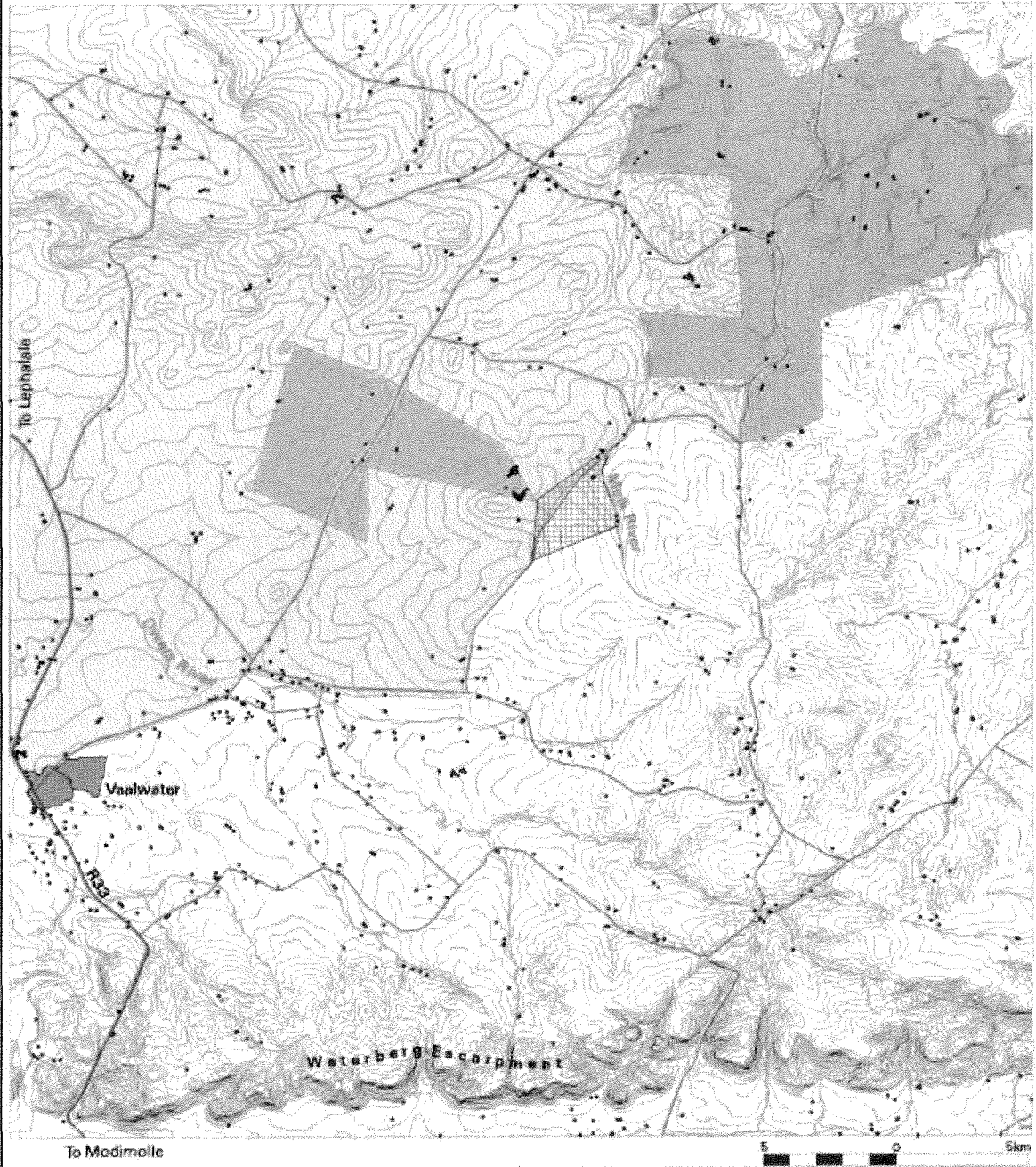












Proposed Thupela Waterberg Photovoltaic Plant



LEGEND

-  Farm identified for Photovoltaic Plant
-  Arterial Road
-  Secondary Road
-  Perennial River
-  Non-perennial River
-  Settlement/Homestead/Structure
-  Town/Built-up Area

-  Waterberg Biosphere Reserve
-  Buffer Zone
-  Transitional Area

Note:
Core (Moepel) area not shown on map
(i.e. it falls outside of the study area)



5.7.2 Waterberg Meander

Linked to the Waterberg Biosphere Reserve, is the Waterberg Meander Route which displays various tourist attractions, sites of interests (cultural geological and environmental), accommodation facilities and community projects. The main routes forming part of the Meander include the R33, R518, R510 and includes areas between Modimolle, Mokopane, Mookgophong, Vaalwater, Marken, and Lephalale (Waterberg Meander Vol. 1, 2009).

Tourist attractions in close proximity to the study area forming part of Waterberg Meander Route include the following:

- The church of St. John the Baptist at 24 Rivers designed by Sir Herbert Baker;
- The Elizabeth Hunter Studio at the E.A. Davidson Memorial Farm School on the farm Vier-en-Twintig-Riviere;
- The Vier-and-Twintig Riviere site of Internment where the British came upon a group of Boer women and children in 1901; and
- The Beadle craft workshop and shop on the farm Klipfontein employing locals from the farm Boschdraai (also referred to as Triple 'B' Ranch). The visitor centre also displays the history of the Baber family in the Waterberg, farms changing farming practices and the lives of the local communities. Essential oils produced on the farm can also be bought.

5.7.3 Game Farms

Various large game farms in the Waterberg area which play a significant role in the conservation and tourism sector include reserves such as Welgevonden, Lapalala Wilderness, Entabeni, Dinaka, and so forth. These establishments and reserves are not situated in close proximity to the proposed site for the PV facility.

5.7.4 Guest Farms and Lodges

For the purpose of the study, guest houses and guest farms are referred to as those accommodation facilities which are less expensive, situated on privately owned farms (less than 2 000 ha) where game and bird viewing, hiking, cycling and so forth forms part of the recreational activities that can be undertaken on the property. These guest houses are then also utilised as accommodation facilities by the property owners (temporarily or permanently).

According to the Waterberg Tourism Association, it is not compulsory for property owners operating accommodation facilities such as lodges to formally register their lodges with them. A formal definition of a lodge is thus not available. For the purpose of the study "lodges" are referred to as boutique lodges or hotels on large properties (larger than 2 000 ha) which can

accommodate various visitors at a time with the intention of catering for national and international visitors who seek holiday destinations hosting the "big five".

From information obtained during the study, it appears that the majority of property owners within close proximity to the site fall within the "guest farms" category.

5.7.5 *Hunting Establishments*

For the purpose of this report, hunting establishments refer to those private initiatives whereby foreign and local hunters visit private properties, mainly during the hunting season, to hunt game and who are then accommodated on the properties for the duration of their stay.

From the information obtained from the surrounding property owners, hunting activities are not undertaken on the properties in the study area and therefore no hunting establishments are located in close proximity to the site.

5.7.6 *Recreational activities and cultural tourism*

The main recreational activities that can be undertaken in the Waterberg area include game and bird viewing, horse riding or horseback safaris, cycling, hiking and so forth. These activities can also be undertaken on the properties in close proximity to the site, although only some are formally advertised such as Horizon Horseback Safaris.

Cultural tourism in the Waterberg refers to opportunities provided to tourists to engage with local communities in their authentic rural setting (Waterberg Meander Vol. 1, 2009). From information obtained the Lehlabile Cultural Tours are situated on the Sterkstroom Road in relative close proximity to the proposed site.

5.7.7 *Local ventures*

As indicated above the majority of the property owners surrounding the site can be referred to as "guest farms." Those guest farms larger than 800 ha in the direct vicinity of the site include the farm Sterkstroom KR 103 and a Portion of the farm Schoongezicht KR 107 (owner Mr. M. Jurgens), Remaining Extent of the farm Schoongezicht KR 107 (Mr. D. Breedt) and Vier-en-Twintig Rivier KR 102/2 (owner Mr. and Mrs. H. van Herwaarden).

The other guest farms in the study area are smaller than 800 ha but do contain game and provide accommodation facilities and thus game viewing opportunities.

Although the majority of property owners in the direct surrounding area to the site refer to their accommodation facilities as lodges, these are only referred to as accommodation facilities (guest houses) for the purpose of the SIA, as per the definition detailed in 5.7.4 above.

Local activities and ventures undertaken on the surrounding properties include the following:

Table 4: Local Activities and Ventures

Farm	Owner	Dwellings	Main Activities
Boschdraai KR 60/1	Mr. C. Baber	Private house Settlement with app. 350 people	Cattle farming
Sterkstroom KR 105 & 105/3	Mr. T. Eloff	Private house	Cattle farming Game
Sterkstroom KR 105/4	Mr. W. van Rooyen	One accommodation facility which can accommodate app. 60 individuals	Guest house Cattle farming Game and bird viewing
Sterkstroom KR 105/7	Mr. and Mrs. T. Hyam	One accommodation facility	Guest house Game and bird viewing
Goedgevonden KR 104	Mr. C. Baber	Kudu Lodge Guest House	Accommodation facilities Cattle farming
Naauwpoort KR 106 & KR 106/2	Mr. C. Hachmann	Accommodation facility which can accommodate app. 100 individuals	Guest house Game and bird viewing
Sterkstroom KR 103 & Portion of Schoongezicht KR 107	Mr. M. Jurgens	App. three different guest houses	Accommodation facilities Game and bird viewing General recreational activities
Remaining extent of the farm Schoongezicht KR 107	Mr. D. Breedt	None at moment, but planning to develop guest houses	Accommodation facilities Game and bird viewing General recreational activities
Vier-en-Twintig River KR 102/2	Mr. and Mrs. H. van Herwaarden	Vier-en-Twintig Riviere Lodge	Lodge

Farm	Owner	Dwellings	Main Activities
			Game and bird viewing
Bellevue KR 99/1	Juan (surname unknown)	Unknown	Unknown
Bellevue KR 101 & Bellevue KR 98/3	Mr. C. Baber	Accommodation facilities	Cattle farming
Bellevue KR 98/1	Mr. and Mrs. N. Heal	Three houses (cottages)	Recreational

5.8 Profile of the local economy

The economy of the MLM and the Vaalwater area is dominated by agricultural activities (game, cattle, and crop farming). The game farming and hunting industries have grown over the past fifteen years with numerous farmers converting from cattle farming to game farming (MLM IDP, 2009). No records, however, could be found to calculate this trend. Eco-tourism activities and game farming generally provide fewer jobs than the traditional agricultural activities. The traditional agricultural sector (cattle and crops), as well as the game farming sector, however, still provides a large part of the employment opportunities in the area, followed by trade and accommodation, then community services, government services and construction industries.

According to the MLM IDP (2009) some of the economic weaknesses in the area include the unavailability of skills to match the economic comparative sectors, as well as the fact that there is no clear marketing strategy to encourage and support business development and investment in the area. Other challenges include:

- Increasing population growth trend;
- Higher incidence of HIV/AIDS compared to both the WDM and Limpopo Province;
- High levels of poverty;
- Limited access to basic services; and
- Limited productive activity in the primary economic sectors (i.e. agriculture and mining). (MLM IDP, 2010).

The Modimolle local economy is showing signs of strong growth in the primary and services sectors which support the fact that the economy is based on production in the primary

sectors. The services component is also starting to play a more important role to support the activities in the primary sector (MLM SDF, 2010).

The Waterberg area has significant potential for further development (especially tourism, hunting and eco-tourism activities) due to its favourable location, distance from main centres like Gauteng, the absence of malaria as well as the scenic beauty and natural diversity of this area. The area's economic base, as indicated in the Economic Development Plan (EDP) for the Limpopo Province, lies largely within the tourism sector and the MLM's IDP (2010) identified tourism thus as the main strength of the area. In addition, the Waterberg District Council listed the tourism sector highly on the priority list.

The Modimolle area also has various deposits of silica and investigations are underway to determine the exploitability of this reserve.

6. IMPACTS ASSOCIATED WITH THE CONSTRUCTION PHASE

The construction timeframe for the proposed PV facility is expected to be between six and nine months and the main construction activities that are planned include, fencing of the site, creation of fire breaks, setting up of connections points by Thupela Energy with some input from Eskom, cable laying, mount installation, installation of inverters and associated electronics, and the construction of the required buildings.

Impacts associated with this phase of the project is thus of a short duration, temporary in nature, but could have long term effects on the surrounding environment.

The following social impacts are anticipated during the construction of the proposed PV facility on the farm Goedgevonden KR 104:

6.1 Employment creation

6.1.1 Discussion

Employment opportunities could be created during the construction phase as a large part of the construction activities would entail manual labour such as the erection of the fence, creation of fire breaks, cable laying, and mount installation. Workers would thus receive induction training on site to undertake the various repetitive tasks. During the entire process they would be supervised. Other construction activities would include manual labour associated with the construction of building structures (i.e. visitors centre, crèche, and kitchen). Specialists would be used for the installation of the inverters and associated electronics.

In total approximately fifty (50) construction workers would be on site on average, increasing to approximately one hundred and twenty six (126) construction workers during the peak construction period. It is therefore fair to state that at least fifty construction workers could be employed for the average length of the construction period (six months), but that this figure could increase for shorter periods. Additional security personnel would be appointed

from the start of the construction process (Personal communication: Dr. P. Calcott: August 2010).

Therefore, concerning employment creation, the proposed PV facility would have definite short-term positive impacts, especially if local labour (e.g. individuals from the farm Boschdraai and Leseding) were used. The farm Boschdraai cannot supply all the residents with permanent employment and short-term opportunities in close proximity to the farm would thus be beneficial to the unemployed, especially young school leavers. There would also be an opportunity for the employment of individuals from Leseding and other areas within the MLM area. At this stage it is even estimated that approximately hundred and twelve (112) jobs could be provided to individuals within the MLM area (which could include residents from Boschdraai and Leseding) during the construction phase (Information received: Dr. P. Calcott: September 2010)

As previously indicated (also refer to Section 5.5.1), the unemployment rate in the study area is approximately 22%. Recent studies undertaken by the Waterberg Biosphere Reserve even indicate an unemployment rate of the 2008 school leavers in the area as 73%. There are therefore various individuals in the area in search of employment, even if the opportunities are only temporary. As indicated above it is also foreseen that it would be possible to make use of local labour for a large section of the construction activities. Opportunities for SMMEs to be considered for some of the construction activities also exist.

Employment of locals and the involvement of local SMMEs would thus definitely enhance the social benefits associated with the project. Failure to involve the local population, emerging contractors, and SMMEs during construction could lead to negative attitude formation against the proposed project and the project proponent.

It should furthermore be noted that infrastructural development type projects usually create expectations that numerous job opportunities for the local community members will be generated. This perception is even more so in cases where the implementation and construction is actually taking place in close proximity to rural settlements. Unrealistic expectations concerning job creation should thus be guarded against.

6.1.2 Assessment Table

Nature: Employment creation during the Construction Phase		
	Without mitigation	With mitigation
Extent	Regional (4)	Regional (4)
Duration	Very short duration (1)	Very short duration (1)
Magnitude	Moderate (6)	Moderate (6)
Probability	Highly probable (4)	Definite (5)
Significance	Medium (44)	Medium (55)
Status (positive or	Positive	Positive

Nature: Employment creation during the Construction Phase	
negative)	
Reversibility	Yes
Irreplaceable loss of resources?	No
Can impacts be mitigated?	Positive impacts can be enhanced
Mitigation:	
<ul style="list-style-type: none"> • Employment of local community members (e.g. source labour from Boschdraai and Leseding or the immediate environment) should be undertaken where possible. • The applicant and its EPC partner should ensure an equitable process whereby locals and previously disadvantaged individuals (women) are taken into account. • The project proponent and contractors should create conditions that are conducive for the involvement of entrepreneurs, small businesses, and SMME's during the construction process. • Tender documentation should contain guidelines for the involvement of labour, entrepreneurs, businesses and SMME's from the local sector. • A local labour desk should be set-up (if not already established) in the beneficiary communities by the main contractor or project proponent to co-ordinate the process of involving local labour. • Communication efforts concerning job creation opportunities should refrain from creating unrealistic expectations. 	
Cumulative impacts:	
<ul style="list-style-type: none"> • Improvement in quality of life even if only for a short duration • Possible economic downfall of individuals after the period of employment has lapsed as they have become used to a certain income level. 	
Residual impacts:	
<ul style="list-style-type: none"> • Capacity building and skills development of those involved in the construction phase of the project 	

6.2 Skills inequities

6.2.1 Discussion

Economic inequities refers to the degree to which employment opportunities created by the proposed project match the actual job skills present in the local communities or the unemployed sector.

Education levels in the study area and status of the educational facilities give a clear indication of the unskilled labour force within and surrounding the study area (also refer to Section 5.4.4). As a result a large part of the population in the MLM and the study area are employed in semi-skilled and unskilled positions (approximately 53%). Detailed skills of the Boschdraai residents and Leseding were not readily available, but based on information

sourced with regards to the sectors in which most of the adult population in the study area is employed in, and based on the existing occupations; one could conclude that unskilled and semi-skilled labour could, thus, be sourced from the residents of Boschdraai and Leseding, and possibly from the immediate environment.

