PROPOSED KABI VAALKOP PHOTOVOLTAIC SOLAR ENERGY FACILITY

East of Orkney, in the City of Matlosana Local Municipality, North West Province

VISUAL IMPACT ASSESSMENT

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Kabi Solar

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1. STUDY APPROACH

1.1. Qualification and Experience of the Practitioner

MetroGIS (Pty) Ltd, specialising in visual assessment and Geographic Information Systems, undertook this visual assessment.

Lourens du Plessis, the lead practitioner undertaking the assessment, has been involved in the application of Geographical Information Systems (GIS) in Environmental Planning and Management since 1990.

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

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

Savannah Environmental (Pty) Ltd appointed MetroGIS (Pty) Ltd as an independent specialist consultant to undertake the visual impact assessment for the Proposed Vaalkop Photovoltaic Solar Energy Facility near Orkney in the North-West Province. Neither the author nor MetroGIS will benefit from the outcome of the project decision-making.

1.2. Assumptions and Limitations

This assessment was undertaken during the planning stage of the project and is based on information available at that time.

1.3. Level of Confidence

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

- The information available, and understanding of the study area by the practitioner:

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[1]Adapted from Oberholzer (2005).

- 3: A high level of information is available of the study area and a thorough knowledge base could be established during site visits, surveys etc. The study area was readily accessible.
- 2: A moderate level of information is available of the study area and a moderate knowledge base could be established during site visits, surveys etc. Accessibility to the study area was acceptable for the level of assessment.
- 1: Limited information is available of the study area and a poor knowledge base could be established during site visits and/or surveys, or no site visit and/or surveys were carried out.

- The information available, understanding of the study area and experience of this type of project by the practitioner:
  - 3: A high level of information and knowledge is available of the project and the visual impact assessor is well experienced in this type of project and level of assessment.
  - 2: A moderate level of information and knowledge is available of the project and/or the visual impact assessor is moderately experienced in this type of project and level of assessment.
  - 1: Limited information and knowledge is available of the project and/or the visual impact assessor has a low experience level in this type of project and level of assessment.

These values are applied as follows:

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

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

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

1.4. Methodology

The study was undertaken using Geographic Information Systems (GIS) software as a tool to generate viewshed analyses and to conduct relevant spatial operations to quantify and analyse the possible visual impact the proposed facility.

Site visits were undertaken to source information regarding land use, vegetation cover, topography and general visual quality of the affected environment. It further served the purpose of verifying the results of the spatial analyses and to identify other possible mitigating/aggravating circumstances related to the potential visual impact.

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

- The creation of a detailed digital terrain model (DTM) of the potentially affected environment using 20m interval contours supplied by the Chief Directorate Geo-Spatial Information;
- The sourcing of relevant spatial data. This included cadastral boundaries, vegetation types, land use activities, topographical features, site placement, etc;
- The identification of sensitive environments upon which the proposed facility could have a potential impact;
- The creation of viewshed analyses from the proposed development area in order to determine the visual exposure and the topography's potential to absorb the potential visual impact. The viewshed analyses take into account the dimensions of the proposed structures.

This report (visual impact assessment) sets out to identify and quantify the possible visual impacts related to the proposed solar energy facility and related infrastructure mentioned above, as well as offer potential mitigation measures, where required.

The following methodology has been followed for the assessment of visual impact:

- **Determine Potential visual exposure**

  The visibility or visual exposure of any structure or activity is the point of departure for the visual impact assessment. It stands to reason that if the proposed solar energy facility and associated infrastructure were not visible, no impact would occur.

  Viewshed analyses of the proposed solar energy facility and the related infrastructure, based on a 20m interval digital terrain model of the study area, indicate the potential visibility.

- **Determine Visual Distance / Observer Proximity to the facility**

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

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

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

- **Determine Viewer Incidence / Viewer Perception**

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

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

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

- **Determine the Visual Absorption Capacity of the landscape**

  This is the capacity of the receiving environment to absorb the potential visual impact of the proposed facility. The VAC is primarily a function of the vegetation, and will be high if the vegetation is tall, dense and continuous. Conversely, low growing sparse and patchy vegetation will have a low VAC.

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

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

The digital terrain model utilised in the calculation of the visual exposure of the facility does not incorporate the potential visual absorption capacity (VAC) of the natural vegetation of the region. It is therefore necessary to determine the VAC by means of the interpretation of the vegetation cover, supplemented with field observations.

- **Determine the Visual impact index**

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

- **Determine Impact significance**

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

2. BACKGROUND

Kabi Solar is proposing the establishment of a Solar Energy Facility (SEF) on a site about 6 km north east of Orkney, within the City of Matlosana Local Municipality in the North-West Province.

The company intends to utilise photovoltaic (PV) technology to construct an alternative energy generation facility with a total generating capacity of ~225 MW.

The proposed solar energy facility generates electricity by means of photovoltaic panels that harness radiation from the sun as a renewable source of energy. Electricity generated by solar energy is generally considered to be an environmentally friendly option.

The project is proposed to be developed on a total area of 778 ha, and will be comprised of the following development Phases:

- *Phase 1* - Proposed **Kabi Vaalkop Solar I PV Facility** on a portion of Portion 200 of Farm Nooitgedacht 434 IP, a portion of Portion 3 of the Farm Vaalkop 439 IP and on a portion of Farm Vaalkop 439 IP. This facility will have a generating capacity of 75 MW. Power from this phase is to be evacuated using the existing Jouberton - Hermes 132 kV power line that crosses the site via the new on-site substation.

- *Phase 2* – Proposed **Kabi Vaalkop Solar II PV Facility** on a portion of Portion 3 of the Farm Vaalkop 439 IP. This facility will have a generating capacity of 75 MW. Power from this phase is to be evacuated via a new on- site substation and a new proposed power line to connect directly into the Eskom Hermes Substation

- *Phase 3* – Proposed **Kabi Vaalkop Solar III PV Facility** on a portion of Portion 200 of Farm Nooitgedacht 434 IP and on a portion of Farm Vaalkop 439 IP. This facility will have a generating capacity of 75 MW. Power from this phase is to be evacuated via a new on-site substation and a new proposed power line to connect directly into the Eskom Hermes substation.

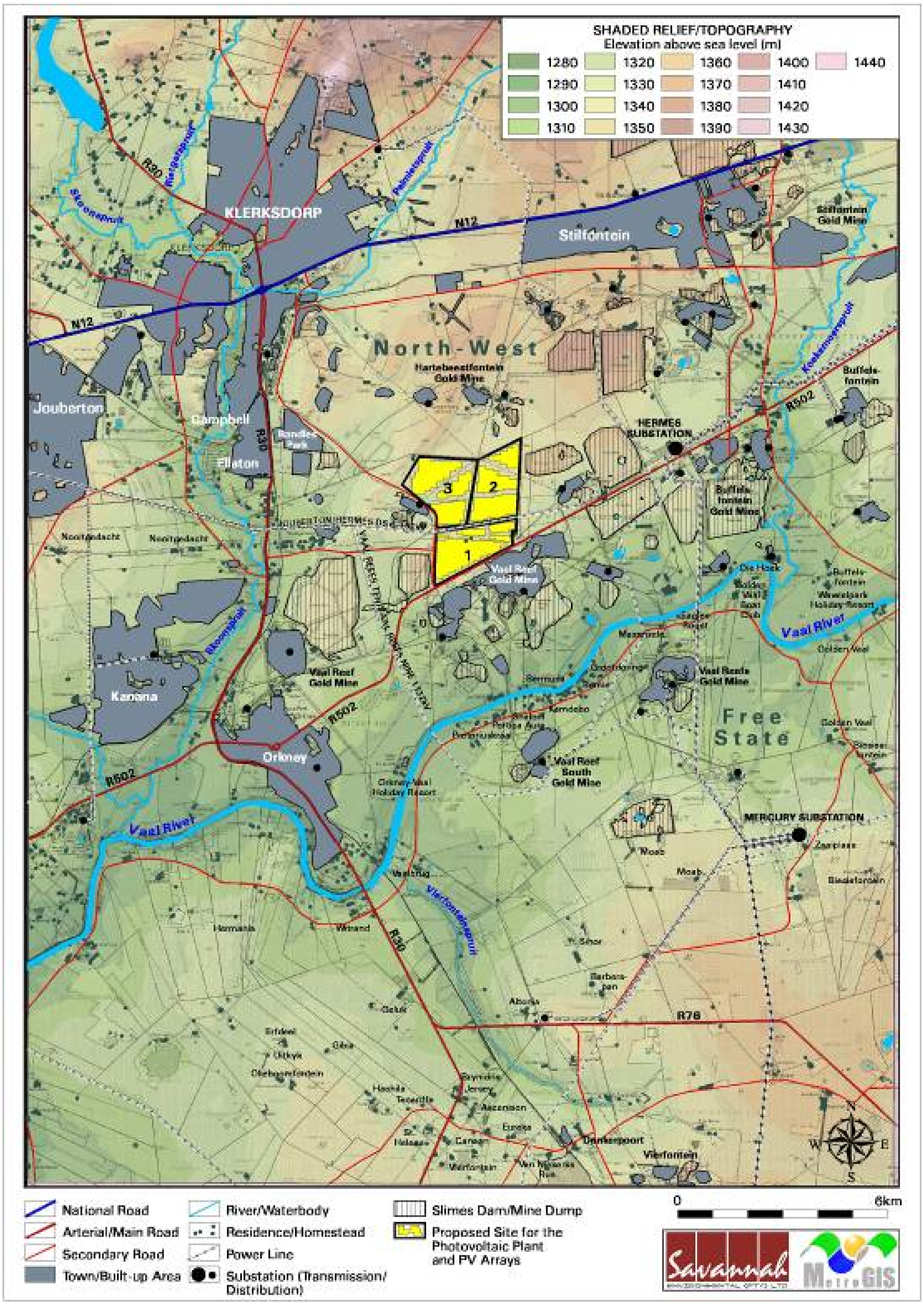
These properties represent a large area and include several mines at places. The proposed development will occur in the north-eastern part of this area.

The solar energy facility will connect to the national grid via a new substation (Vaalkop substation) to be constructed under Jouberton-Hermes 132 kV transmission that crosses the site and that will feed into Eskom's Hermes Substation, which lies 5.8km to the east of the site. New overhead power lines connecting Vaalkop substation to Hermes are being contemplated to evacuate the power from the second and third phases of the proposed development. The location of the proposed three phases is shown on **Map 1**.

Infrastructure will include the following:

- An array of photovoltaic solar panels;
- Underground cabling between the PV panels;
- Invertors;
- A new substation – on site;
- A new 132 kV power line to connect to the Hermes substation, 6km east of the site;
- An administrative building;
- Internal access roads;
- A workshop area for maintenance and storage; and
- Security lighting.

The infrastructure above will be located within the confines of the farms identified for the PV energy facility (apart from the power line to Hermes substation).



Map 1: Layout of the Vaalkop SEF indicating the proposed three phases (marked 1, 2 and 3 on the map).

3. SCOPE OF WORK

The scope of work for the proposed SEF includes the determination of the potential visual impacts in terms of nature, extent, duration, magnitude, probability, and significance of the construction and operation of the proposed facility.

