VISUAL IMPACT ASSESSMENT

10MW PHOTOVOLTAIC ELECTRICITY GENERATION FACILITY
ON THE FARM ROOIPAD 15/9
AUGRABIES
NORTHERN CAPE PROVINCE

Prepared for

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MARCH 2012

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EXECUTIVE SUMMARY

The author was approached by Rosenthal Environmental Consultants on behalf of Mulilo Renewable Energy Pty Ltd to provide an assessment of the potential visual impacts that will be incurred by the construction of a 10MW solar voltaic electricity generation facility on the Farm Rooipad 15/9 Augrabies in the Northern Cape Province.

As the development will be confined to an area of 20ha or less, only a Basic Assessment process was required in terms of the environmental legislation, however, in view of the sensitivity of the local environment with its proximity to the Augrabies Falls National Park it was decided that a full Visual Impact Assessment was necessary.

The findings of the report rely heavily on visual analysis done by means of a 3D computer model covering approximately 400^2 km around the sites. This area includes the visually sensitive areas within the Augrabies Falls National Park which may be affected.

The two potential sites are situated on Farm Rooipad 15/9 just north of the R359, west of Augrabies and south of the Orange River and the Augrabies Falls National Park.

At present Farm Rooipad 15/9 is zoned for agriculture and is largely unused. There are no sustained agricultural activities on the site and it appears that no one lives on the land.

The visual character of the overall landscape is complex.

The farm on which the sites are situated is sparsely covered by grasses and small thorn trees and crossed by seasonal watercourses. This situation continues further to the south and south west.

The Augrabies Falls National Park lies just beyond the northern boundary of the farm and here the land becomes more broken and boulder strewn containing several ridgelines and the Orange River gorge. Several elevated areas in the park allow for partial views over one or the other of the two sites.

Adjacent to the Orange River and to the east of the site around Augrabies the land takes on an agrarian character with neatly laid out vineyards and a relatively large number of trees.

The Blouputs substation lies close to the south-west corner of the site and is fed by electricity transmission lines that are clearly visible across the landscape.

The only public access to the area around the sites is via the R 359. This is a tarred road which travels west from Augrabies and grants access to the farming areas along the river to the west. Access to the solar facility will be via this road.

At places, such as from the Moon Rock viewpoint in the park, all of these elements can be viewed at once but more generally, as a viewer moves through the landscape, these elements give way to one another and the sense of place changes continuously.

The one visual element that is missing in the overall landscape is that of industry although the Blouputs substation and the presence of power lines in the landscape hint at this. The implementation of the solar facility will add an additional industrial element to the landscape, however its nature, low and flat, the fact that it will only be seen edge on from most viewpoints, and that those viewpoints within the park a relatively few, provided that site 1 is chosen, means that it will only affect the sense of place minimally.

The project will entail the construction and operation of a 10 MW photovoltaic solar electricity generation facility and associated infrastructure that will require approximately 20 ha of land. The structures which hold the solar panels will not exceed 2,5 – 3m and will hug the terrain. A new short entrance road to the site from the R359 will be required and there will be a network of roads between the panels to allow for maintenance. A relatively small building, also restricted to 2,5m in

height will be required for the running of the facility. The power generated by the facility will be connected to the grid by means of overhead lines that link into the Blouputs substation.

Once the facility has been constructed it will have an operational life of approximately 25 years during which time only routine security maintenance will be required, the only visual impact of which will be the occasional movement of vehicles on the site.

It will be possible to completely reverse the visual effects of the development at a future date should this become desirable.

The relative flatness of the terrain results in an indeterminate viewshed in which significant views of the facility will only be possible from the R359 near the site and from elevated viewpoints within the surrounding terrain. Most of these viewpoints are only slightly above the height of the facility and so views will be edge on rather than from the top down. This greatly reduces the potential visual impacts. (See Figures 7 and 8 for the viewshed and read the notes in section 3.4 above.)

It will be noted that the area of the viewshed is far less extensive for site 1 when compared with site 2, and the use of site 1 will have far less impact on the park. This includes not being visible from the Moon Rock lookout point and other main view sites including the falls.

The extent of the visual impact has been assessed at sub-regional as no significant views are expected beyond 10km from the site.

The visual influence on the following areas was analysed:

- The visitor's facilities in the park and surrounding areas. Site 1 will not be visible from these areas but site 2 is potentially visible from some elevated areas close to the visitor's facilities however, the local vegetation should block most of these views.
- Site 1 is not visible from either the Moon Rock viewpoint or the viewpoint adjacent to the Ararat Road but the facility on Site 2 will be visible at a distance of 4.4km and further from these viewpoints.
- Site 1 will only be visible from a limited stretch of road in the west of the park close to where it crosses the R359 but will not be visible from all the roads close to the park's visitor's facilities.
- Both of the sites will be partially visible from some of the elevated viewpoints on the farms to the south and west of the site but these views are not expected to be significant.
- Site 2 may be visible from some of the more elevated areas in the Augrabies agricultural areas but site 1 will not be visible from these areas.
- Views of both sites will be possible from some of the ridgelines to the north of the Orange River but these views are not expected to be significant as they are 10km and further from the sites.

The visual absorption capacity of the landscape for this type of development is relatively low and the contrast in land use between the farming and conservation activities and the industrial nature of the solar facility results in its compatibility with the surrounding landscape also being low.

The relatively low nature of the solar facility, the fact that from most significant viewpoints, other than the R359, the facility will only be visible edge on, and the distance between these viewpoints and the facility mean that the intensity of the visual impact will not rise above medium, and for most viewpoints it will be low.

The duration of the visual impact will be long-term; however, the visual impacts should be entirely reversible in the future.

Visitors to the park will have a high sensitivity to the visual environment which raises the significance of the visual impact.

The overall significance of the visual impact for the operational phase has been assessed at being medium for site 1 without mitigation and medium-low with mitigation. For site 2 this assessment rises to medium-high without mitigation and medium with mitigation.

The complexity of the visual environment, especially in southerly views from the park, makes it less likely that viewer will react entirely negatively when viewing the facility as there are other significant man-made visual elements within the vista including the covered vines which are of a similar height to the solar panels.

The limited views, especially of site 1 which does not affect any of the major viewpoints in the park, could be seen by many of the visitors as a positive step towards creating a more ecologically sound environment.

A small possibility exists that for limited periods of time a flash of reflected sunlight may be experienced from within the park. Should the facility be constructed on site 1 this possibility will be eliminated from all the areas of the park that are commonly accessed by the visitors as this can only occur within the viewshed. The implementation of the single axis tracking form of solar panels, as opposed to fixed panels, will ensure that this does not occur at all.

The primary mitigation measure in terms of visual issues is the use of site 1 which will influence a smaller area than site 2, avoid any visual impact on the more frequented areas of the park, and require a shorter length of transmission line to the Blouputs Substation.

It is important that visual issues be central in all thinking concerning the facility, from design and construction to operation and decommissioning. Specific impacts that are identified at any stage should be sensitively dealt with in order to ensure the visual integrity of the environment. It is important therefore that management takes any visual issues seriously throughout the life of the project.

The use of tree lines to shield the facility from view is not indicated as these would incur a higher visual impact than the facility itself and their long-term maintenance could be problematic, however, the use of groups of indigenous thorn trees placed strategically in the surrounding landscape to mitigate specific visual impacts that are identified once the facility is constructed could be of some value.

Although the sense of place will be affected by the inclusion of an ‘industrial’ element within the local environment, the change, except for along the R359, will only affect a limited number of viewpoints and is therefore considered within acceptable limits.

In terms of visual issues it is therefore recommended that the development be allowed to proceed provided that mitigation measures are implemented in full and that a final check of the viewshed is done once the final siting and design of the facility is complete to check that it still falls within the findings of this report.

1 INTRODUCTION

The author was approached by Rosenthal Environmental Consultants on behalf of Mulilo Renewable Energy Pty Ltd to provide a Visual Impact Assessment of the potential visual impacts that will be incurred by the construction of a 10MW solar voltaic electricity generation facility on the Farm Rooipad 15/9 Augrabies in the Northern Cape Province.

No alternative land uses on the site were presented for assessment, but two alternative sites within the boundaries of the farm will be assessed.

1.1 VISUAL ASSESSMENT EXPERIENCE AND EXPERTISE

Over the past 10 years the author has been involved in the compilation of more than one hundred visual impact assessments. These included such high profile studies as:

- The Green Point Stadium
- Chapman's Peak Drive Toll Structures
- The Berg River Water Project
- Agulhas Golf Estate
- Several large scale Eskom projects
- Two large scale projects in the Waterfront
- PPC Cement Factory Riebeek West
- Upgrade of Zanzibar waterfront
- 2 solar facilities Kenhardt Northern Cape
- Wind Farm Caledon Western Cape (71 3Mw turbines)
- 2 wind farms Swellendam District Western Cape

1.2 STATEMENT OF INDEPENDENCE

I hereby declare that I have no conflicts of interest related to the work of this report. Specifically, I declare that I have no personal financial interests in the property and/or development being assessed in this report, and that I have no personal or financial connections to the relevant property owners, developers, planners, financiers or consultants of the development other than the fees obtained for compiling this report.

I declare that the opinions expressed in this report are my own and a true reflection of my professional expertise.

1.3 COPYRIGHT

1.4 ASSUMPTIONS AND LIMITATIONS

Although the project will occur in the Northern Cape Province, this report has been compiled according to the requirements of the document 'Guidelines for Involving Visual and Aesthetic Specialists in EIA Processes' issued by the Department of Environmental Affairs and Development Planning of the Provincial Government of the Western Cape, dated June 2005. This is as a result of there being no applicable guidelines for the Northern Cape.

The assessment criteria that have been used in this report conform to the requirements of the above mentioned guidelines and may differ from those used by the other assessment specialists. Certain assessment criteria specific to visual impacts, but not to other disciplines, such as visual absorption capacity of the local environment, the compatibility of the development with the local visual environment and the sensitivity of the viewers are not part of the generic methodology but are essential in understanding the visual implications of any development and have therefore played a vital part in the findings of this visual impact assessment.

It is for this reason that the use of numerical means of determining the significance of the visual impact is specifically discouraged in the guidelines. Due to the complex nature of determining visual impacts this method can lead to results which are inaccurate and it is therefore not used in this report.

As the development will be confined to an area of 20ha or less, only a Basic Assessment process was required in terms of the environmental legislation, however, in view of the sensitivity of the local environment with its proximity to the Augrabies Falls National Park it was decided that a full Visual Impact Assessment was necessary.

All basic information about the project has been obtained from Mulilo Renewable Energy Pty Ltd and Rosenthal Environmental. A generic layout for the facility was used as a point of departure which will be amended as per the mitigation requirements of the various specialists in their environmental reports. Any changes to the basic information that may occur in the final planning stages of the project have therefore not been taken into consideration in this report but parameters within which such changes may take place have been specified.

The findings of the report rely heavily on visual analysis done by means of a 3D computer model covering approximately 400^2 km around the sites. This area includes the visually sensitive areas within the Augrabies Falls National Park which may be affected.

As a basis for the model the following information was used: for areas north, east and west of the sites the 5m contours provided by the chief Directorate National Geospatial Information were used; to the south of the site and along the eastern edge of the model, including the area around the Augrabies Falls visitors Center, the 20m contours from the same source were used; and for the area immediately around the sites, 500mm contours interpolated from satellite imagery provided by the engineers on the project were used. There were problems with the integration of the three sets of data but it is believed that the resultant computer model is accurate enough for the purposes of this report.

As the applicant is a company specializing in the building of green alternatives in power generation, no alternative usages of the site have been considered or assessed. This report therefore deals only with the implementation of a single activity in the form deemed by the applicant to be implementable on the site.

The no-development alternative has been used as a baseline from which to assess the potential visual impacts of the facility.

1.5 METHODOLOGY

The following sequence was employed in this visual impact assessment.

- A desktop survey was made using maps and aerial photographs. These were used to identify landforms and landscape patterns and areas of potential visual impact.
- A 3D digital terrain model was created using 5m, 20m and 500mm contours. (See above) A simple model of the arrays was placed in the model using 3,5m as the height, rather than the proposed 2.5m so that any visual impacts were slightly exaggerated. This helped to compensate for any shortcomings in the base data from which the terrain model was created
- Cameras were placed within the model at significant viewpoints and on tracks along all the major roads within the park and the R359 adjacent to the sites. Still images were taken from the significant viewpoints and short videos were rendered along all the roads to determine areas from which the two alternative sites would be visible.
- The viewshed for each corner of the two sites was rendered.
- A photographic survey of the site and surrounding areas was conducted using the input from the model to identify potential viewpoints that would be visually affected.
- Significant viewpoints and areas where views of the sites will be possible were identified and the visual impact on these was analysed.
- An evaluation was made of potential visual impacts on all areas where visual influence is anticipated.
- Relevant mitigation measures were proposed.