6.2.2 Assessment Table

Nature: Skills inequities during the Construction Phase		
	Without mitigation	With mitigation
Extent	Regional (4)	Regional (4)
Duration	Very short duration (1)	Very short duration (1)
Magnitude	Moderate (6)	Moderate (6)
Probability	Highly probable (4)	Definite (5)
Significance	Medium (44)	Medium (55)
Status (positive or negative)	Positive	Positive
Reversibility	Not applicable	
Irreplaceable loss of resources?	No	
Can impacts be mitigated?	Positive impacts can be enhanced	
Mitigation:		
<ul style="list-style-type: none"> A broad-based approach should be followed to identify and involve relevant organisations which could assist the main contractor and project proponent in identifying people whose skills may correspond with the job specifications. In cases for the semi-skilled jobs, where the relevant skills do not exist, training should be provided to willing local community members to enable them to fill the positions. 		
Cumulative impacts:		
<ul style="list-style-type: none"> Capacity building and skills development of those involved in the construction phase of the project 		
Residual impacts:		
<ul style="list-style-type: none"> Capacity building and skills development of those involved in the construction phase of the project 		

6.3 Capacity building and skills training

6.3.1 Discussion

Capacity building and skills training during the construction phase will range from training labours in assembly and installation of panel mounts through to more advanced skills, such as electrical wiring (Personal communication: Dr. P. Calcott, 2010).

Capacity building and skills training would thus have the greatest impact if the skills would be transferable to other type of construction or electricity generation related projects.

6.3.2 Assessment Table

Nature: Capacity building and skills training		
	Without mitigation	With mitigation
Extent	Regional (4)	Regional (4)
Duration	Very short duration (1)	Medium-term (3)
Magnitude	Moderate (6)	Moderate (6)
Probability	Highly probable (4)	Definite (5)
Significance	Medium (44)	High (65)
Status (positive or negative)	Positive	Positive
Reversibility	Not applicable	
Irreplaceable loss of resources?	No	
Can impacts be mitigated?	Positive impacts can be enhanced	
Mitigation:		
<ul style="list-style-type: none"> • In cases for the semi-skilled jobs, where the relevant skills do not exist, training should be provided to willing local community members to enable them to fill the positions. • Capacity building initiatives could link in with the planned capacity building and skills training initiatives to be undertaken as part of the Waterberg Biosphere Reserve's outreach programmes. • As part of Thupela Energy's social responsibility it could consider contributing funds for the initiation phase of the Waterberg Biosphere Reserve's Skills Training Facilitation Project. • The project proponent and contractors should create conditions that are conducive for the involvement of entrepreneurs, small businesses, and SMME's during the construction process. 		
Cumulative impacts:		
<ul style="list-style-type: none"> • Capacitated individuals 		

Nature: Capacity building and skills training
<ul style="list-style-type: none"> • Enhancement of skills levels of individuals involved in construction process
Residual impacts:
<ul style="list-style-type: none"> • Capacitated individuals • Enhancement of skills levels of individuals involved in construction process

6.4 Inflow of outside workforce

6.4.1 Discussion

It is estimated that an average number of fifty (50) construction workers would be required on site on a daily basis. During peak construction periods this could increase to approximately one hundred (100) workers. No construction workers would be housed on site and no construction camp for accommodation purposes would be built (Personal communication: Dr. P. Calcott, 2010).

Due to the size of the construction workforce it is evident that the impacts associated with the inflow of temporary workers to the area could result in various negative impacts on the surrounding property owners and possibly on local communities. These impacts relate to the following:

- Additional pressure on the local infrastructure (e.g. water, sanitation) in the area during working hours;
- Littering on site with the possibility of waste blowing to surrounding farms impacting on the health of animals and the visual aesthetics of the area;
- Possible misconduct of construction workers;
- Possible conflict between the local communities (e.g. residents at Boschdraai, Leseding and local farm workers) and the "outside" workforce;
- Crime levels are noted to be low in the study area. The influx of outsiders to an area is usually perceived to increase the crime levels in such an area. Similar security concerns are also prevalent among the property owners in the study area as it is highly likely the crime could increase due to the inflow of outsiders; and
- An inflow of workers and the associated construction activities (vehicle movement, noise, dust) could result in temporary intrusion impacts on surrounding property owners and tourists;
- The possible increase in the HIV/Aids prevalence, as the study area already shows high incidences of HIV/Aids; and

- The development of informal vending “stations” where food and small goods are sold could, if not properly managed, also lead to littering, and possible pollution of water sources.

The negative social impacts associated with the inflow of workers are expected to manifest predominantly during the peak periods of the construction phase of the project. The intensity would depend on whether local labour would be used and the actual percentage of workers that would be from the local labour pool.

6.4.2 Assessment Table

Nature: Inflow of outside workforce		
	Without mitigation	With mitigation
Extent	Site of development and surrounding area (2)	Site of development and surrounding area (2)
Duration	Very short duration (1)	Very short duration (1)
Magnitude	Moderate (6)	Moderate (6)
Probability	Highly probable (4)	Probable (3)
Significance	Medium (36)	Low (27)
Status (positive or negative)	Negative	Negative
Reversibility	Yes	
Irreplaceable loss of resources?	No	
Can impacts be mitigated?	Yes	
Mitigation:		
<ul style="list-style-type: none"> • Local labourers should be employed where possible. • Local labourers should remain at their existing residences and no workers can be allowed on site during night time. No workers should thus be accommodated on site at night. • Working hours should be kept to normal working hours. • Before construction commences, representatives from the MLM, community leaders, community-based organisations and the surrounding property owners, should be informed of the details of the contractors, size of the workforce and construction schedules. • Construction workers should be easily identifiable by wearing uniforms and even identity tags. • Local community organisations and policing forums / neighbourhood watches must be informed of the presence of the outside workforce. • Care should be taken to avoid conflict between the local communities and the “outside” 		

<p>Nature: Inflow of outside workforce</p> <p>workforce.</p> <ul style="list-style-type: none"> • Sufficient water and sanitation facilities should be provided for the workers on site during the construction period. • The construction site should be properly managed to avoid any environmental pollution (due to inadequate water and waste infrastructure and services) and littering. • Informal vending stations should not be allowed on or near the construction site. Construction workers should preferably receive daily meals and beverages to avoid the need for a vending station. • Information distributed as part of the existing HIV/Aids awareness campaigns should again be focused on and communicated to the local workforce.
<p>Cumulative impacts:</p> <ul style="list-style-type: none"> • Additional pressure on infrastructure • Littering could have a negative impact on animals with subsequent economic losses for the property owners • Possible increase in criminal activities in the area
<p>Residual impacts:</p> <ul style="list-style-type: none"> • Possibility of outside workers remaining in the area after construction has ceased

6.5 Inflow of jobseekers

6.5.1 Discussion

According to information obtained by the local municipality it was found that the majority of residents in the area are South African citizens, with a very low influx of citizens from the SADC countries. It therefore does not seem as if the area is challenged by a massive inflow of immigrants to the area, but due to the economic and political climate in most southern African countries and the global economic fluctuations, the inflow is expected to continue.

Even if limited numbers of additional outsiders (from other provinces) or foreigners come to the area in search of employment, it is possible that the small number of outsiders and foreigners already present in the area could come into conflict with the local community members in search of employment. The inflow of jobseekers (foreigners or locals) to the site is thus anticipated to occur and could even materialise prior to the construction phase when people become aware of the proposed project.

The majority of negative social impacts associated with the inflow of jobseekers are usually experienced if the jobseekers, especially those not originally from the area, remain in the area for long periods or even after construction has stopped. This could result in added

pressure on the existing infrastructure and services and even in an increase in crime levels and conflict between locals and the jobseekers.

6.5.2 Assessment Table

Nature: Inflow of jobseekers		
	Without mitigation	With mitigation
Extent	Site of development and surrounding area (2)	Site of development and surrounding area (2)
Duration	Medium term (3)	Short term (2)
Magnitude	Moderate (6)	Moderate (6)
Probability	Highly probable (4)	Probable (3)
Significance	Medium (44)	Medium (30)
Status (positive or negative)	Negative	Negative
Reversibility	Yes	
Irreplaceable loss of resources?	No	
Can impacts be mitigated?	Yes to a certain extent	
Mitigation:		
<ul style="list-style-type: none"> • Thupela Energy, local leaders and the MLM should jointly develop a transparent communication and recruitment process to minimise the influx of jobseekers to the area. • The recruitment process and the use of contractors should be clearly communicated to the local communities. • Maximise the use of local labour and contractors where possible by developing a strategy to involve local labour in the construction process. • The communication strategy of Thupela Energy and its EPC partner regarding the proposed project should ensure that unrealistic employment expectations are not created. • A representative of Thupela Energy or its EPC partner could attend community meetings arranged within the various wards to discuss the employment and recruitment process. 		
Cumulative impacts:		
<ul style="list-style-type: none"> • Added pressure on service delivery and the existing infrastructure with resultant additional socio-economic burdens for the MLM and surrounding property owners 		
Residual impacts:		
<ul style="list-style-type: none"> • Possible permanent settlement of job seekers in the area with associated cumulative impacts as indicated above 		

6.6 Impacts on agricultural practices

6.6.1 Discussion

The site proposed for the construction of the PV facility is currently used for harvesting of cattle fodder (i.e. pasture purposes). This agricultural practice would thus have to cease and could result in negative economic impacts if the fodder harvested here cannot be substituted elsewhere or if alternative grazing areas cannot be found for the cattle currently being fed on the fodder. It is however planned to allow the grazing of sheep on site between the panels which would result in some agricultural practices continuing on site.

As the property owner of the farm Goedgevonden KR 104 also owns other properties in the area it is assumed that this negative impact has been considered and that it can be successfully mitigated.

6.6.2 Assessment Table

Nature: Impacts on agricultural practices		
	Without mitigation	With mitigation
Extent	Site of development (1)	Site of development (1)
Duration	Medium term (3)	Short term (2)
Magnitude	High (8)	Moderate (6)
Probability	Highly probable (4)	Improbable (2)
Significance	Medium (44)	Medium (30)
Status (positive or negative)	Negative	Negative
Reversibility	Yes	
Irreplaceable loss of resources?	Yes	
Can impacts be mitigated?	Yes	
Mitigation:		
<ul style="list-style-type: none"> • Fodder harvested on site should be substituted elsewhere • Alternative grazing areas should be found 		
Cumulative impacts:		
<ul style="list-style-type: none"> • None expected 		
Residual impacts:		
<ul style="list-style-type: none"> • None expected 		

6.7 Traffic related impacts

6.7.1 Discussion

During the construction phase the actual construction vehicles (e.g. excavators or bulldozers) would probably be stored on site and movement of these vehicles between the construction site and source areas would be kept to the minimum. A large number of delivery vehicles (large trucks of some being between 20 to 30 tons) would have to access the site for the delivery of the mounts, panels, and electrical equipment. Concrete footings would be used and concrete will be mixed in a designated area on-site. At this stage the number of vehicles is estimated at a minimum of 150 trucks and a maximum of 200 trucks for the duration of the construction period which would result in approximately two heavy vehicles per day. The frequency of the trips cannot yet be determined (Personal communication: Dr. P. Calcott, 2010). It should be noted that the number of trucks could change as it would also be dependent on the finalisation of the construction methods.

The construction related vehicles would most probably make use of the tarred Modimolle-Vaalwater Road (R33) and the tarred Vaalwater-Melkrivier Road (R518) and then turn-off onto the Sterkstroom or Vier-en-Twintig-Riviere gravel roads to access the site.

Concerns were raised concerning the possible impact of heavy construction vehicles speeding on the gravel roads when travelling to and from the construction site. The impact on the safety of other road users, as well as pedestrians (especially children) could materialise near the access road to the farm Boschdraai (from the Sterkstroom gravel road) where approximately 350 individuals reside. Other social impacts refer to the effect of an increase in heavy traffic on the surface of the gravel roads. It is anticipated that the large number of construction vehicles would have a definite detrimental impact on the gravel roads which could last for a couple of years. It should, however, be noted that a Traffic Impact Assessment was undertaken as part of the EIA.

If locals from Boschdraai (app. 8 km from the proposed site) and Leseding (app. 25 km from the proposed site) would be employed during the construction period, they would be transported from their existing residences to the site and back on a daily basis. This would result in an additional increase in heavy vehicles (e.g. buses) on the local roads. Concerns in this regard again relate to the safety of other road users and pedestrians, but also to the impact of the increase in traffic on the surfaces of the local roads.

Any access to properties surrounding the proposed site is not expected to be affected during the construction phase. Property owners that have to pass the construction site to access their farms would thus have continuous access to their properties. Noise and dust impacts and possible delays when property owners have to wait to pass heavy vehicles on the local access road would be particularly intrusive to the surrounding property owners of the farms Schoongezicht KR 107 and Sterkstroom KR 103.

Irrespective of the number of trucks, it is fair to state that the increase in heavy vehicles on the local roads would potentially have a detrimental impact on the road conditions. The intensity of the impact would thus depend on the actual figures (numbers of trucks and frequency) which cannot be determined at this stage. Also refer to the Traffic Impact Assessment.

6.7.2 Assessment Table

Nature: Traffic related impacts		
	Without mitigation	With mitigation
Extent	Local (3)	Local (3)
Duration	Short term (2)	Very short duration (1)
Magnitude	Moderate (6)	Moderate (6)
Probability	Highly probable (4)	Probable (3)
Significance	Medium (44)	Medium (30)
Status (positive or negative)	Negative	Negative
Reversibility	No	
Irreplaceable loss of resources?	No	
Can impacts be mitigated?	Yes to some extent	
Mitigation:		
<ul style="list-style-type: none"> • The contractor should arrange meetings with affected residents (farm owners) before construction commences. During these meetings, the contractor's plans, procedures and schedules, as well as the anticipated intrusion impacts should be clarified. • Residents of the farms Schoongezicht KR 107 and Sterkstroom KR 103 should be allowed access to their properties at all times. • The movement of construction vehicles through the local area should be limited to off-peak periods (if possible) to minimise adverse impacts on the movement of pedestrians (individuals walking to and from work and schoolchildren) and to a lesser extent on private vehicular traffic. • Signs should preferably be erected at strategic locations throughout the area, warning residents, and visitors about the hazards around the construction site and the presence of heavy vehicles. • Strict vehicle safety standards should be implemented and monitored. • Construction vehicles should keep to the speed limits. • The local gravel access roads should be graded (possibly every six months) by the project proponent to limit the degradation of the road surface. 		
Cumulative impacts:		

Nature: Traffic related impacts
<ul style="list-style-type: none"> Poor road and surface conditions which are unlikely to be attended to by the MLM
Residual impacts:
<ul style="list-style-type: none"> Poor road and surface conditions which are unlikely to be attended to by the MLM

6.8 Impacts on tourism

6.8.1 Discussion

The greater Waterberg area, as well as the areas surrounding the proposed site are host to numerous recreational, cultural and tourism related facilities (game farms, guest farms, lodges and so forth – also refer to Section 5.7).

During the construction phase one could expect some impacts on the tourism industry due to the increased construction vehicle movement, noise pollution, because of the actual construction activities, and negative visual impacts associated with the construction site. These intrusions would be more marked where tourism related facilities are in close proximity to the actual construction site and where the construction site can be seen. Some short term negative impacts in this regard could thus be experienced by some of the surrounding property owners. The intensity of this impact, however, is difficult to establish as it would also be dependent on the experience of the tourist of the quality of the area and sense of place.

It is however, believed that these temporary negative impacts would not result in long term negative financial impacts for the local tourism sector or for the property owners who occasionally entertain visitors on their guest farms.

It should furthermore be noted that local accommodation facilities in close proximity to the site could benefit during the construction period, as the members of the specialist construction team or any outside workers could make use of local establishments for the duration of their stay in the area.

6.8.2 Assessment Table

Nature: Impacts on tourism		
	Without mitigation	With mitigation
Extent	Local (3)	Local (3)
Duration	Very short duration (1)	Very short duration (1)
Magnitude	Moderate (6)	Moderate (6)
Probability	Highly probable (4)	Probable (3)
Significance	Medium (40)	Medium (33)

Nature: Impacts on tourism		
Status (positive or negative)	Possibly Negative and Positive	Positive
Reversibility	Yes	
Irreplaceable loss of resources?	No	
Can impacts be mitigated?	Yes	
Mitigation:		
<ul style="list-style-type: none"> • Mitigation measures concerning the anticipated traffic related impacts would also be applicable. • The construction phase should preferably not coincide with the main tourist season (if any) to limit the temporary impact on the tourism industry. • Construction activities should be limited over weekends, on public holidays and specific tourist related activities, festivals and/or events held in the area • Members of the specialist construction teams should preferably be accommodated at guest farms or lodges in the area 		
Cumulative impacts:		
<ul style="list-style-type: none"> • Possible further positive economic spin-offs and returns of members of the specialist teams to the area as tourists • Exposure of the Waterberg area to various individuals with possible future positive impacts on the tourism sector 		
Residual impacts:		
<ul style="list-style-type: none"> • None anticipated 		

6.9 Safety and Security

6.9.1 Discussion

Concerns concerning an increase in crime levels are usually dependent on the perceived magnitude of the risk due to the size of the "outside" workforce that would be present in the area during the construction phase.

Even though no construction workers are expected to be accommodated on site, an inflow of workers could, as a worst case scenario and irrespective of the size of the workforce, pose some security risks. Criminals could also use the opportunity due to "outsiders" being in the area to undertake their criminal activities. Materials and goods would be stored on site in some type of storage facility for the duration of the construction period, and this in itself can lure criminals to the area. Safety of individuals residing in the area and animals, especially

rare game species such as rhinoceros, sable antelope, buffalo, and so forth remain of concern.

The negative impacts associated with the inflow of workers could, however, be limited should a local labour force be used. The crime rates are said to be low in the MLM area and the proposed project should thus avoid any actions that could increase the risk of criminal activity.

Safety at and around the construction site should be ensured by limiting any fire risks, fencing off the construction area to avoid unauthorised access of especially school children and by employing security personnel. In this regard, the project proponent indicated that it is planned to establish a fire capability on site from the start of the construction phase, which could include a fire fighter and individual man pack sprayers. Permanent security personnel would be on site for the duration of the construction period.

