well as thresholds of significance are discussed.

Further aspects that need to be considered by visual specialists in EIA processes include:

- affected parties who stand to benefit or lose,
- risks and uncertainties related to the project,
- assumptions that have been made, and their justification,
- levels of confidence in providing the visual input or assessment,
- management actions that can be employed to avoid or mitigate adverse effects and enhance benefits, and
- the best practicable environental option from the perspective of the visual issues and impacts.

Finally, pointers for the effective communication of the findings are given.

Part E lists specific evaluation criteria for reviewing visual input by a specialist, where this becomes necessary. Further guidance on this is given in the document on *Guideline for the review of specialist input in EIA processes*.

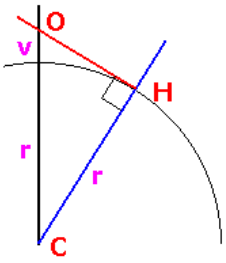
CONTENTS

APPENDIX II1

FORMULA FOR DERIVING THE APPROXIMATE VISUAL HORIZON

The Mathematics behind this Calculation

This calculation should be taken as a guide only as it assumes the earth is a perfect ball 6378137 metres radius. It also assumes the horizon you are looking at is at sea level. A triangle is formed with the centre of the earth (C) as one point, the horizon point (H) is a right angle and the observer (O) the third corner. Using Pythagoras's theorem we can calculate the distance from the observer to the horizon (OH) knowing CH is the earth's radius (r) and CO is the earth's radius (r) plus observer's height (v) above sea level.



Sitting in a hotel room 10m above sea level a boat on the horizon will be 11.3km away. The reverse is also true, whilst rowing across the Atlantic, the very top of a mountain range 400m high could be seen on your horizon at a distance of 71.4 km assuming the air was clear enough.

APPENDIX IV

CUMULATIVE IMPACT ASSESSMENT

1 Landscape Change

Nature:
Adding to the industrialisation of landscape character associated with the authorised project as well as other authorised projects in the Karoshoek Valley.

The assessment has shown that the proposed project is unlikely to significantly extend the impact of authorized sites. It will however intensify impacts within the Karoshoek Valley.

	Without mitigation	**With mitigation**
Extent	Region, (3)	Region, (3)
Duration	Long term (4)	Long term (4)
Magnitude	Low (4)	Minor to Low (3)
Probability	Probable (3)	Probable (3)
Significance	**Medium (33)**	**Medium to Low (30)**
Status (positive or negative)	Negative	Negative
Reversibility	High	High
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes, but only the impact of low elements including heliostats and minor buildings.	

Mitigation:
Low level impacts associated with the heliostat field can be mitigated.

Planning:
- Plan levels to minimise earthworks to ensure that levels are not elevated;
- Plan to maintain the height of structures as low as possible;
- Minimise disturbance of the surrounding landscape and maintain existing vegetation around the development;

Operations:
- Reinstate any areas of vegetation that have been disturbed during construction;
- Remove all temporary works;
- Monitor rehabilitated areas post-decommissioning and implement remedial actions;
- Minimise disturbance and maintain existing vegetation as far as is possible both within and surrounding the development area;
- Colouring of mirror backs;

Decommissioning:
- Remove infrastructure not required for the post-decommissioning use of the site;
- Return all affected areas to productive agricultural use;
- Monitor rehabilitated areas post-decommissioning and implement remedial actions.

2 The visibility of the facility to, and potential visual impact on users of roads in close proximity

Nature:
Proposed Solar projects within the Karoshoek Valley will add industrial elements to an otherwise natural landscape. Industrialisation of a natural landscape as seen

from the local Kleinbegin and Kenhardt roads to the west and the N10 and N14 to the north.

The assessment indicates that due to intervening landform, CSP 7 is unlikely to have any significant impact on either the N10 or N14.

The local roads to the west (Kleinbegin and Kenhardt Roads) are located relatively close to the west of the site. The power tower will be visible from this area. It will be seen in the context of other authorised towers and will generally appear within a relatively natural setting.