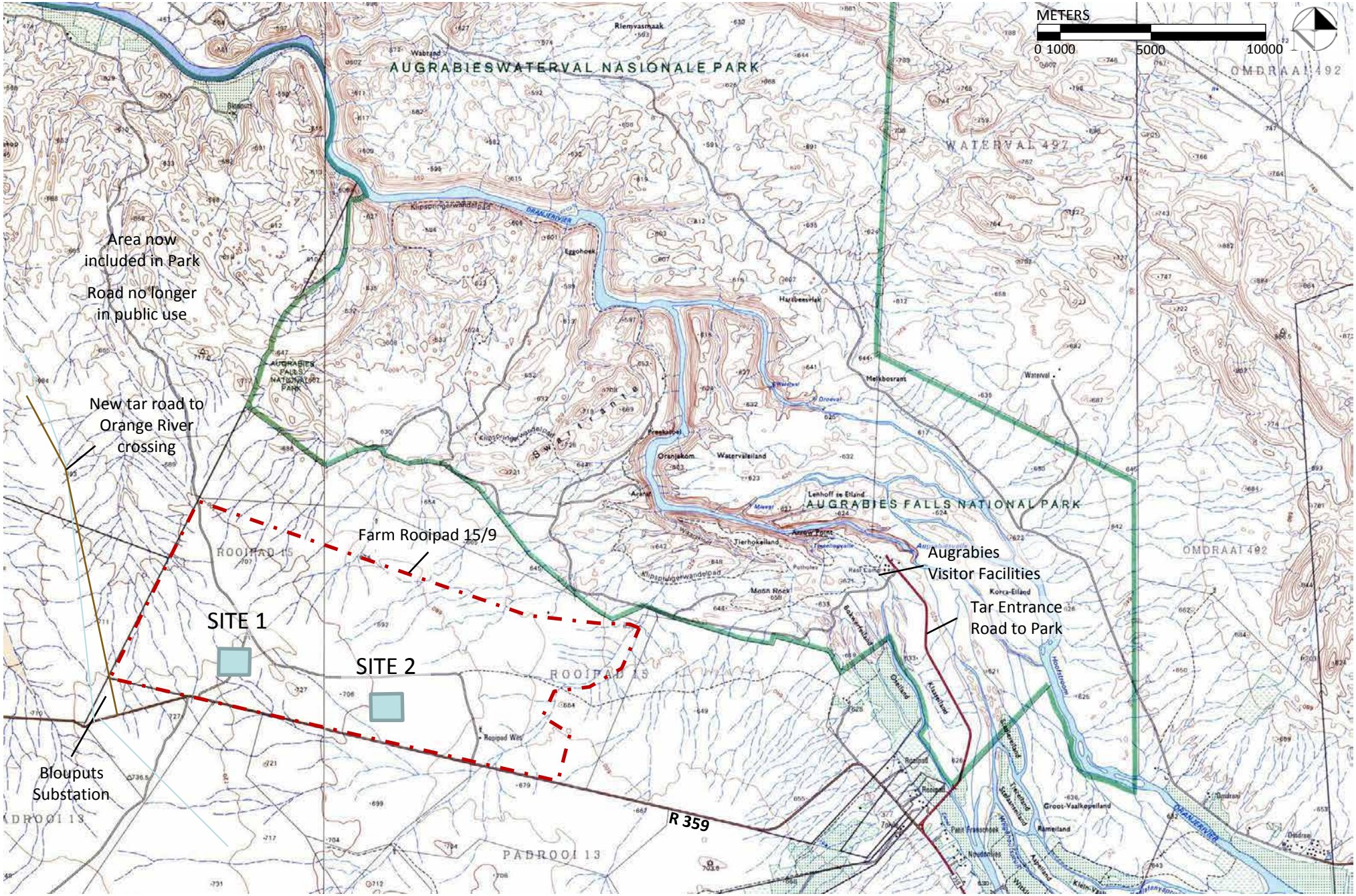
2 LOCALITY AND STATUS OF THE STUDY AREA

See Figures 1 - 3

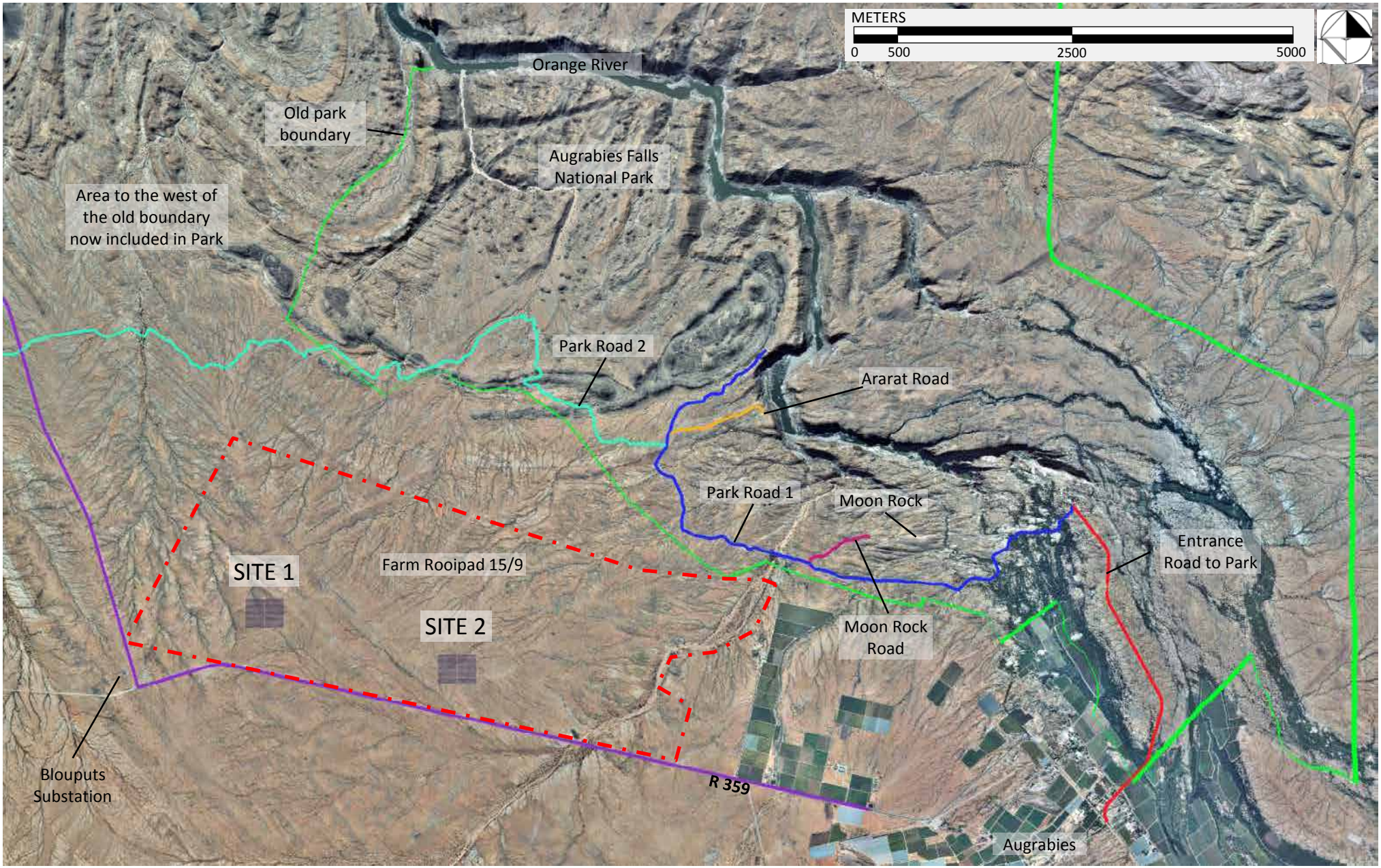
The two potential sites are situated on Farm Rooipad 15/9 just north of the R359, west of Augrabies and south of the Orange River and the Augrabies Falls National Park.

At present Farm Rooipad 15/9 is zoned for agriculture and is largely unused although some ostriches are kept on the land. There are no sustained agricultural activities on the site and no one lives on the land.

Suitable rezoning is being sought to enable the construction of the photovoltaic facility on one of the two identified sites within the boundaries of the farm, along with the associated infrastructure and servitudes.

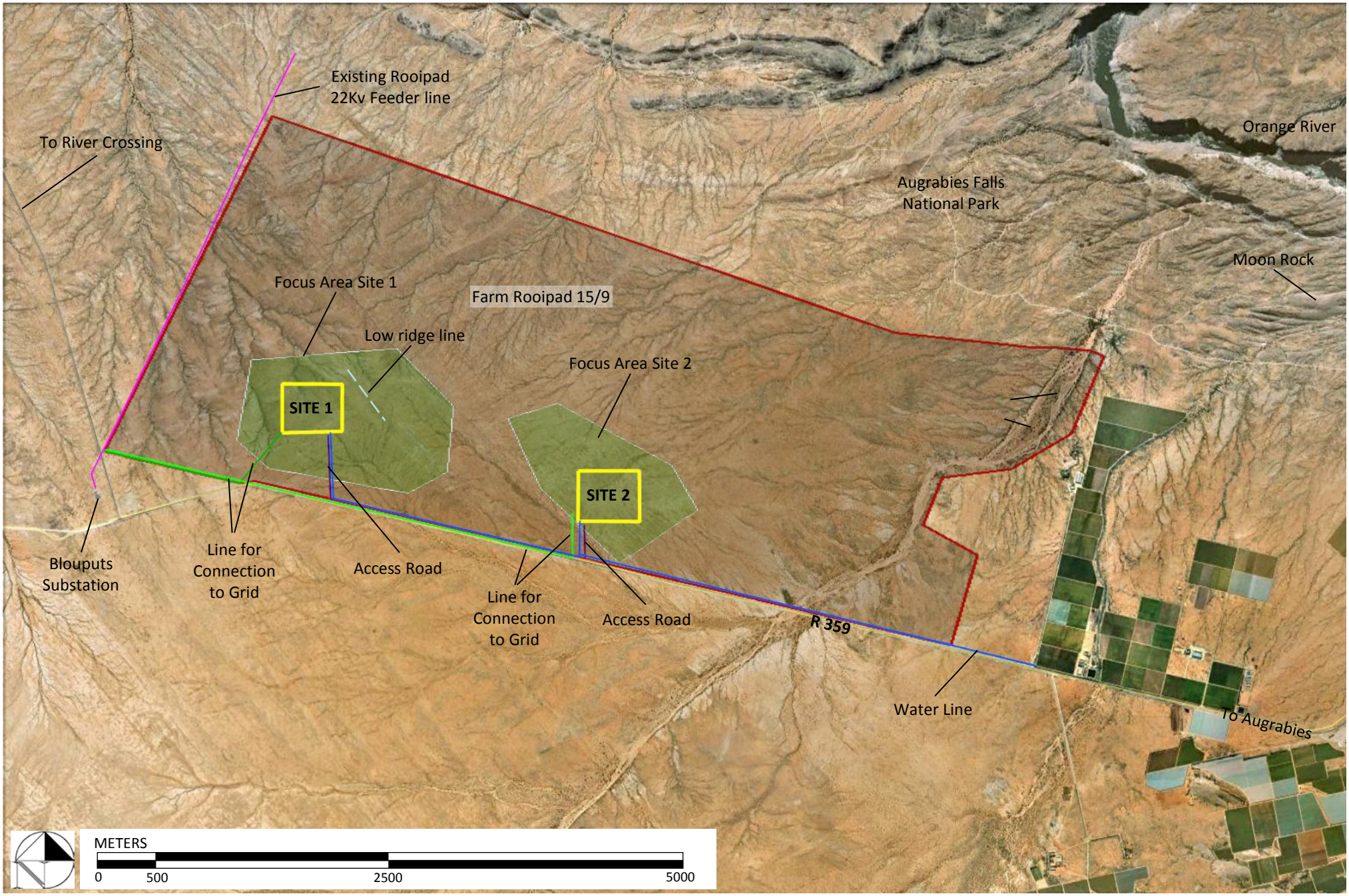


REGIONAL LOCALITY FIGURE 1



Note: Image generated from 3D computer model. The designations of the roads in the Park are for the purposes of this report.

AERIAL VIEW SHOWING OVERALL LANDSCAPE CHARACTER FIGURE 2



AERIAL PHOTOGRAPH WITH OVERLAY OF PROPOSED SITES AND PLANNED INFRASTRUCTURE FIGURE 3

3 DESCRIPTION OF VISUAL CHARACTERISTICS

3.1 GENERAL DESCRIPTION OF SITE AND SURROUNDING AREA

The area around the two potential sites is relatively flat with some gentle slopes and low ridgelines. The area is crisscrossed by many seasonal drainage lines, many of them very shallow, and there is evidence of small ephemeral pans in some areas.

The vegetation common to the area consists mainly of grasses and small thorn trees and bushes, the bushes being concentrated along the lines of the drainage channels. The vegetation is relatively sparse and the shallow reddish sand is openly visible in many areas as is the bedrock which breaks the surface in places. Unlike the areas to the north of the site, there are relatively few large rocks and boulders lying on the surface.

South of the site, the land slopes gently down towards the R359 tar road which runs from Augrabies westwards as far as the Blouputs substation and then northwards to a bridge across the Orange River which gives access to the limited farming areas along the Orange River on both the north and south banks of the river. These farms are completely surrounded by the Augrabies Falls National Park.

The Blouputs substation lies adjacent to the R359 at the point where it turns northwards towards the river, west of the site. A power line runs northwards from the Blouputs substation along the western boundary of Rooipad 15/9 and further northwards across the Augrabies Falls national park with the pylons being clearly visible from the elevated points in the terrain including from Moon Rock and the Ararat viewpoint.

To the south of the R359 the land is also relatively flat and natural with no farming activities that break the ground. A similar situation exists on the land to the west of the site.

In general the landscape can be described as arid but to the west of the site and in a strip along the Orange River, relying on water from the Orange River for irrigation, there is concentrated agricultural activity consisting mainly of grape and fruit farming and dried fruit production. Around Augrabies this area is relatively wide and the landscape is dotted with farmsteads and other farm structures as well as a hotel and guest houses catering for the visitors to the falls.

To the north of the site lies the Augrabies Falls National Park in which the landscape becomes more broken and there are rows of low hills and rocky valleys that give way to the Orange River canyon which is more than 50m deep in places. These ridgelines alternately allow for views towards the south and the site, and block them, depending on the position of the viewer in the landscape. Some viewpoints, like Moon Rock and the view site near Ararat, allow for panoramic views over the landscape which include portions of Farm Rooipad 15/9.

The reception, visitor's center and accommodation in the park, as well as the falls, lie to the north-east of the site at a distance of approximately 7.5 km and further. This area has greater natural water resources and is home to a great number of larger trees. These, as well as the broken nature of the landscape, block many views out over the surrounding terrain from this area. This includes many potential views of Rooipad 15/9.

A road, designated 'park road 1' for the purposes of this report, runs eastwards for the reception area and accommodation center in the park through the trees and across the watercourses eventually giving access via two side roads to the Moon Rock lookout point and the Ararat view site adjacent to the river, and an elevated lookout point adjacent to the road. Site 2 of the proposed development will be visible from these points. Many visitors to the park use these roads to access the viewpoints and surrounding areas of the park, and the road is good enough to be used by ordinary sedan vehicles.

Another road runs off 'park road 1' towards the western areas of the park. This road is designated 'park road 2' in this report. It snakes through the ridgelines eventually passing under the R359 and giving access to the areas of the park to the west of the R359. This section of road does not give direct access to the river and is used for game viewing. At present most of this road is only accessible in four wheel drive vehicles thus limiting the number of people who use it. Site 1 will be visible over a short distance of this road as it nears the crossing with the R359.

To the north of the Orange River lies a flat but relatively broken stretch of land which gives way to a series of higher ridgelines that rise approximately 150m above the average height of the area around the river and form the northern extent of the viewshed. These ridgelines which are within the park boundaries lie 10km and further from the sites and views of the facility on either of the alternative sites will be possible from their summits.

3.2 THE VISUAL ENVIRONMENT AND SENSE OF PLACE

The visual environment in the area around the proposed facility is very complex. It contains arid grass and thorn bush plains and treed areas, areas of concentrated agriculture, areas of human habitation and areas in which no signs of habitation can be seen, a highly fractured geological landscape that includes hills, boulder strewn plains and valleys, and the Orange River gorge.

At places, such as from the Moon Rock viewpoint, all of these elements can be viewed at once but more generally, as a viewer moves through the landscape, these elements give way to one another and the sense of place changes continuously. An example of this is the unexpected power of the untamed visual nature of area around the falls which is only a few minutes' drive from the highly organized and human impacted landscape of the Augrabies agricultural area through which the visitor to the falls has to pass.

The one element that is missing in the overall landscape is that of industry although the Blouputs substation and the presence of power lines in the landscape hint at this, and the vineyards covered in netting, sometimes covering extensive areas, add an unexpected element to the visual environment that affects the agricultural sense of place considerably.

The implementation of the solar facility will add an additional industrial element to the landscape, however its nature, low and flat, that it will only be seen edge on from most viewpoints, and that those viewpoints within the park a relatively few, provided that site 1 is chosen, means that it will only affect the sense of place minimally.

The implementation of the plans for site 1 will not have and unacceptable effect on the sense of place within the park and should have no effect on the desirability of the park as a tourist destination.

3.3 DESCRIPTION OF THE PROPOSED DEVELOPMENT

See Figures 4 - 6

The project will entail the construction and operation of a 10 MW photovoltaic solar electricity generation facility and associated infrastructure that will require approximately 20 ha of land.

The project will consist of the following elements that have visual implications:

General –

- A gravel entrance road that will cross Rooipad 15/9 giving access to the site from the R359. This will be approximately 300m in length for site 2 and 500m for site 1.