The main purpose is to analyse various visual impact parameters, i.e. visibility, exposure, proximity, visual absorption capacity and viewer incidence, and to integrate these into an index of visual impact.

The study area for the visual assessment encompasses a geographical area of 24x32 km (the extent of the maps displayed below) and includes a minimum 6km buffer zone from the boundaries of the proposed development area.

4. THE AFFECTED ENVIRONMENT

Regionally, the site is located in an extensive mining area, and is surrounded by several mines and towns. The main towns are Orkney, Stilfontein and Klerksdorp, with the latter being a major regional centre.

Mines occur in a dense pattern around the site. As indicated on **Map 2**, and the photographs in Figure 1, discard rock dumps and slimes dams of the Vaal Reef Gold Mine are located in close proximity to the development area (within 1.5km).

Roads and power line infrastructure is well developed in the area. Roads include the N12 national road, the R502 and a number of secondary roads. The proposed development site is bordered by roads on the southern and western boundaries. At least five transmission lines intersect the development site, with others criss-crossing the study area in all directions. Eskom's Hermes Substation is approximately 6 km east of the site.

The Klerksdorp aerodrome is located 4km north of the development site.

The topography is characterised by generally flat land with a few low lying ridges and koppies. The sense of place of the area is dominated by the large number of slimes dams and waste rock dumps that have altered the topography substantially by virtue of their large footprint and vertical dimensions.

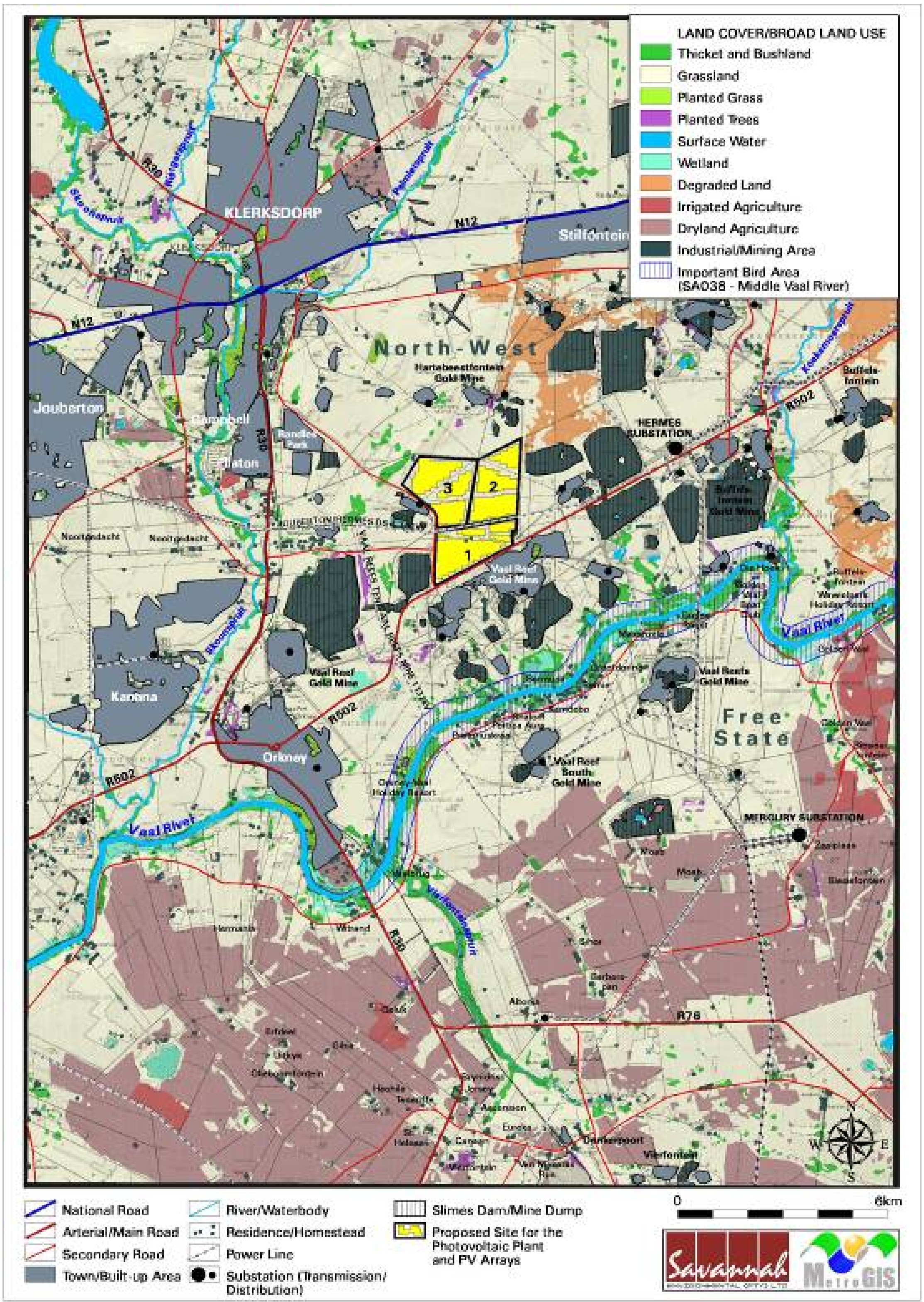
The Vaal River with a number of tributaries, such as Koekemoerspruit and Skoonspruit are the main hydrological features in the area.

Development in the study area is dominated by mining, which is the major economic force for development in close-by towns. The population density in towns is high, with more than 1000 people per km^2. Whereas towns such as Orkney and Stilfontein exist mainly as mine towns, Klerksdorp has grown into a major regional centre, providing secondary and tertiary services to a large geographical area, including the wider agricultural community.

Farming activities are limited to areas outside of mining land, and include mainly areas north of the N12 national road and south of the Vaal river, where cultivation of primarily maize is predominant.

Potential sensitive receivers are possibly found in residential areas of towns in the study area. Farmsteads that might be influenced by possible visibility are only located in the southern part of the study area, but because of distance, the level of exposure to the SEF will be low.

Figure 1: Views of the proposed development site, with waste rock dumps, slimes dams, and power lines ever present in the area.



Map 2: Land cover, indicating large scale mining activity and township development in the study area.

5. ISSUES WITH REGARD TO POSSIBLE VISUAL IMPACT

Solar energy generation is generally considered to be an environmentally friendly electricity generation option. Anticipated issues related to the potential visual impact of the SEF are few and expected to be moderate to low, owing to the extreme nature of transformation in the area where mining development has transformed the topography and sense of place to a large degree.

The issues relating to visual impact that have been identified thus far include the following:

- *The visibility of the facility to, and potential visual impact on, observers travelling along main and secondary roads within the study area, specifically the roads abutting the development area*.

- *The visibility of the facility to, and potential visual impact on towns and residential areas affected by visual exposure*.

- *The visibility of the facility to, and potential visual impact on holiday resorts and other tourist facilities or places of leisure along the Vaal river*.

- *The potential visual impact of the facility on aircraft approaching or taking off from the airfield north of the site in terms of the reflection of sunlight from the solar panels.*

- *The potential visual impact of ancillary infrastructure (i.e. power line, substation, administrative building, internal access roads and workshop) on observers in close proximity to the proposed facility*.

- *The potential visual impact of operational, safety and security lighting of the facility at night on observers residing in close proximity of the facility*.

- *Potential visual impacts associated with the construction phase*.

- *The potential to mitigate visual impacts and inform the design process*.

6. RESULTS

6.1. Potential visual exposure

The phased nature of the Vaalkop solar energy facility necessitates that the visual impacts of individual phases are evaluated separately to provide analysis of each phase; ***and*** in combination with one another to provide analysis of the cumulative impact of the entire facility.

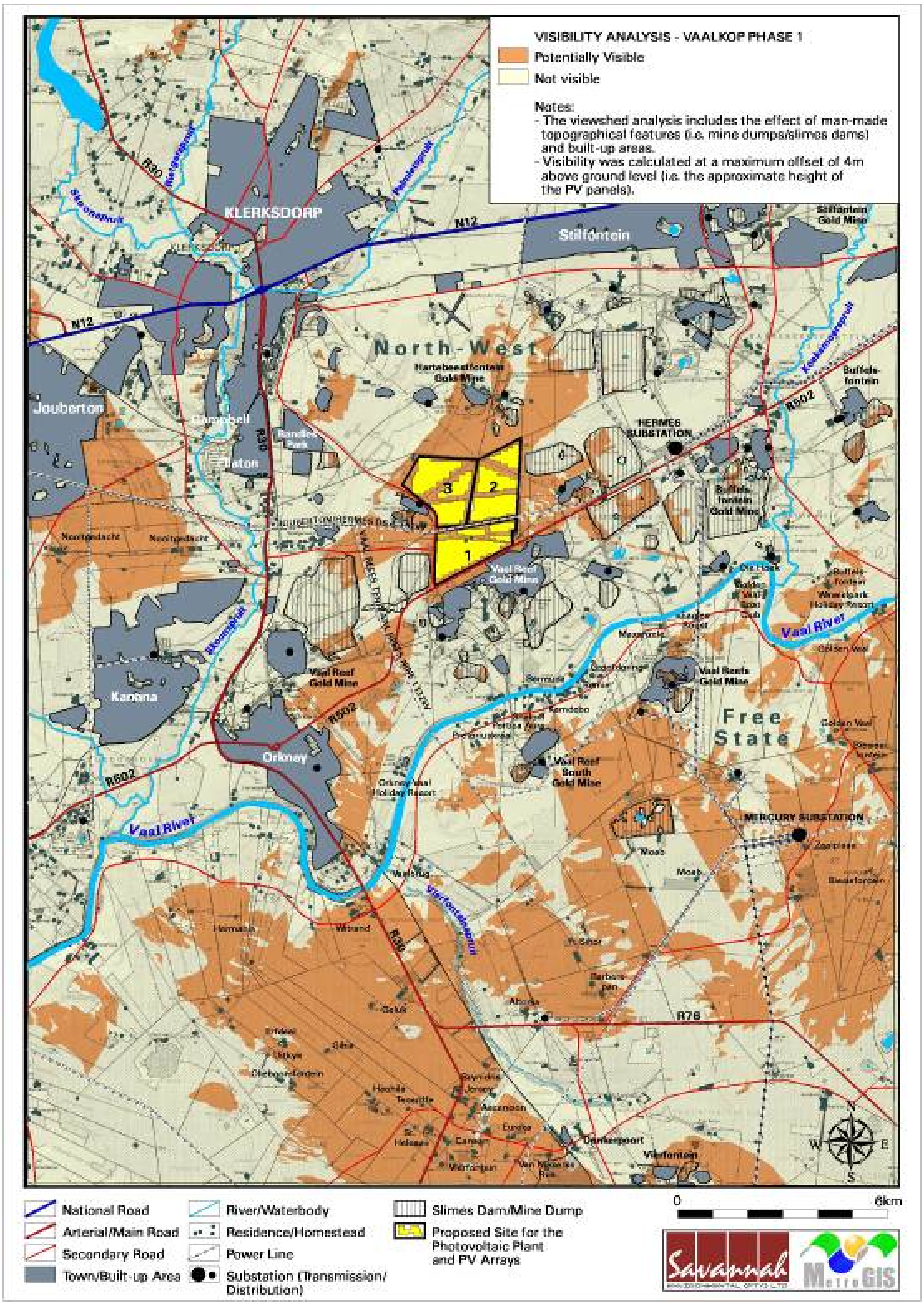
The visibility analysis was undertaken from PV panel positions for each phase at an offset of 4 m above average ground level (i.e. the maximum height of the metal frames) in order to simulate a worst case scenario.