Due to distance and topography, heliostats are unlikely to be obvious to the Kleinbegin Road or visible to the Kenhardt Road.

The Power Tower will be add an obvious industrial element in the view from these roads. It is likely that diffuse reflection from the receiver will make the tower more obvious. In cumulative terms this will slightly intensify the impact associated with authorised projects.

	Without mitigation	**With mitigation**
Extent	Region, **(3)**	Region, **(3)**
Duration	Long term, **(4)**	Long term, **(4)**
Magnitude	Minor, **(2)**	Minor, **(2)**
Probability	Highly Probable, **(4)**	Highly Probable, **(4)**
Significance	**Medium, (36)**	**Medium, (36)**
Status (positive or negative)	Negative	Negative
Reversibility	High	High
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	**Yes**, however, only impacts associated with the lower elements can realistically be mitigated. This will not change the larger impacts associated with the tower structure.	

Mitigation:
Low level impacts associated with the heliostat field can be mitigated.

Planning:
- Plan levels to minimise earthworks to ensure that levels are not elevated;
- Plan to maintain the height of structures as low as possible;
- Minimise disturbance of the surrounding landscape and maintain existing vegetation around the development;

Operations:
- Reinstate any areas of vegetation that have been disturbed during construction;
- Remove all temporary works;
- Monitor rehabilitated areas post-decommissioning and implement remedial actions;
- Minimise disturbance and maintain existing vegetation as far as is possible both within and surrounding the development area;
- Colouring of mirror backs;

Decommissioning:
- Remove infrastructure not required for the post-decommissioning use of the site;
- Return all affected areas to productive agricultural use;

- Monitor rehabilitated areas post-decommissioning and implement remedial actions.

3 Impact on Settlements and Homesteads

Nature:
Industrialisation of a natural landscape as seen from local homesteads.

The project will only have a significant impact on homesteads within the Karoshoek Valley. The most major impact will occur where heliostats are visible. It is unlikely that this will occur.

This means that the only impact is likely to be the sight of an additional tower within the valley landscape. In cumulative terms this will slightly intensify the impact associated with authorised projects.

	Without mitigation	**With mitigation**
Extent	Region, **(3)**	Region, **(3)**
Duration	Long term, **(4)**	Long term, **(4)**
Magnitude	Small, **(0)**	Small, **(0)**
Probability	Highly Probable, **(4)**	Highly Probable, **(4)**
Significance	**Low, (28)**	**Low, (28)**
Status (positive or negative)	Negative	Negative
Reversibility	High	High
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	**Yes**, however, only impacts associated with the lower elements can realistically be mitigated. This will not change the larger impacts associated with the tower structure.	

Mitigation:
Low level impacts associated with the heliostat field can be mitigated.

Planning:
- Plan levels to minimise earthworks to ensure that levels are not elevated;
- Plan to maintain the height of structures as low as possible;
- Minimise disturbance of the surrounding landscape and maintain existing vegetation around the development;

Operations:
- Reinstate any areas of vegetation that have been disturbed during construction;
- Remove all temporary works;
- Monitor rehabilitated areas post-decommissioning and implement remedial actions;
- Minimise disturbance and maintain existing vegetation as far as is possible both within and surrounding the development area;
- Colouring of mirror backs;

Decommissioning:
- Remove infrastructure not required for the post-decommissioning use of the site;
- Return all affected areas to productive agricultural use;
- Monitor rehabilitated areas post-decommissioning and implement remedial actions.

4 The visibility of the facility to, and potential visual impact on other sensitive receptors

Nature:
Industrialisation of a natural landscape as seen from sensitive uses.

Other sensitive receptors that have been identified within the region include the FM Safaris ecotourism operation to the north east and on the northern side of the Orange River.

The assessment indicates that the proposed tower is likely to be visible to a portion of FM Safaris operation. Whilst a view of the development may be possible, it is likely that it will not be obvious as only the top of the tower is likely to be visible over a ridgeline at a minimum distance of 25.5km.