Construction related accidents are also always a concern when construction activities are undertaken. Local doctors and ambulance facilities for accidents would be used and it is anticipated that there would be sufficient capacity for minor emergencies. Major emergencies could be problematic as the nearest hospital is located at Modimolle, but due to the type of activities undertaken, major emergencies are unlikely to occur.

6.9.2 Assessment Table

Nature: Safety and security		
	Without mitigation	With mitigation
Extent	Local (3)	Local (3)
Duration	Very short duration (1)	Very short duration (1)
Magnitude	Moderate (6)	Moderate (6)
Probability	Highly probable (4)	Probable (3)
Significance	Medium (40)	Medium (30)
Status (positive or negative)	Negative	Negative
Reversibility	Yes	
Irreplaceable loss of resources?	No	
Can impacts be mitigated?	Yes to some extent	
Mitigation:		
<ul style="list-style-type: none"> Employing local community members could minimise the potential for criminal activity or perceived perception of an increase in criminal activity due to the presence of an outside workforce. 		

<p>Nature: Safety and security</p> <ul style="list-style-type: none"> • Screening of workers that apply for work could be useful to lessen perceived negative perceptions about the outside workforce. • Construction workers should be easily identifiable by wearing uniforms and even identity tags. • Local community organisations and policing forums must be informed of the presence of the outside workforce. • Care should be taken to avoid conflict between the local communities and the “outside” workforce • The property owners surrounding the construction area should be involved during the construction process by communicating the construction schedule and movement of workers with these representatives. • Property owners and their workers, as well as local communities (e.g. Boschdraai due to their location to the site) and their community structures should be motivated to be involved in crime prevention and by reporting crimes. • The construction site should be fenced and access to the area controlled. • Permanent security personnel should be at the site for the duration of the construction period. • Security personnel should be aware of the possibility of animal theft and poaching and should be able to identify possible criminal elements and/or criminal activities in this regard. • Procedures and measures to prevent, and in worst cases, attend to fires should be developed in consultation with the surrounding property owners
<p>Cumulative impacts:</p> <ul style="list-style-type: none"> • Possible increase in crime levels with subsequent possible economic losses or in worst-case scenarios loss of lives of animals and individuals
<p>Residual impacts:</p> <ul style="list-style-type: none"> • Same as above

6.10 Impact on infrastructure and services

6.10.1 Discussion

As indicated above under Section 6.7, the local roads would be under pressure due to the number of heavy construction vehicles that would make use of these roads during the construction phase with consequences lasting longer than the construction period. This issue, however, would not again be discussed here.

No other impacts on existing infrastructure and services are anticipated during the construction period, except when a power outage would be experienced for a few hours when

the connection to the grid would be undertaken (Personal communication: Dr. P. Calcott, 2010).

Concerning the impact on infrastructure and services, the reader is also referred to the Traffic Impact Assessment that has been undertaken as part of the EIA.

6.10.2 Assessment Table

Nature: Impact on Infrastructure development and maintenance		
	Without mitigation	With mitigation
Extent	Local (3)	Local (3)
Duration	Short term (2)	Very short duration (1)
Magnitude	Moderate (6)	Moderate (6)
Probability	Highly probable (4)	Probable (3)
Significance	Medium (44)	Medium (30)
Status (positive or negative)	Negative	Negative
Reversibility	Yes	
Irreplaceable loss of resources?	No	
Can impacts be mitigated?	Yes	
Mitigation:		
<ul style="list-style-type: none"> Mitigation measures with regards to the anticipated traffic related impacts would also be applicable Construction schedules should be discussed and finalised with the MLM and other affected stakeholders Timeframes for power outages should be communicated to the affected parties 		
Cumulative impacts:		
<ul style="list-style-type: none"> None anticipated 		
Residual impacts:		
<ul style="list-style-type: none"> None anticipated 		

6.11 General intrusions

6.11.1 Discussion

Apart from the dust and noise pollution expected to occur as a result of the construction vehicle movement (discussed under Section 6.7), the construction activities at the

construction site would also include increased dust and noise levels, as well as some negative visual impacts associated with the construction site.

Residents and property owners along the roads used, especially those with dwellings in close proximity to the roads and site would thus be negatively impacted on by the dust created by the heavy vehicles and noise created by the construction teams.

6.11.2 Assessment Table

Nature: General intrusions		
	Without mitigation	With mitigation
Extent	Local (3)	Local (3)
Duration	Very short duration (1)	Very short duration (1)
Magnitude	Moderate (6)	Moderate (6)
Probability	Highly probable (4)	Probable (3)
Significance	Medium (40)	Medium (30)
Status (positive or negative)	Negative	Negative
Reversibility	Yes	
Irreplaceable loss of resources?	No	
Can impacts be mitigated?	Yes	
Mitigation:		
<ul style="list-style-type: none"> • Construction should take place during normal working hours and the contractor should limit construction activities with potential noise impacts to non intrusive times. • Ensure that all vehicles comply with noise abatement regulations. • The adjacent property owners must be informed of the construction schedule • Gravel roads at the construction sites frequently used by construction vehicles and areas where the vegetation has been removed should be sprayed with water to suppress dust. • Construction vehicles should be in good working order to limit any potential for pollution 		
Cumulative impacts:		
<ul style="list-style-type: none"> • None anticipated 		
Residual impacts:		
<ul style="list-style-type: none"> • None anticipated 		

7. IMPACTS ASSOCIATED WITH THE OPERATIONAL PHASE

The operational phase of a PV facility is between 30 and 50 years and thus viewed as a long term process. The operating hours are from approximately ninety minutes pre-dawn to just before sunset, seven days a week. The main operational activity will be the manual adjustment of the solar panel mounts

Depending on the type of project, the impacts usually associated with this phase are therefore perceived by affected parties to be more severe. The duration of these impacts, however, should not only be the critical issue, but aspects such as the extent, the intensity and significance would have to be considered. Aspects rated high would thus warrant intense mitigation measures.

The following section provides a description of the impacts anticipated to occur during the operational stages of the proposed facility:

7.1 Employment creation

7.1.1 Discussion

In total approximately ninety (90) individuals could be employed with approximately forty (40) people on site at any given time, apart from the security personnel. One shift would be undertaken per day, but the security personnel would cover three shifts per day. A team of around thirty (30) panel operators will be on site from just pre-dawn to just pre-dusk every day. They will work in teams, with a supervisor, turning panel mounts. The canteen that would serve basic food and beverages to the workers would be run by approximately two (2) individuals.

Night maintenance would predominantly consist of panel cleaning. This will principally be done without water, either with big dusters or compressed air. Occasionally dirt would have to be removed with water cleaning. A small team (i.e. 2 to 3 individuals) will work across the site cleaning one panel each at a time.

Therefore, long-term direct job opportunities for locals exist. Secondary employment opportunities for locals would refer to the security personnel and catering services. The farm Boschdraai hosts two villages with a total of 350 residents or approximately 50 families. Those falling within the working age category and who are currently unemployed (especially young unemployed school leavers), could thus secure permanent employment at the PV facility. There would also be a further opportunity for individuals from Leseding and the entire MLM area to be employed.

Over and above the direct employment opportunities that would be created during the operational phase of the facility, a number of downstream benefits may emerge due to the increased income of some, although it is not possible to determine in which sectors it would be spent.

Overall, the employment creation as part of the operation and management of the PV facility would thus improve the quality of life among the beneficiaries (employees).

7.1.2 Assessment Table

Nature: Employment creation		
	Without mitigation	With mitigation
Extent	Regional (3)	Regional (3)
Duration	Long term (4)	Long term (4)
Magnitude	Moderate (6)	Moderate (6)
Probability	Highly Probable (4)	Definite (5)
Significance	Medium (52)	Medium (65)
Status (positive or negative)	Positive	Positive
Reversibility	Yes	
Irreplaceable loss of resources?	No	
Can impacts be mitigated?	Positive impacts can be enhanced	
Enhancement:		
<ul style="list-style-type: none"> • Employees should be sourced from Ward 3 and Ward 1, then from the wider area. • Contractors should capacitate locals where practical. • The project proponent should consider training and capacity building programmes to lessen the skills disparity • The skill requirements should be communicated to the local community leaders and community based organisations • The Contractors and/or Thupela Energy should make use of local recruitment agencies or other relevant community based organisations to obtain a list of jobseekers • An equitable process whereby minorities and previously disadvantaged individuals (women) are taken into account should be implemented. 		
Cumulative impacts:		
<ul style="list-style-type: none"> • Through the employment of locals other anticipated negative social impacts could be mitigated • Improved quality of life of those employed • Increased purchasing power of those employed through the project. • Indirect benefits to businesses 		

Nature: Employment creation
<ul style="list-style-type: none"> • Stimulation of local economy
Residual impacts:
<ul style="list-style-type: none"> • Skilled and capacitated individuals

7.2 Skills inequities

7.2.1 Discussion

Economic inequities refers to the degree to which employment opportunities created by the proposed project match the actual job skills present in the local communities or the unemployed sector. The following positions would be available:

- General Manager: 1
- Production supervisor: 1
- Technical manager (overseeing the technical aspects of the site, mostly high power electrical skills): 1
- Technical assistants: 2
- Security personnel: 18
- Mount and panel operators (unskilled labourers): 57 (This figure could increase based on the number of jobs per MW capacity created in this field, which could increase the total number of employees to approximately ninety (90) people as indicated in Section 7.1)

In addition there could be two (2) cooks employed and two (2) cleaning and administrative personnel.

The majority of skills therefore required for the operation and management of the facility fall within the unskilled to semi-skilled category. Some highly skilled personnel would also be required.

More than half of the population within the working age category in the MLM are employed in semi-skilled and unskilled positions. All the positions are thus expected to be sourced from the local labour pool and even the unemployed sector.

Through training and skills development, the proposed project would provide employees from the local community with transferable skills and could thus result in the overall improvement of the quality of life of those involved.

The visitors centre in itself, which would have a strong educational focus, would assist in local capacity building as it would:

- Assist with the social upliftment of local communities through site visits and educational tours undertaken by local school children and/or tourists; and
- Assist in creating awareness concerning renewable energy sources in general.

7.2.2 Assessment Table

Nature: Skills inequities		
	Without mitigation	With mitigation
Extent	Regional (3)	Regional (3)
Duration	Long term (4)	Long term (4)
Magnitude	Moderate (6)	Moderate (6)
Probability	Highly Probable (4)	Definite (5)
Significance	Medium (52)	Medium (65)
Status (positive or negative)	Positive	Positive
Reversibility	Yes	
Irreplaceable loss of resources?	No	
Can impacts be mitigated?	Yes, impacts can be enhanced	
Mitigation:		
<ul style="list-style-type: none"> • A broad-based approach should be followed to identify and involve relevant community based organisations and/or local recruitment agencies which could assist the main contractor in identifying people whose skills may correspond with the job specifications. • In cases for the middle to lower skilled jobs, where the relevant skills do not exist, training should be provided to willing local community members to enable them to fill the positions. • Capacity building initiatives could link in with the planned capacity building and skills training initiatives to be undertaken as part of the Waterberg Biosphere Reserve's outreach programmes. • As part of Thupela Energy's social responsibility it could consider contributing funds for the initiation phase of the Waterberg Biosphere Reserve's Skills Training Facilitation Project. 		
Cumulative impacts:		
<ul style="list-style-type: none"> • Through the employment of locals other anticipated negative social impacts could be mitigated • Capacity building through skills development as part of the project 		
Residual impacts:		
<ul style="list-style-type: none"> • Capacity building through skills development as part of the project 		

7.3 Capacity building and skills training

7.3.1 Discussion

During the operational phase, further individually tailored made training programmes would be embarked upon which would be undertaken in association with accredited training operators. Employees will be given paid leave to attend, and attendance will be seen as part of their work, and thus compulsory.

Should employees leave the facility in search of work elsewhere in the field they would be equipped with portable skills. With the cooperation of accredited training facilities, Thupela Energy would facilitate the process whereby they assist employees in finding work elsewhere (if required).

Capacity building and skills training would thus have the greatest impact if the skills would be transferable to other type of construction or electricity generation related projects.

The visitor centre would have a strong educational and awareness creation focus. Exposure to large numbers of schoolchildren would also enhance the capacity building initiatives of the facility.

7.3.2 Assessment Table

Nature: Capacity building and skills training		
	Without mitigation	With mitigation
Extent	Regional (4)	Regional (4)
Duration	Short term (2)	Medium-term (3)
Magnitude	Moderate (6)	Moderate (6)
Probability	Highly probable (4)	Definite (5)
Significance	Medium (48)	High (65)
Status (positive or negative)	Positive	Positive
Reversibility	Not applicable	
Irreplaceable loss of resources?	No	
Can impacts be mitigated?	Positive impacts can be enhanced	
Mitigation:		
<ul style="list-style-type: none"> Capacity building initiatives could link in with the planned capacity building and skills training initiatives to be undertaken as part of the Waterberg Biosphere Reserve's outreach programmes. As part of Thupela Energy's social responsibility it could consider contributing funds for the 		

Nature: Capacity building and skills training
<p>initiation phase of the Waterberg Biosphere Reserve's Skills Training Facilitation Project.</p> <ul style="list-style-type: none"> • The project proponent and contractors should create conditions that are conducive for the involvement of entrepreneurs, small businesses, and SMME's during the operational phase. • The project proponent should invest in improving the quality of life of employees and their families through the provision of capacity building and skills training programmes • School excursions to the visitors centre should be arranged between the project proponent and local school representatives
Cumulative impacts:
<ul style="list-style-type: none"> • Capacitated individuals • Enhancement of skills levels of individuals involved in operation and management of facility
Residual impacts:
<ul style="list-style-type: none"> • Capacitated individuals • Enhancement of skills levels of individuals involved in operation and management of facility

7.4 Impact on the municipality

7.4.1 Discussion

Thupela Energy is responsible for funding of the project. Although the project falls within the jurisdiction of the MLM, the municipality will not contribute to the project. It is thus not anticipated that the proposed project would have any financial bearing on the MLM, although it could assist in improving the overall service delivery by strengthening the local electricity grid. This would be possible by reducing the amount of power that would be needed from Modimolle for Vaalwater, thereby creating additional supply for its own supply needs in the Modimolle area.

A huge backlog in terms of electricity provision exists as the MLM needs to supply 2 555 households with electricity. In addition, the MLM has to contribute a substantial amount to Eskom for the upgrading of the substation near Modimolle (MLM IDP, 2010 & Minutes of meeting with representatives of WDM and MLM, 2010). From a social perspective this enhancement of the electricity supply could assist the MLM to improve the quality of life of various individuals in settlements currently without power. Additional power could also be available for the development of business and economic activities in the area.

7.4.2 Assessment Table

Nature: Impact on Municipality		
	Without mitigation	With mitigation
Extent	Regional (3)	Regional (3)

Nature: Impact on Municipality		
Duration	Long term (4)	Long term (4)
Magnitude	Moderate (6)	Moderate (6)
Probability	Highly Probable (4)	Definite (5)
Significance	Medium (52)	Medium (65)
Status (positive or negative)	Positive	Positive
Reversibility	Yes	
Irreplaceable loss of resources?	No	
Can impacts be mitigated?	Positive impacts can be enhanced	
Mitigation:		
<ul style="list-style-type: none"> • Ensure that locals benefit from the improved electricity supply by assisting the MLM in providing a stable electricity supply to some without electricity 		
Cumulative impacts:		
<ul style="list-style-type: none"> • Improvement in quality of life of various individuals benefiting through the improvement of the local electricity supply • Possible positive economic spin-offs due to the improved and stable electricity supply 		
Residual impacts:		
<ul style="list-style-type: none"> • Same as above 		

7.5 Impact on energy efficiency

7.5.1 Discussion

The Waterberg area receives its electricity from the Matimba Power Station in Lephalale. The Vaalwater substation receives its power from Modimolle. One reason for the system being rather fragile is due to the length of the transmission and distribution lines stretching from Lephalale to Modimolle and Vaalwater. Currently capacity problems are experienced at the Modimolle and Vaalwater substations.

Power outages in the area are quite common which have negative social impacts on the residents as food deteriorates and water shortages are experienced as water needs to be pumped from boreholes. The water shortages could thus have severe negative impacts on the farming community when they are unable to supply their animals with adequate quantities of water, as well as community members that have to go without water for extensive periods. The more affluent property owners have taken steps to mitigate the negative impacts by investing in back-up generator systems.

The proposed PV facility could potentially assist in mitigating the above electricity supply problems. Through the generation of additional electricity, power can be fed back into the system to individual consumers through the VS (i.e. Vaalwater/Sterkstroom) or the VG (Vaalwater/.....) lines, as well as to the Vaalwater substation. In addition, this would cumulatively be beneficial to the larger Waterberg area (Personal communication: Dr. P. Calcott: August 2010).

It should also be noted that although solar power is intermittent, it could still be sufficient to ensure that fridges be functioning for some time during the day. Adequate water quantities can then also be pumped during specific periods during the day. The proposed PV facility could thus address the two most pressing electricity issues mentioned above and property owners would then be less reliant on their back-up generator systems during power outages.

The increase in power security because of the proposed PV facility could thus significantly improve the quality of life for many people such as those property owners with extensive farming practices, rural communities dependent on pumped borehole water, and property owners with tourism accommodation facilities (e.g. lodges and guest farms).

It should, however, be noted that the alleviation would only be applicable during the day time and that one would have to rely on a back-up system from Eskom during the night time or during rainy weather.