- No dedicated viewshed analyses were undertaken for the substation and ancillary infrastructure (i.e. administrative building, internal access roads and workshop). These structures are located within the proposed development site, particularly the proposed *Phase 1* development area, and are not expected to be highly visible amongst the PV panel infrastructure (i.e. the area of potential visual exposure will fall entirely within the viewshed catchment of the PV panels).

The viewshed analyses for each of the proposed phases indicate areas from which the PV panels would be visible (any number of panels with a minimum of one). The results of the viewshed analyses for the proposed facility are shown on the maps overleaf (**Map 3-5**) and are briefly discussed as follows.

Phase 1 – Kabi Vaalkop Solar I (**Map 3**):
Potential visibility of the Phase 1 development area extends primarily south, west and north with intermittent visual exposure due to the topography and the occurrence of mine related structures. Vaal Reef Gold Mine village and sections of the R502 road will experience high levels of exposure, due to the close proximity of SEF structures in the southern parts of the development area. Moderate to high exposure is expected in these areas.

Visual exposure to the west affects the area south of Jouberton and the eastern fringes of Orkney. Visual exposure south of the Vaal River affects mostly farmsteads and roads, such as the R30 and R76 main roads.



Map 3: Potential visual exposure of Phase 1of the proposed Vaalkop Solar Energy Facility.

Phase 2 – Kabi Vaalkop Solar II (**Map 4**):

Visual exposure of Phase 2 is concentrated immediately around and north of the development site. Further exposure occurs intermittently to the west and the far south.

Phase 3 – Kabi Vaalkop Solar III (**Map 5**):

Potential visibility of Phase 3 shows the same pattern as Phase 2, but with remarkably less visual exposure to the west and the south. Affected areas are limited to the southern parts of Jouberton and Nooitgedacht farmstead, and a few farmsteads south of the Vaal River. It is noted that these farmsteads are 12km and further away from the proposed SEF development area.

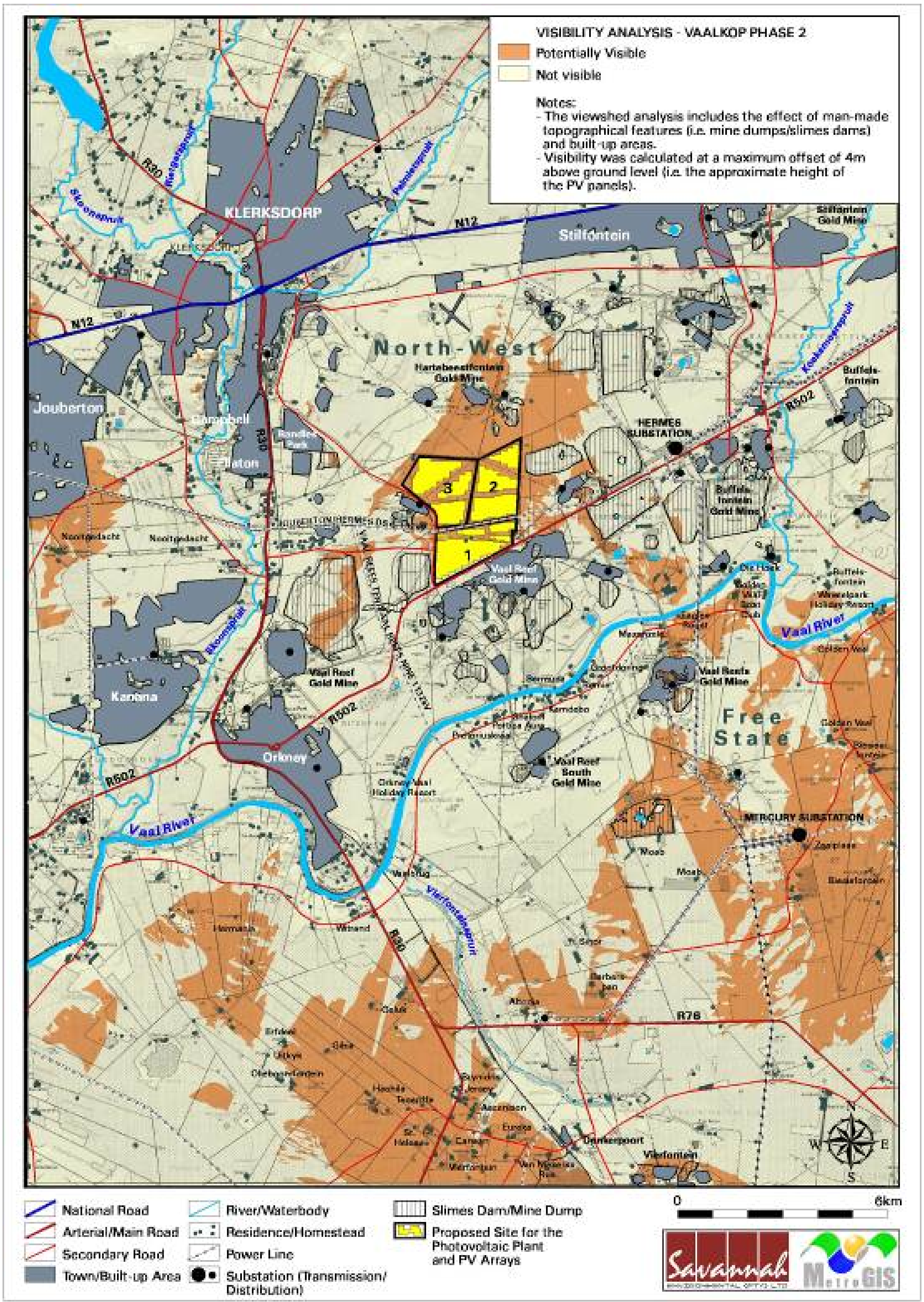
It is evident from the above analysis that the different phases present similar patterns of possible visual impact, which may be magnified in terms of cumulative impacts.

Cumulative Viewshed Analysis (**Map 6**)

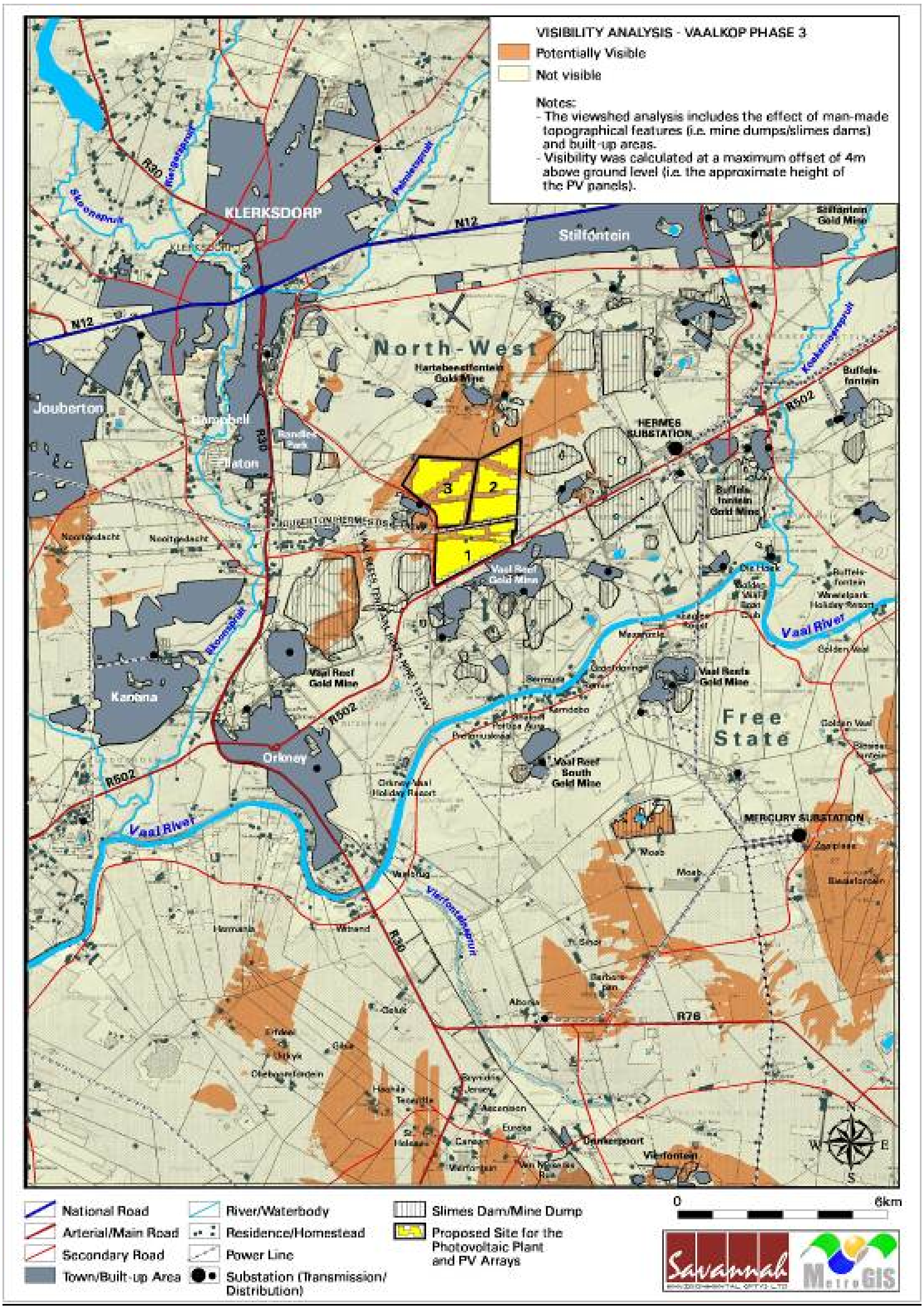
Cumulative visual effects are the combined effects that arise through the interaction of two or more phase developments. It is evident that the combination of Phase 1 & 2, in particular, may institute a cumulative impact in terms of visual exposure. The dark orange areas on Map 6 indicate a high frequency of visual exposure (i.e. PV panels or parts thereof from all three phases may be visible) while the yellow areas represent a low frequency (i.e. PV panels or parts thereof from only one phase may be visible).

Potential visual exposure of all three phases is highest within and immediately north of the development area. This area is primarily mining land with no visual receptors other than mine workers at the Hartebeestfontein Gold Mine.