- A series of photovoltaic arrays that will be geometrically arranged across the site.
- The arrays will be approximately 2.5m in height and follow the shape of the terrain.
- The arrays will be supported by light-weight pedestals which will be anchored to the ground by means of concrete foundations.
- There are two possible types of arrays that may be used:
    - Fixed arrays which will run in rows from east to west and face north with the panels being fixed at a defined angle from the horizontal. This type of array has no moving parts.
    - Single axis tracking arrays in which the orientation of the arrays is north/south and the panels pivot along the north/south axis following the course of the sun from east to west over the course of the day.
- The fixed arrays will face the Augrabies Falls National Park to the north but only the support structures and rear of the panels will be visible to viewpoints along the R359.
- The single axis tracking arrays will face east in the morning and west in the evening with the facility being seen edgewise from the areas of the park to the north, and the R359 to the south.
- The arrays will be accessed by a network of roads within the site. These may be gravel or take the form of shallow concrete channels which will serve both as roads and as storm water run-off from the site. This final design will be determined after the recommendations of the environmental team have been made known and within the technical specifications of the engineering team.
- Several inverter units housed in kiosks or small structures will be required between the arrays.
- An operations building of approximately 60m^2 and approximately 2,5m in height will be required. This will include a storage room and office with bathroom and will be used for maintenance and security activities.
- Several water tanks will be required to provide for the cleaning of the arrays and the needs of the maintenance and security staff.
- A 22kV overhead line will be required to convey the power to the existing power lines west of the site, which will in turn convey the power to the Blouputs substation. For site I this line will be approximately 1,6km in length and for site 2 approximately 3,3km in length.
- The facility will be surrounded by a security fence.
- There will be motion sensitive security lighting along the fencing which will only activate when movement is sensed.
- It will be necessary to lay in a water line from the adjacent farm Vuursteenkop which will follow the road reserve of the R359 and then the new entrance road to the site. This could be be longer than 5km for site 1, and less if a borehole is used.

Construction Phase –

- The site will be cleared of vegetation.
- The roads will be constructed including the installation of a new gate adjacent to the R359 to allow access to Rooipad 15/9 and the site.
- Lay down areas will be established.

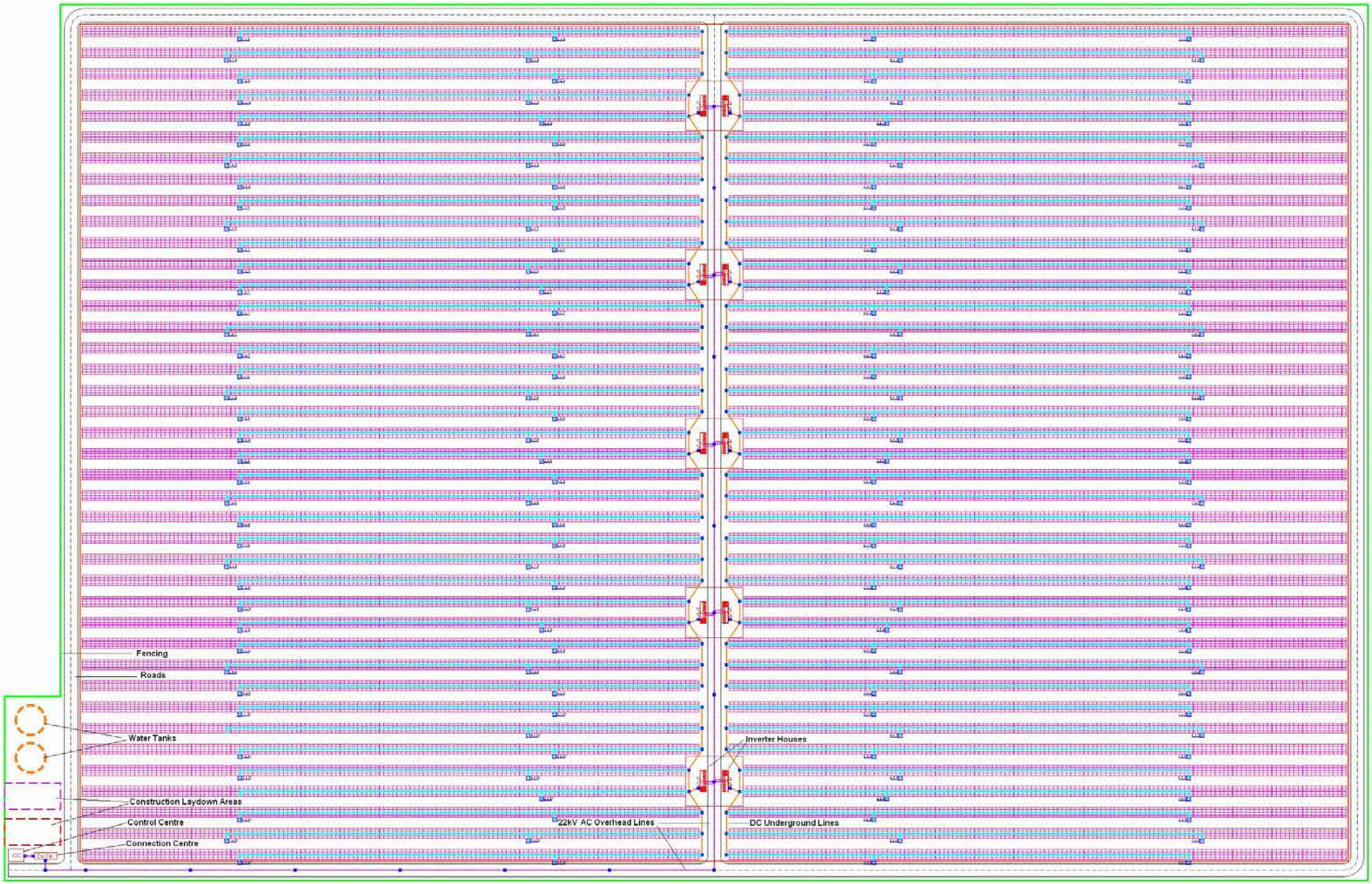
- The foundations constructed.
- The arrays will be installed.
- The water pipeline from Augrabies will be installed.
- The infrastructure facilities/buildings will be constructed.
- The fencing and security measures will be erected.
- Transmission lines connected.

Operational Phase –

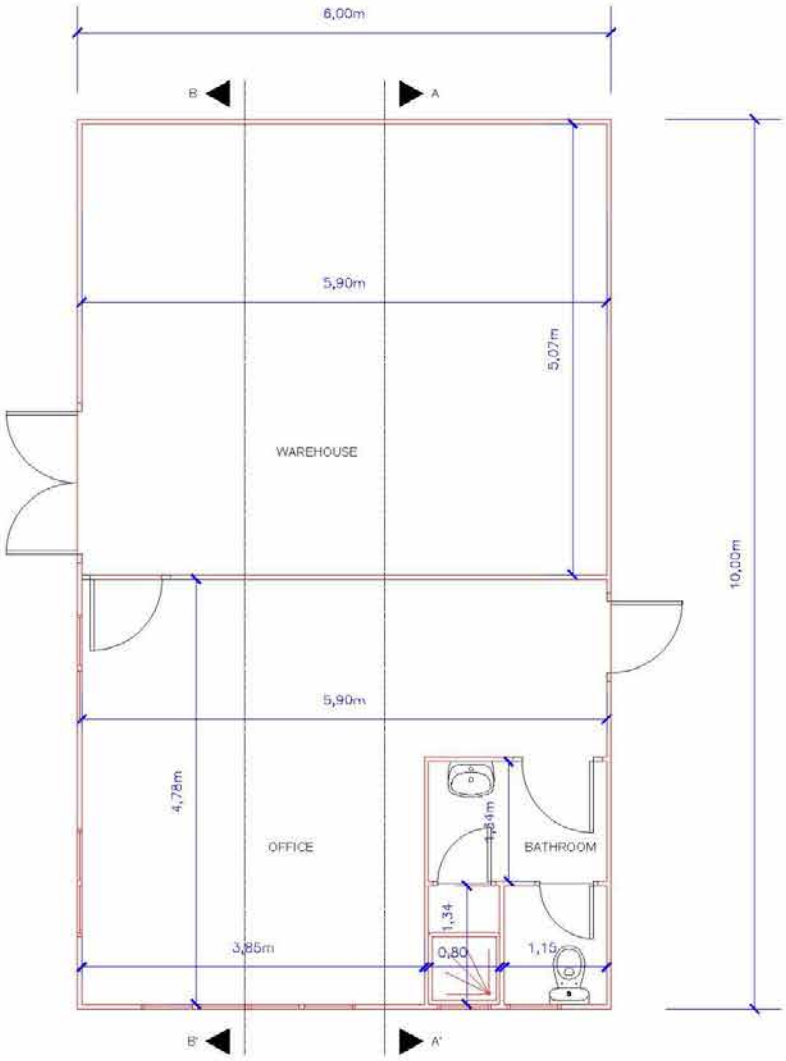
- The operational phase of the facility is initially estimated at approximately 25 years during which only maintenance in order to keep the arrays in optimal working order will be necessary.
- The electricity generated by the facility will be fed into the grid via an existing 22kV Eskom line that runs along the western boundary of Rooipad 15/9 and feeds into the Blouputs Substation.
- Maintenance and security personal will be needed on the site.
- Visible activity on site should be restricted to the security operations and the maintenance and cleaning of the arrays. This will entail the limited use of vehicles.
- The vegetation between the arrays will need to be kept to a level where the operational efficiency of the arrays is not compromised

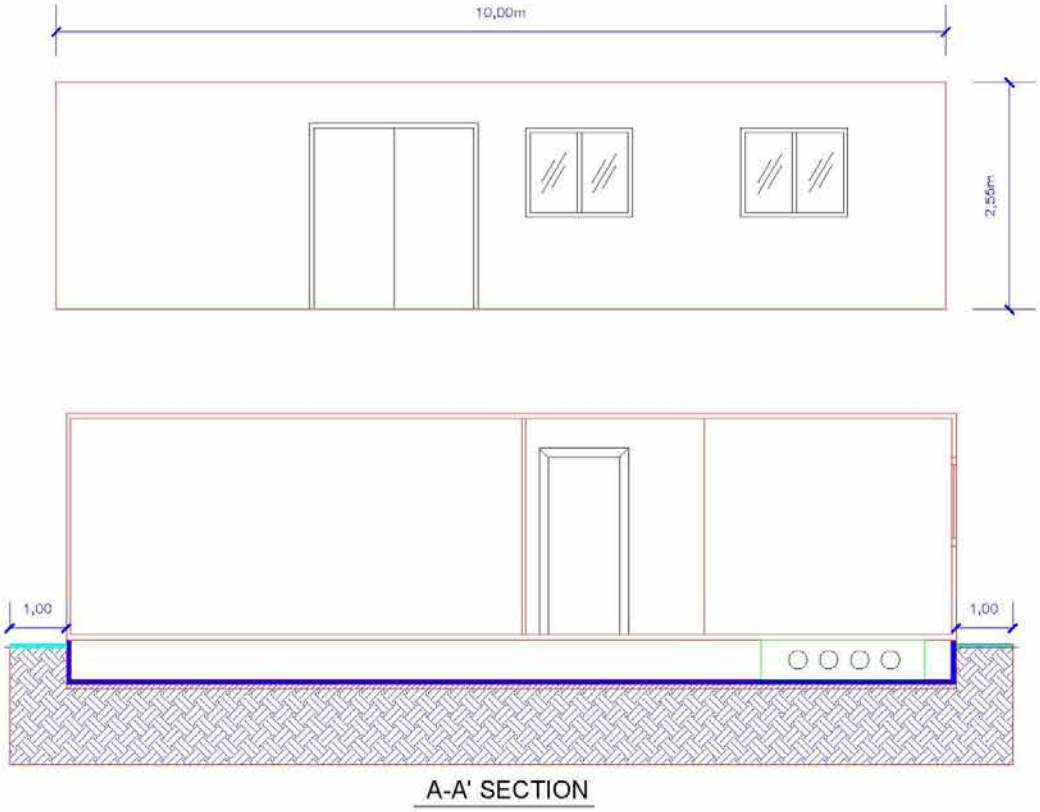
Decommissioning Phase –

- Provided that a minimum amount of earth moving is done and the minimum concrete is used It should be possible to completely reverse the visual impacts of the facility should this be desirable at a later stage. Although it is likely that after the initial 25 year life of the facility it will be renewed or replaced with new technology of a similar nature, the full rehabilitation of the land should be possible provided that this is taken into consideration during the design, implementation and operational phases so that no irreversible activities are undertaken.
- The entire facility will be disassembled and removed from site.
- The land will be returned to a state in which the natural vegetation can once again grow freely and the original visual nature of the land be re-established.