7.5.2 Assessment Table

Nature: Impact on energy efficiency		
	Without mitigation	With mitigation
Extent	Regional (3)	Regional (3)
Duration	Long term (4)	Long term (4)
Magnitude	Moderate (6)	Moderate (6)
Probability	Probable (3)	Highly Probable (4)
Significance	Medium (39)	Medium (52)
Status (positive or negative)	Positive	Positive
Reversibility	Yes	
Irreplaceable loss of resources?	No	
Can impacts be mitigated?	Positive impacts can be enhanced	
Mitigation:		
<ul style="list-style-type: none"> Ensure that locals benefit from the improved electricity supply by assisting the MLM in providing a stable electricity supply to some without electricity 		

Nature: Impact on energy efficiency
<ul style="list-style-type: none"> • Liaise with Eskom with regards to the end beneficiaries receiving the additional power to ensure a system whereby locals really receive the benefits of the improved electricity supply
Cumulative impacts:
<ul style="list-style-type: none"> • Improvement in quality of life of various individuals benefiting through the improvement of the local electricity supply • Possible positive economic spin-offs due to the improved and stable electricity supply
Residual impacts:
<ul style="list-style-type: none"> • Same as above

7.6 Local procurement

7.6.1 Discussion

Apart from the technical components it is expected that some local procurement of goods, materials and services could occur which would result in positive economic spin-offs. This aspect, however, would be dependent on the outcome of the tender process.

The impact of the project on the procurement of local businesses and previously Historically Disadvantaged South Africans (HDSAs) can therefore not be determined at this stage. It is, however recommended that the project proponent commits itself to involving locals (HDSAs and SMMEs) in the procurement of capital goods, consumables and services, if these are locally available.

Local procurement could result in indirect economic spin-offs and benefits such as increased income, and expansion of other local economic sectors.

7.6.2 Assessment Table

Nature: Local procurement		
	Without mitigation	With mitigation
Extent	Regional (3)	Regional (3)
Duration	Long term (4)	Long term (4)
Magnitude	Moderate (6)	Moderate (6)
Probability	Probable (3)	Highly Probable (4)
Significance	Medium (39)	Medium (52)
Status (positive or negative)	Positive	Positive
Reversibility	Yes	

Nature: Local procurement	
Irreplaceable loss of resources?	No
Can impacts be mitigated?	Positive impacts can be enhanced
Mitigation:	
<ul style="list-style-type: none"> Local sourcing of materials to assist in providing more economic and employment opportunities for the local people 	
Cumulative impacts:	
<ul style="list-style-type: none"> Stimulation of and support to local businesses and local economy which could ensure that benefits accrue to the local communities 	
Residual impacts:	
<ul style="list-style-type: none"> Same as above 	

7.7 Impact on sense of place

7.7.1 Discussion

The social impact associated with the impact on the sense of place relates to the change in the landscape character and visual impact of the proposed PV plant. The permanent visual impact on property owners in the area was assessed as part of the Visual Impact Assessment (VIA). The following discussion should thus be read from a social perspective as the impact on the sense of place, but also in conjunction with the VIA. It should further be noted that the assessment was based on the maximum height of 6 m above ground level of the facility's panels/mounts. However, indications are that these could be lowered to approximately 4 m above ground level.

PV facilities can have significant visual impacts and the proposed PV facility has the potential to alter the landscape character and therefore negatively affect the sense of place. Due to the rural character of the area, there is limited existing disturbance by infrastructure such as roads, transmission lines, telephone poles, dwellings, other developments, and so forth. The impact of the PV facility on the visual environment would, however, differ based on the receptors' perception of such a facility. Some people could view the facility as having a significant negative impact on the beauty of the landscape, while others could view them in a positive light and even use the presence of the facility and the concept of "green energy" as part of the area's marketing efforts. The majority of individuals consulted and property owners in the study area have a deep appreciation for the beauty of the natural bushveld and tranquillity of the area. It is thus believed that the PV facility would, by most property owners, be negatively experienced.

It is anticipated that the facility would not be clearly visible from the local gravel road to the north of the site (24 Rivers-Naaupoort-Olievenfontein gravel road), but only from limited sections on this road. This would thus result in a limited impact on tourists travelling on this road. Those travellers and property owners making use of the local entrance road to access their respective farms (e.g. the farms Schoongezicht KR 107 and Sterkstroom KR 103) and the Kudu Lodge accommodation facility on the farm Goedgevonden KR 104 would, however, be able to clearly view the PV facility. It should be noted that the farm Sterkstroom KR 103 also has another entrance on the southern border of the farm. From a social perspective this impact would only occur when the travellers are opposite to the site, and irrespective of the travellers sentiment with regards to the sense of place, it is not anticipated that it would have a continuous negative impact on the traveller or property owners' experience of the area.

From a social viewpoint, the farms nearest to the facility, that are perceived to be mostly affected by the change in the sense of place and change in the landscape character include the farms Sterkstroom KR 105/4, Naauwpoort KR 106, Goedgevonden KR 104, Schoongezicht KR 107 and Sterkstroom KR 103.

The PV facility would be visible from the farm Sterkstroom 105/4 to the north of the farm Goedgevonden KR 104. According to the property owner and the VIA it would definitely be visible from the property's accommodation facility which can house approximately forty individuals. The farm Sterkstroom KR 105/4 is categorised as a guest farm for the purpose of the study (also refer to Section 5.7.4). Visitors are not usually present on a daily basis and the accommodation facility is mainly used over weekends (Personal communication with Mr. Van Rooyen: 4 August 2010). From a social point of view it is anticipated that visitors to the farm Sterkstroom KR 105/4 would not continuously look at the facility while enjoying their stay at the property, or while busy with their team building exercises or while on a game drive. The undisturbed view of the bushveld from the north to the south east and to the north remains and the vegetation absorption capacity should also be taken into consideration. The perception of the impact of the facility on the sense of place of each visitor though could differ and the intensity of the impact is thus difficult to quantify.

Kudu Lodge, which is situated on the farm Goedgevonden 104, is in very close proximity to the proposed site and the PV facility would be visible from this accommodation facility. The PV facility would thus have a definite visual and intrusion impact on this facility and to a lesser extent on the accommodation facilities on the farms Naauwpoort KR 106, Schoongezicht KR 107, and Sterkstroom KR 103. The less significant impact on the latter two farms is due to the further distance of these farms' accommodation facilities from the proposed PV facility. The vegetation absorption capacity on the two farms would assist in mitigating this impact and it is thus not believed that the facility would be continuously visible to visitors to these properties. Concerning all three of these farms, the undisturbed view to the south and east would remain. Visibility of the facility concerning farms further to the north such as Sterkstroom KR 105/7, Sterkstroom KR 105, and Sterkstroom KR 105/3 are anticipated to be less and only from certain viewpoints of these properties and not from the existing accommodation facilities on these farms.

It is not anticipated that the facility would be visible to the farms to the west of the farm Goedgevonden KR 104 as the facility is proposed on the south-eastern section of the farm. Accommodation facilities on these farms are thus further away from the proposed site and property owners of and/or visitors to these farms would probably not pass the facility when accessing these farms.

Again, however, the perception of the impact on the facility on the sense of place could differ for each visitor and the intensity of the impact is again difficult to quantify. As indicated above, the facility could be positively experienced due to it being perceived as "green energy" which could even enhance the marketing potential of the area to those concerned and/or interested in the development of renewable energy sources.

Concerns were also raised concerning reflection from the panels. Should this be present, the negative visual impact on some of the surrounding properties would be worsened. It has, however, been guaranteed by the project proponent that there would not be any reflection as the panels are designed to absorb the sunlight (Minutes of meeting with adjacent property owners, 2010).

Even though the impact on the sense of place could result in negative impacts on the visitors' experience of the area and in extreme cases result in negative economic impacts, the impact on the sense of place is still rated as moderate (with mitigation) as the intensity of the impact would be dependent on each affected individual's perception and the possibility that some individuals would view the facility in a positive sense due to its contribution to the environment as a renewable energy source. From a social perspective, however, it remains critical that the proposed PV facility development should give ultimate priority to the mitigation of the negative visual impacts. Concerns about the success of mitigation measures remain.

7.7.2 Assessment Table

Nature: Impact on sense of place		
	Without mitigation	With mitigation
Extent	Local (2)	Local (2)
Duration	Long term (4)	Long term (4)
Magnitude	Moderate (6)	Moderate (6)
Probability	Definite (5)	Highly probable (4)
Significance	Medium (60)	Medium (48)
Status (positive or negative)	Negative	Negative
Reversibility	No	
Irreplaceable loss of resources?	No	

Nature: Impact on sense of place	
Can impacts be mitigated?	To a very limited extent
Mitigation:	
<ul style="list-style-type: none"> • The design and specific positioning of the plant should aim to minimise the possible negative visual impact of the facility on the surrounding property owners. • The panel mounts should have the lowest height practically possible. • The contours of the site should be used to assist in determining the location with the least negative visual impact (possible concealment behind elevated areas). • The site should preferably be located in such a way that exposure to the local roads are as slight as possible. • The vegetation absorption capacity should be utilised as far as possible to minimise the negative visual impact. • It should be ensured that there is no reflection from the panels. • The design of buildings should blend in with surrounding environment • Lighting issues should receive the attention it deserves to avoid any light pollution at night • The mitigation measures of the Visual Impact Assessment should be strictly implemented 	
Cumulative impacts:	
<ul style="list-style-type: none"> • Negative impact on sense of place could result in negative perceptions of visitors concerning the scenic quality of the area, which could again in worst case scenarios result in them refraining from visiting the area again. • Possibility that the proposed PV facility create possibilities for other developments to be established in the area 	
Residual impacts:	
<ul style="list-style-type: none"> • Distinct change in rural character and quality of the area 	

7.8 Impacts on surrounding property owners

7.8.1 Discussion

This aspect refers to the possible impact of the PV facility and activities undertaken on site on the following:

- The daily living and movement patterns of the surrounding property owners;
- Surrounding land-uses; and
- Guest farms, guest houses, and accommodation facilities.

Only one of the neighbouring property owners (Vier-en-Twintig-Riviere KR 102/2) is currently operating a formal privately owned guest farm. The PV facility is not in close proximity to the dwellings on this property. Kudu Lodge is on the farm Goedgevonden KR 104 and therefore does not qualify as neighbouring property. The property owners consulted, however, indicated that various "lodges" are planned on the different properties. It thus seems as if there is a move to extend their existing tourism facilities to cater for national and international tourists.

From observations and discussions with the surrounding property owners the impression was created that the existing accommodation facilities include various private houses which could accommodate groups of people who would be visiting these private game farms, mainly on a weekend basis. Furthermore it is questionable whether these property owners have already formally marketed their facilities to visitors around the globe and who are unknown to them. It seems as if the visitors still include groups of people known to the property owners or their families. In addition no signboards advertising these facilities could be observed. This situation makes it difficult to assess the impact of the proposed PV facility on these types of visitors, the frequency of visits and so forth, as no official published information regarding such visitors are available.

Once operational, the impact on the daily living and movement patterns of neighbouring residents is expected to be minimal and intermittent (e.g. the increase in traffic to and from site). The traffic related impacts in this regard are discussed under Section 7.12 and will thus not again be elaborated on. Even though various property owners are of the opinion that the proposed development does not "fit in" with the existing surrounding land uses (game and cattle farming), it is not anticipated that any activities undertaken as part of the operation and maintenance of the PV facility would negatively affect the surrounding property owners' daily living patterns. They would thus be able to continue their game or cattle farming practices without interference from the PV facility as the facility:

- Is expected to create limited noise;
- Is expected to have no negative impacts on the air quality;
- Could generate positive tourism interests with subsequent increase in lodge or guest farm occupancy rates.

Should the surrounding property owners receive improved and stable electricity supply, it could even have positive impacts on their quality of life.

The visitors centre with its main aim of education regarding solar energy and environmental issues would attract visitors to the site and the area. At this stage the number of visitors and vehicles coming to the facility cannot be determined. An inflow of outsiders to the area, however, could result in negative intrusion impacts on the daily living patterns of the surrounding property owners. Mitigation measures in this regard would therefore have to be considered.

However, it is *not* anticipated that the presence and visual impact of the PV facility, even though it could affect the visitor's sense of place, would result in less visitors coming to the area. The negative impact on the surrounding property owners with regards to the operation and management of their farms as "guest farms" with accommodation facilities is thus rated as moderate and expected to be responsive to mitigation.

7.8.2 Assessment Table

Nature: Impacts on surrounding property owners		
	Without mitigation	With mitigation
Extent	Local (2)	Local (2)
Duration	Long term (4)	Long term (4)
Magnitude	Moderate (6)	Low (4)
Probability	Probable (3)	Probable (3)
Significance	Medium (60)	Medium (48)
Status (positive or negative)	Negative / Positive	Neutral / Positive
Reversibility	Yes	
Irreplaceable loss of resources?	No	
Can impacts be mitigated?	To a certain extent	
Mitigation:		
<ul style="list-style-type: none"> Mitigation measures listed under Section 7.12.2 should be applicable Effective management of the facility and visitors centre to avoid any environmental pollution focusing on water, waste and sanitation infrastructure and services, and limiting any increase in noise levels (due to visitors) and so forth The project proponent could consider the provision of free electricity to surrounding property owners to enable them to also experience positive impacts associated with the facility 		
Cumulative impacts:		
<ul style="list-style-type: none"> Negative impact on sense of place could result in negative perceptions of visitors concerning the scenic quality of the area, which could again in worst case scenarios result in them refraining from visiting the area again. Possibility that the proposed PV facility create possibilities for other developments to be established in the area 		
Residual impacts:		
<ul style="list-style-type: none"> Distinct change in rural character and quality of the area 		

7.9 Impact on tourism activities

7.9.1 Discussion

Four tourist attractions of the Waterberg Meander are situated in close proximity to the proposed site, namely the Church of St. John the Baptist and the Elizabeth Hunter Studio. These are situated on the farm Vier-en-Twintig-Riviere. The Beadle Craft Workshop and Shop is on the farm Klipfontein to the north of the proposed facility and can be accessed via the Sterkstroom Road. Lehlabile Cultural Tours is also situated on this road.

It is assumed that visitors to these facilities (that would not be interested in visiting the proposed PV facility and/or who possibly perceive the facility in a negative light) would most probably make use of the tarred Vaalwater-Melkrivier Road after which they would use the gravel road to Vier-en-Twintig Riviere to access the first two tourist attractions. It is thus unlikely that visitors (when travelling from Vaalwater) would always pass the proposed site to the north on the local "Naaupoort-Olievenfontein" gravel road which links with the Sterkstroom Road and the Vier-en-Twintig Rivers Road. It is furthermore anticipated that the visitors travelling from Vaalwater to the Beadle Craft Workshop and Shop as well as to the Lehlabile Cultural Tours would make use of the tarred Vaalwater-Melkrivier Road and then turn off on the Sterkstroom Road to access the facility. However, visitors to other attractions forming part of the Waterberg Meander situated to the north and east of the site would be more likely to pass the proposed site to the north. As indicated elsewhere, it is not anticipated that the facility would be clearly visible from the local gravel road to the north of the site. Should visitors briefly see the facility when passing by it is not expected that it would severely impact on their tourism experience in such a negative way that they would:

- Refrain from visiting the area in future;
- Recommend to other tourists to refrain from visiting the area.

Visitors to Kudu Lodge on the farm Goedgevonden KR 104, the farm Sterkstroom KR 103, and the farm Schoongezicht KR 107 would have a clear view of the facility as they would pass directly in front of the entrance to the site. Again it is anticipated that it would only result in a temporary negative impact on these visitors. Should they, however, be able to continuously have a clear view of the facility (which is unlikely) when undertaking activities on the farms, such as cycling, game and bird viewing and so forth it could impact on their wilderness experience.

The probability is rather likely that tourists would return to an area where PV facilities are present if they had a pleasant overall holiday experience.

The above mentioned possible negative impact would thus not be applicable to those visitors who would be visiting the visitors centre as a tourist destination.

International and national tourists are also becoming increasingly aware of environmental issues, and the so-called "green tourism" sector of the market is globally showing some

growth. As the Waterberg area is largely reliant for its economic well-being on tourists, the proposed facility could even benefit local tourism through the following:

- It could become a popular tourist destinations with subsequent increased exposure of other tourism attractions in the area and the larger Waterberg area with possible cumulative increases in the occupancy of existing accommodation facilities (lodges and guest farms), as well as the future planned accommodation facilities;
- It could pave the way for tourism establishments, which benefit from the increase in a stable power supply, to advertise their establishments as facilities with a lower carbon-footprint; and
- The proposed visitors centre with the focus on environmental education and awareness creation in itself would stimulate local tourism and be beneficial to the tourism sector of the Waterberg in general.

The MLM SDF (2010) stated that "business and commercial activities should promote tourism activities." The proposed PV facility could thus adhere to these guidelines as it would include a visitor centre which could promote tourism in the area.

From a social point of view it is thus believed that the possible temporary negative impacts in terms of tourism could be sufficiently mitigated to avoid any long term negative impacts on the local tourism industry. It is thus anticipated that the facility would rather be beneficial to the local tourism sector with potential subsequent positive financial impacts for those involved in this sector.