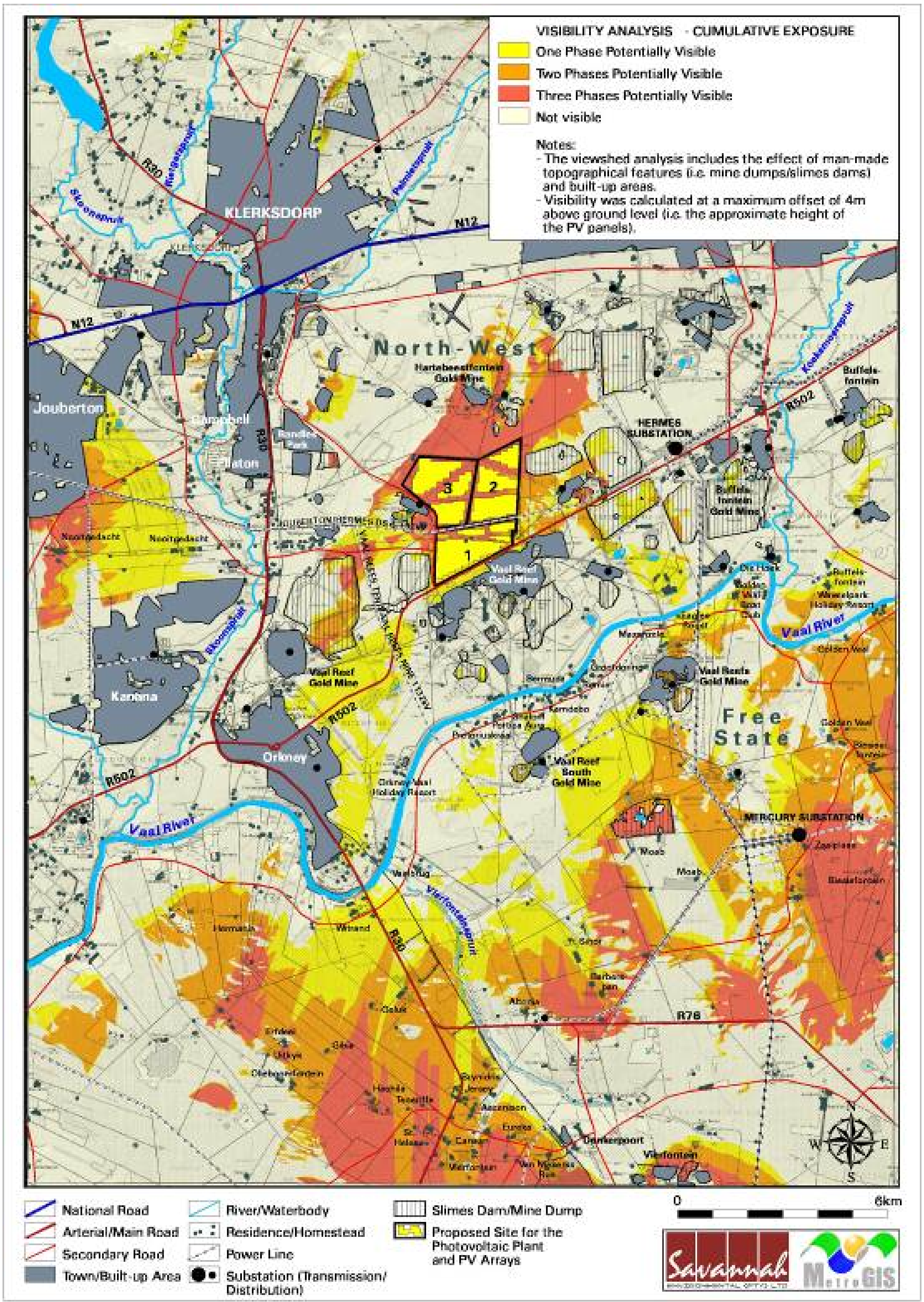
Visual exposure extends intermittently west and south. Residential areas mostly affected are Vaal Reef Gold Mine village (south of Phase 1), parts of Jouberton township, farmsteads south of Jouberton and farmsteads south of the Vaal river. It is noted that these farmsteads are 10 km and further away from the development area. Affected roads include the R502, R30 and R76 arterial roads, as well as a few secondary roads.



Map 4: Potential visual exposure of Phase 2 of the proposed Vaalkop Solar Energy Facility.



Map 5: Potential visual exposure of Phase 3 of the proposed Vaalkop Solar Energy Facility.



Map 6: Potential cumulative visual exposure of the 3 phases of the proposed Vaalkop solar energy facility.

On-site Substation & 132 kV Power Line (**Map 7**)

An on-site substation will be constructed to feed power from all three phases into two power lines (i.e. the existing Jouberton – Hermes DS 1 132 kV power line, and a new overhead 132 kV line).

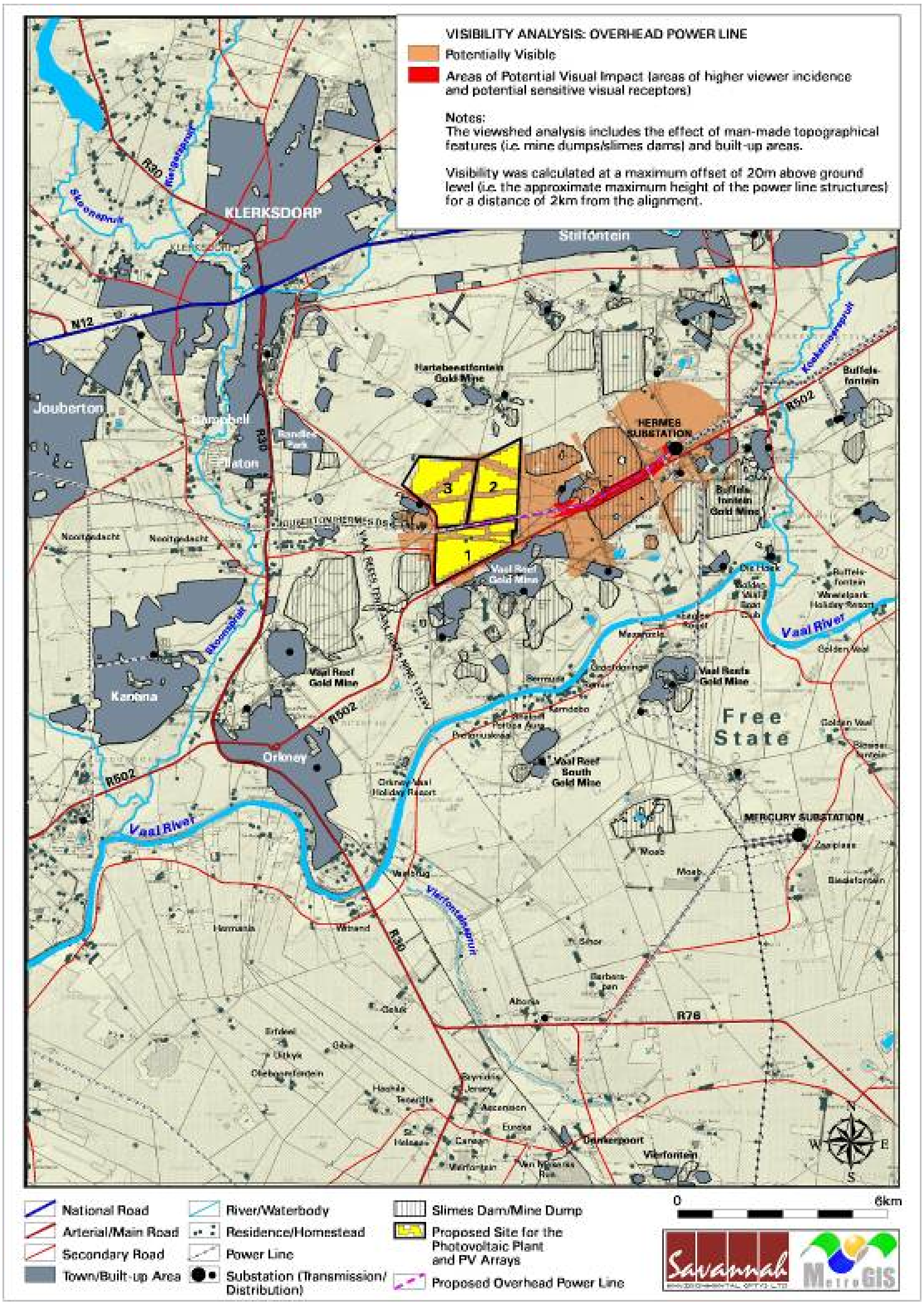
Potential visual exposure of the substation falls within the viewshed of the PV panels as described above, and is not further analysed.

A new overhead 132 kV power line will be constructed to connect directly to the Eskom Hermes Substation via the new substation. This line will be used by the Kabi Vaalkop Solar II PV Facility and the Kabi Vaalkop Solar III PV Facility. The line will follow an existing corridor of power lines feeding into Hermes Substation from the west, as indicated on **Map 7**.

Following the path of the existing Jouberton / Hermes DS 1 132 kV line, the proposed new power line will join a corridor of 5 existing power lines that provide electricity to several mines in the area. This corridor becomes wedged between an old slimes dam and the R502 arterial road, as showed on the photograph in Figure 2 below.

Figure 2: View of power lines between the R502 and an old slimes dam.

Visual exposure of the proposed lines is effectively screened by slimes dams and waste rock dumps occurring in the area. Consequently the viewshed for the proposed new power line covers a small area, limiting potential visual receptors to travellers on the R501 road. Given the number of existing power lines (i.e. 5), cumulative visual impacts have already been established, which is unlikely to be exacerbated with the addition of the proposed new power line. It is concluded that these lines provide prospects of visual absorption capacity which will render visual impact of the proposed new power line as being neutral.



Map 7: Potential visual exposure of the proposed 132 kV power line feeding into the Eskom Hermes Substation, 6 km east of the site.

6.2. Visual distance / observer proximity to the facility

MetroGIS determined the proximity radii based on the anticipated visual experience of the observer over varying distances. The distances are adjusted upwards for larger facilities and downwards for smaller facilities (i.e. depending on the size and nature of the proposed infrastructure). MetroGIS developed this methodology in the absence of any known and/or acceptable standards for South African PV energy facilities.