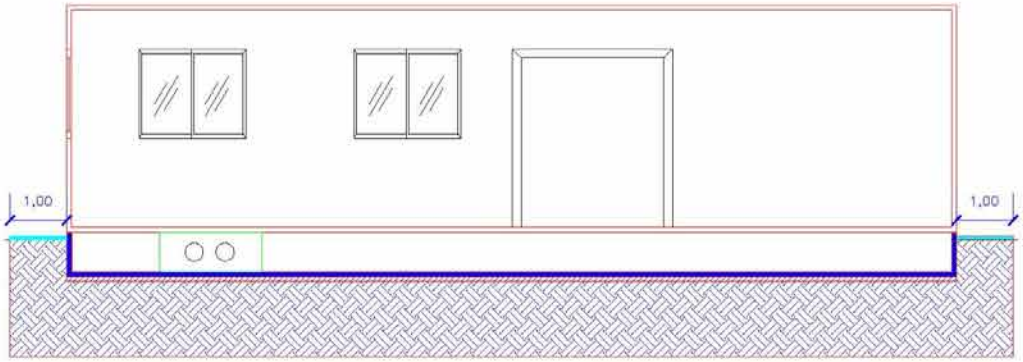


GENERIC PLANS FOR THE PROPOSED SOLAR FACILITY – GENERAL LAYOUT FIGURE 4





A-A' SECTION

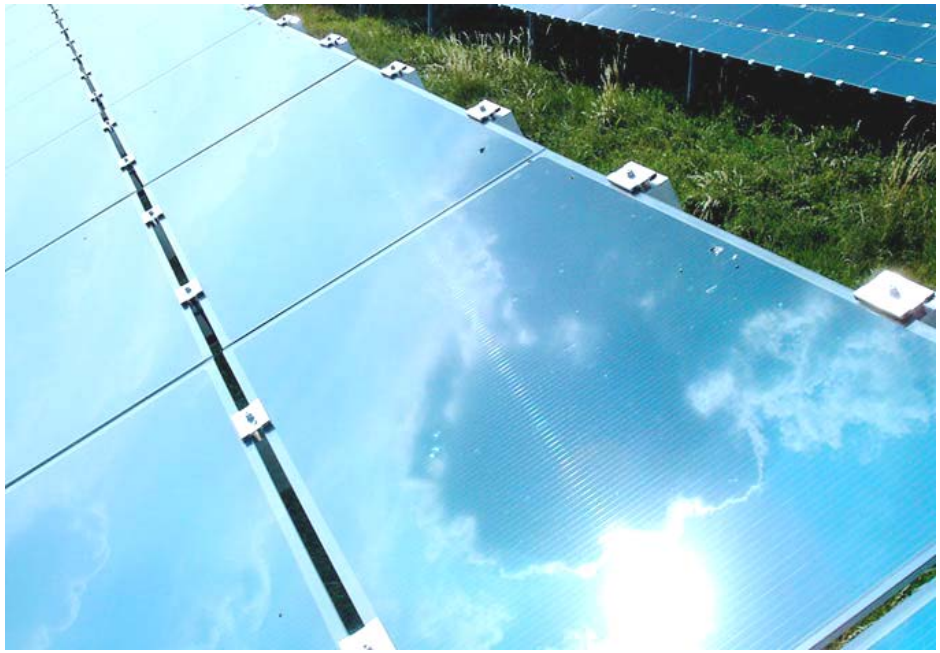


B-B' SECTION

GENERIC PLANS FOR THE PROPOSED SOLAR FACILITY – CONTROL CENTER FIGURE 5

A) Photovoltaic Facility in Arid Setting

B) Large Scale Photovoltaic Facility



C) Close Up – Solar Panels

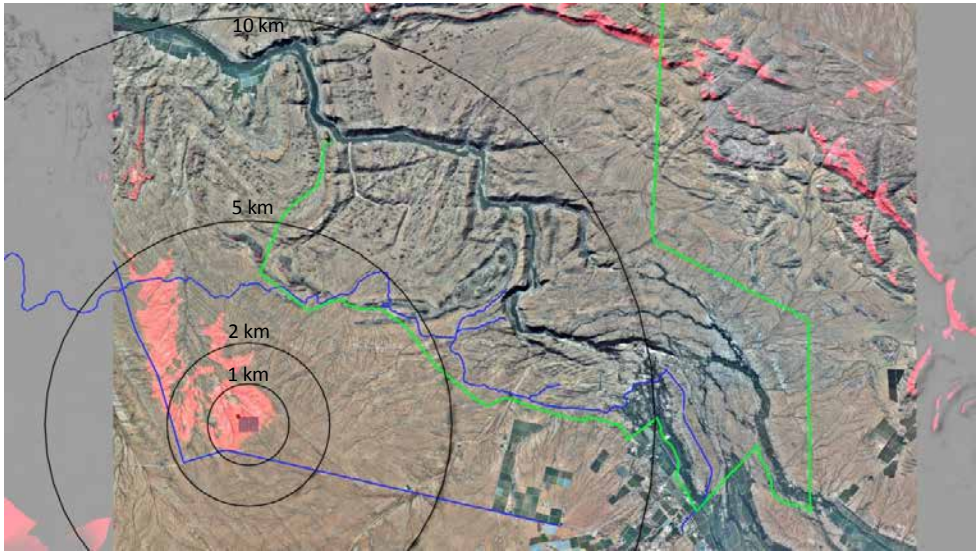
PHOTOGRAPHS SHOWING VISUAL NATURE OF PHOTOVOLTAIC INSTALLATIONS FIGURE 6

3.4 NOTES ON THE INTERPRETATION OF THE GRAPHICS

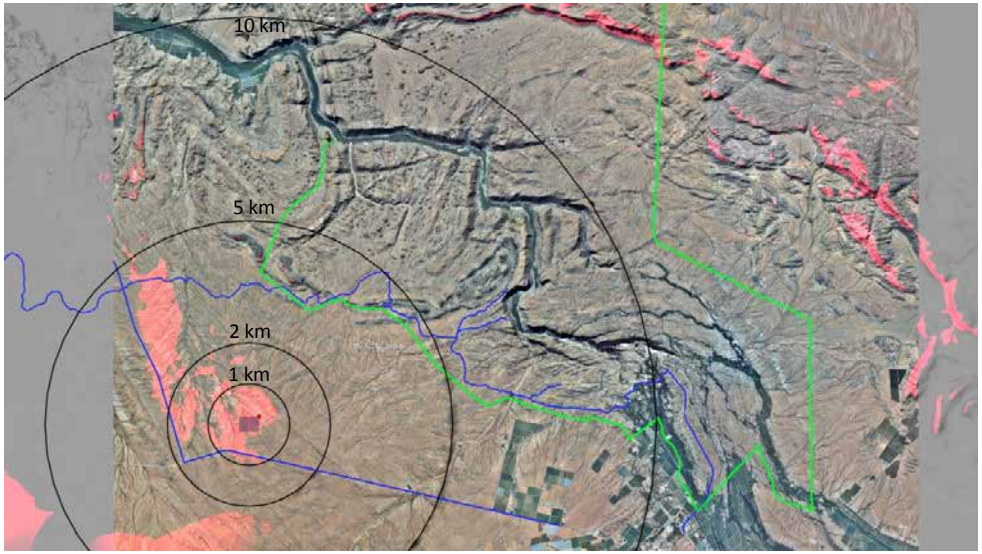
See Figures 7 - 14

A three dimensional computer model covering approximately 400 square kilometers surrounding the site, including the areas of the park that may be visually affected, was used to analyse the visibility of the proposed facility from the surrounding terrain. This technique has the ability to determine such things as the viewshed and identify areas of potential risk in a way that is impossible on the ground. There are however limits to the kind of graphics that can be produced and these need to be understood in order to interpret the graphics used in the report correctly. The following points need to be borne in mind:

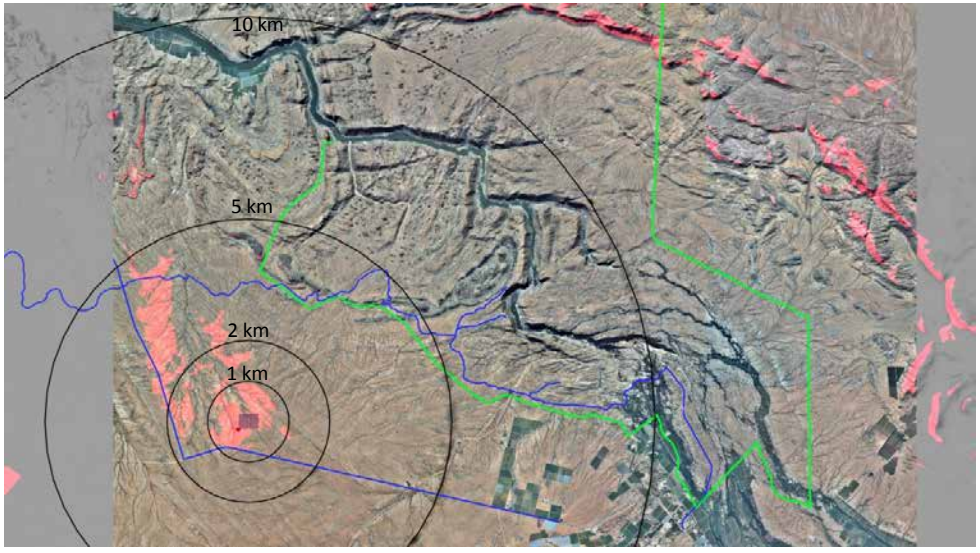
- The accuracy of the output is determined by the quality of the input data. 5m contours were used for the larger part of the model, however these were not available for the whole area and so a strip along the eastern side of the model, including the area around the visitor's facilities in the park and the area to the south of the R359 used only 20m contours. The areas around the sites used half meter contours that were interpolated from satellite imagery. This input was considered accurate enough for the purposes of this report.
- No vegetation was modeled, and features of less than 5m in height, such as boulders and low ridgelines, are also not represented in the model giving the output a smooth appearance when compared to the real landscape. This means that the model will return more potential viewpoints than there are in the actual landscape slightly exaggerating the visual impact. It also means that from some viewpoints the vegetation between the site and the viewpoint will partially or totally screen the facility from sight.
- Many more points than those included in the report were generated; including short videos with a viewpoint 2,5m above all the roads in the park, and only those viewpoints representing a worst case scenario were used. The height of 2,5m was used as the game drive vehicles allow for views from this height.
- In order to compensate any inadequacies in the model, the facility was modeled as being 3,5 meters in height rather than the planned 2.5 meters. This again slightly exaggerates the output but this was necessary as in some of the renderings the distance from the viewpoint to the site resulted in the facility being no more than a very thin line on the horizon.
- The aerial photograph used to map onto the model was high resolution but when stretched over the approximately 400 square kilometers of the model each pixel was spread over several square meters. This gives the rendered images a melted look. The dark blotches on some of the images represent trees in the landscape and it will be seen, for example, in viewpoint seven, that the viewer is in a heavily treed area and therefore the view shown is likely to be obscured by the trees.
- The untextured area down either side of the viewshed images is because no aerial photograph was mapped to these parts of the model. The modeled topography of these areas is however correct.
- In the viewshed images the red shading represents the areas from which views of the facility are theoretically possible. In reality the local vegetation, topography and structures will render views from large parts of these areas impossible. They however serve the purpose to show, for example, that the area over which site two is potentially visible is far larger than for site one. They can also be used to determine which sections of the roads in the park are liable to have views of the facility.



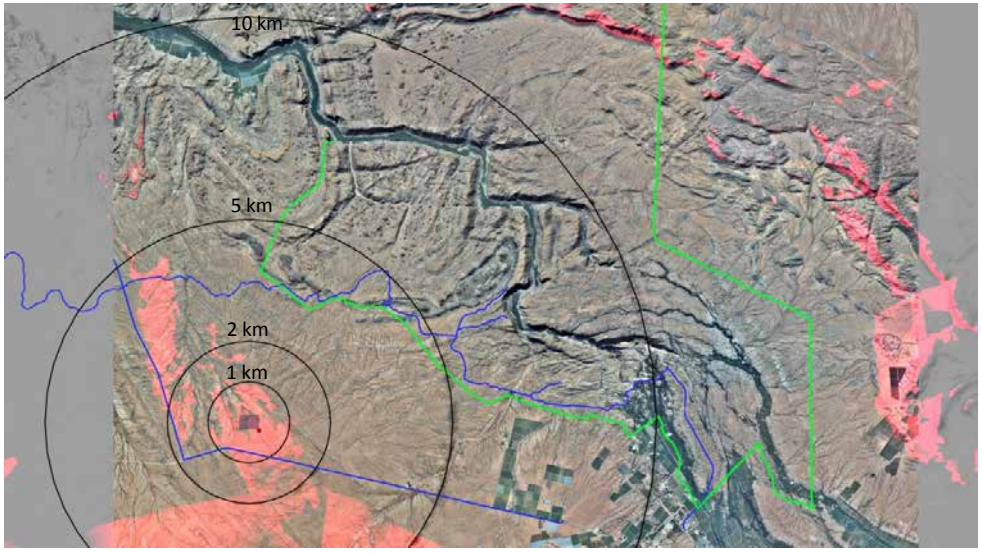
Viewshed Site 1 North-west Corner



Viewshed Site 1 North-east Corner

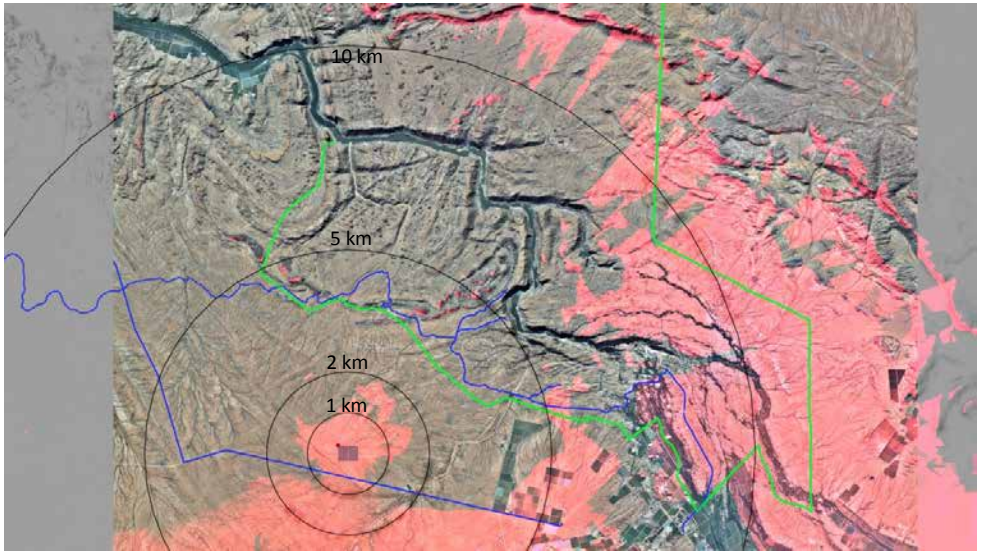


Viewshed Site 1 South-west Corner

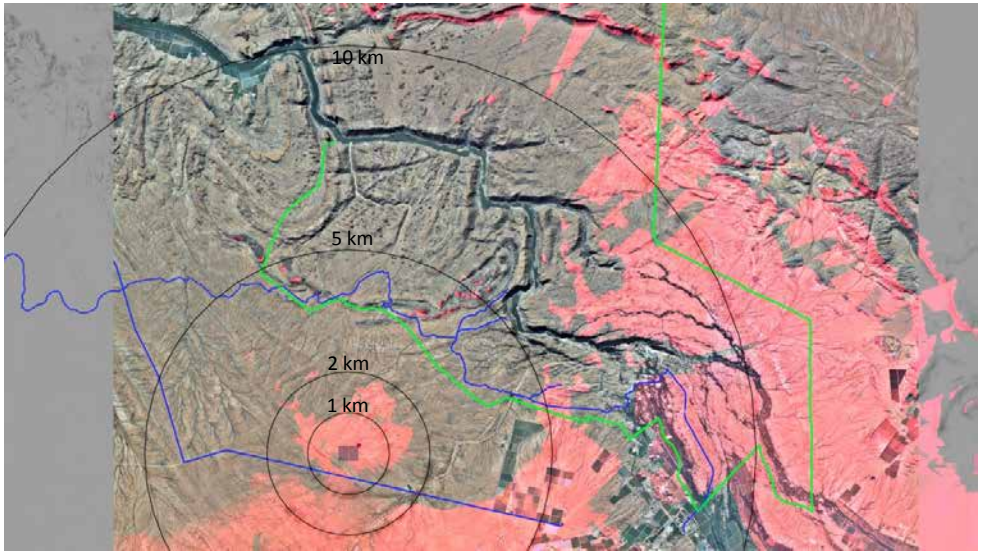


Viewshed Site 1 South-east Corner

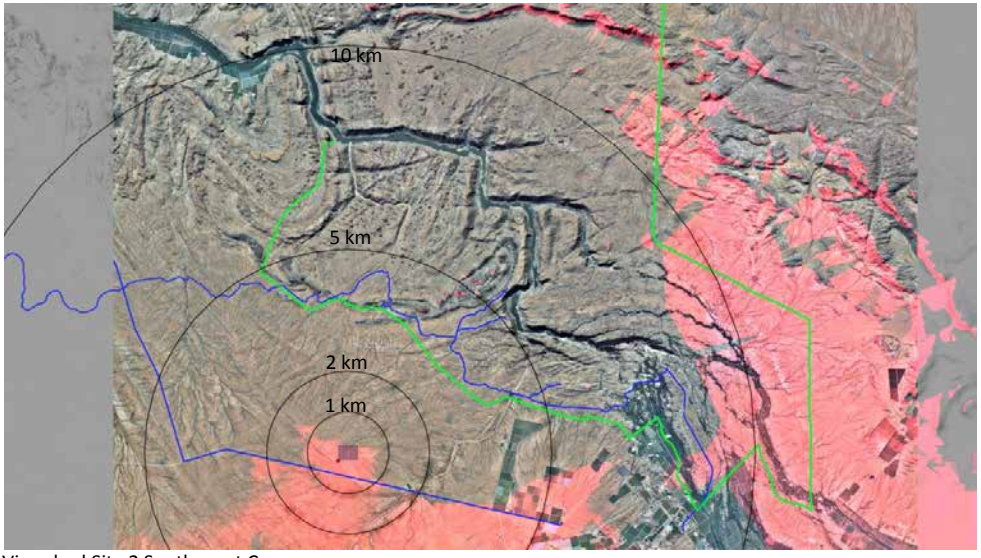
Note: Please read the notes in the text as to the interpretation of these images