7.9.2 Assessment Table

Nature: Impact on tourism activities		
	Without mitigation	With mitigation
Extent	Regional (3)	Regional (3)
Duration	Long term (4)	Long term (4)
Magnitude	Moderate (6)	Moderate (6)
Probability	Probable (3)	Highly probable (4)
Significance	Medium (39)	Medium (52)
Status (positive or negative)	Potentially negative / Positive	Positive
Reversibility	No	
Irreplaceable loss of resources?	No	
Can impacts be mitigated?	Positive impacts can be enhanced / Potential negative impacts can be mitigated	

Nature: Impact on tourism activities
<p>Mitigation:</p> <ul style="list-style-type: none"> • The project proponent, representatives of the MLM, tourism operators, and property owners involved in the tourism sector should jointly investigate and promote the role which the visitors centre and PV facility could play concerning the local tourism industry. • The project proponent should work closely with the above mentioned role players when developing the visitors centre. • Repeat visits to the area, PV facility and visitors centre should be encouraged. • Guest farms, guest houses, camp sites, lodges, game farms and so forth could use the presence of the proposed PV facility for "green tourism" marketing purposes • The presence of the PV facility could be included in the Waterberg tourism bureau's information leaflets and visitors guides, as well as in the publications of the Waterberg Meander.
<p>Cumulative impacts:</p> <ul style="list-style-type: none"> • Increased visitors to the area with positive financial impacts on the local tourism sector
<p>Residual impacts:</p> <ul style="list-style-type: none"> • Positive economic outcome due to increased tourism

7.10 Impact on Waterberg Biosphere

7.10.1 Discussion

Even though biospheres do not necessarily exclude any development, it is sensitive to development other than conservation and eco-tourism. A small portion of the farm Goedgevonden KR 104, which is the proposed site for the PV facility, is located within the transition zone of the Biosphere Reserve and the north-western beacon of the farm boundary borders the Waterberg Biosphere Reserve's buffer zone. The area to be utilised for the proposed facility however does not fall within the Biosphere Reserve. Within the transitional zone limited agricultural and infrastructural developments are permitted (Savannah Environmental: Draft Environmental Scoping Report, 2010).

Therefore the PV facility together with other development pressures, could have a negative impact on the Waterberg Biosphere Reserve's "sense of place", but it is not expected to have a direct negative impact on the conservation and community upliftment aims of the Waterberg Biosphere Reserve or any of the tourism related attractions linked to the biosphere as part of the Waterberg Meander.

It should also be noted that in certain sections of the Biosphere there are extensive development such as rural villages and formally proclaimed towns. Parts of the biosphere area also consist of areas showing a high potential for crop farming (MLM SDF, 2010).

The proposed PV facility could even have a positive impact if it is ensured that local people benefit from the facility by employment creation and if the facility is successful in acting as a new tourist attraction. It would then link with the aim of the Biosphere to "... ensure that local people benefit from the growing tourism industry..." (Waterberg Meander Vol. 2, 1009).

Representatives of the Waterberg Biosphere Reserve have indicated that "... in principal the Waterberg Biosphere Reserve is supportive of projects that will result in sustainable utilisation of natural resources whilst at the same time creating jobs..." (Comments: Dr. Anthony Roberts, 2010). There are, however, still concerns concerning the negative visual impact and subsequent impact on the "sense of place." As also discussed under Section 7.7 it is of the utmost importance to limit the negative visual impact of the facility. From a social perspective, it is however, doubtful, to how successful mitigation measures could be.

7.10.2 Assessment Table

Nature: Impact on Waterberg Biosphere		
	Without mitigation	With mitigation
Extent	Regional (3)	Regional (3)
Duration	Long term (4)	Long term (4)
Magnitude	Moderate (6)	Moderate (6)
Probability	Highly probable (4) (negative) Probable (3) (positive)	Probable (3) (negative) Probable (3) (positive)
Significance	Medium (52) (negative) Medium (39) (positive)	Medium (39) (negative) Medium (39) (positive)
Status (positive or negative)	Potentially negative / Positive	Potentially positive / Positive
Reversibility	Yes	
Irreplaceable loss of resources?	No	
Can impacts be mitigated?	To a very limited extent (negative impacts) Yes (positive impacts)	
<p>Mitigation: The mitigation measures as under Section 7.7.2 are also applicable to this section and are again listed:</p> <ul style="list-style-type: none"> • The design and specific positioning of the plant should aim to minimise the possible negative visual impact of the facility on the surrounding property owners. • The panel mounts should have the lowest height practically possible. • The contours of the site should be used to assist in determining the location with the least negative visual impact (possible concealment behind elevated areas). • The site should preferably be located in such a way that exposure to the local roads are as slight 		

<p>Nature: Impact on Waterberg Biosphere</p> <p>as possible.</p> <ul style="list-style-type: none"> • The vegetation absorption capacity should be utilised as far as possible to minimise the negative visual impact. • It should be ensured that there is no reflection from the panels. • The mitigation measures of the Visual Impact Assessment should be strictly implemented • The mitigation measures under Section 7.9.2 to enhance the positive impacts in terms of the tourism potential of the PV facility are also applicable
<p>Cumulative impacts:</p> <ul style="list-style-type: none"> • Negative impact on sense of place. • Possibility that the proposed PV facility create possibilities for other developments to be established in the area
<p>Residual impacts:</p> <ul style="list-style-type: none"> • Distinct change in rural character and quality of the area

7.11 Impact of rezoning

7.11.1 Discussion

The land under discussion is currently zoned as "agricultural." According to representatives of the MLM, the land identified for the proposed facility could be rezoned to "industrial." However, an application is being made for "Special Rezoning." There are different categories of industrial type zoning (e.g. light and heavy industrial). The correct land use category to be rezoned to would have to be finalised in consultation with the MLM and independent town planners (Minutes of the meeting with representatives of the WDM and MLM, 2010).

The WDM Strategic Development Framework (2010) indicated that "Activities in the core zones should be restricted to activities, which does not compromise the environmental integrity of the area, while the buffer and transition zones may allow for activities that are more intensive." At this stage it is thus not anticipated that the rezoning of the land would be in conflict with the WDM SDF, although it should be mentioned that the Waterberg Biosphere Reserve is currently developing its own Environmental Management Framework and Environmental Management Plan which could again guide the rezoning process.

Concerns from surrounding landowners concerning the rezoning of the land refer to the perception that the change in land use would be an intrusion on the existing land-uses in the area which mainly include game and cattle farming. Other concerns relate to the possibility that the proposed project could expand or could create a precedent for other similar developments in the area.

Property owners are furthermore concerned that rezoning would influence the status of their farms and their rights as property owners (e.g. the reimbursement for damages suffered in the event of fires) and even possible devaluation of their properties.

The social impacts in this regard thus relate to the impact on the "sense of place" and the safety risks associated with the proposed developments. These issues are dealt with under Sections 7.7 and 7.14.

7.11.2 Assessment Table

Nature: Impact of rezoning		
	Without mitigation	With mitigation
Extent	Local (2)	Local (2)
Duration	Long term (4)	Long term (4)
Magnitude	Moderate (6)	Moderate (6)
Probability	Probable (3)	Probable (3)
Significance	Medium (36)	Medium (36)
Status (positive or negative)	Negative	Negative
Reversibility	Yes	
Irreplaceable loss of resources?	Yes	
Can impacts be mitigated?	To some extent	
Mitigation:		
<ul style="list-style-type: none"> Any application for expansion of the facility should be carefully dealt with. Any possible expansion of the PV facility would have to be clearly communicated to the surrounding property owners and the relevant legislative processes would have to be followed. Also refer to Sections 7.7.2 and 7.14.2. 		
Cumulative impacts:		
<ul style="list-style-type: none"> Possibility that the proposed PV facility create possibilities for other developments to be established in the area 		
Residual impacts:		
<ul style="list-style-type: none"> Distinct change in land-use 		

7.12 Impacts on traffic patterns

7.12.1 Discussion

The traffic impacts associated with the operation of the facility refers to the transportation of workers to and from the site, deliveries to the canteen, as well as to the visitors coming to the visitors centre. It has been estimated that approximately seven vehicles would be travelling to and from the site per day (Minutes of meeting with adjacent landowners, 2010).

As it is anticipated that local labour would be used, and that the thirty daily employees would have to be transported from either Boschdraai farm or Leseding and Vaalwater to the site and back to their individual residences. At this stage it is planned to use one or two buses for this purpose. Transportation would be done twice a day. The most obvious route from Vaalwater would be the tar road from Vaalwater to Melkriver and then turning off at the Sterkstroom turnoff (approximately 24 km from Vaalwater) onto the gravel road leading to the site (approximately 10 km). This would thus result in two daily additional trips by one bus on the Vaalwater-Melkriver road, as well as two daily additional trips by one bus on the Sterkstroom-Vier-en-Twintig-Riviere road.

These additional trips could result in limited intermittent noise and dust pollution, as well as safety risks associated with speeding on the local gravel roads. The Sea Para School on the gravel road has been closed but should this facility open again speeding should be intensely mitigated in this area.

Deliveries to the canteen would generate one additional trip every two to three days. The above trips and this increase in traffic are not seen to result in severe negative impacts. The main impact in this regard would rather be the trips undertaken to the visitors centre. At this stage the number and frequency of such trips cannot be finalised although it is anticipated that it would be one bus at a time. It can thus only be concluded that the additional traffic in this regard would have an intermittent and limited negative impact on the surrounding property owners and road users.

Impact on access to properties is not expected to be affected during the operational phase. The road leading to the site (turn off from Naauwpoort /Vier-en-Twintig Riviere / Olievenfontein Road) would still be available to the property owners of the farm Sterkstroom KR 103 and Schoongezigt KR 107 to use to access the respective farms.

7.12.2 Assessment Table

Nature: Impacts on traffic patterns		
	Without mitigation	With mitigation
Extent	Local (2)	Local (2)

Nature: Impacts on traffic patterns		
Duration	Very short duration (1)	Very short duration (1)
Magnitude	Low (4)	Low (4)
Probability	Probable (3)	Probable (3)
Significance	Low (21)	Low (21)
Status (positive or negative)	Negative	Negative
Reversibility	Yes	
Irreplaceable loss of resources?	No	
Can impacts be mitigated?	Yes	
Mitigation:		
<ul style="list-style-type: none"> • Speeding on the local roads should be avoided for safety reasons and for dust creation. • The access road to the site could be upgraded to accommodate additional traffic volumes, as well as to create some safe viewing areas where passing motorists could stop to view the facility to limit the risk of accidents • Signage along the local roads should be put up to direct visitors to the facility to limit the risk of accidents 		
Cumulative impacts:		
<ul style="list-style-type: none"> • Increased safety risks • Noise and dust pollution 		
Residual impacts:		
<ul style="list-style-type: none"> • None 		

7.13 Impacts on infrastructure and services

7.13.1 Discussion

A Traffic Impact Assessment would be undertaken as part of the EIA. The following discussion should thus be read from a social perspective and in conjunction with the TIA.

The MLM IDP (2010) stated that there is "insufficient budget for resealing, gravelling, and maintaining of roads." It is thus highly unlikely that the MLM or provincial government would attend to the upgrading of the gravel roads in the study area. Various concerns have been raised concerning the impact of heavy vehicles associated with the PV facility on the local roads not only during the construction phase, but also during the operational phase.

Although the issue of additional pressure on the existing water, sanitation and waste infrastructure and services were raised during consultation sessions it is considered that these would be addressed by the project proponent as they would supply these services on site. No additional impact on existing infrastructure and services are therefore expected.

7.13.2 Assessment Table

Nature: Impacts on infrastructure and services		
	Without mitigation	With mitigation
Extent	Regional (3)	Regional (3)
Duration	Long term (4)	Long term (4)
Magnitude	Moderate (6)	Low (4)
Probability	Probable (3)	Probable (3)
Significance	Medium (36)	Medium (33)
Status (positive or negative)	Negative	Negative
Reversibility	Yes	
Irreplaceable loss of resources?	No	
Can impacts be mitigated?	To some extent	
Mitigation:		
<ul style="list-style-type: none"> Refer to mitigation measures as proposed under Section 7.12. 		
Cumulative impacts:		
<ul style="list-style-type: none"> Possible poor road conditions 		
Residual impacts:		
<ul style="list-style-type: none"> Possible poor road conditions 		

7.14 Safety related impacts

7.14.1 Discussion

It is not anticipated that the proposed PV facility would result in severe safety and security impacts. Should children or other individuals gain unauthorised access to the site it could, however, create safety risks. The site should thus be properly fenced and access controlled and managed by security guards to avoid such a situation. Thupela Energy indicated that they would employ security personnel on a permanent basis which would assist in mitigating the possible impact.

The concerns of property owners concerning illegal poaching of game on the surrounding properties remain an issue which is difficult to respond to mitigation. An inflow of people to an area creates an opportunity for criminal elements. The recent number of rhinoceros poaching in the country worsens the property owners' fears in this regard.

The fire fighting services in the district and MLM area is currently understaffed and there is a need for additional personnel in the Vaalwater area. As the proposed facility could increase the risk of fires, it would be useful if attention could be given to the provision of some kind of fire fighting and emergency services on site to attend to any possible emergencies in the study area. The applicant has indicated their willingness to have some form of fire fighting capacity in the area that would be available for fire fighting in the wider area. The details and practical operations would thus be finalised as part of the final planning phases and operational aspects.

7.14.2 Assessment Table

Nature: Safety related impacts		
	Without mitigation	With mitigation
Extent	Local (3)	Local (3)
Duration	Long term (4)	Long term (4)
Magnitude	Moderate (6)	Low (4)
Probability	Probable (3)	Probable (3)
Significance	Medium (36)	Medium (33)
Status (positive or negative)	Negative	Negative
Reversibility	Yes	
Irreplaceable loss of resources?	No	
Can impacts be mitigated?	Yes	
Mitigation:		
<ul style="list-style-type: none"> • The site should be properly fenced. • Fire fighting and emergency services should be available on site. • Schoolchildren visiting the visitors centre should be supervised at all times to avoid accidents. • Normal operational safety guidelines should be adhered to. • Security personnel should be aware of the possibility of animal theft and poaching and should be able to identify possible criminal elements and/or criminal activities in this regard. • Procedures and measures to prevent, and in worst cases, attend to fires should be developed in consultation with the surrounding property owners. 		

Nature: Safety related impacts
Cumulative impacts:
<ul style="list-style-type: none"> Increased fire risk for neighbouring properties
Residual impacts:
<ul style="list-style-type: none"> Some safety and security risks

7.15 Health related impacts

7.15.1 Discussion

As the operations at the proposed PV facility would not result in any air pollution, the subsequent health impacts on communities and property owners in close proximity or sensitive receptors are deemed insignificant. Additional waste would however be generated by the employees on site. This impact is expected to be mitigated through the proper design of the facilities on site and waste management activities which are required to be implemented.

On a global scale the project is anticipated to have positive social and health related impacts through the "greener" technology that will be used (limited noise / no emissions and so forth).

7.15.2 Assessment Table

Nature: Health related impacts		
	Without mitigation	With mitigation
Extent	Local (2)	Regional (3)
Duration	Long term (4)	Long term (4)
Magnitude	Minor (2)	Minor (2)
Probability	Improbable (1)	Probable (3)
Significance	Low (8)	Low (27)
Status (positive or negative)	Positive	Positive
Reversibility	Yes	
Irreplaceable loss of resources?	No	
Can impacts be mitigated?	Positive impacts can be enhanced	
Mitigation:		
<ul style="list-style-type: none"> Marketing of the "green" technology to be used can assist in awareness creation about the 		

Nature: Health related impacts
benefits of "green" technology.
<ul style="list-style-type: none"> • Engineering aspects and the design of the facility should ensure no environmental pollution. Proper waste, water and sanitation infrastructure and facilities must thus be installed.
Cumulative impacts:
<ul style="list-style-type: none"> • Wider awareness of "green" technology
Residual impacts:
<ul style="list-style-type: none"> • Same as above

7.16 Noise impact

7.16.1 Discussion

Due to the rural characteristics of the area, existing noise levels are anticipated to be low. Noise generating sources could relate to:

- The number of workers that would be on site on a daily basis;
- The influx of visitors to the proposed development;
- Vehicle movement;
- Maintenance to be undertaken at night, especially due to the even lower ambient noise levels experienced at night; and
- Some instances where lawn mowers could be used to mow the grass between the panels instead of being the responsibility of the sheep grazing in between the panels.

Dwellings in close proximity to the area are limited and the closest sensitive receptors are on the surrounding farms which in some cases could be approximately 1 km or further away from the facility. From a social observation it is perceived that there could be limited intermittent noise impact on Kudu Lodge on the farm Goedgevonden KR 104 and possibly on the other farms surrounding the property. This noise impact could be irritating, but is not anticipated to be socially disruptive.

7.16.2 Assessment Table

Nature: Noise impact		
	Without mitigation	With mitigation
Extent	Local (2)	Local (2)
Duration	Long term (4)	Very short duration (1)

Nature: Noise impact		
Magnitude	Minor (2)	Minor (2)
Probability	Probable (3)	Improbable (1)
Significance	Low (24)	Low (6)
Status (positive or negative)	Possibly negative	Neutral
Reversibility	Yes	
Irreplaceable loss of resources?	No	
Can impacts be mitigated?	Yes	
Mitigation:		
<ul style="list-style-type: none"> • Employees should understand that excessive noise could be problematic and should thus attend to this issue in a sensitive manner • The use of lawnmowers should be kept to the minimum • Schoolchildren should be supervised at all times to try to keep noise levels to a minimum 		
Cumulative impacts:		
<ul style="list-style-type: none"> • None anticipated 		
Residual impacts:		
<ul style="list-style-type: none"> • Possible slight increase in noise levels at specific times only 		

7.17 Lighting pollution

7.17.1 Discussion

Due to the rural landscape of the area, no light pollution is currently experienced. Any illumination at night could have a negative impact on the sense of place especially on the surrounding farms.

Maintenance personnel that would undertake their work at night would probably use torchlight. In addition no high mast lights would be installed. Security lights would rather take the form of infrared security cameras and/or CCTV monitoring.