The proximity radii (calculated from the boundary lines of the farm selected for the solar energy facility) are shown on **Map 7** and are as follows:

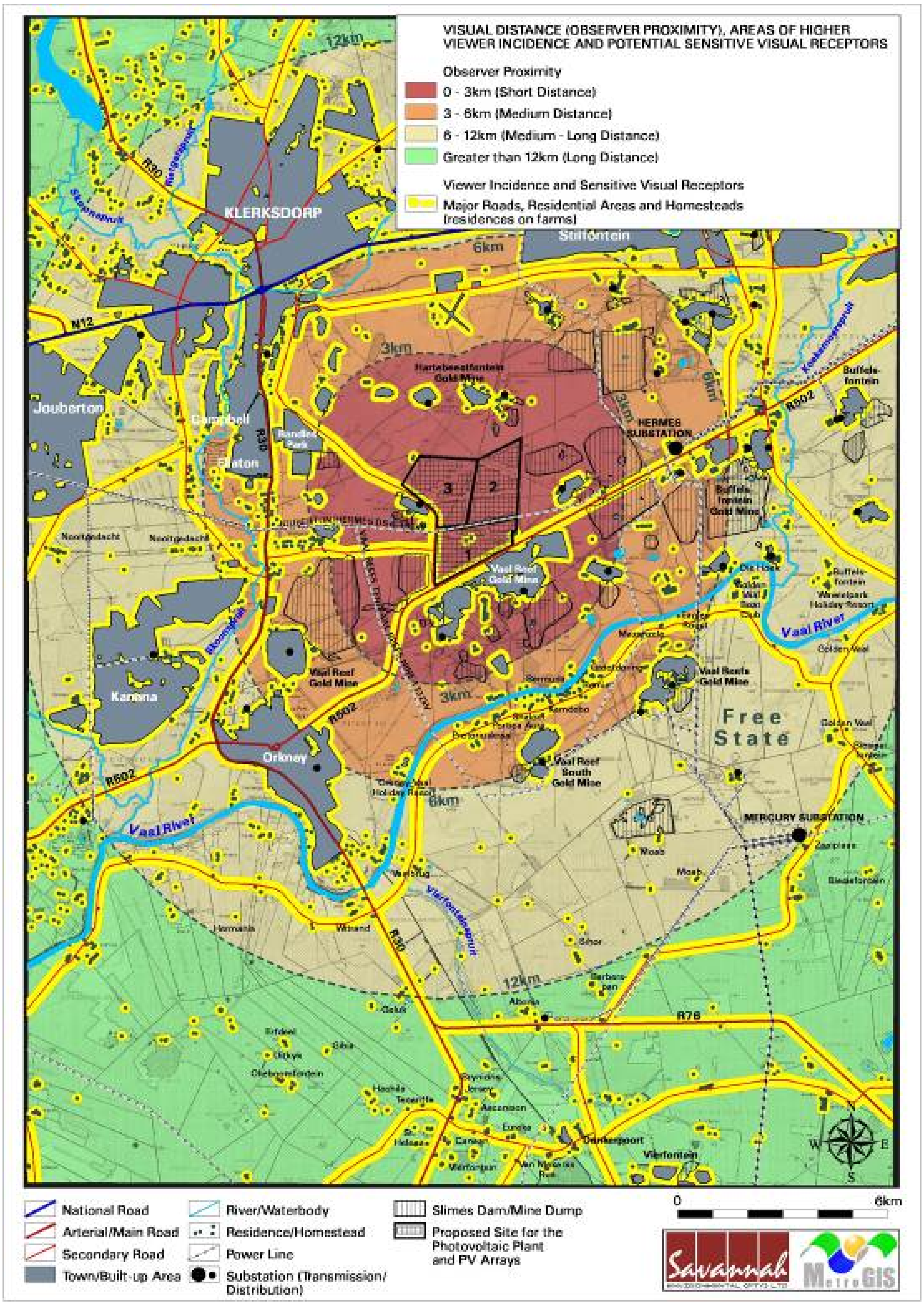
- 0 - 3km. Short distance view where the facility would dominate the frame of vision and constitute a high visual prominence.
- 3 - 6km. Medium distance view where the facility would be easily and comfortable visible and constitute a moderate visual prominence.
- 6 - 12km. Medium to longer distance view where the facility would become part of the visual environment, but would still be visible and possibly recognisable if the complete facility (all three phases) is exposed. This zone constitutes a low visual prominence.
- Greater than 12km. Long distance view of the facility where it could potentially still be visible though not as easily recognisable. This zone constitutes a very low visual prominence for the facility where any views of it will be regarded as insignificant.

6.3. Viewer incidence / viewer perception

Viewer incidence is calculated to be the highest along roads, and in residential areas close to and around the proposed development site (refer to **Map 8)**. This includes the following areas:

- Vaal Reef Gold Mine village;
- Orkney;
- Kanana;
- Jouberton;
- Klerksdorp;
- Stilfontein;
- N12 national road;
- Arterial roads R502, R30, and R76;
- Secondary roads;
- Farmsteads

Residents in the nearby towns, commuters and travellers using the roads, and residents on farmsteads could be negatively impacted upon by visual exposure to the solar energy facility.



Map 8: Observer proximity to the proposed Vaalkop solar energy facility and areas of high viewer incidence.

The spatial development pattern around the proposed SEF site is diverse, ranging from mining and township development to open space and farmland. In general the sense of place has been disturbed by views of township development, huge mine dumps, transmission lines, and traffic. It is anticipated that viewer perception with regard to the solar energy facility would not be negative.

6.4 Visual absorption capacity

The area around the proposed development site has been developed by mining activity, township establishment, and infrastructure development. Visually the landscape is dominated by views of mine dumps, shafts, buildings, power lines and roads.

The Visual Absorption Capacity (VAC) of the landscape is relatively high due to the nature and height of mining infrastructure and buildings. The proposed SEF is not regarded as a conflicting land use, and could therefore be assimilated into the landscape as yet another development. In general PV panels are perceived to be aesthetically pleasing by virtue of the design and materials used, and where viewed against the background of mine dumps may be easily absorbed by the receiving environment.

6.5. Visual impact index

The combined results of the visual exposure, viewer incidence/perception and visual distance of the proposed solar energy facility are displayed on **Map 9**.

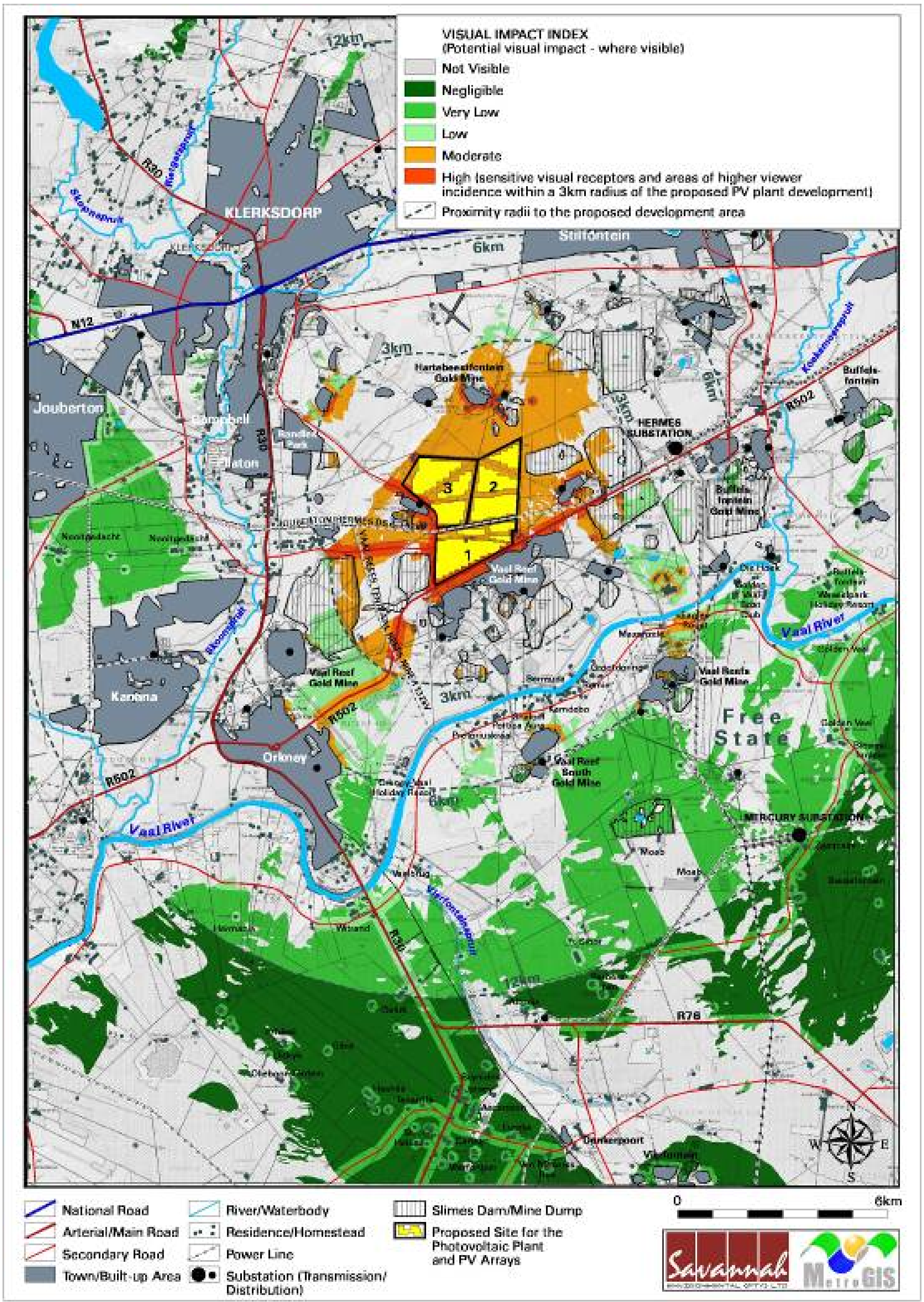
The quantitative analyses of possible impact have been integrated as a visual impact index. The sum of values assigned for each visual impact parameter is used to identify and visualise areas of high, moderate and low visual impact. Typically a location with close proximity to the proposed facility, a high viewer incidence, a predominantly negative perception and high visual exposure would have a high value on the index, thereby signifying a high visual impact.

The following is of relevance:

- The proposed SEF has a small area of moderate to high visual impact within 3km around the site. Affected areas of possible high sensitivity are the Vaal Reef Gold Mine village and the R502 arterial road.

- Visual impact in the medium distance (i.e. between 3km and 6km), is low and will only affect isolated locations. The section of the R502 towards Okney, as well as the eastern fringes of the town may, however, experience moderate visual impacts.

- Beyond 6 km from the proposed SEF development area the visual impact is expected to be very low, becoming negligible from 12 km.



Map 9: Combined Visual Impact index for the three phases of the proposed Vaalkop Solar Energy Facility.

6.6 Visual impact assessment: methodology

The previous section of the report identified specific areas where likely visual impacts would occur. This section will attempt to quantify these potential visual impacts in their respective geographical locations and in terms of the identified issues (see Section 5: ISSUES WITH REGARD TO POSSIBLE VISUAL IMPACT) related to the visual impact.

The methodology for the assessment of potential visual impacts states the **nature** of the potential visual impact (e.g. the visual impact on users of major roads in the vicinity of the proposed facility) and includes a table quantifying the potential visual impact according to the following criteria:

- **Extent** - site only (very high = 5), local (high = 4), regional (medium = 3), national (low = 2) or international (very low = 1)[2].
- **Duration** - very short (0-1 yrs = 1), short (2-5 yrs = 2), medium (5-15 yrs = 3), long (>15 yrs = 4), and permanent (= 5).
- **Magnitude** - None (= 0), minor (= 2), low (= 4), medium/moderate (= 6), high (= 8) and very high (= 10)[3].
- **Probability** – very improbable (= 1), improbable (= 2), probable (= 3), highly probable (= 4) and definite (= 5).
- **Status** (positive, negative or neutral).
- **Reversibility** - reversible (= 1), recoverable (= 3) and irreversible (= 5).
- **Significance** - low, medium or high.

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

The significance weighting for each potential visual impact (as calculated above) is as follows:

- <=30 points: Low (where the impact would not have a direct influence on the decision to develop in the area)
- 31-60 points: Medium/moderate (where the impact could influence the decision to develop in the area)

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[2]Due to the declining visual impact over distance, the **extent** (or spatial scale) rating is reversed (i.e. a localised visual impact has a higher value rating than a national or regional value rating). This implies that the visual impact is highly unlikely to have a national or international extent, but that the local or site-specific impact could be of high significance.