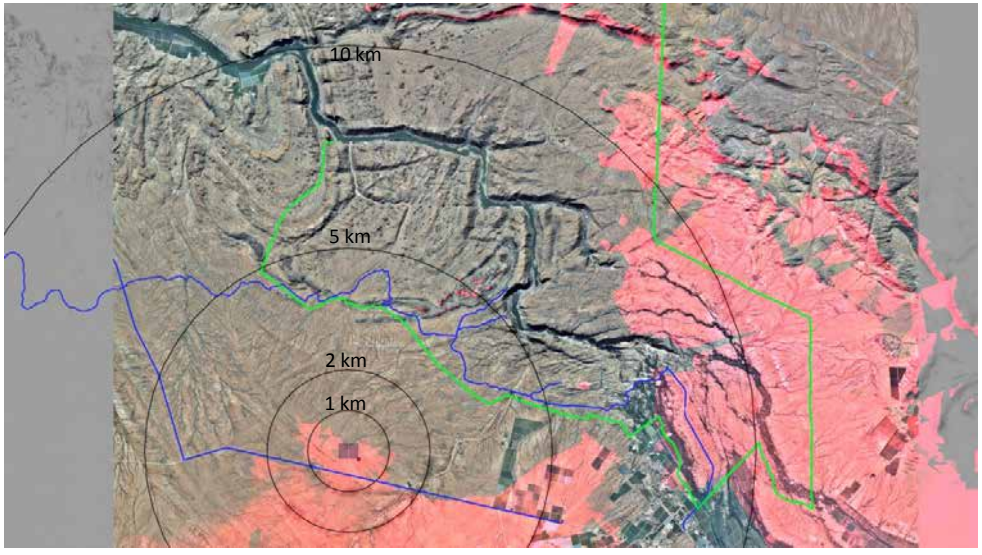
Viewshed Site 2 North-west Corner



Viewshed Site 2 North-east Corner

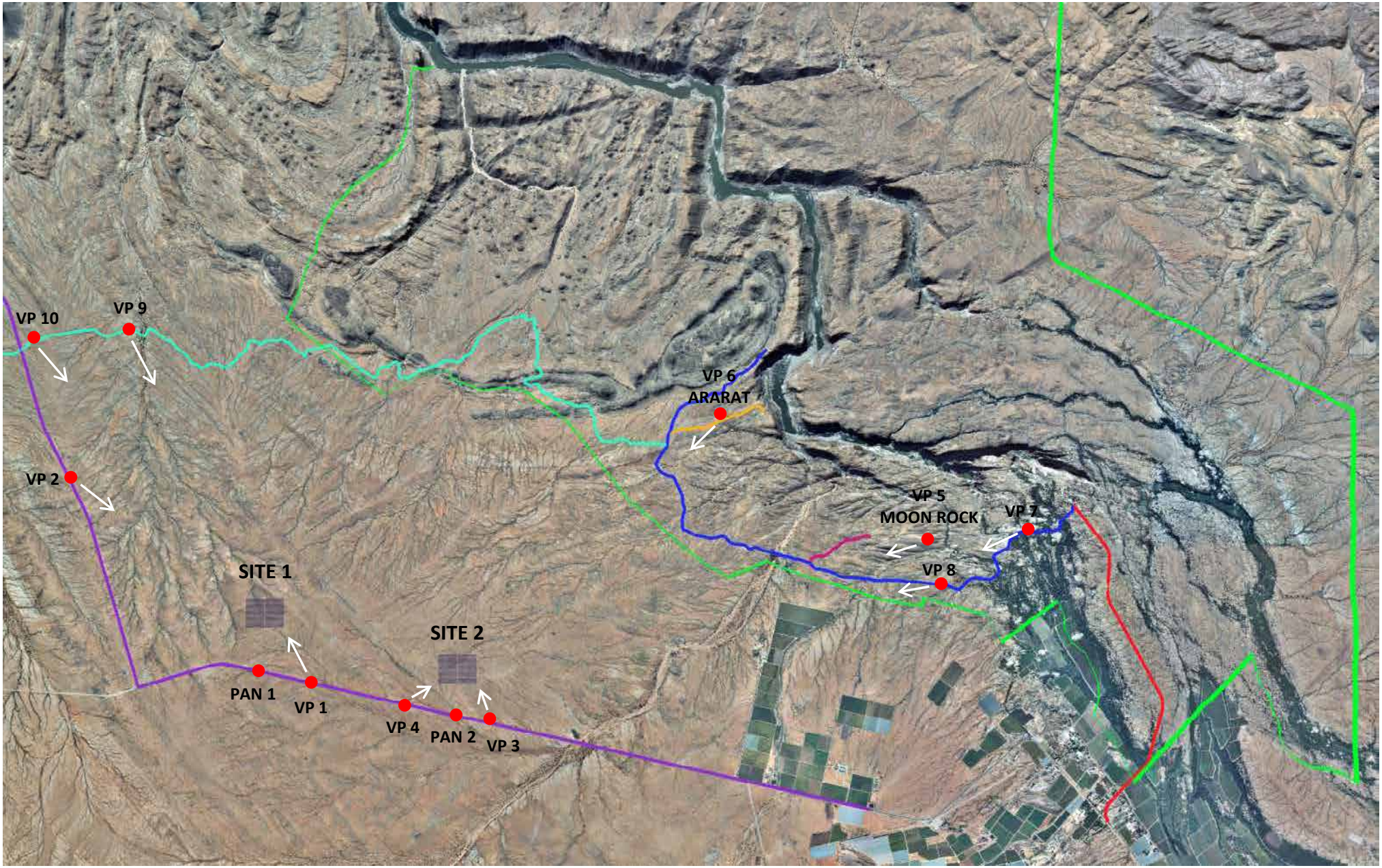


Viewshed Site 2 South-west Corner



Viewshed Site 2 South-east Corner

Note: Please read the notes in the text as to the interpretation of these images

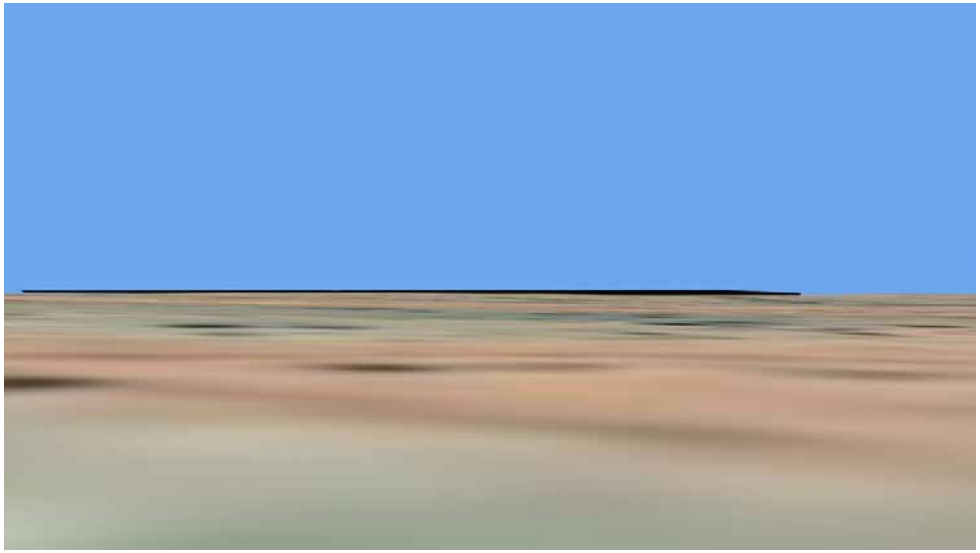


KEY TO VIEWPOINTS FIGURE 9

NW N E

PANORAMA 1 - View of Site 1 from the R359 (Facility will be on the skyline)

NOTE: Please be aware of the fisheye effect which is the result of joining several photographs together into a panorama. The road is straight.



VIEWPOINT 1 - The facility on site 1 from the R359 south-east of site. (Distance 750 m)

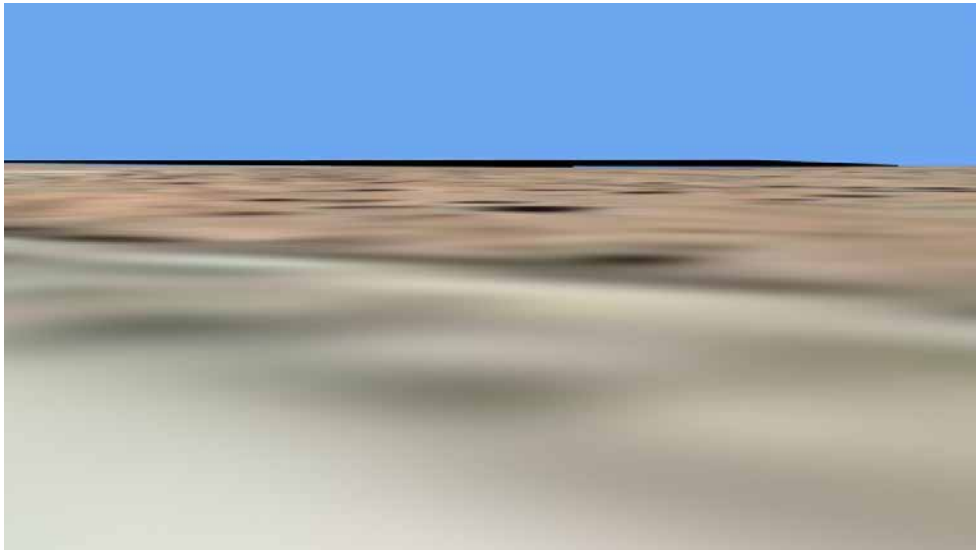
VIEWPOINT 2 - The facility on site 1 from the R359 north-west of site. (Distance 2500 m)

PHOTOGRAPHS AND RENDERING SHOWING POSITION OF FACILITY WITHIN THE SURROUNDING LANDSCAPE – SITE 1 FROM R359 FIGURE 10

NW N E

PANORAMA 2 - View of Site 2 from the R359 (Facility will be on the skyline)

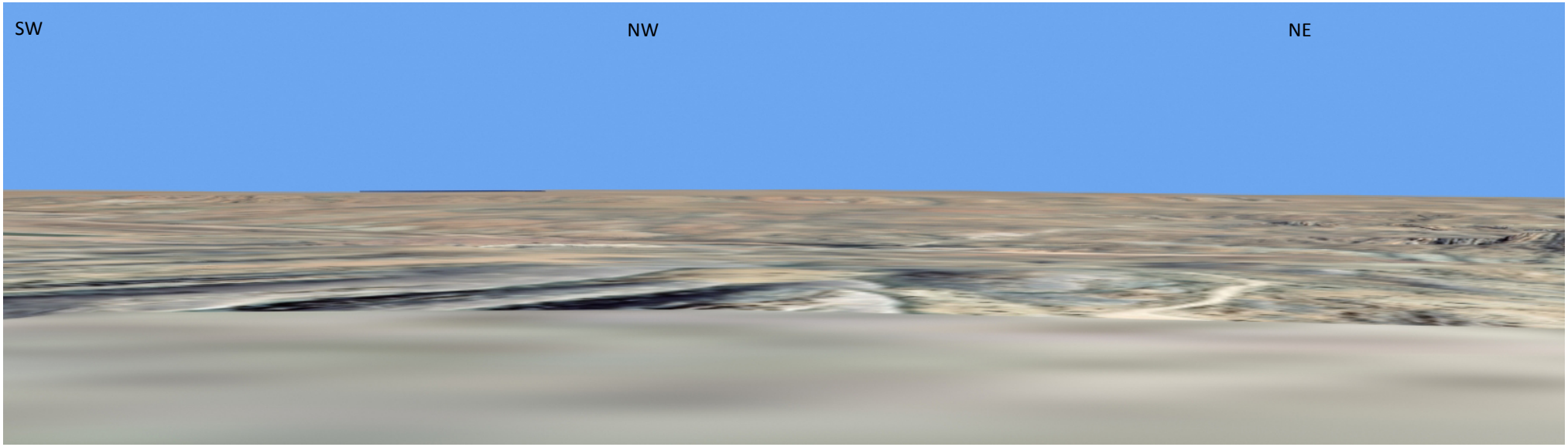
NOTE: Please be aware of the fisheye effect which is the result of joining several photographs together into a panorama. The road in each panorama is straight.



VIEWPOINT 3 - The facility on site 2 from the R359 south-east of site. (Distance 350 m)

VIEWPOINT 4 - The facility on site 2 from the R359 south-west of site. (Distance 275 m)

PHOTOGRAPHS AND RENDERING SHOWING POSITION OF FACILITY WITHIN THE SURROUNDING LANDSCAPE – SITE 2 FROM R359 FIGURE 11

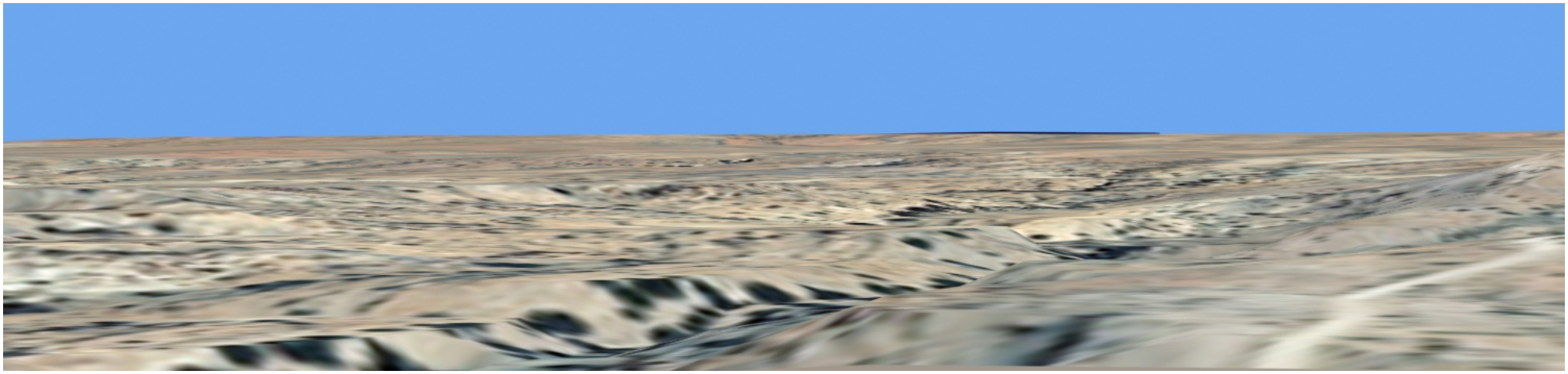


Viewpoint 5 - Render of Site 2 from Moon Rock (Distance to facility 5800m)