7.17.2 Assessment Table

Nature: Lighting pollution		
	Without mitigation	With mitigation
Extent	Local (2)	Local (2)

Nature: Lighting pollution		
Duration	Long term (4)	Long term (4)
Magnitude	Low (6)	Minor (2)
Probability	Probable (3)	Probable (3)
Significance	Medium (36)	Low (24)
Status (positive or negative)	Negative	Negative
Reversibility	Yes	
Irreplaceable loss of resources?	No	
Can impacts be mitigated?	Yes	
Mitigation:		
<ul style="list-style-type: none"> • Security lighting should be kept to the minimum • Lighting should be downward pointing and preferably no high mast lights should be installed • Security lights operating on motion sensors should be installed to minimise illumination of the area 		
Cumulative impacts:		
<ul style="list-style-type: none"> • Possible change of landscape character especially at night 		
Residual impacts:		
<ul style="list-style-type: none"> • Possible lighting pollution 		

8. CONCLUDING REMARKS

8.1 Attitude formation and potential for social mobilisation

Negative social impacts and the social desirability associated with the proposed project could result in attitude formation and follow-on social mobilisation against the project. At this stage there is some open attitude formation against the proposed project amongst some of the surrounding property owners. The most important factors which lead to the attitude formation include the following:

- The opinion that the facility should be situated in closer proximity to Vaalwater;
- The impact associated with the inflow of workers and visitors to the area;
- The perception that the surrounding residents would not receive any direct benefits from the facility and therefore the issue of receiving free electricity was raised on various occasions by different property owners;

- The perception that the proposed project could result in the devaluation of the surrounding properties due to the impact on the sense of place and negative visual impact (It should be noted that an Economic Impact Assessment has been conducted as part of the EIA and this document should be read in conjunction with the Economic Impact Assessment);
- The proximity of the facility to the Waterberg Biosphere Reserve and the possible impact of the facility on their status in the biosphere;
- The perception that the proposed facility would have a negative impact on the local tourism ventures, especially those of the Waterberg Meander.

The EIA process would attend to the issues above to determine the intensity of the various anticipated impacts, but it is recommended that a future transparent and comprehensible communication process should be embarked upon to address these. Thupela Energy should continue to communicate with the affected property owners at public forums attended by all the relevant role players. Sensitive issues should be dealt with accordingly.

8.2 General Conclusions

Based on the social assessment, the following general conclusions and findings should be noted:

- The potential negative impacts associated with the construction phase are typical of construction related projects and not just focused on the construction of the PV facility. These relate to the inflow of workers to the area, inflow of jobseekers, intrusion influences (e.g. noise pollution, increased vehicle movement and so forth), as well as safety and security issues. In most cases these impacts could respond to the mitigation measures proposed.
- Given the socio-economic profile of the population within the area, the possible job creation during the construction phase and operational phase of the proposed project is deemed as a significant positive injection into the area. It is anticipated that the unskilled and semi-skilled positions could be filled by local labourers.
- The majority of households in the study area live under severe poor conditions with low skills levels and low household income profiles. The proposed project could therefore assist in improving this situation for those who could obtain permanent employment at the facility. Even if it would only be a small contribution to the economic well-being of the larger population it should still be seen as a major positive impact on those affected.
- It is thus imperative that local labour be sourced otherwise no direct economic benefits would accrue to the locals. Preference should thus be given to the use of local labour during the construction and operational phases of the project as far as possible. Locals should also be allowed an opportunity to be included in a list of possible local suppliers and service providers.

- Failure to involve the local population, emerging contractors, and SMME's during construction could lead to negative attitude formation against the proposed project and the project proponent.
- The use of local labour could mitigate other negative social impacts associated with the inflow of outsiders.
- An inflow of outside jobseekers to the construction site is likely and could result in various negative impacts, but mainly if the jobseekers remain in the area after the construction has been completed.
- Capacity building and skills training among employees are critical and would be highly beneficial to those involved, especially if they receive portable skills to enable them to also find work elsewhere and in other sectors.
- The increase in construction vehicles would result in detrimental impacts on the local road conditions which could have lasting implications as it is not expected that the quality of the gravel roads would be sufficiently tended to by the MLM.
- Negative impacts on the local tourism sector are possible during the construction and operational phase although it is anticipated that these can be successfully mitigated and would not result in long-term negative financial implications. The local tourism industry can even benefit during the construction phase due to lodge occupancy by some construction team members. It is thus anticipated that the facility would rather be beneficial to the local tourism sector in the long term with potential subsequent positive financial impacts for those involved in this sector.
- Anticipated safety and security impacts during the construction phase remain a concern and should be sensitively and thoroughly dealt with.
- The MLM could benefit from the proposed project as a result from the improvement in the electricity supply in the area with subsequent positive economic spin-offs.
- Some local procurement of goods, materials and services could occur which would result in positive economic spin-offs
- The overall "sense of place" would be negatively influenced by the proposed project due to the facility's negative visual impact, and the change in land-use. In most cases it is extremely difficult to quantify the "soft" issues such as the impact on "sense of place" as the intensity would depend on each different individual's perception and experience of the area.
- It is, however, not anticipated that the proposed project would alter the host community's standard of living or quality of life or directly negatively impact on the activities undertaken on these properties, even though it would have a negative impact on the sense of place.

- The proposed PV facility would not be detrimental to the health of the host community, even though it would change the character of the area due to the visual impact associated with such a facility.
- It should be noted that the visual impact is a concern for the several property owners and this issue is not expected to be successfully mitigated.
- It is expected that the negative intrusion impacts associated with the project on the lifestyle within the area and activities undertaken on the farms, would remain high on the agenda of the surrounding residents, and directly affected landowners. Hence, if approved, the activities and management of the facility by Thupela Energy would in future still be closely monitored.
- The property owners' concerns concerning safety and security issues during the operational phase should be sensitively dealt with and be addressed as far as possible.
- The proposed PV facility could become a major tourist attraction in its own right and complement the existing tourism attractions in the area, thereby resulting in promoting a positive image of the area with resultant positive impact on the local tourism industry, economy, and environment.
- The project is anticipated to have positive social and health related impacts through the "greener" technology that will be used (limited noise / no emissions and so forth).
- On a global scale the project has the potential to assist in reducing carbon dioxide emissions which would thus have an ameliorating impact on global climate change.

From a social perspective it can be concluded that the proposed PV facility would not result in permanent damaging social impacts and that the socio-economic benefits associated with facility outweigh the negative social impacts. No negative social impacts that could be classified as fatal have been identified and there are no impacts of such a high significance that they could prevent the project from continuing. It is thus concluded that the proposed project is acceptable from a social point of view, if mitigation measures are strictly implemented.

9. RECOMMENDATIONS

From a social perspective the following recommendations are made:

- The proposed mitigation measures should be implemented to limit the negative impacts and enhance the positives.
- The project proponent should not just use the possible employment opportunities to obtain support from the local communities, but should be committed to creating long

term employment and capacity building, thereby ensuring long-term sustainable development in the area.

- Construction related skills obtained by individuals during the construction phase should be transferable to other sectors beyond the construction industry as further major construction projects in the area are quite unlikely.
- As the area could experience an inflow of outside jobseekers, the project proponent, local leaders and the MLM should jointly develop a strategy to minimise the influx of jobseekers to the area
- The jobs created during the operational phase, however, will have a more marked impact on the local community if it is ensured that the benefits to the local community and youth are enhanced.
- Benefits concerning the project should accrue to locals, especially concerning the improvement in the local electricity supply.
- The negative visual impact of the facility on the surrounding area should receive the attention it deserves.

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10.3 Consultation

The following individuals were consulted for the purpose of the Social Impact Assessment

Dr. R. Baber: Chairperson Waterberg Biosphere / Property Owner Farm Klipfontein / Manager: Farm Boschdraai

Ms. T. Baber: Property Owner Farm Klipfontein / Business Owner Beadle Craft Workshop and Shop

Mr. P. Siebe: Waterberg District Municipality

Mr. H. Phogone: Modimolle Local Municipality

Mr. H. and Mrs. M. van Herwaarden: Property owner Farm Vier-en-Twintig Rivier

Ms. Y. Fourie: Waterberg Tourism Office

Mr. T. Eloff: Property Owner Farm Sterkstroom KR 105/6 and 105/8

Mr. T. Hyam: Property Owner Farm Sterkstroom KR 105/7

Mr. R. Jurgens: Manager Farm Sterkstroom 102 and 103

Mr. D. Breedt: Property Owner Farm Schoongezigt Remaining Extent

Mr. N. and Mrs. C. Heal: Property Owners Farm Bellevue Portion 1 (Rainbows End)

Mr. W. and Mrs. W. van Rooyen: Property owner Farm Sterkstroom Portion 105/4

Appendix K: Socio-Economic Study

**Waterberg Photovoltaic Plant
Environmental Impact
Assessment:
Economic Specialist Study**

Final Report

22 October 2010

Prepared for:
Savannah Environmental

Prepared by:
Dr. Hugo van Zyl
Independent Economic Researchers



EXECUTIVE SUMMARY

This report provides economic specialist input into the EIA phase of the proposed Waterberg Photovoltaic (PV) Plant on the farm Goedgevonden 104 KR near Vaalwater in Limpopo Province.

A critical aspect of economic desirability is whether the proposed development complements **national energy planning, economic development planning, and spatial development planning**. The project achieves a high degree of fit with national energy planning policy with respect to renewable energy which has links to climate change, environmental impact, and energy security/flexibility considerations. National targets that include solar energy have been set and significant financial and other incentives have been offered to renewable energy developers in order to encourage projects. The project also has the potential to contribute to greater energy supply stability and security in the local area and region through diversification of energy sources. This will benefit all electricity consumers in the local area including local farmers, residents, tourism operators, and other business users.

At a regional and local scale, the concept of a solar facility is broadly supported in economic planning documents and the levels of support for renewable energy projects in other parts of South Africa indicates that their potential to add to economic development is recognised. With regard to specific spatial planning, the PV plant site is situated in a rural area which largely conforms with PV plant locations in other countries. The key question that remains with regard to the plant's compatibility with sound planning is thus its specific environmental impacts that are the subject of the EIA process.

While risks cannot be ignored, risk to **financial viability** are considered minor once a long term contract has been agreed on with the relevant authorities that secures payment for the electricity generated based on the National Energy Regulator (NERSA) Renewable Energy Feed-in Tariff (REFIT). The project will, however, have to compete with other privately developed solar energy projects in order to secure a contract from NERSA.

As no significant pollution or other external factors have been identified for the PV plant, it is anticipated that **agricultural production** and related activities will be able to continue as at present **on surrounding farms** in the area. Impacts on these farms will thus be neutral from an agricultural production point of view. Note that this assumes high levels of management and control of worker, sub-contractors and visitors access to the site and behaviour on the site and in surrounding areas.

Drawing on the visual assessment and direct observation of the site and surrounds, it seems most reasonable to conclude that the development would make a significant change to the current sense of place of the immediate surrounding area and would not be without tourism risks. However, one also needs to consider that the structures making up the PV plant would be relatively low-lying, the site's relatively low visual exposure potential and the high potential for screening and mitigation within the landscape. These factors indicate that it would be reasonable to expect medium risks to **tourism** in the wider area without mitigation and low risks with mitigation.

Positive impacts on tourism would stem from the potential attraction that the PV plant would introduce. Such facilities are certainly a rarity at a national scale and can create an interesting attraction that should appeal to tourists particularly if they are interested in renewable energy and sustainable living themes. The PV plant also has the potential to contribute to the tourism package on offer in the area through its potential to enhance the 'sustainable tourism' or 'eco-friendly' brand of the area.

Considered as a whole, the key potential drivers of negative tourism impacts (primarily visual impacts) do not seem to be significant enough to provide any clear basis to conclude that the project would entail more than a low level of risk for tourism. With mitigation, it is considered possible that this risk would be off-set by the positive attraction and eco-friendly image enhancement provided by the project. It is therefore predicted that the net tourism impacts (i.e. positive and negative) associated with the project would be low negative to neutral with mitigation in the wider area. With respect to specific properties with high visual exposure to the PV plant site, it is predicted that the net tourism impacts (i.e. positive and negative) with mitigation would be very low negative for the Sterkstroom 103 and Schoongezicht 107 farming unit and very low to low negative for Sterkstroom 105/4.

The project has the potential to have a highly significantly positive impact on economic activity in the local area and sub-region given the size of the **new spending injection** associated with it and the need for economic opportunities. Preliminary estimates indicate that a total of approximately R162 million would be spent on the entire **construction phase**. The majority of the specialised machinery and equipment would need to be imported as it is not currently available in South Arica. Notwithstanding the need for relatively high proportions of imports, the construction of the project represents a significant investment. Roughly 126 jobs of six month duration would be associated with the entire construction phase with the majority of jobs in the low and medium skill sectors as expected. It is anticipated that approximately 112 of these jobs would be allocated to workers from the Modimolle municipal area. Direct incomes flowing to workers from the Modimolle

municipal area would sum to R2.6 million over 6 months. R800 000 would accrue to workers from the rest of the country over the same period.

It is anticipated that roughly R11 million would be spent annually on operations. The Modimolle municipal area would benefit most from expenditure on salaries and a portion of engineering services and sundry supplies. A key benefit of the project would be its potential to create permanent jobs with an emphasis on labour intense operational methods. It is expected that approximately 90 direct employment opportunities would be created by the project with the majority of these in low skill level positions. It is also anticipated that all of these jobs would be filled by people from the Modimolle municipal area with a focus on Vaalwater and Boschdraai. The project would achieve a labour intensity of roughly 18 jobs per MW of capacity primarily due to the labour intensive operational protocol developed by the proponent. The labour intensity of the project is a significant benefit particularly when compared with other energy supply options.

In order to maximise benefits, reasonable targets should be set for the use of local labour, opportunities for the training of workers should be maximised, and local sub-contractors should be used where possible. It is important to recognise that the nature of the project dictates that large portions of skills, materials and other sub-contractors will have to come from outside the local area with a high portion of international imports. Any targets should reflect this, remain relatively broad and allow for adaptation if necessary. The proponent should also continue, as is their stated intention, to explore ways to enhance local community benefits with a focus on broad-based BEE through mechanisms such as community shareholding schemes and trusts.

In **conclusion**, when considering the overall quantifiable as well as more qualitative costs and benefits of the project it is anticipated that the latter should be more prominent allowing for the achievement of a net benefit with mitigation in the wider area and region. This implies that, with mitigation, the project would be desirable on balance from an economic impact perspective. The achievement of a net benefit at a local scale surrounding the site would be particularly dependent on extensive mitigation as the key risks of the project would be felt at this scale.

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1 INTRODUCTION

1.1 Terms of reference

Thupela Energy is proposing the construction of the Waterberg Photovoltaic (PV) Plant on a portion of Portion 2 of the Farm Goedgevonden KR 104 near Vaalwater in the Limpopo Province. The proposed project would utilise photovoltaic panels with a combined generation capacity of a maximum of up to 5 Mega Watts (MW). The plant and associated infrastructure is expected to cover an area of roughly 20 hectares (but not more than 30 ha), out of the broader 50 hectares making up the entire farm portion. The overarching objective for the proposed solar facility is to maximise electricity production through exposure to the solar resource, while minimising infrastructure, operational and maintenance costs, as well as social and environmental impacts.

Savannah Environmental has been appointed as the lead consultants by the proponents to conduct the EIA process of the proposed development being done in terms of the NEMA regulations. This economic specialist study forms part of the assessment phase of the EIA process. Its brief is to:

- » Describe the existing economic characteristics/context of the local area and broader region.
- » Identify and assess potential economic impacts at local as well as wider scales as relevant. These are expected to include the following:
 - Broad level review of the need and financial viability/risks associated with the project.
 - Degree of compatibility or fit with local, regional, and national economic development visions and plans including renewable energy plans.
 - Impacts on overall economic development potential in the area including impacts on commercial enterprises nearby the site (incl. agriculture, small businesses, tourism establishments and others).
 - Impacts on property values nearby.
 - Impacts associated with project expenditure on direct and indirect employment and household incomes. These impacts should be investigated through an examination of how the project and the spending injection associated with it may impact on the local, regional and national economy.
- » Propose and assess additional impacts, if required, based on professional expertise, experience and compliance with the relevant specialist study guidelines and best practice.

1.2 Approach and information sources

The approach adopted involved the following steps in line with accepted EIA practice:

1. Investigate the existing economic context within which the project would be established.
2. Identify economic impacts.
3. Assess economic impacts including those of a cumulative nature.
4. Recommend mitigation measures and re-assess impacts.

Guidance on approach was taken from the Department of Environmental Affairs and Development Planning (Western Cape) guidelines on economic specialist input to EIA processes which are broadly based on a cost-benefit approach to assessment (van Zyl et al., 2005). They include guidance on the appropriate level of detail required for the assessment in order that it is adequate for informing decision-making without going into superfluous detail (i.e. superfluous detail in this report as well as superfluous detail when the briefs of other specialist studies forming part of the EIA are taken into account). While these guidelines were developed as part of a Western Cape government initiative, they are equally applicable to other parts of South African and were endorsed at a national level by the then Department of Environment Affairs and Tourism. Impact significance ratings were generated using Savannah Environmental guidelines for impact rating (see Appendix 1 for an outline of these guidelines). All ratings reflect a consideration of direct, indirect, and cumulative impacts.

Information was gathered from the following sources in order to investigate the existing economic situation that would be affected by the project:

- » Information generated during consultations with the public and authorities.
- » Census 2001 and Community Survey 2007 data from the Statistics South Africa database.
- » Local economic development and planning documents.

Details on the approaches used to assess impacts are contained in the individual sections dealing with the impacts.