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

- >60: High (where the impact must have an influence on the decision to develop in the area)

6.7 Visual impact assessment: primary impacts

6.7.1 The solar energy facility

Potential visual impact on observers travelling along main and secondary roads within the study area, specifically the roads abutting the development area.

Potential visual impact on users of the R502 and secondary roads in close proximity of the proposed solar energy facility (i.e. within 3 km) is expected to be of **medium** significance. Limited mitigation measures are possible.

Table 1: Impact table summarising the significance of visual impacts on observers travelling along arterial and secondary roads in close proximity to the proposed solar energy facility.

Nature of Impact: Potential visual impact on observers travelling along arterial and secondary roads in close proximity to the proposed solar energy facility					
	Phase 1	***Phase 2***	***Phase 3***	***Combined Solar Energy Facility***	
	No mitigation				***Mitigation considered***
Extent	Local **(4)**	Local **(4)**	Local **(4)**	Local **(4)**	Local **(4)**
Duration	Long term **(4)**	Long term **(4)**	Long term **(4)**	Long term **(4)**	Long term **(4)**
Magnitude	High **(8)**	Low **(4)**	Low **(4)**	Moderate **(6)**	Low **(4)**
Probability	Probable**(3)**	Improbable**(2)**	Improbable**(2)**	Probable**(3)**	Probable**(3)**
Significance	Medium **(48)**	Low **(24)**	Low **(24)**	Medium **(42)**	Medium **(36)**
Status (positive or negative)	Negative				N/a
Reversibility	Recoverable **(3)**				N/a
Irreplaceable loss of resources?	No				N/a
Can impacts be mitigated?	Yes				

Mitigation: Planning & Operation: • Retain a buffer (approximately 30 to 50 m wide) of intact natural vegetation. Consult an ecologist with regard to appropriate species and placement of additional vegetation cover to soften the visual affect of SEF infrastructure.
Cumulative impacts: The construction of PV panels will increase the cumulative visual impact of industrial and / or power related infrastructure (such as power lines and substations) within the region.
Residual impacts: The visual impact will be removed after decommissioning, provided the facility and ancillary infrastructure is removed. Failing this, the visual impact will remain.

Potential visual impact on visual impact on towns and residential areas affected by visual exposure.

It is envisaged that Phase I of the SEF may have a visual impact on residents of the Vaal Reef Gold Mine village, which is situated less than 500 m south of the proposed development area. At present residents of the northern fringes of the village experience views of open space to the north. These views will be impacted upon by infrastructure of the proposed Phase 1 development. The significance of this impact is regarded as **moderate to high**.

Residents in the eastern parts of Orkney, approximately 6 km west of the proposed Phase 1 development area, may experience visual impacts of **low to moderate** significance. Limited mitigation measures are possible

The above residential areas have little to no visual exposure of Phase 2 and Phase 3. It is unlikely that these phases will have any significant visual impact on residential areas.

Table 2: Impact table summarising the significance of visual impacts on towns and residential areas.

Nature of Impact: Potential visual impact on towns and residential areas affected by visual exposure.					
	Phase 1	***Phase 2***	***Phase 3***	***Combined Solar Energy Facility***	
	No mitigation				***Mitigation considered***
Extent	Local **(4)**	Local **(4)**	Local **(4)**	Local **(4)**	Local **(4)**
Duration	Long term **(4)**	Long term **(4)**	Long term **(4)**	Long term **(4)**	Long term **(4)**
Magnitude	High **(8)**	Low **(4)**	Low **(4)**	Moderate **(6)**	Low **(4)**
Probability	Highly Probable**(4)**	Improbable**(2)**	Improbable**(2)**	Probable**(3)**	Probable**(3)**
Significance	High **(64)**	Low **(24)**	Low **(24)**	Medium **(42)**	Medium

					(36)
Status (positive or negative)	Negative				Neutral
Reversibility	Recoverable **(3)**				Recoverable **(3)**
Irreplaceable loss of resources?	No				No
Can impacts be mitigated?	Yes				
Mitigation: Planning & Operation: • Retain and maintain a buffer (approximately 30 to 50 m wide) of intact natural vegetation. Consult an ecologist with regard to appropriate species and placement of additional vegetation cover to soften the visual affect of SEF infrastructure.					
Cumulative impacts: The construction of PV panels will increase the cumulative visual impact of industrial and / or power related infrastructure (such as power lines and substations) within the region.					
Residual impacts: The visual impact will be removed after decommissioning, provided the facility and ancillary infrastructure is removed. Failing this, the visual impact will remain.					

Potential visual impact on holiday resorts and other tourist facilities or places of leisure along the Vaal river.

Visual impacts may occur to a small number of holiday resorts and leisure facilities along the Vaal river (e.g. Eagles Roost and the Golden Vaal Boat Club). Activities are mostly associated with water sport, such as fishing, sailing, skiing, etc, as is evident from a number of jetties along the river bank.

Visual exposure of Phase 1 and Phase 2 of the proposed SEF development may occur from a few locations along the Vaal river. However, it is envisaged that trees along the river bank will effectively shield the SEF from visibility. In most likelihood, views of the SEF area will be dominated by established impacts of existing development, such as buildings, and in particular mining activity. The significance of visual impacts of the proposed SEF is regarded as **low**.

Table 3: Impact table summarising the significance of visual impacts on holiday resorts and other tourist facilities or places of leisure along the Vaal river.

Nature of Impact: Potential visual impact on holiday resorts and other tourist facilities or places of leisure along the Vaal river.					
	Phase 1	***Phase 2***	***Phase 3***	***Combined Solar Energy Facility***	
	No mitigation				***Mitigation considered***
Extent	Local **(4)**	Local **(4)**	Local **(4)**	Local **(4)**	N/a
Duration	Long term **(4)**	Long term **(4)**	Long term **(4)**	Long term **(4)**	N/a
Magnitude	Minor **(2)**	Minor **(2)**	None **(0)**	Minor **(2)**	N/a
Probability	Probable**(3)**	Probable**(3)**	Improbable**(2)**	Probable**(3)**	N/a
Significance	Low **(30)**	Low **(30)**	Low **(16)**	Low **(30)**	N/a
Status (positive or negative)	Negative				N/a
Reversibility	Recoverable **(3)**				N/a
Irreplaceable loss of resources?	No				N/a
Can impacts be mitigated?	No				
Mitigation: None.					
Cumulative impacts: The construction of PV panels will increase the cumulative visual impact of industrial and / or power related infrastructure (such as power lines and substations) within the region.					
Residual impacts: The visual impact will be removed after decommissioning, provided the facility and ancillary infrastructure is removed. Failing this, the visual impact will remain.					

Potential visual impact on aircraft approaching or taking off from the airfield north of the site in terms of the reflection of sunlight from the solar panels.

The issue of glare and glint from PV panels has been raised by pilots both locally and abroad. Glint is a momentary flash of bright light, whereas glare is a continuous source of bright light, reflected from the surface of PV panels. A number of studies have been undertaken locally and abroad, notably the work of Barret & Devita (2011) and Sintec. Whereas the observance of glare has been reported by pilots, it was concluded by these studies that glint and glare does not significantly impact on the safety of aircraft operating in the proximity of an SEF. Mitigation measures in this regard include the following:

- Solar photovoltaic panels are designed to absorb rather than reflect light;

- Typical panels are designed to reflect only some 2% of incoming sunlight;
- The location of the SEF is not in line with the final approach of any of the runways.

Table 4: Impact table summarising the significance of visual impacts on aircraft approaching or taking off from the airfield north of the site in terms of the reflection of sunlight from the solar panels.

Nature of Impact: Potential visual impact on aircraft approaching or taking off from the airfield north of the site in terms of the reflection of sunlight from the solar panels.					
	Phase 1	***Phase 2***	***Phase 3***	***Combined Solar Energy Facility***	
	No mitigation				***Mitigation considered***
Extent	Local **(4)**	Local **(4)**	Local **(4)**	Local **(4)**	N/a
Duration	Long term **(4)**	Long term **(4)**	Long term **(4)**	Long term **(4)**	N/a
Magnitude	Minor **(2)**	Minor **(2)**	Minor **(2)**	Minor **(2)**	N/a
Probability	Improbable **(2)**	Improbable **(2)**	Improbable **(2)**	Improbable **(2)**	N/a
Significance	Low **(20)**	Low **(20)**	Low **(20)**	Low **(20)**	N/a
Status (positive or negative)	Negative				N/a
Reversibility	Recoverable **(3)**				N/a
Irreplaceable loss of resources?	No				N/a
Can impacts be mitigated?	No				
Mitigation: None.					
Cumulative impacts: The construction of PV panels will increase the cumulative visual impact of industrial and / or power related infrastructure (such as power lines and substations) within the region.					
Residual impacts: The visual impact will be removed after decommissioning, provided the facility and ancillary infrastructure is removed. Failing this, the visual impact will remain.					

6.7.2. Ancillary infrastructure

Potential visual impact of on site ancillary infrastructure on observers in close proximity to the proposed Solar Energy Facility.

Ancillary infrastructure associated with the SEF include a new substation, a new 132 kV power line, transformer, cabling between project components, internal access roads and a workshop for maintenance and storage.

Within the solar energy facility footprint, internal access roads will be required to construct each panel (construction phase) as well as to maintain the panels (operational phase). Such a network of roads has the potential of manifesting as landscape scarring, and thus a potential visual impact within the viewshed areas. They will not be as highly visible as the panels, however, as they posses no height. This reduces the probability of this impact occurring.

The transformer, substation and workshop could also present a visual impact. Existing vegetation will need to be removed for these structures to be built.

No dedicated viewshed has been generated for the above infrastructure. It will all be located within the proposed facility footprint, and will thus lie within that of the primary infrastructure (i.e. PV panels). It is envisaged that the area of potential visual exposure will lie within that of the PV panels. No mitigation measures, other than avoiding the unnecessary removal of vegetation, are possible.

The proposed 132 kV power line falls outside of the development area for Phases 1, 2 & 3, following a corridor of 6 km towards the Hermes Substation. A dedicated viewshed analysis has been generated for the power line. Due to the existence of power lines (i.e the Jouberton / Hermes DS 1 132kV feeder conductor and four 88 kV feeder conductors), as well as slimes dams in close proximity to the proposed new power line, no additional visual impact is anticipated. No mitigation measures are possible.

The anticipated visual impact of all on site infrastructure, as well as the new 132 kV power line is likely to be of **low** significance. Table 5 below summarises the assessment of ancillary infrastructure and their anticipated impact. Table 6 deals with the proposed 132 kV line separately.

Table 5: Impact table summarising the significance of on site ancillary infrastructure on observers in close proximity to the proposed Solar Energy Facility.