The impact of CSP 7 on FM Safaris is therefore likely to be low but may add slightly to impacts associated with closer projects particularly Ilanga 1 and CSP 1.

	Without mitigation	**With mitigation**
Extent	Regional **(3)**	NA
Duration	Long term **(4)**	NA
Magnitude	Small **(0)**	NA
Probability	Very Improbable **(1)**	NA
Significance	**Low (7)**	NA
Status (positive or negative)	**Negative**	NA
Reversibility	High	NA
Irreplaceable loss of resources?	No irreplaceable loss	NA
Can impacts be mitigated?	**No**	

Mitigation:
No mitigation possible.

5 Night Time Lighting Impacts

Nature:
The cumulative impact of the lighting associated with other solar energy projects in the area.

Currently lighting in the area is comprised of occasional low level lights associated with isolated homesteads. The project is therefore seen in a relatively dark area during night time hours.

There is potential for security lighting and operational lighting associated with solar energy projects to transform the night time landscape in the area.

The extent of lighting associated with solar projects in the area is not known. The assessment found that;

- If full security floodlighting of facilities is required then, the proposed project could add slightly to impacts associated with this project;

- If full security floodlighting is not required and only low level lighting of operational areas (buildings), then the proposed extension will add negligible additional impact to the authorised project.

In the former case, the proposed project will add slightly to cumulative impacts.

In the latter case, the proposed extension will not add to cumulative impacts.

	Without mitigation	**With mitigation**
Extent	Site and immediate surroundings **(2)**	Local **(1)**
Duration	Long term **(4)**	Long term **(4)**
Magnitude	Minor **(2)**	Small **(0)**
Probability	Probable **(3)**	Very improbable **(1)**
Significance	**Low (24)**	**Low (5)**
Status (positive or negative)	Negative	Negative
Reversibility	High	High
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	

Mitigation:

1) Use of motion sensors to turn on security lights when needed.
2) Use of infrared security systems.
3) Preventing light spill through careful design.

6 Possible impact of glint and glare.

Nature:
The cumulative impact of the project on glint and glare associated with solar projects in the area.

The assessment indicates that the proposed project is unlikely to create glint and glare impacts. It is therefore also unlikely to contribute to glint and glare associated with solar projects in the area.

	Without mitigation	**With mitigation**
Extent	Local **(1)**	NA
Duration	Long term **(4)**	NA
Magnitude	Small **(0)**	NA
Probability	Very improbable **(1)**	NA
Significance	**Low (5)**	**NA**
Status (positive or negative)	Negligible	NA
Reversibility	High	NA
Irreplaceable loss of resources?	No	NA
Can impacts be mitigated?	NA	NA

Mitigation:
Mitigation is not necessary as no impact is anticipated.

7 Visual impacts associated with construction of the proposed project.

Nature:
The site is unlikely to be visible to receptors. Impacts are likely to include dust from site operations once the site has been cleared, storage areas which may be as high as the heliostat development and delivery trucks using local roads.

It is also possible that waste-blow could be problematic.

Subject to timing, construction of the proposed project could add slightly to cumulative impacts including;

- Waste blow;
- Dust; and
- Construction traffic.

	Without mitigation	**With mitigation**
Extent	Site and immediate surroundings, **(2)**	Local**, (1)**
Duration	Very short duration, **(1)**	Very short duration, **(1)**
Magnitude	Minor **(2)**	Small, **(0)**
Probability	Probable, **(3)**	Improbable, **(2)**
Significance	Low, **(15)**	Low, **(4)**
Status (positive or negative)	Negative	Negative
Reversibility	High	High
Irreplaceable loss of resources?	There will be no irreplaceable loss.	There will be no irreplaceable loss.
Can impacts be mitigated?	Yes	

Mitigation:

- Minimise clearance of vegetation;
- undertake dust prevention measures;
- Maintain stockpiles to less than 3 m high; and
- Manage waste effectively and prevent waste blowing around and off site.