1.3 Assumptions and limitations

The following assumptions and limitations apply to this study:

- » The brief for the study stipulated the assessment of one site alternative and the no-development alternative. This meant that comparisons with other, potentially more or less suitable sites, was not possible. In this regard, I&APs have voiced concerns that a more suitable site may exist near Vaalwater where the facility would be more in character with its surroundings while ensuring that job opportunities are closer to those in need of employment. However, viability is closely linked to the project's ability to feed into the electricity grid in key areas such as the proposed site where it is needed and can add to stability (see Project Description section for motivation for site choice).
- » All technical, financial (i.e. market surveys, business plans, and costs) and other information provided by the proponent, other specialists, surrounding farmers and other official sources is assumed correct. The process undertaken by the proponent to identify the site is assumed rigorous and adequate for decision-making purposes.
- » The quantification of economic impacts in order to inform the assessment of the significance of impacts was not possible, nor considered necessary, for all impacts. Where possible, quantification focused on impacts considered most important in the overall assessment. Assessments of impact significance made without quantification (and based on a consideration of the likely magnitudes of impacts and/or expert judgements) are, however, considered adequate unless otherwise specified.
- » It needs to be recognised that predicting the economic impacts of most projects and particularly those, such as solar plants, which are not well known in the South African context, faces inherent uncertainties which tend to affect confidence in impact assessment.
- » The information generated by the soils/agriculture specialist is assumed adequate to inform decision-making around any losses of agricultural land and the associated trade-offs.

1.4 Expertise and declaration of independence

This report was compiled by Dr. Hugo van Zyl. Dr. van Zyl holds a PhD in economics from the University of Cape Town. He has thirteen years experience focusing on the analysis of projects and policies with significant environmental and development implications and has been involved in project appraisals of infrastructure projects, industrial and mining developments, mixed use developments, conservation projects, and eco-tourism initiatives throughout Southern Africa. He has lead, participated in

and co-ordinated research in economic impact assessment, environmental resource economics, and project appraisal and has contributed specialist input to over 50 environmental assessments (EIAs and SEAs). Dr. van Zyl is also the lead author of the Western Cape Department of Environmental Affairs and Development Planning guidelines on economic specialist input into EIAs (van Zyl et al., 2005).

Dr. Hugo van Zyl is independent and has no vested or financial interests in the proposed development being either approved or rejected.

2 PROJECT DESCRIPTION AND SOURCE OF IMPACTS¹

The solar facility is proposed on a portion of Portion 2 of the Farm Goedgevonden KR 104, which is located approximately 24 km north east of the town of Vaalwater within the Modimolle Local Municipality (see Figure 1). No other site alternatives are proposed for this project as the placement of a solar facility is strongly dependent on several factors including climatic conditions, topography, grid connection, the extent of the site, access to the site, etc. The site has been identified by Thupela Energy through extensive pre-feasibility studies as being highly desirable for the establishment of a photovoltaic plant as per the following technical, logistical, and environmental characteristics:

- » Climatic conditions: The economic viability of a photovoltaic plant is directly dependent on the annual direct solar irradiation values.
- » Topography: A relatively flat surface area is required for the placement of the photovoltaic panels and to facilitate construction of the plant.
- » Extent of site: Space is a restraining factor; for example a 1 MW fixed plant will require ~ 3 ha (thin film technology) or 1.4 ha (conventional photovoltaic technology). The proposed site is approximately 50 ha in extent, which will be more than sufficient for the installation of the plant as well as its associated infrastructure within the boundary of the broader site.
- » Power transmission considerations: Eskom's Mink power line traverses the site and therefore a switching station will be established whereby Thupela Energy can "turn in" to the said power line. It has been determined through preliminary discussions with Eskom that this line has capacity to receive the power from the proposed facility.

¹ Information sourced from the EIA Scoping Report (Savannah, 2010).

- » Environmentally suitable: The identified site has been transformed as it is used for pasture purposes. This lends itself to the establishment of the solar facility as it is preferable, from an ecological perspective, to utilise a transformed site.

The larger site identified by Thupela Energy covers an area of approximately 50 ha, which is larger than the development footprint for the proposed facility (estimated to cover an area of ~ 20 ha). Therefore the facility and its associated infrastructure can be appropriately placed within the boundary of the larger site.

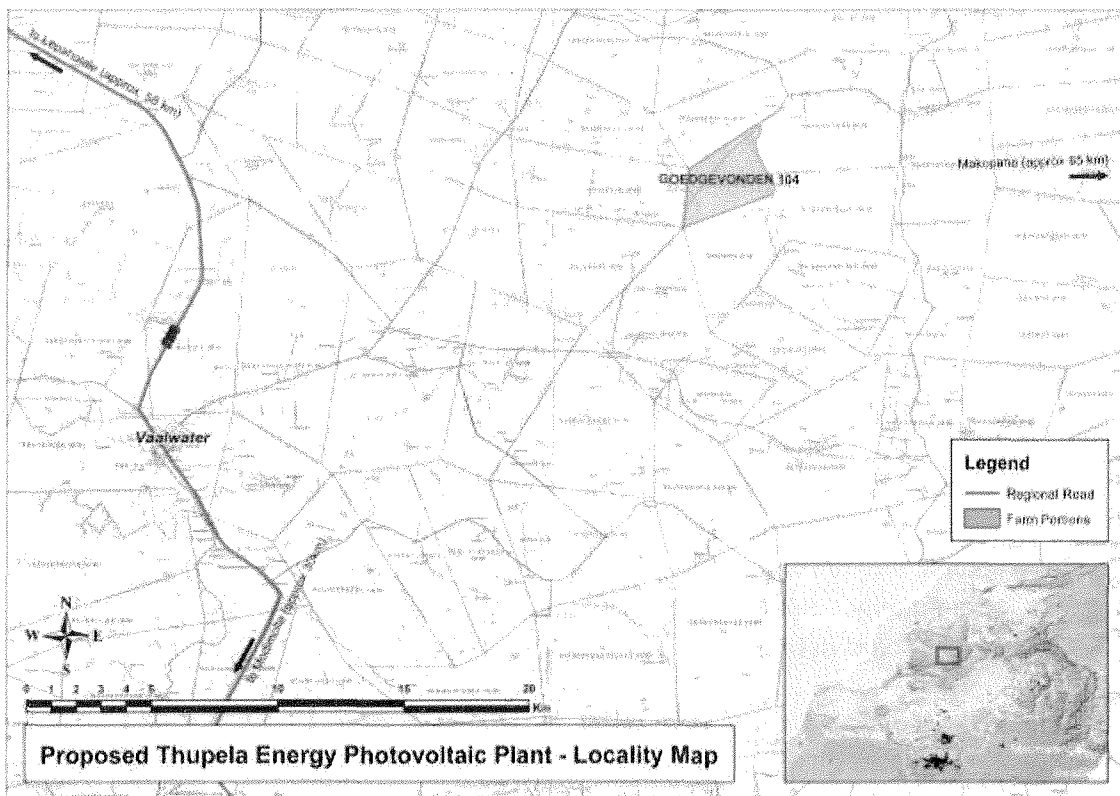


Figure 1: Location of the farm on which the Waterberg Photovoltaic Project would be established

2.1 Components of the facility and phasing

The facility is proposed to accommodate the following:

- » An array of photovoltaic panels with a generating capacity of up to 5 MW.
- » A switching station for the “turn in” into Eskom’s existing Mink power line which crosses the site. It has been determined through preliminary discussions with

Eskom that this line has capacity to receive the power from the proposed solar facility.

- » An extraction point and low volume water supply pipeline for the extraction of water from existing on-site boreholes. This will only be for the purpose of ablution facilities on site as the photovoltaic panels will be cleaned using pressurised air.
- » Access roads within the site (for the purposes of construction and limited maintenance).
- » Workshop, laydown and storage areas.
- » A Visitors Centre utilising an 'Eco Loo' system for the purpose of sanitation.

The construction phase is expected to require roughly 6 – 9 months for completion. The operational life of the photovoltaic panels is expected to be a minimum of 25 years. Their useful life can, however, be extended beyond 25 years through regular maintenance and/or upgrades in technology.

3 DESCRIPTION OF THE AFFECTED ECONOMIC ENVIRONMENT

The significance of impacts is often highly dependent on the economic environment or context within which they occur. For example, job creation in a small local community with a stagnating economy and high unemployment will be far more significant than it would be in a larger community with a healthy economy. In order to offer such baseline information to the impact assessment this section describes the economic environment. The main information sources used were Census 2001 data, Community Survey 2007 data, Integrated Development Plans, and Demarcation Board data.

The site is roughly 24 km north-east of Vaalwater and forms part of the Modimolle Local Municipality, which, in turn, is the largest local municipality forming part of the Waterberg District Municipality in Limpopo Province. Information regarding the economic context is thus primarily provided for the area immediately surrounding the site, Vaalwater, the Modimolle local municipal area and the Waterberg District municipal area.

3.1 Current land uses

The Modimolle Municipality is predominantly rural in nature, with the majority of land either in a mostly natural state or under cultivation. Modimolle/Phahameng is the nodal growth point of the municipality, while Vaalwater (Mabatlane) and Alma (Mabaleng) can be described as service points (MLM, 2010).

The wider area's most important economic activity is farming focused on livestock, game and selected crops. The tourism sector is also prominent and increasingly important particularly in relation to the Waterberg Biosphere Reserve area. A large percentage of land owners in the local area and region follow diversified income strategies that combine farming activities (including the breeding of game for sale) with tourism activities. These range from small accommodation offerings to large safari lodges that offer tours, hunting and other activities.

At present the proposed site for the PV plant is zoned for Agriculture, and is mainly used for grazing. Previously the site was irrigated using two centre-pivots and crops such as tobacco were cultivated. Cultivation was, however, stopped a number of years ago on the site. The key contributors to this decision were difficulties in maintaining viability in the face of poor soils and growing conditions.

3.2 Demographics

The total 2001 population in the Modimolle Municipality was 72 813 whilst that of Vaalwater was estimated at 8 334 (see Table 1). The population of the wider Waterberg District was 614 158 in 2001.

The Statistics SA 2007 Community Survey estimated that the total population in Modimolle was 52 605 (StatsSA, 2008). This would imply a significant reduction in population numbers relative to 2001 which is thought unlikely. The sample size used in the 2007 Community Survey was a fraction of that used in the 2001 Census which may explain discrepancies in population estimates. In addition, the Modimolle Local Municipality notes that Department of Local Government and Housing (DLGH) 2007 Settlement Database estimated total population at 80 043 which seems more realistic at least relative to Census 2001 estimates. Given uncertainties, the municipality is currently engaging in a data verification process to establish more accurate data whilst utilising the 2001 Census estimates in the interim for planning and budgeting (MLM, 2010).

Relatively nearby the proposed site lies the farm settlement of Boschdraai which emerged in response to the need for permanent housing for farm workers in the area. This settlement houses roughly 350 people in 35 to 40 houses and a compound building mostly for younger people (R. Baber, Waterberg Biosphere Reserve, pers. com.).

Table 1: Population numbers in the wider study area (2001)

	Waterberg District Municipality	Modimolle Local Municipality	Vaalwater
Black African	557 845	62 702	8 036
Coloured	1 713	191	-
Indian or Asian	1 440	123	-
White	53 160	9 797	298
Total	614 158	72 813	8 334

Source: StatsSA, 2002

3.3 Employment

As with the rest of the country, unemployment is a major challenge in the area and 'jobless' growth remains a feature of the economy. Based on the 2001 Census figures in Table 2 below, the Modimolle Municipality had an unemployment rate of approximately 24% which was similar to the national average at the time. However, Vaalwater (41% unemployed), and, to a lesser degree, the Waterberg District (31% unemployed) had higher unemployment rates by comparison indicating an above-average level of need for employment particularly in the Vaalwater area.

More recent estimates from the 2007 Community Survey indicate that unemployment remains a major challenge in the Modimolle Municipality, but that unemployment rates have improved to 20% for 2007 (StatsSA, 2008). This corroborates the unemployment estimates of 22% for 2008 contained in the Modimolle IDP (MLM, 2010). It is likely that the economic slow-down of the last two to three years has resulted in further pressure on employment. No recent official unemployment estimates were available for Vaalwater.

The majority of the working age population of Boschdraai are employed on Boschdraai farm itself and on other surrounding farms. Although accurate estimates are not available, it is thought that roughly 100 residents of Boschdraai have permanent jobs while between 20 and 30 are not permanently employed and rely on piecemeal work such as that offered by the Working for Water programme and projects such as road construction (R. Baber, Waterberg Biosphere Reserve, pers. com.).

Table 2: Unemployment in the wider study area (2001)

	Waterberg District Municipality	Modimolle Local Municipality	Vaalwater
Employed	140 368	22 734	1 098
Unemployed	62 614	6 987	766
% unemployed	31%	24%	41%

Source: StatsSA, 2002

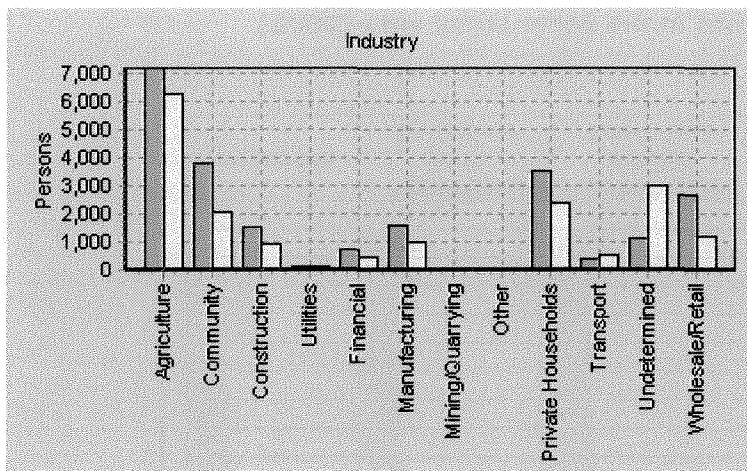
For the Modimolle Municipality and Waterberg District Municipal areas, the dominant sector in terms of employment provision is agriculture, hunting and forestry providing 31% and 24% of all employment opportunities respectively in these areas (see Table 3 below). Other important sectors in the Modimolle Municipality include community, social and personal services (17% of employment), private households (15% of employment) and wholesale and retail trade (12% of employment). Similar patterns with regard to important sectors are to be found in the wider Waterberg District with the exception of mining which provides 9% of the employment in the District whilst not featuring among employers in Modimolle Municipality. By comparison with the wider Modimolle municipal area, Vaalwater has particularly high proportions of people employed by private households (23% of employment), in community, social and personal services (21% of employment) and in wholesale and retail trade (18% of employment) reflecting its status as a local service centre.

Table 3: Employment per industry in the wider study area (2001)

	Waterberg District Municipality	Modimolle Local Municipality	Vaalwater
Agriculture, hunting; forestry and fishing	24%	31%	11%
Mining and quarrying	9%	0%	0%
Manufacturing	6%	7%	7%
Electricity; gas and water supply	1%	0%	1%
Construction	5%	7%	11%
Wholesale and retail trade	12%	12%	18%
Transport; storage and communication	2%	2%	2%
Financial, insurance, real estate & bus. services	4%	3%	3%
Community, social and personal services	15%	17%	21%
Other and not adequately defined	0%	0%	0%
Private Households	15%	15%	23%
Undetermined	7%	5%	3%
	100%	100%	100%

Source: StatsSA, 2002

Figure 2 shows that between 1996 and 2001 the number of jobs in the Modimolle Municipality increased by the greatest proportion in the wholesale and retail trade along with community, social and personal services sectors. Significant increases were also to be found in the agriculture, hunting and forestry and the private households sectors. Over a longer timeframe, the municipal Integrated Development Plan (IDP) notes that the sectors showing an increase in employment from 1996 to 2007 were the community services, finance, trade and construction sectors. Sectors which had a decline in employment contribution for the same period were transport, electricity, manufacturing, mining and agriculture. The IDP also points out that it is of particular concern that the agriculture sector's employment contribution is declining, since this sector is a major contributor to the employment opportunities in Modimolle Municipality (MLM, 2010).



Source: Demarcation Board using Census 2001 & 1996

Figure 2: Jobs per sector for the Modimolle Municipality (1996 – light bars, 2001 – darker bars)

3.4 Income levels

Table 4 below reports on household income levels in the study area. Approximately 57% of households in the Waterberg District and 53% in the Modimolle municipal area had incomes below R9,600 per year in 2001. Vaalwater fared substantially worse than these areas with 71% of households with incomes below R9,600 per year. Of particular concern in the Vaalwater area is the high portion of households with no source of income (i.e. 42%).

More recent estimates indicate that income levels remain a key concern. In 2009 it was estimated that 88% of the households in the Modimolle municipal area were earning less than R38 400 per year (MLM, 2010). This is a greater percentage than in 2001 without adjusting for inflation.

Table 4: Household incomes in the wider study area (2001)

	Waterberg District Municipality	Modimolle Local Municipality	Vaalwater
No income	22%	15%	42%
R1 - R4 800	12%	14%	5%
R4 801 - R9 600	23%	24%	24%
R9 601 - R19 200	16%	18%	16%
R19 201 - R38 400	13%	13%	7%
R38 401 - R76 800	7%	8%	3%
R76 801 - R153 600	4%	5%	2%
R153 601 - R307 200	2%	2%	1%
R307 201 - R614 400	0%	0%	0%
R614 401 - R1 228 800	0%	0%	0%
R1 228 801 - R2 457 600	0%	0%	0%
R2 457 601 and more	0%	0%	0%
	100%	100%	100%

Source: StatsSA, 2002

4 IDENTIFICATION OF ISSUES

The following impacts were identified as relevant for assessment based on the guidelines for economic specialist input (van Zyl et al., 2005), information from consultations with the public and nature of the project and receiving environment:

1. Fit or compatibility with planning guidance
2. Financial viability and associated risks
3. Impacts on tourism in the wider area and near the site
4. Impacts on agriculture on surrounding farms
5. Impacts on property values
6. Impacts associated with expenditure linked to the construction and operation of the development

These impacts were rated using accepted EIA conventions for determining their significance. Significance ratings were not appropriate or necessary for the evaluation of planning fit and financial viability.