Nature of Impact: Potential visual impact of on site ancillary infrastructure on observers in close proximity to the proposed Solar Energy Facility.					
	Phase 1	***Phase 2***	***Phase 3***	***Combined Solar Energy Facility***	
	No mitigation				***Mitigation considered***
Extent	Local **(4)**	Local **(4)**	Local **(4)**	Local **(4)**	Local **(4)**
Duration	Long term **(4)**	Long term **(4)**	Long term **(4)**	Long term **(4)**	Long term **(4)**
Magnitude	Moderate **(6)**	Moderate **(6)**	Moderate **(6)**	Moderate **(6)**	Moderate **(6)**
Probability	Improbable **(2)**	Improbable **(2)**	Improbable **(2)**	Improbable **(2)**	Improbable **(2)**
Significance	Low **(28)**	Low **(28)**	Low **(28)**	Low **(28)**	Low **(28)**[4]
Status (positive or negative)	Negative				Neutral
Reversibility	Recoverable **(3)**				Recoverable **(3)**
Irreplaceable loss of resources?	No				No
Can impacts be mitigated?	Yes				

[4] The value increments are too coarse to reflect a reduction in significance as a result of mitigation, thus the apparent nil effect. Some reduction of significance may occur. Good practice requires the mitigation of any potential aggravation of visual impact, and the mitigation as proposed is intended to achieve that.

Mitigation:

Planning:

- Plan internal roads and ancillary infrastructure to avoid or minimise the clearing of vegetation. Consolidate infrastructure and favour already disturbed areas over non-disturbed areas within the development area.
- Retain a buffer (approximately 30 - 50 m wide) of intact natural vegetation along the southern boundary of Phase 1 .
- Where possible, supplement the buffer with additional vegetation to increase visual absorption capacity. Consult an ecologist / landscape architect with regard to appropriate species and placement at strategic locations.

Construction:

- Rehabilitate all construction areas.
- Avoid the unnecessary removal of vegetation, especially with regard to the construction of access roads an buildings.

Operation:

- Maintain roads to avoid erosion.
- Maintain ancillary buildings.

Decommissioning:

- Remove infrastructure and rehabilitate all disturbed areas.
- Monitor rehabilitated areas and implement remedial actions.

Cumulative impacts:

The construction of ancillary infrastructure will increase the cumulative visual impact of roads and / or power related infrastructure (such as power lines and substations) within the region. Another solar energy facility is also proposed in the area, but has not yet been approved.

Residual impacts:

The visual impact will be removed after decommissioning, provided the facility and ancillary infrastructure is removed. Failing this, the visual impact will remain.

Table 6: Impact table summarising the significance of the proposed 132 kV power line on observers in close proximity to the power line.

Nature of Impact:

Potential visual impact of the proposed 132 kV power line on observers in close proximity to the power line.

	No mitigation	***Mitigation considered***
Extent	Local **(4)**	n/a
Duration	Long term **(4)**	n/a
Magnitude	Moderate **(6)**	n/a
Probability	Improbable**(2)**	n/a
Significance	Low **(28)**	n/a
Status (positive or negative)	Negative	n/a
Reversibility	Recoverable **(3)**	n/a
Irreplaceable loss of resources?	No	n/a
Can impacts	No	

be mitigated?	

Mitigation: • No mitigation is possible
Cumulative impacts: The construction of the proposed 132 kV power line is unlikely to increase the cumulative visual impact of power lines due to the existence of up to 5 power lines in the same corridor area.
Residual impacts: The visual impact will be removed after decommissioning, provided the facility and power lines is removed. Failing this, the visual impact will remain.

6.7.3. Lighting Impacts

Potential visual impact of lighting at night on observers in close proximity to the proposed Solar Energy Facility.

The immediate area south of Phase 1 has a relatively high incidence of possible sensitive receptors, owing to the location of the R502 and the Vaal Reef Gold Mine village south of the development area. Light trespass and glare from security and night time operational lighting may have negative impacts for visual receptors in close proximity, especially traffic on the R502 and residents in the northern area of the mine village that may experience light trespass and glare as an annoyance.

Sky glow, which is the effect of the night sky being illuminated when light reflects of particles in the atmosphere, may also occur. This effect intensifies with the increase in the amount of light sources, especially if luminaries are not shielded and upward spill of light occurs. It should be noted that the urban area of Orkney (6 km west of the SEF development area), as well as other towns in the study area, are existing sources of light, and as such will reduce the probability of sky glow emanating from the SEF being prominent.

The anticipated impact of glare and light trespass is likely to be of **high** significance. The impact can be mitigated with a **medium** significance rating as a result.

Table 7: Impact table summarising the significance of lighting at night on observers in close proximity to the proposed Solar Energy Facility.

Nature of Impact: Potential visual impact of lighting at night on observers in close proximity to the proposed Solar Energy Facility.					
	Phase 1	***Phase 2***	***Phase 3***	***Combined Solar Energy Facility***	
	No mitigation				***Mitigation***

					considered
Extent	Local **(4)**	Local **(4)**	Local **(4)**	Local **(4)**	Local **(4)**
Duration	Long term **(4)**	Long term **(4)**	Long term **(4)**	Long term **(4)**	Long term **(4)**
Magnitude	High **(8)**	Moderate **(6)**	Moderate **(6)**	High **(8)**	Moderate **(6)**
Probability	Highly Probable **(4)**	Probable **(3)**	Probable **(3)**	Highly Probable **(4)**	Probable **(3)**
Significance	High **(64)**	Medium **(42)**	Medium **(42)**	High **(64)**	Medium **(42)**
Status (positive or negative)	Negative				Neutral
Reversibility	Recoverable **(3)**				Recoverable **(3)**
Irreplaceable loss of resources?	No				No
Can impacts be mitigated?	Yes				

Mitigation:

Planning & Operation:

- Shielding the sources of light by physical barriers (walls, vegetation, or the structure itself).
- Limiting mounting heights of lighting fixtures.
- Making use of downward directional lighting.
- Making use of minimum lumen or wattage in fixtures.
- Making use of Low Pressure Sodium lighting or other types of low impact lighting.
- Making use of motion detectors. This will allow the site to remain in relative darkness, until lighting is required for security or operational purposes.

Cumulative impacts:

The existing urban areas in the region generate lighting impact at night. The impact of the Solar Energy Facility will contribute to a regional increase in lighting impact.

Residual impacts:

None. The visual impact will be removed after decommissioning, provided all sources of lighting are removed.

6.8 Visual impact assessment: secondary impacts

6.8.1 The solar energy facility and ancillary infrastructure

Potential visual impact of the facility on the visual character of the landscape and sense of place of the region.

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

A visual impact on the sense of place is one that alters the visual landscape to such an extent that the user experiences the environment differently, and more specifically, in a less appealing or less positive light. Specific aspects contributing to the sense of place of this region include un-impacted picturesque landscapes, dramatic mountains and isolation.

The visual impact on the visual character of the landscape and sense of place of the region is expected to be of **low** significance, due to the large degree of transformation of the natural environment, and the establishment of visual impacts by virtue of urban and mining development. No mitigation is possible.

Table 8: Impact table summarising the significance of visual impacts on the visual character of the landscape and sense of place of the region.

Nature of Impact: Potential visual impact on the visual character of the landscape and sense of place of the region.					
	Phase 1	***Phase 2***	***Phase 3***	***Combined Solar Energy Facility***	
	No mitigation				***Mitigation considered***
Extent	Local **(4)**	Local **(4)**	Local **(4)**	Local **(4)**	N/a
Duration	Long term **(4)**	Long term **(4)**	Long term **(4)**	Long term **(4)**	N/a
Magnitude	Low **(4)**	Low **(4)**	Low **(4)**	Low **(4)**	N/a
Probability	Improbable **(2)**	Improbable **(2)**	Improbable **(2)**	Improbable **(2)**	N/a
Significance	Low **(24)**	Low **(24)**	Low **(24)**	Low **(24)**	N/a
Status (positive or negative)	Negative				N/a
Reversibility	Recoverable **(3)**				N/a
Irreplaceable	No				N/a

loss of resources?		
Can impacts be mitigated?	No	
Mitigation: None.		
Cumulative impacts: The construction of PV panels will increase the cumulative visual impact of industrial and / or power related infrastructure (such as power lines and substations) within the region.		
Residual impacts: The visual impact will be removed after decommissioning, provided the facility and ancillary infrastructure is removed. Failing this, the visual impact will remain.		

6.9. The potential to mitigate visual impacts

The primary visual impact, namely the appearance of the Solar Energy Facility is not possible to mitigate. The functional design of the PV panels cannot be changed in order to reduce visual impacts.

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

- It is recommended that the existing vegetation cover be maintained in all areas outside of the actual development footprint, both during construction and operation of the proposed facility. This will minimise visual impact as a result of cleared areas, power line servitudes and areas denuded of vegetation.
- Maintain a buffer of 30 - 50 m between the R502 and the development footprint of Phase 1. This will leave some distance between the facility and the visual receptors. Avoid the removal or disturbance of natural vegetation within the buffer. Of relevance is that the PV panels and other infrastructure will remain visible in the landscape. With a buffer in place, however, the facility will remain evident, but will not dominate the visual landscape to such a degree.
- Maintain natural vegetation in all areas outside of the actual development footprint, during construction and operation of the facility. This will minimise visual impact as a result of cleared areas, and areas denuded of vegetation.
- In terms of ancillary infrastructure, it is recommended that access roads and on site infrastructure be planned so that the clearing of vegetation is minimised. This implies consolidating infrastructure as much as possible and making use of already disturbed areas rather than pristine sites, wherever possible.
- Mitigation of lighting impacts includes the pro-active design, planning and specification lighting for the facility. The correct specification and placement of lighting and light fixtures for the proposed solar energy facility and

ancillary infrastructure will go far to contain rather than spread the light. Mitigation measures include the following:

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

- Mitigation of visual impacts associated with the construction phase, albeit temporary, would entail proper planning, management and rehabilitation of the construction site. Recommended mitigation measures include the following:

    - Ensure that vegetation is not unnecessarily cleared or removed during the construction period.
    - Reduce the construction period through careful logistical planning and productive implementation of resources.
    - Plan the placement of lay-down areas and any potential temporary construction camps in order to minimise vegetation clearing (i.e. in already disturbed areas) wherever possible.
    - Restrict the activities and movement of construction workers and vehicles to the immediate construction site and existing access roads.
    - Ensure that rubble, litter, and disused construction materials are appropriately stored (if not removed daily) and then disposed regularly at licensed waste facilities.
    - Reduce and control construction dust through the use of approved dust suppression techniques as and when required (i.e. whenever dust becomes apparent).
    - Restrict construction activities to daylight hours in order to negate or reduce the visual impacts associated with lighting.
    - Rehabilitate all disturbed areas, construction areas, roads, slopes etc immediately after the completion of construction works. If necessary, an ecologist should be consulted to assist or give input into rehabilitation specifications.

- During operation, the maintenance of the PV panels and ancillary structures and infrastructure will ensure that the facility does not degrade, thus aggravating visual impact.

- Roads must be maintained to forego erosion and to suppress dust, and rehabilitated areas must be monitored for rehabilitation failure. Remedial actions must be implemented as a when required.

- Once the facility has exhausted its life span, the main facility and all associated infrastructure not required for the post rehabilitation use of the site should be removed and all disturbed areas appropriately rehabilitated. An ecologist should be consulted to give input into rehabilitation specifications.

- All rehabilitated areas should be monitored for at least a year following decommissioning, and remedial actions implemented as and when required.