Viewpoint 5 - Photograph of View Moon Rock

NOTE: Site 1 not visible from this point

PHOTOGRAPHS AND RENDERING SHOWING SITE 2 FROM MOON ROCK FIGURE 12

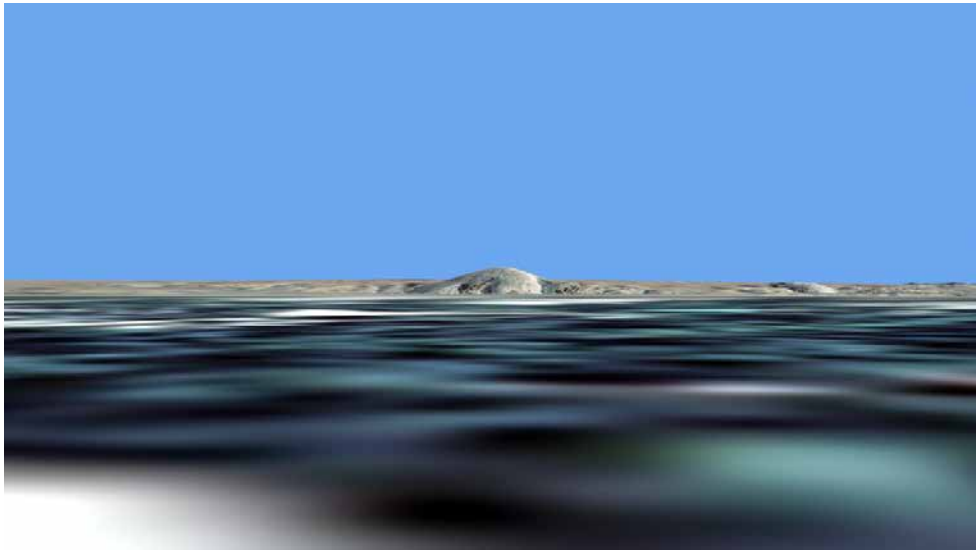


Viewpoint 6 - Render of Site 2 from Ararat Viewpoint (Distance to site 4400m)

Viewpoint 6 - Photograph from Ararat Viewpoint

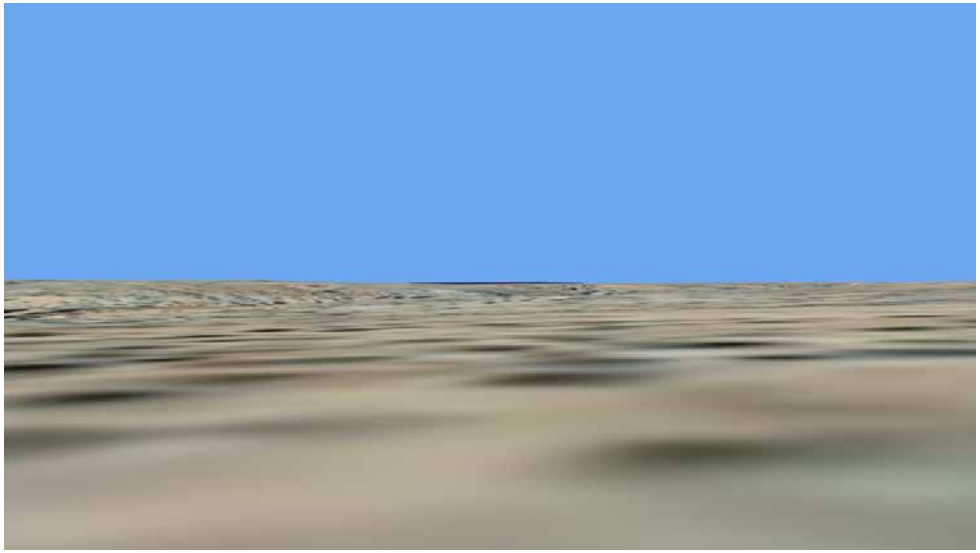
NOTE: Site 1 not visible from this viewpoint

PHOTOGRAPHS AND RENDERING SHOWING SITE 2 FROM ARARAT VIEW SITE FIGURE 13

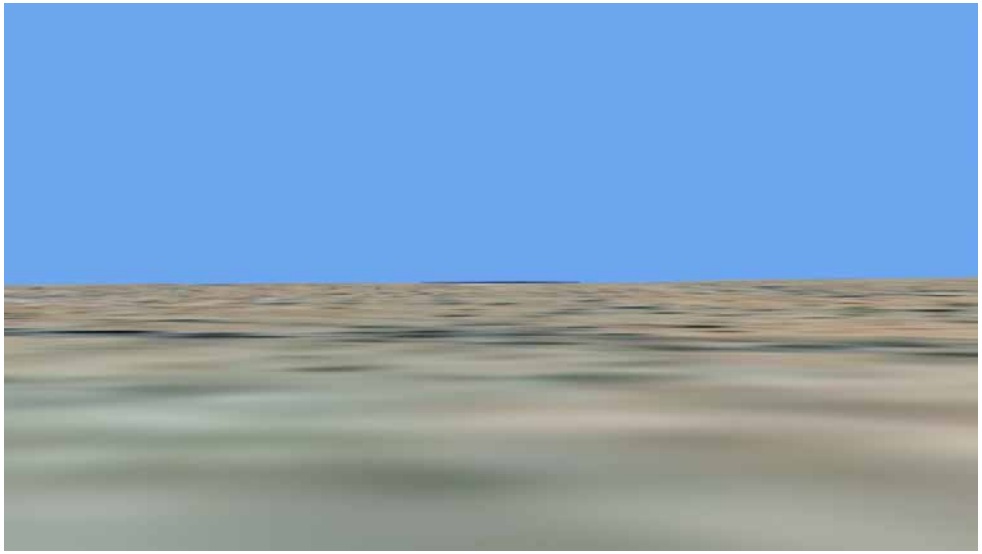


Viewpoint 7 - Render from park road 1 – Site 2 visible adjacent to Moon Rock (7200m)

Viewpoint 8 - Render from park road 1 – site 2 visible (5900m)



Viewpoint 9 - Render from park road 2 – Site 1 visible (3650m)



Viewpoint 10 - Render from park road 2 – Site 1 visible (4200m)

4 VISUAL IMPACT ASSESSMENT

4.1 VIEWSHED AND VISIBILITY OF SITE

The "viewshed" refers to the theoretical outer-most extent or area from which a site can be seen. It must, however, be remembered that visibility may be obscured in reality by objects within the viewshed such as existing buildings, trees, lower ridges, outcrops and other topographical or natural features, and also by distance where an object can visually blend into its background or be completely lost to sight.

See Figures 7 and 8

The viewshed is often determined by ridgelines or other physical features in the landscape which prevent any views from beyond a certain point. This is called a defined viewshed and, as with a watershed which determines the direction of flow of water, a development will be visible from one side of this type of viewshed but not from the other. This kind of viewshed can be defined by a line on a map.

Except for a limited area along the ridgelines to the north of the Orange River this kind of viewshed does not apply to this project.

A second type of viewshed is called an indeterminate viewshed. This is when, due to the lack of defining features in the landscape, the development may become partially or totally visible from many points scattered across the landscape but there are also many points within the same landscape from which the development will not be visible. This type of viewshed is normally applicable to undulating landscapes such as the one surrounding the site. With an indeterminate viewshed the main factor defining the boundaries of the viewshed is distance and this is closely related to the height and bulk of the development. A development that hugs the landscape will be lost to view sooner than one that stands out from the landscape.

The viewshed of the proposed development is indeterminate in that partial or complete views of the facility will be possible from some of the more elevated points within the landscape but the natural undulations of the land and local vegetation will hide the development from view over most of the area in which these views from elevated viewpoints are possible.

The viewshed for each site has been calculated for each of its corner points, hence four viewshed images for each site. It will be noticed that each corner has a slightly different viewshed. This is because of the different heights of the individual corners, and also the relationship of the corners to the various screening elements within the landscape.

The red shading in the Figures 7 and 8 shows the areas from which the facility will be potentially visible although in many areas views will not in fact be experienced. It is important to note, for example, that the areas around the tourist facilities in the park are shaded for site 2 and therefore potential views of the site exist from this area, however, in reality, the local vegetation, boulders, etc. limit any views outside of the visitors area and it is highly unlikely that any significant visual impact associated with the development will occur despite the red shading.

Two additional factors affect the determination of the viewshed for this particular project.

- The limited height of the arrays will help to limit the number of viewpoints from which the facility is significantly visible, and also increases the screening effect of the local vegetation and topography. A development of greater height would stand out more from the landscape. This also limits the distance over which significant views will be possible.
- The fact that most views are on approximately the same horizontal plane as the arrays, only being slightly above or below their level, means that most views of the facility will only be of the edge of the arrays. This limits the percentage of the overall view from any viewpoint which is affected.

A comparison of the two sets of viewshed images in Figures 7 and 8 shows clearly that the viewshed for site 1 is considerably smaller than for site 2 and that site 1 will have potentially far less effect on areas within the park.

The unmitigated usage of lighting at night could increase the area of visual influence, and therefore the viewshed, considerably. Under certain atmospheric conditions the reflection of any light escaping upwards will be visible over a wider area, especially when there is low cloud cover, even if the light sources are not seen. This will be exacerbated by that fact that there few other light sources in the vicinity. The strict control of lighting is therefore essential.

4.2 ASSESSMENT

4.2.1 EXTENT OF THE IMPACT

This assessment measures the extent of geographical area that will be impacted by the development.

Extent of Visual Impact	
Rating	*Definition of Rating*
Site Specific	*Very small extent of visual influence – usually limited to the site*
Local	*Limited to the site and immediate surrounding area (1-5km)*
Sub Regional	*The visual influence covers a greater area (6-10km)*
Regional	*The influence covers an area that includes an entire geographic region or allows the visual impact to be extend beyond one region into another*
National	*The visual impact can be experienced across national boundaries and has national implications.*

The extent of the visual impact is considered sub-regional as no significant views of the facility should occur beyond 10 km from the site. This is mainly as a result of the limited height of the facility and the fact that there are no viewpoints in the terrain that are significantly higher than the development allowing for views onto the entire 20 ha. facility.

Table 4.1 Extent of Impact

	Construction	**Operational**	**Night***
No Development Alternative	-	-	-
Development Alternatives	sub-regional	sub-regional	sub-regional

*The night time column is included to assess the potential affect of any lighting at night.

4.2.2 ZONES OF VISUAL INFLUENCE

This assessment describes the significant areas within the viewshed from which the development may be visible and estimates the degree to which these areas will be visually influenced.

Zones of Visual Influence – estimate of visibility	
Rating	*Definition of Rating*
Low	*The proposed development will only be partially and or, (in the case of movement along roads etc.) intermittently visible and take up a relatively small percentage of the overall vista.*
Medium	*The proposed development will be readily visible but its visual influence will be limited by distance, compatibility etc.*
High	*The entire or a large portion of the proposed development will be visible in a way that seriously changes the visual nature of the area when viewed from the identified viewpoints.*

4.2.2.1 The R359

The most significant view of the facility on both sites will occur along the R359 when approaching the facility in either direction and immediately adjacent to the facility.

View of both sites will be from slightly below for both sites on the east/west leg of the road and for approximately the same elevation for site 1 on the north/south leg of the road. This means that only the leading edge of the facility will be visible and only the support structures and undersides of the panels will be visible as views are from the south and the west. This is true for both the fixed axis panels and the single axis tracking panels for site 2 and site 1 in the morning, but for site 1 the panels will face onto the north/south leg of the road in the afternoon as they track the sun to the west.

From most viewpoints the facility will be seen on the skyline and this will raise the visual influence, however, the minimum distance of the viewer of approximately 300m to site 2 and 500m to site 2 helps to lower the visual influence.

The new entrance road to either of the sites will be readily visible at it junction with the R359 and the 22kV lines linking the facility to the grid will also be clearly visible adjacent to the road and crossing it near the Blouputs substation. The transmission lines for site 2 are longer than for site 1, (approximately 3.3km as opposed to 1,5km,) and therefore the visual impact of the lines for site 2 will have a higher visual influence than site 1.

The water pipeline along the verge of the road should only be visible during the construction phase provided that the installation scars are rehabilitated.

The security lighting and any other lighting on either site, when in use, could raise the visual influence on the road at night unless strict mitigation measures are applied.

Table 4.2 - Zones of Visual Influence – The R359

Alternative	Distance	Mitigation	Construction	Operational	Night
No development Alternative	-	-	-	No visual influence	-
Site 1	±300m	Without mitigation	Low to High*	Low to high	High
		With mitigation	Low to High	Low to Medium	Low
Site 2	±500m	Without mitigation	Low to High	Low to high	High
		With mitigation	Low to High	Low to Medium	Low

***** This depends on the position of the viewer

4.2.2.2 The Visitor facilities in the park and surrounding areas

The viewshed diagrams show that site 1 will not be visible from the areas around the visitor facilities in the park and therefore site 1 will have no visual influence on this area.

Site 2 is potentially visible from any elevated points within this area however significant views are unlikely due to the screening nature of the local topography and vegetation. (See Figure 13 viewpoint 7.) Any potential views are also mitigated by the distance of more than 6km to the site.

The site will not be visible anywhere along the river's edge at the falls.

Table 4.3 - Zones of Visual Influence – Visitor facilities in the park and surrounding areas

Alternative	Distance	Mitigation	Construction	Operational	Night
No development Alternative	±6km and further	-	-	No visual influence	-
Site 1		Without mitigation	Not visible	Not visible	Low
		With mitigation	Not visible	Not visible	Not visible
Site 2		Without mitigation	Low	Low	Low
		With mitigation	Low	Low	Not visible

4.2.2.3 The View sites within the park (Moon Rock and view site adjacent to Ararat road)

Site 1 will not be visible from any of the viewpoints associated with the readily accessible areas of the park including from Moon Rock and the view site adjacent to the Ararat road.

Site 2 will be visible from both the Moon Rock viewpoint at a distance of 5,8km and the Ararat viewpoint at a distance of 4,4km. Only the leading edge of the development will be visible on the skyline.

Due to the low nature of the facility the intervening vegetation will go a long way to mitigating its visibility.

The transmission lines for both sites will be marginally visible against the backdrop of the existing lines around the Blouputs substation. Distance will mitigate these views.

Table 4.4 - Zones of Visual Influence – The View sites within the park (Moon Rock and adjacent to Ararat)

Alternative	Distance	Mitigation	Construction	Operational	Night
No development Alternative	±4.4km and further	-	-	No visual influence	-
Site 1		Without mitigation	Not visible	Not visible	Low
		With mitigation	Not visible	Not visible	Not visible
Site 2		Without mitigation	Low	Low	Medium
		With mitigation	Low	Low	Low

4.2.2.4 Roads within the park

Site 1 will not be visible from 'park road 1' which includes the access to Moon Rock and Ararat.

Site 2 will be partially visible over a short distance when approaching the Moon Rock turnoff at a distance of approximately 5km. It will be seen on the skyline but it is likely that the vegetation adjacent to the site will mitigate these views considerably. (See Figure 8 and Viewpoint 8)

Site 2 will not be visible from Park Road 2 but there is a stretch of approximately 400m along park road 2 near the point where it crosses the north/south leg of the R359 where site 1 will be visible against the skyline. (See Figure 7 and Viewpoints 9 and 10)

Table 4.5 - Zones of Visual Influence – Roads within the park

Alternative	Distance	Mitigation	Construction	Operational	Night
No development Alternative	±5km and further	-	-	No visual influence	-
Site 1		Without mitigation	Low	Low	Medium
		With mitigation	Low	Low	Low
Site 2		Without mitigation	Low	Low	Medium
		With mitigation	Low	Low	Low

4.2.2.5 Areas to the south and west of the site

Partial views of both of the alternative sites will be possible from the more elevated areas of the farm land to the south and the west of the sites with the most views of site 2 being restricted to the south and views of site 1 occurring in both the south and the west.

These views are not anticipated to be significant as under normal circumstance there will be no viewers in these areas.