- Secondary impacts anticipated as a result of the proposed solar energy facility (i.e. visual character and sense of place) are not possible to mitigate. There is also no mitigation to ameliorate the negative visual impacts on tourist routes, tourist destinations and conservation areas within the region.

  Where sensitive visual receptors are likely to affected, it is recommended that the developer enter into negotiations regarding the potential screening of visual impacts at the receptor site. This may entail the planting of vegetation, trees or event the construction of screens. Ultimately, visual screening is most effective when placed at the receptor itself.

Good practice requires that the mitigation of both primary and secondary visual impacts as listed above be implemented and maintained on an ongoing basis.

7. CONCLUSION AND RECOMMENDATIONS

Analyses and visual impact assessments for the proposed three phases of the Vaalkop Solar Energy Facility have been undertaken separately. In some instances Phase 1 has been identified as having higher visual impacts compared to the other two phases. Apart from this, the impacts for the combined phases of the solar energy facility are only slightly greater than those for the individual phases. In general, the proximity of the three phases to one another means that the impacts generated are very similar for each phase.

The proposed facility utilises a renewable source of energy to generate power. It does not emit any harmful by-products or pollutants and is not negatively associated with health risks to observers. It is therefore perceived to be accepted in a more favourable light by visual receptors.

The facility has a generally unfamiliar novel and futuristic design that invokes a curiosity factor not generally present with other conventional power generating plants, to the effect that people would actually visit the area to see the facility.

A particular sense of place has been established by the development of mining activities with highly visual components, such as tailings dams and waste dumps. Together with township development and electricity infrastructure (power lines and substations), the visual environment has already been impacted upon. As a result the visual prominence of the proposed SEF is expected to be absorbed to a great extend.

A number of mitigation measures have been proposed (Section 6.9), which, if implemented and maintained, will reduce the significance of the certain visual impacts associated with the proposed facility.

If mitigation is undertaken as recommended, it is concluded that the significance of anticipated visual impacts will remain at acceptable levels. As such, the facility would be considered to be acceptable from a visual perspective.

8. IMPACT STATEMENT

The finding of the Visual Impact Assessment undertaken for the Proposed Vaalkop Solar Energy Facility near Orkney is that the visual environment surrounding the site, especially within a 3 km radius, will be visually impacted upon for the anticipated operational lifespan of the facility (i.e. 20 - 30 years).

This impact is applicable to the individual phases of the proposed solar energy facility and to the combined solar energy facility, with only the intensity of impacts being greater for the combined facility. This is due to the individual phases being clustered together in a somewhat contained area.

The following is a summary of impacts remaining, assuming mitigation as recommended is exercised:

- The potential visual impact on observers travelling along arterial and secondary roads in close proximity to the proposed solar energy facility is expected to be of **medium** significance.
- The potential visual impact on towns and residential areas will differ by virtue of proximity to the SEF development area. The potential visual impact for

Orkney will be **low** to **moderate**, whereas the Vaal Reefs Gold Mine village will experience visual impacts of **moderate** to **high** significance.

- The potential visual impact on holiday resorts and other tourist facilities or places of leisure along the Vaal river is expected to be of **low** significance, due to the low level of visual exposure and high visual absorption capacity of trees along the river banks.

- The potential visual impact on aircraft approaching or taking off from the airfield north of the site in terms of the reflection of sunlight from the solar panels will be **low**.

- In terms of ancillary infrastructure, the anticipated visual impact of the transformers, access roads and substation, is expected to be of **low** significance.

- Visual impacts related to lighting will be **high** in terms of sensitive receptors in close proximity (< 500 m). This impact can be mitigated with a resultant significance rating of **medium**.

- Lastly, the anticipated impact on the visual character and sense of place of the region will be of **low** significance.

The anticipated visual impacts listed above (post mitigation measures) range from moderate to low. None of these are considered to be fatal flaws from a visual perspective. The main considerations are the established visual impacts by virtue of mining and township development and the visual context of existing industrial and electrical type infrastructure within the study area.

Considering all factors, it is recommended that the development of the facility as it is proposed, be supported, subject to the implementation of the recommended mitigation measures (Section 6.9) and the management plan (Section 9)

9. MANAGEMENT PROGRAMME

The management programme tables aim to summarise the key findings of the visual impact report and to suggest possible management actions in order to mitigate the potential visual impacts.

Table 9: Management Programme – Planning.

OBJECTIVE: The mitigation and possible negation of visual impacts associated with the planning of the Proposed Vaalkop Solar Energy Facility.		
Project Component/s	The solar energy facility and ancillary infrastructure (i.e. PV panels, access roads, transformer, substation, security lighting, and workshop).	
Potential Impact	Primary visual impact of the facility due to the presence of the PV panels and associated infrastructure as well as the visual impact of lighting at night.	
Activity/Risk Source	The viewing of the above mentioned by observers on or near the site (i.e. within 3 km of the site) as well as within the region.	
Mitigation: Target/Objective	Optimal planning of infrastructure to minimise visual impact.	
Mitigation: Action/control	**Responsibility**	**Timeframe**
Retain and maintain natural and / or cultivated vegetation in all areas outside of the development footprint.	Kabi Solar/ design consultant	Early in the planning phase.
Plan the access road and ancillary infrastructure such that clearing of vegetation is minimised. Consolidate infrastructure and make use of already disturbed sites rather than pristine areas.	Kabi Solar/ design consultant	Early in the planning phase.
Retain a 200 m buffer on the southern boundary of Phase 1.	Kabi Solar/ design consultant	Early in the planning phase.
Consult a lighting engineer in the design and planning of lighting to ensure the correct specification and placement of lighting and light fixtures for the solar energy facility and the ancillary infrastructure. The following is recommended: o Shield the sources of light by physical barriers (walls, vegetation, or the structure itself); o Limit mounting heights of fixtures, or use foot-lights or bollard lights; o Make use of minimum lumen or wattage in fixtures; o Making use of down-lighters or shielded fixtures; o Make use of Low Pressure Sodium lighting or other low impact lighting. o Make use of motion detectors on security lighting, so allowing the site to remain in darkness until lighting is required for security or maintenance purposes.	Kabi Solar/ design consultant	Early in the planning phase.
Performance	Minimal exposure of PV panels, ancillary infrastructure and lighting at	

Indicator	night to observers on or near the site (i.e. within 3 km) and within the region.
Monitoring	Not applicable.

Table 10: Management programme – Construction.

OBJECTIVE: The mitigation and possible negation of visual impacts associated with the construction of the Proposed Vaalkop Solar Energy Facility.		
Project Component/s	Construction site	
Potential Impact	Visual impact of general construction activities, and the potential scarring of the landscape due to vegetation clearing and resulting erosion.	
Activity/Risk Source	The viewing of the above mentioned by observers on or near the site (within 3 km of the site).	
Mitigation: Target/Objective	Minimal visual intrusion by construction activities and intact vegetation cover outside of immediate works areas.	
Mitigation: Action/control	**Responsibility**	**Timeframe**
Ensure that vegetation is not unnecessarily cleared or removed during the construction period.	Kabi Solar / EPC contractor	Early in the construction phase.
Reduce the construction period through careful logistical planning and productive implementation of resources.	Kabi Solar / EPC contractor	Early in the construction phase.
Plan the placement of lay-down areas and temporary construction equipment camps in order to minimise vegetation clearing (i.e. in already disturbed areas) wherever possible.	Kabi Solar / EPC contractor	Early in and throughout the construction phase.
Restrict the activities and movement of construction workers and vehicles to the immediate construction site and existing access roads.	Kabi Solar / EPC contractor	Throughout the construction phase.
Ensure that rubble, litter, and disused construction materials are appropriately stored (if not removed daily) and then disposed regularly at licensed waste facilities.	Kabi Solar / EPC contractor	Throughout the construction phase.
Reduce and control construction dust through the use of approved dust suppression techniques as and when required (i.e. whenever dust becomes apparent).	Kabi Solar / EPC contractor	Throughout the construction phase.
Restrict construction activities to daylight hours in order to negate or reduce the visual impacts associated with lighting.	Kabi Solar / EPC contractor	Throughout the construction phase.
Rehabilitate all disturbed areas, construction areas, servitudes etc immediately after the completion of construction works. If necessary, an	Kabi Solar / EPC contractor	Throughout and at the end of the construction phase.

ecologist should be consulted to assist or give input into rehabilitation specifications.		
Performance Indicator	Vegetation cover on and in the vicinity of the site is intact (i.e. full cover as per natural vegetation within the environment) with no evidence of degradation or erosion.	
Monitoring	Monitoring of vegetation clearing during construction (by contractor as part of construction contract). Monitoring of rehabilitated areas quarterly for at least a year following the end of construction (by contractor as part of construction contract).	

Table 11: Management programme – Operation.

OBJECTIVE: The mitigation and possible negation of visual impacts associated with the operation of the Proposed Vaalkop Solar Energy Facility.		
Project Component/s	The solar energy facility and ancillary infrastructure (i.e. panels, access roads, substation, workshop, masts and power lines).	
Potential Impact	Visual impact of facility degradation and vegetation rehabilitation failure.	
Activity/Risk Source	The viewing of the above mentioned by observers on or near the site (within 3 km).	
Mitigation: Target/Objective	Well maintained and neat facility.	
Mitigation: Action/control	**Responsibility**	**Timeframe**
Maintain the general appearance of the facility as a whole, including the panels, servitudes and the ancillary structures.	Kabi Solar	Throughout the operational phase.
Maintain roads and servitudes to forego erosion and to suppress dust.	Kabi Solar	Throughout the operational phase.
Monitor rehabilitated areas, and implement remedial action as and when required.	Kabi Solar	Throughout the operational phase.
Performance Indicator	Well maintained and neat facility with intact vegetation on and in the vicinity of the facility.	
Monitoring	Monitoring of the entire site on an ongoing basis (by operator).	

Table 12: Management programme – Decommissioning.

OBJECTIVE: The mitigation and possible negation of visual impacts associated with the decommissioning of the Proposed Vaalkop Solar Energy Facility.		
Project Component/s	The solar energy facility and ancillary infrastructure (i.e. PV panels, access roads, substation, workshop, transformer, and power lines).	
Potential Impact	Visual impact of residual visual scarring and vegetation rehabilitation failure.	
Activity/Risk Source	The viewing of the above mentioned by observers on or near the site.	
Mitigation: Target/Objective	Only the infrastructure required for post decommissioning use of the site retained and rehabilitated vegetation in all disturbed areas.	
Mitigation: Action/control	**Responsibility**	**Timeframe**
Remove infrastructure not required for the post-decommissioning use of the site.	Kabi Solar	During the decommissioning phase.
Rehabilitate access roads and servitudes not required for the post-decommissioning use of the site. If necessary, an ecologist should be consulted to give input into rehabilitation specifications.	Kabi Solar	During the decommissioning phase.

Monitor rehabilitated areas quarterly for at least a year following decommissioning, and implement remedial action as and when required.	Kabi Solar	Post decommissioning.

Performance Indicator	Vegetation cover on and in the vicinity of the site is intact (i.e. full cover as per natural vegetation within the environment) with no evidence of degradation or erosion.
Monitoring	Monitoring of rehabilitated areas quarterly for at least a year following decommissioning.

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