Table 4.6 - Zones of Visual Influence – Areas to the south and west of the site

Alternative	Distance	Mitigation	Construction	Operational	Night
No development Alternative	±500m and further	-	-	No visual influence	-
Site 1		Without mitigation	Low	Low	Medium
		With mitigation	Low	Low	Low
Site 2		Without mitigation	Low	Low	Medium
		With mitigation	Low	Low	Low

4.2.2.6 Augrabies agricultural areas

Site 1 will not be visible to any of the agricultural areas to the west at Augrabies but partial views of site 2 may be possible from a limited number of elevated viewpoints. At a distance of more than 4km and further none of these views is expected to be significant.

Table 4.7 - Zones of Visual Influence – Augrabies agricultural areas

Alternative	Distance	Mitigation	Construction	Operational	Night
No development Alternative	±4km and further	-	-	No visual influence	-
Site 1		Without mitigation	Not visible	Not visible	Not visible
		With mitigation	Not visible	Not visible	Not visible
Site 2		Without mitigation	Low	Low	Medium
		With mitigation	Low	Low	Low

4.2.2.7 Other areas

Views of both sites will be possible from some of the ridgelines within the park to the north of the Orange River at a minimum distance of 10km. None of these views is expected to be significant as the ridgelines are not of a sufficient height to allow for views down onto the facility and therefore the foreshortening will limit the perceived scale of the development.

Table 4.8 - Zones of Visual Influence – Other areas

Alternative	Distance	Mitigation	Construction	Operational	Night
No development Alternative	±10km and further	-	-	No visual influence	-
Site 1		Without mitigation	Low	Low	Low
		With mitigation	Low	Low	Low
Site 2		Without mitigation	Low	Low	Low
		With mitigation	Low	Low	Low

4.2.3 VISUAL ABSORPTION CAPACITY OF THE AREA

This assessment rates the area surrounding the project in terms of its basic landscape character with respect to its ability to visually absorb the proposed project.
*This concept is closely linked to the concept of compatibility with the surrounding landscape, but the emphasis is on the **area's** ability to absorb the development and **not** on the **development's** ability to fit into the surroundings*

Visual Absorption Capacity	
Rating	*Definition of Rating*
Low	*The landscape is very sensitive to alterations in its visual nature*
Medium	*The landscape can visually absorb small to medium sized alterations in its character.*
High	*The landscape can visually absorb medium to large changes in its character.*

***Note**: In this category 'low' is considered problematic and 'high' is considered desirable.*

The visual absorption capacity of the local landscape in the area immediately surrounding the site is low although the local vegetation will have somewhat of a mitigating affect. The development will be more easily absorbed within the larger area as a result of the undulations of the landscape and the relatively low nature of the installation.

Table 4.9 - Visual Absorption Capacity

Alternative	Mitigation	Construction	Operational	Night
No development Alternative	-	-	High	-
Site 1	Without mitigation	Low	Low	Low
	With mitigation	Low	Medium-low	Low
Site 2	Without mitigation	Low	Low	Low
	With mitigation	Low	Low	Low

4.2.4 COMPATIBILITY WITH THE SURROUNDING LANDSCAPE

*This assessment evaluates the extent to which the **proposed development** conforms to usages in the surrounding landscape. Important to this assessment are the concepts of sameness, scale, diversity, texture, colour etc.*

Compatibility with surrounding Landscape	
Rating	*Definition of Rating*
High - Appropriate	*The proposed development fits in well with the type and style of the surrounding landscape and no new or different elements are introduced.*
Medium - Moderately Appropriate	*The proposed development can blend into the surrounding landscape but its type and style may be different and new elements are introduced but not in a jarring way.*
Low - Inappropriate	*The proposed development is at odds with the type and style of development in the surroundings, and new and jarring elements are introduced*

***Note**: In this category 'low' is considered problematic and 'high' is considered desirable.*

In general the facility will not be compatible with the agricultural and natural visual aspects of the surrounding landscape, however, this is mitigated by the presence in the local visual environment of the Blouputs substation and the power lines that connect to it.

The transmission lines will be seen in the context of the existing lines and therefore although the number of lines will be increased, no new visual elements will be added to the landscape by their installation.

Table 4.10 - Compatibility with the Surrounding Landscape

Alternative	Mitigation	Construction	Operational	Night
No Development Alternative	-	-	High	-
Development alternatives	Without mitigation	Low	Low	Low
	With mitigation	Low	Medium	High

4.2.5 INTENSITY OF VISUAL IMPACT

This assessment refers to the intensity with which the visual nature of the landscape will be altered.

Intensity of Visual Impact	
Rating	*Definition of Rating*
Low	*The sense of place and visual functions of the area are negligibly altered and the perceived character of the area is not qualitatively changed.*
Medium	*The sense of place and visual functions of the area are altered and the perceived visual character of the area is altered but not in an unacceptable way.*
High	*The sense of place and visual functions of the area are severely altered in a way that changes the perceived character of the area.*

4.2.5.1 The R359

The sections of the road adjacent to each site will experience a high intensity visual impact but this will drop of as the view moves away from the sites.

The transmission lines will add to the intensity of the visual impact and the longer lines required for site 2 mean that the intensity of the impact will be spread over a greater area for site 2 when compared to site 1.

Table 4.11 - Intensity of Visual Impact – The R359

Alternative	Distance	Mitigation	Construction	Operational	Night
No development Alternative	-	-	-	No visual influence	-
Site 1	±300m	Without mitigation	Low to High*	Low to high	High
		With mitigation	Low to High	Low to Medium	Low
Site 2	±500m	Without mitigation	Low to High	Low to high	High
		With mitigation	Low to High	Low to Medium	Low

** This depends on the position of the viewer*

4.2.5.2 The Visitor facilities in the park and surrounding areas

Only site 2 has the potential to have a visual impact on this area and the intensity of that impact will be low to very low.

Table 4.12 - Intensity of Visual Impact – Visitor facilities in the park and surrounding areas

Alternative	Distance	Mitigation	Construction	Operational	Night
No development Alternative	±6km and further	-	-	No visual influence	-
Site 1		Without mitigation	Not visible	Not visible	Low
		With mitigation	Not visible	Not visible	Not visible
Site 2		Without mitigation	Low	Low	Low
		With mitigation	Low	Low	Not visible

4.2.5.3 The View sites within the park (Moon Rock and view site adjacent to Ararat road)

The intensity of the visual impact on these areas will be raised by the fact that the visual nature of he facility has no precedent within the landscape. This only applies for site 2.

Table 4.13 - Intensity of Visual Impact – The View sites within the park (Moon Rock and adjacent to Ararat)

Alternative	Distance	Mitigation	Construction	Operational	Night
No development Alternative	±4.4km and further	-	-	No visual influence	-
Site 1		Without mitigation	Not visible	Not visible	Low
		With mitigation	Not visible	Not visible	Not visible
Site 2		Without mitigation	Medium	Medium	Medium
		With mitigation	Low	Low	Low

4.2.5.4 Roads within the park

Although the assessment is the same for both sites the areas that are affected by each site are different. Site 1 will affect an approximately 400m stretch of park road 2 and site 2 will affect a similar length of park road 1. In both instances the facility will be seen against the skyline thereby raising the intensity of the visual impact.

Table 4.14 - Intensity of Visual Impact – Roads within the park

Alternative	Distance	Mitigation	Construction	Operational	Night
No development Alternative	±5km and further	-	-	No visual influence	-
Site 1		Without mitigation	Medium	Medium	High
		With mitigation	Medium	Medium-low	Low
Site 2		Without mitigation	Medium	Medium	High
		With mitigation	Medium	Medium-low	Low

4.2.5.5 Areas to the south and west of the Site

From most of these areas the facility will be seen against the backdrop of the hills to the north of the Orange River thereby lowering the intensity of the visual impact

Table 4.15 - Intensity of Visual Impact – Areas to the south and west of the site

Alternative	Distance	Mitigation	Construction	Operational	Night
No development Alternative	±500m and further	-	-	No visual influence	-
Site 1		Without mitigation	Low	Low	Medium
		With mitigation	Low	Low	Low
Site 2		Without mitigation	Low	Low	Medium
		With mitigation	Low	Low	Low

4.2.5.6 Augrabies agricultural areas

Only site 2 has the potential for visual impacts in this area and the intensity is expected to be low.

Table 4.16 - Intensity of Visual Impact – Augrabies agricultural areas

Alternative	Distance	Mitigation	Construction	Operational	Night
No development Alternative	±4km and further	-	-	No visual influence	-
Site 1		Without mitigation	Not visible	Not visible	Not visible
		With mitigation	Not visible	Not visible	Not visible
Site 2		Without mitigation	Low	Low	Medium
		With mitigation	Low	Low	Low

4.2.5.7 Other areas

Distance to the viewpoints north of the Orange River, 10km and further, will serve to limit the intensity of the visual impact on these viewpoints.

Table 4.17 - Intensity of Visual Impact – Other areas

Alternative	Distance	Mitigation	Construction	Operational	Night
No development Alternative	±10km and further	-	-	No visual influence	-
Site 1		Without mitigation	Low	Low	Low
		With mitigation	Low	Low	Low
Site 2		Without mitigation	Low	Low	Low
		With mitigation	Low	Low	Low

4.2.6 DURATION OF VISUAL IMPACT

This assesses the visual impact in terms of the lifespan of the development and therefore the lifespan of the visual impact.

Duration of Impact	
Rating	*Definition of Rating*
Temporary	*Change will occur but the timing is unknown*
Short-term	*Up to 3 years*
Medium-term	*3 to 15 years*
Long-term	*More than 15 years*
Permanent	*The nature of the impact is such that it will be irreversible over time.*

The duration of visual impacts associated with the construction phase will be short-term.

The duration of visual impacts associated with the operational phase will be long-term. It will not be permanent as it will be possible to reverse the visual impact should the facility be decommissioned.

4.2.7 SENSITIVITY OF THE VIEWERS

This rating seeks to categorise the potential viewers and describe the effect that the proposed development will have on their experience of the visual environment.

Only two categories of viewers will be affected by the implementation of the facility.

- The local inhabitants. Only the limited number of inhabitants whose farms have views of the facility, and those who use the R359 to access the farms along the western reaches of the Orange River will be affected. In general those who live in the agricultural areas of Augrabies itself will not be affected on a day to day basis. There is little tourist traffic on the R359.
- Visitors to the area, specifically those who come to experience the Augrabies Falls National Park. There viewers will be sensitive to the presence in the landscape of an industrial type development which has no other precedent within the surrounding areas.

The overall sensitivity of the viewers is assessed as low for the local inhabitants and high for the visitors to the park.

This assessment category, in terms of this particular development, plays an important role in increasing the overall significance of the visual impact.

4.2.8 OVERALL SIGNIFICANCE OF THE VISUAL IMPACT

This rating combines the ratings for the extent of the impact, the duration of the impact, the intensity of the impact and the sensitivity of the viewers to arrive at a rating for the impact as a whole.

It is very difficult to arrive at a single overall significance rating for a project of this type. This rating is based on the ratings in the sections preceding this one, but also on the experience of the independent visual specialist. There will always be a limited number of viewpoints within the viewsheds from which the ratings in the table below may be considered too high or too low.

The overall significance of the visual impact during the construction phase is assessed as being high for both alternatives as the unexpected nature of the construction activities will draw the attention of any viewers whereas during the operational phase the facility should eventually become an accepted part of the overall visual environment.

Table 4-18 – Overall Significance of Visual Impact

Alternative	Mitigation	Construction	Operational	Night
No development Alternative	-	-	Low	-
Site 1	Without mitigation	High	Medium	High
	With mitigation	Medium-high	Medium-low	Low
Site 2	Without mitigation	High	Medium-high	High
	With mitigation	Medium-high	Medium	Low

4.2.9 STATUS OF THE VISUAL IMPACT

This assessment rates the estimated perception of the development by viewers in terms of being positive, neutral, or negative.

The usual reaction to the sight of any new development, especially by those who know an area well, is negative, and that is likely to be the initial reaction to the proposed development by the viewers who use the R359, however, it is believed that, with time, the facility will become part of the accepted landscape and achieve a neutral status for users of the road even though it is unlikely that it will be viewed as visually positive by any of them.

Those visitors who will be able to view the facility from within the park generally will not have expectations of what the views from the park include and so the views of the facility will not register as something new within the visual environment but rather as one more visual element in a very complex vista.

The sites are a long way from the viewpoints within the park and are set in a landscape that, in views towards the south, has evidence of significant human activity, including the power lines, the Blouputs substation and the covered vineyards. Views of the facility will therefore affect the sense of place but not be entirely unexpected. For most visitors to the park the view of the facility should therefore be neutral.

The limited views, especially of site 1 which does not affect the major viewpoints in the park, could be viewed by many of the visitors as a positive step towards creating a more ecologically sound environment.

4.2.10 REVERSIBILITY

Provided that the basic landform is not altered by large scale earthworks the visual impacts will be entirely reversible and the land can be returned to its original visual status. This is of course dependant on the prevention of any future activities on site that could have long-term negative visual implications.

4.2.11 PROBABILITY OF THE IMPACTS OCCURRING

This quantifies the probability of the impact occurring as described in the text.

Probability of Occurrence	
Improbable	*<40% chance of occurring*
Possible	*40%-70% chance of occurring*
Probable	*>70% to 90% chance of occurring*
Definite	*>90% chance of occurring*

It is probable that the visual impacts described in this report will occur.

4.2.12 CONFIDENCE IN THE ASSESSMENT

This states the level of confidence that the visual assessor has in the assessments above. It is possible that, because of such factors as the availability or quality of the input data, the assessor may have more confidence in certain assessments than in others.

Confidence in the Assessments	
Low	*Data is insufficient or unavailable and further input may change the assessment*
Medium	*Some data is inadequate or unavailable but it is unlikely that the assessment will change significantly.*
High	*The available data is detailed and accurate leading to high confidence in the assessments*

The confidence in the findings of this report is medium-high provided that the eventual development stays within the parameters described above. Any significant changes to the layout, number of structures, or their architectural character could invalidate the findings of this report.

4.3 CUMULATIVE IMPACTS

The solar facility will represent an incremental increase in the 'industrial' elements in the overall landscape. These are represented at present by the Blouputs substation and the power lines that cross the area.

It is believed that the facility will not seriously affect the sense of place and change the balance in the visual environment in a way that is unacceptable, but the cumulative effect of any increase in the coverage of the facility, or the addition of other such installations in the area could have a seriously detrimental effect and change the sense of place in an unacceptable way.

It is therefore recommended that, should the project be authorized, it be done so on the condition that the facility not be expanded at a later stage.

4.4 REFLECTION OF SUNLIGHT INTO THE AUGRABIES FALLS NATIONAL PARK

The possibility exists that at certain time of the year parts of the park may be affected by concentrated reflected sunlight off the solar panels. This will draw the attention of those who experience it to the facility and there will be a temporary very high visual impact of short duration which in its nature is foreign to the visual environment.

This potential impact will only occur with the fixed arrays which, as a result of their facing north, could reflect light back at the complimentary angle to the angle of the sunlight striking the surface of the panels. The effect will however only be experienced in areas that fall within the viewshed and if site 1 is used, this area will be very limited.

The use of the single axis tracking arrays would obviate this problem as all complimentary angles to the sun in the north would be south of the site and therefore not affect the park to the north.

It is therefore recommended that the single axis tracking arrays be used if technically feasible.

5 RECOMMENDED MITIGATION MEASURES

5.1 GENERAL PRINCIPLES

These general principles inform the mitigation measures in the sections below, but have also been included to cover any unforeseen situations over the life of the facility which cannot be known at present but may have visual implications at a later stage in the life of the facility.

- The visual impact must always be taken into account when contemplating any activities or development on the site. Concern for visual issues must become part of the overall ethos of managing the site.
- The treatment of any visual issues must be seen as being long-term so as to avoid incremental visual degradation of the site over time.
- The ability to leave the site as close to its present state as possible should the facility be decommissioned must inform all planning, construction and operational criteria.

5.2 DESIGN PHASE

- Site 1 is to be used as it has a far smaller viewshed that site 2 and will have less visual impact on the surrounding terrain including specifically the park.
- Once the final layout of the site is determined, especially if it is moved from the position assessed in this document, the viewshed must be rechecked for potential visual impacts on the park. No construction should be allowed before this has been done.
- The single axis tracking arrays are to be preferred, if technically feasible, as the north/south orientation of the arrays will ensure that there are no reflection impacts on the park to the north.
- All structures are to be kept as low as possible in the landscape.
- The use of concrete is to be kept to a minimum as this will facilitate better decommissioning.
- The gate along the R359, and any signage, is to be in line with local usages and not draw attention.
- All colours and finishes used for the building, water tanks and fence etc. should be specifically chosen for their ability to blend into the surrounding landscape. i.e. white and bright greens are not to be used. Unpainted galvanizing of the metal components, once it has weathered, will blend well into the environment. (This excludes the solar panels the colour of which is fixed.)
- Excavation on the site is to be kept to the absolute minimum required for the successful implementation of the project.
- The fencing design is to imitate the agricultural fencing in the area while at the same time providing the security that is necessary. It is to be visually permeable. No barbed wire is to be used with preference being given to a visually acceptable electronic means of security which has a lower visual impact.
- Any necessary lighting must be shielded in such a way that no direct light is allowed to escape into the surrounding terrain or up into the sky. Only the areas that are necessary to

be lit must be lit, the surrounding terrain being protected from any light pollution. (See Addendum 2 for the general principles involved.)

- Partial screening of the facility in response to specific visual impacts that are identified by the park once the facility is finished can be achieved by the planting of groups of endemic trees in the terrain between the site and the identified viewpoint at points where the optimal mitigation is achieved. These are to be placed in-situ with input from a suitably qualified person who understands the local vegetation. Once the trees are established there should be no need for any form of irrigation. The aim of this measure must be to break the perceived scale of the facility rather than to hide it.
- The planting of tree lines should be avoided as this could result in a higher visual impact than that of the facility itself and it could be difficult, in view of the depth and paucity of the soil in places, to maintain them successfully over time.
- It is suggested that as part of the management plan a link be established with the park which can be used to address any visual issues as they arise and find mutually acceptable solutions.

5.3 CONSTRUCTION PHASE

- A photographic record of the site and its immediate surrounding area must be kept as part of the EMP to serve as a baseline for measurement of all future visual impacts and as an aid to the full rehabilitation of the site should the facility be decommissioned in future.
- The disturbance of the natural environment is to be kept to within the 20 ha. boundary of the site. To this end the lay-down areas should be accommodated within the areas that are to be covered by the arrays that have not yet been installed.
- All areas where disturbance of the existing environment is not necessary are to be marked or fenced off and access to these areas by the construction crews is to be prohibited. This includes the avoidance of the creation of short-cut paths across any watercourse areas within the site that are to be preserved.
- All topsoil on areas that are to be disturbed, such as the roads and building footprint, is to be stockpiled or spread in such a way that it can be reclaimed in the event of decommissioning.
- All stockpiles necessary for the construction of the facility, such as cement and other building materials, diesel etc., must be prevented from entering the natural environment by any means whatsoever including dispersion by wind or water.
- Care must be taken to limit the unintentional importation of alien plants with the building material or on the transport used. Alien infestations can have serious long-term visual implications not only on the site, but further afield, if the seeds are allowed to disperse into the environment, especially along the water courses.
- All littering is to be strictly controlled. The existing environment does not appear to have any problems with litter but the dispersion of plastic waste such as chip packets and soda cans could have a long-term negative visual effect on the surrounding environment.
- All areas that need to be disturbed in the construction process but are not required during the operation of the facility must be rehabilitated as soon as possible after their use is no longer needed. This includes any trench areas for the water pipe and the areas disturbed by the installation of the pylons.
- The use of fire by the construction workers is to be strictly controlled so that veldt fires are prevented. These could have a significant short-term visual impact if allowed to occur.

5.4 OPERATIONAL PHASE

- Littering is to be strictly controlled over the entire life of the project.
- All waste is to be regularly removed from facility to a recognized dumping site. Waste, in any form, should not be allowed to collect on the site.
- The use of any cleaning materials or defoliants to aid in the control of vegetation is to be strictly monitored so that their long-term use does no cause future problems should the site be decommissioned.
- The use of lighting is to be monitored over the entire life of the project so as to minimise light pollution. (See note on lighting in section 5.2 'Design Phase' above.)
- A strict fire prevention policy must be implemented and monitored.

5.5 DECOMMISSIONING PHASE

- The site is to be returned to as near as its existing visual state as is possible.
- All waste material is to be removed from site.

6 CONCLUSION AND RECOMMENDATIONS

The visual analysis has clearly shown that placing the facility on site 1 will have significantly less of a visual impact, especially on those areas of the Augrabies Falls National Park that are regularly frequented by visitors, than if the facility were placed on site 2. Site 1 is therefore the preferred site of the two in terms of visual issues. This is reinforced by the fact that the transmission line for connection to the grid will also be far shorter and therefore incur less of a visual impact.

While the sense of place in the area will be affected by the inclusion of an 'industrial' element in the overall visual environment where at present there is no precedent, it is believed that this change is within acceptable limits. The reasons for this are as follows:

- The facility will become another element in a complex visual environment that includes evidence of much human activity, (including the netted vineyards which are very similar in form and height to the facility although differ in colour and reflectivity.) The visual environment that will be affected is not a pristine one.
- While the facility will cover an extensive area, at no point will it be seen in its entirety, with most significant views being of its edge, or from slightly below. This limits the visual exposure of the facility.
- The percentage of the overall view from the viewpoints in the park that will be affected is relatively small and although the facility will be seen on the skyline from some of these viewpoints, its low and topography-hugging nature means that the natural integrity of the landscape will not be seriously compromised.
- The relatively limited height of the facility of approximately 2,5m maximum will limit the visual impact and, together with the points above, allow the local vegetation and topography to afford some screening.
- The relatively long distance between the site and the significant viewpoints, except for those along the R359, will help to mitigate the visual impact and lower its intensity.
- The potential problem of reflected light onto the park, which is inherent in the use of fixed arrays, can be overcome by the use of single axis tracking arrays.
- Once the facility is constructed there will be no additional visual impacts related to its operation such as emissions or the production of waste.
- The visual impact should be entirely reversible over time should the facility be decommissioned.

There is little that can be done in terms of complete shielding of the facility from the surrounding landscape but the implementation of the mitigation measures will ensure that all visual impacts are managed and kept to a minimum. The most important of these are the use of site 1 rather than site 2, and the implementation of the single axis tracking arrays if technically feasible.

The rural night time experience must be maintained and to this end it is important that the lighting mitigation measures be implemented in full and that they are also included in the Environmental Management Program so that they will be applied into the future.

Due to the sensitivity of the site and some of the potential viewers, the overall significance of the visual impact for site 1 is assessed at medium-low with full mitigation. This is considered acceptable within the local context.

In terms of visual issues it is therefore recommended that the development be allowed to proceed provided that mitigation measures are implemented in full and that a final check of the viewshed is done once the final siting and design of the facility is complete to check that it still falls within the findings of this report.

ADDENDUM 1

Lighting Pamphlet

Good Neighbor OUTDOOR LIGHTING

PRESENTED BY THE NEW ENGLAND LIGHT POLLUTION ADVISORY GROUP (NELPAG) AND SKY PUBLISHING CORP.

What is good lighting?

Good outdoor lights improve visibility, safety, and a sense of security, while minimizing energy use, operating costs, and ugly, dazzling glare.

Why should we be concerned?

Many outdoor lights are poorly designed or improperly aimed. Such lights are costly, wasteful, and distractingly glary. They harm the nighttime environment and neighbors' property values.

Glare Here's the basic rule of thumb: If you can see the bright bulb from a distance, it's a bad light. With a good light, you see lit ground instead of the dazzling bulb. "Glare" is light that beams directly from a bulb into your eye. It hampers the vision of pedestrians, cyclists, and drivers.

Light Trespass Poor outdoor lighting shines onto neighbors' properties and into bedroom windows, reducing privacy, hindering sleep, and giving the area an unattractive, trashy look.

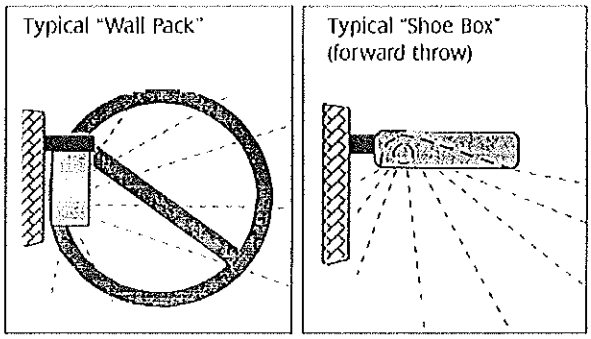
Energy Waste Many outdoor lights waste energy by spilling much of their light where it is not needed, such as up into the sky. This waste results in high operating costs. We waste over a billion dollars a year in the United States needlessly lighting the night sky.

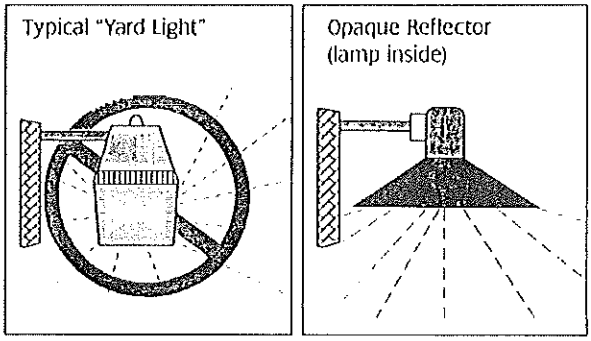
Sky Glow Rays that beam uselessly above the horizon create murky skyglow – the "light pollution" that washes out our view of the stars.

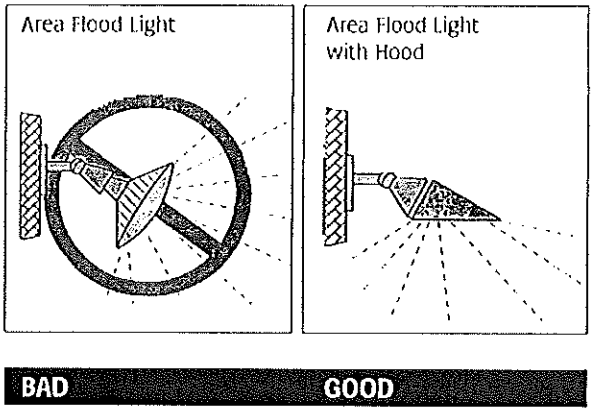
How do I switch to good lighting?

1 Provide only enough light for the task at hand; don't over-light, and don't spill light off your property. Specifying enough light for a job is sometimes hard to do on paper. Remember that a full Moon can make an area quite bright. Some lighting systems illuminate areas 100 times more brightly than the

Some Good and Bad Light Fixtures







full Moon! More importantly, by choosing properly shielded lights, you can meet your needs without bothering neighbors or polluting the sky.

2. Aim lights down. Choose "full-cutoff shielded" fixtures that keep light from going uselessly up or sideways. Such fixtures produce minimum glare. They create a pleasant-looking environment. They increase safety because you see illuminated people, cars, and terrain, not dazzling bulbs.
3. Install fixtures carefully to maximize their effectiveness on the targeted area and minimize their impact elsewhere. Proper aiming of fixtures is crucial. Most are aimed too high. Try to install them at night, when you can see where all the rays actually go.

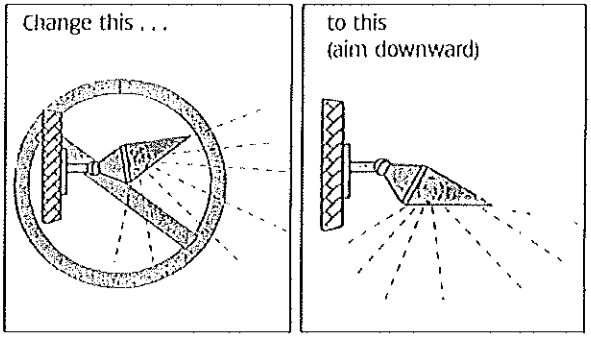
Properly aimed and shielded lights may cost more initially, but they save you far more in the long run. They can illuminate your target with a low-wattage bulb just as brightly as a wasteful light does with a high-wattage bulb.

4. Choose energy-efficient low-pressure sodium (LPS) or high-pressure sodium (HPS) lamps wherever yellowish light will do the job. Use less efficient white lights only where ideal color rendition is important.
5. Where feasible, put lights on timers to turn them off each night after they are no longer needed. Put home security lights on a motion-detector switch, which turns them on only when someone enters the area; this provides a great deterrent effect!

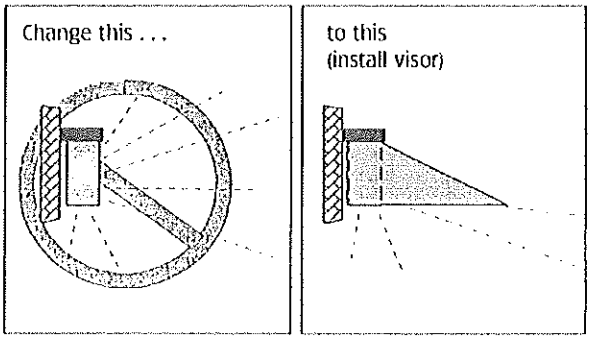
Replace bad lights with good lights.

You'll save energy and money. You'll be a good neighbor. And you'll help preserve our view of the stars.

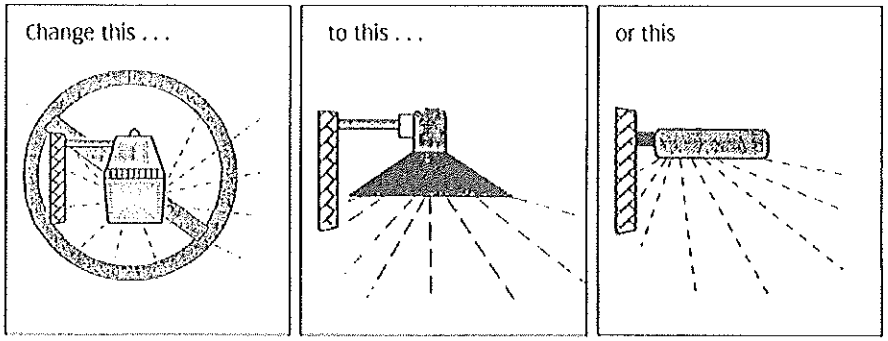
What You Can Do To Modify Existing Fixtures



FLOOD LIGHT



WALL PACK



YARD LIGHT | OPAQUE REFLECTOR | SHOE BOX

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We urge all individuals and groups interested in the problems of light pollution and obtrusive lighting to support the IDA and subscribe to its newsletter. IDA membership costs $30 per year; send your check to IDA, 3225 N. First Avenue, Tucson, AZ 85719, U.S.A.

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