The key environmental impacts that could result in economic costs (i.e. externalities) are assessed in the sections dealing with impacts on tourism, agriculture and on surrounding property values. The economic implications of the loss of conservation worthy habitat are not expected to be significant given the disturbed nature of the site.

5 ASSESSMENT OF IMPACTS AND IDENTIFICATION OF MANAGEMENT ACTIONS

This section provides an assessment of the impacts identified above and suggests management actions to avoid or reduce negative impacts; or to enhance positive benefits.

5.1 Compatibility or fit with policy and planning

The key strategic objectives for the proposed solar facility are to maximise electricity production through exposure to the solar resource, while minimising infrastructure, operational and maintenance costs, as well as social and environmental impacts (Savannah Environmental, 2010). This section assesses the likely impact of the project in terms of contributing to renewable energy policy imperatives along with a wider consideration of the projects fit or compatibility with economic development planning objectives.

5.1.1 *Energy policy imperatives and the environment*²

Historically, South Africa has relied heavily on non-renewable fossil fuels (primarily coal) for energy generation purposes. This reliance remains a key feature of the current energy mix with just over 90% of our electricity generation need met by non-renewables. Given South Africa's abundance of coal reserves relative to most other countries, it is not particularly surprising that our energy mix favours coal and it is to be expected that coal will remain dominant. However, relatively recent imperatives with regard to global warming, other environmental impacts associated with 'dirty' fuels and energy security have elevated renewable energy solutions to a far more prominent position both within energy policy and in the economic development arena in general. This has happened at a rapid pace particularly in response to the threats associated with global warming. Most governments in the global community now recognise that the roll-out of renewable energy at an unprecedented scale will be needed among a number of other actions to curb global warming. Targets for the promotion of renewable energy now exist in more than 58 countries, of which 13 are developing countries. In addition, the renewable energy industry is now a major economic player, with the industry employing over 2.5 million people worldwide. Renewable energy companies have grown significantly in size in recent years, with the market capitalisation of publicly traded renewables

² This section borrows heavily from a previous study done by the author which also required the consideration of project contribution to meeting renewable energy goals (see van Zyl, 2010).

companies doubling from \$50 billion to \$100 billion in just two years from 2005 to 2007 (NERSA, 2009).

There may still be disagreement on the equitable sharing of responsibilities for curbing global warming among nations. However, proposals tabled at the 2009 UN Climate Change conference in Copenhagen by a group consisting of the United States, China, Brazil, South Africa and India indicate that key developing nations including South Africa recognise that they will not be able to avoid significant responsibilities. When one looks at the developing nations as a wider group, South Africa stands out as a country that is going to have to introduce particularly significant measures as it is characterised by high levels of Greenhouse Gas (GHG) emissions relatively to other countries at similar stages of development. Du Plooy (2009) points out the following in this regard:

- » South Africa's CO² production doubled between 1980 and 2004 and is higher than that of Brazil, which has more than four times the population, and only slightly lower than the UK.
- » South Africa's economy is 5-10 times less carbon efficient (or its carbon intensity is 5-10 times higher) than the US, UK or Japan. Regarding total emissions, South Africa is not nearly as significant a contributor to climate change as China. However, South Africa is a far greater contributor to the world's CO² emissions than to the world's GDP and on this score just about exactly equaled China in 2003 at 2.8 tonnes of CO² for every \$1000 of GDP generated, compared to the US at 0.55.
- » South African emissions per capita are still half that of the US and slightly lower than Russia's, but three times higher than China's and nine times higher than India's.

South African energy policy has started to change from one that did very little to encourage renewable energy to one that actively encourages it. The Government's 2003 White Paper on Renewable Energy has set a target of 4% of electricity demand (equivalent to 10,000 Giga-watt hours (GWh)) from renewable energy sources in 2013 (DME, 2003).³ This target has been further refined to differentiate among different renewables. For independent solar power producers such as the project proponent, the NERSA target has been set at a relatively modest 200 Mega-watt (MW) of new capacity over the period 2010 – 2013.⁴ Bear in mind that the Integrated Resource Plan (IRP) for power supply in South Africa is currently undergoing revision. Given South Africa's leading role at the 2009 UN Climate

³ To put this into context, Europe as a whole has a renewable energy target of 20% by 2020.

⁴ This target implies to the installation of all forms of solar power and it is not yet clear how much will be allocated to photovoltaic sources (P. Calcott, Thupela, pers. com.).

Change conference in Copenhagen and increasingly widespread pressure for more renewable energy, it seems likely that renewables targets are set to increase.

In order to facilitate the roll-out of renewable energy and meet targets, three key economic incentives have been put in place to encourage investment in renewable energy. Firstly, tax incentives in the form of accelerated depreciation allowances for renewable energy developments are in place. Secondly, a 2c/KWh tax on electricity generated from non-renewable resources was implemented by National Treasury with effect from July 2009 with the intention of helping to manage the current electricity supply shortage and protecting the environment. Thirdly, and probably most importantly, the National Energy Regulator of South Africa (NERSA) recently announced a renewable energy feed-in tariff (REFIT) which has been positively received by the renewable-energy industry (van der Merwe, 2009). The specific objectives and key principles of the REFIT are to (NERSA, 2009):

1. Create an enabling environment for renewable electricity power generation in South Africa
2. Establish a guaranteed price for electricity generated from renewables for a fixed period of time that provides a stable income stream and an adequate return on investment
3. Create a dynamic mechanism that reflects market, economic and political developments
4. Provide access to the grid and an obligation to purchase power generated
5. Establish an equal playing field with conventional electricity generation
6. Create a critical mass of renewable energy investment and support the establishment of a self sustaining market

NERSA (2009) points out that: "Feed-in Tariffs (FIT) have been used in at least 36 other countries and are, in essence, guaranteed prices for electricity supply rather than conventional consumer tariffs. The basic economic principle underpinning the FITs is the establishment of a tariff (price) that covers the cost of generation plus a "reasonable profit" to induce developers to invest. This is quite similar to the concept of cost recovery used in utility rate regulation based on the costs of capital. Under this approach it becomes economically appropriate to award different tariffs for different technologies. The price for the electricity produced should be set at a level and for a period that provides a reasonable return on investment for a specific technology."

The renewable energy technologies identified thus far for the REFIT Phase I and II, and the approximate prices that energy suppliers would pay the renewable energy generators, are (NERSA, 2009 & 2009a):

- » Wind (R1.25 per kilowatt hour (KWh))
- » Small hydro (94 cents/KWh)
- » Landfill gas (90 cents/KWh)
- » Concentrated Solar Power (CSP) trough without storage (314 cents/KWh)
- » Large scale grid connected PV systems larger than 1 MW (394 cents/KWh)
- » Biomass solid (118 cents/KWh)
- » Biogas (96 cents/KWh)
- » CSP Tower with storage of 6 hrs per day (231 cents/KWh)

The differences between these tariffs indicate that solar power requires a greater subsidy than the other forms of renewable energy eligible for the REFIT. Solar energy does, however, show substantial promise despite a lack of facilities currently in operation and South Africa certainly is blessed with large areas where solar radiation levels are high and well distributed (Holm et al., 2008). In addition, the solar sector seems to show more promise for further technological advances. At a global scale, growth in the use of solar PV has been robust - installed capacity has quadrupled from 2 GW in 2004 to roughly 8 GW at the end of 2007 (NERSA, 2009).

In summary, the policy case for the urgent roll-out of renewable energy in South Africa has been made at a national government level using compelling arguments that are in line with international policy trends. Targets that include solar energy have been set (which may be revised upwards) and significant financial and other incentives have been offered to renewable energy developers in order to encourage projects and move decisively towards full-cost pricing of energy (i.e. prices which reflect global warming and other environmental impacts).

5.1.2 Local energy security

Aside from contributing to the achievement of national goals and policy imperatives outlined in the preceding section, the project has the potential to contribute to greater energy supply stability and higher levels of energy security in the local area through diversification of sources. This will benefit all electricity consumers in the local area including farmers, residents, tourism operators and other business users.

With regard to the local electricity supply situation, the Modimolle Municipality IDP has noted that the municipality currently has a total capacity of 23 MW. Out of the 23 MW, Modimolle town has a capacity of 20 MW and is currently using 17 MW while Vaalwater has a capacity of 3 MW and is currently using 2.8 MW (MLM, 2010). The municipality is in the process of installing additional capacity of 20 MW in Modimolle town. It has also identified the need to install a further 10 MW of capacity in Vaalwater and plans to start the process of raising funds for this project (A. Edwards, MLM, pers com). Aside from the need to increase capacity, electricity

supply stability in the area is not optimal and farmers in the surrounding area have raised the issue of power outages as a serious concern.

All power in the Modimolle Municipality currently comes from the 3 990 MW Matimba Power Station in Lephalale and is distributed via a sub-station in Modimolle town. The proposed PV plant would therefore provide some level of diversification which would assist in establishing greater supply security particularly in the surrounding farming area and Vaalwater. For instance, if the area experienced shortages or temporary supply cuts from Matimba, it would essentially be in a position to at least draw from the PV plant as a form of back-up option during daylight hours. This would enable those in the area to handle power outages far better as critical functions would still be possible such as the pumping of water for farming and the maintenance of minimal levels of cooling in refrigeration equipment.

Diversification and the increased security associated with it would be the key benefit of the project. It should also be noted that the PV plant would reduce overall distribution costs in the area. These reductions would stem from having to draw less power from Matimba Power Station which is significantly further removed from the local area.

5.1.3 *Fit with local development and spatial planning*

Economic development imperatives inform spatial planning imperatives. A critical aspect of economic desirability is thus whether the proposed development complements economic planning as reflected in spatial development planning. Note that the importance of the role played by local municipalities throughout South Africa in fostering sustainable economic development is set to continue increasing in keeping with an expectation for local government to be more 'developmental'. Tools such as Integrated Development Plans (IDPs) and their accompanying Spatial Development Frameworks (SDFs) play a prominent role in this regard. Bear in mind that the basic purpose of SDFs are to specify the spatial implications of IDPs designed to optimise economic opportunities. Specifically, a SDF has the following objectives and characteristics (Dennis Moss Partnership, 2003):

- It expresses government policy and the views and aspirations of all I&APs.
- Government departments and other authorities and institutions involved in future development and land use planning in the municipality will be bound by the SDF proposals.
- It provides certainty to the affected communities regarding future socio-economic and spatial development in the area.

- It provides a basis for co-ordinated decision-making and policy formulation related to future land use.
- It creates opportunities for preparing development and action plans to which financial budgets can be linked.

The proposed PV plant ideally needs to 'fit' with what is envisaged in the IDP, SDF, structure plans and other planning documents in order for it to clearly 'fit' with the optimal distributions of economic activity as envisaged in these plans. Or, if it doesn't obviously fit with existing planning, there need to be clear and compelling reasons why a deviation from planning should be considered.

The key documents that provide guidance regarding planning in the area are the 2010/2011 Waterberg IDP, the 2010/2011 Modimolle IDP, the 2009 Modimolle Local Economic Development (LED) Strategy and the 2010 Modimolle SDF. Considered as a whole, these documents recognise the importance of integrated and diversified economic development that makes optimal use of each locality's comparative advantages. The concept of a solar plant is thus broadly supported and the levels of support for renewable energy projects in other parts of South Africa indicates that interest in their potential to add to economic development is recognised.

With regard to specific spatial planning that applies to the proposed PV plant site, the Modimolle SDF is most relevant. The SDF cautions that the rural environment should be protected from development that is not in line with the rural character of the area (MLM, 2010). It provides the following principles for evaluating applications for developments outside the urban edge:

- » "Uses should be rural in nature, or should require a rural setting in order to be functional or viable.
- » The development should not require extensive service infrastructure.
- » The development should not have any negative environmental impact.
- » The development should not create possibilities for other developments to establish in the area.
- » Uses that primarily service the local market.
- » Uses which are resource based.
- » Uses which are located at a defined and approved service delivery centre."

Given the newness of solar PV projects to South Africa, it is difficult to come to clear conclusions regarding planning fit. No comparable sized solar plants currently exist in South Africa. Broad guidance on plant location trends is, however, available from other countries. The majority of solar power plants that have been established in

other parts of the world are set in rural areas where land uses such as agricultural or natural areas are dominant. Some are located relatively remotely from towns or cities while others are relatively close to settlements and few are to be found in sub-urban areas. This is probably a function of higher property values in sub-urban areas which affects viability and introduces trade-offs with urban expansion. The proposed location of the PV plant is thus not out of line with international trends. The key question that remains with regard to its compatibility with sound planning is thus its specific environmental impacts (H. Phogole, MLM, pers. com.). These are the subject of the EIA process, of which this report forms part, and will need to be considered by the local and regional planning authorities.

5.2 Financial viability and risks

Long term positive economic impacts can only flow from a project that is financially sustainable (i.e. financially viable in the long term with enough income to cover costs). As with other solar power and renewables projects, the proposed project would not be financially viable without the gradual phasing out of implicit subsidies for non-renewables and coal in particular. This phasing out also needs to be combined with the phasing in of subsidies for renewable in order to 'level the playing field'. In combination, the tax on non-renewables, the accelerated depreciation allowance and REFIT outlined previously have catalysed high levels of interest in establishing renewable energy projects such as the Waterberg PV Plant. These measures essentially ensure the financial viability of appropriate renewables projects in order to encourage these types of projects. The Waterberg PV Plant is thus highly likely to prove financially viable assuming it is able to secure a long term contract based on the REFIT tariff - this has been confirmed with the proponent (P. Calcott, Thupela Energy, pers com).

As mentioned previously, NERSA has thus far only committed to offering private solar power producers long term power purchase contracts up to a maximum of 200 MW by 2013. It is therefore likely that the project will have to compete with other private solar projects for long term contracts. This competition may prove intense and at this stage it is not possible to determine whether the project will be one of the project chosen to qualify for a long term contract - the NERSA adjudication process will determine this.

The financial returns that motivate developments such as the Waterberg PV Project are necessary as the promise of profit is what fuels much of our economy. It does, however, need to be recognized that achieving profits for some can come at a cost to wider society. The remainder of this report focuses on the economic impacts (including costs and benefits) that would accrue to wider society in order to provide information on the overall economic desirability of the project.

5.3 Impacts on tourism

Tourism plays an important role in the economy of the local area and region and has the potential to play an increasingly prominent role as a driver of economic development. It is thus important to consider the potential impacts of the proposed development on this sector in general. In addition, land owners in the immediate vicinity of the site are partially reliant on tourism for their livelihoods. Impacts on tourism are thus assessed in this section making the distinction between impacts on the overall tourism potential of the area and impacts on key nearby land owners that would have the greatest visual exposure to the PV plant and have raised concerns regarding its potential impacts.

5.3.1 *Impacts on overall tourism potential in the area*

Tourism impacts are often driven by changes in the attractiveness or sense of place in an area. The proposed development thus has the potential to impact on tourism as its nature dictates that it should impact on the character of the area (i.e. visual). Potential positive impacts could also arise should the development provide an added attraction in the area that could draw tourists.

In order to assess tourism impacts, information on current tourism use and potential future use focusing on the area surrounding the site was gathered. A field trip to the area was conducted and discussions were held with tourism stakeholders in order to get their views on potential impacts and inform assessment. Pertinent information from other specialist studies was examined, discussions were held with the specialists where necessary, and an assessment of impacts made. In this regard, the visual specialist study was most relevant.

The current tourism 'use' of the site is not direct in nature as there are no tourism facilities on the site. However, the site is indirectly part of the tourism package of the area as it can be seen from vantage points on surrounding properties that are used for tourism purposes. It can also be seen from selected smaller roads that form part of the Waterberg Meander. The site is situated just outside the transition zone of the Waterberg Biosphere and is thus not strictly part of, but is close to, the designated Biosphere area and would be visible from some properties that do fall within the Biosphere. Discussions with the spokesperson for the Biosphere revealed concern with regard to visual impacts and potential clashes with the rural character of the area and tourism. However, the urgent need for renewable energy projects was also recognised in addition to the potential for renewable projects to enhance the eco-friendly brand of an area (A. Roberts, Waterberg Biosphere, pers. com.).

Negative impacts

With regard to the potential negative tourism impacts of renewable energy projects, very little accessible research work has been done on the impacts of solar PV plants. Significantly more research has been conducted on wind energy. This is understandable given its potential for visual impacts and its greater prominence as a renewable energy provision option in general. While this research is not directly applicable to the assessment of solar PV plants, it is nevertheless useful in building an understanding of the issues and potential impacts of the proposed facility and is therefore summarised below.

The potential for wind farms to have negative impacts on tourism is something that has received more research attention in Europe and the United States given the far greater number of wind farms in these countries. A recent review of research on the economic impact of wind farms on tourism covering 40 studies in the UK and Ireland and other reports from Denmark, Norway, the US, Australia, Sweden and Germany provides a comprehensive source of information on this issue (GCU, 2008). In summary it found that:

- » "There is often strong hostility to developments at the planning stage on the grounds of the scenic impact and the perceived knock on effect on tourism. However developments in the most sensitive locations do not appear to have been given approval so that where negative impacts on tourism might have been a real outcome there is, in practice, little evidence of a negative effect.
- » There is a loss of value to a significant number of individuals but there are also some who believe that wind turbines enhance the scene.
- » An established wind farm can be a tourist attraction in the same way as a hydro-electric power station. This of course is only true whilst a visit remains a novel occurrence.
- » In Denmark, a majority of tourists regard wind turbines as a positive feature of the landscape
- » Over time hostility to wind farms lessens and they become an accepted even valued part of the scenery. Those closest seem to like them most.
- » Overall there is no evidence to suggest a serious negative economic impact of wind farms on tourists"

These findings indicate that clear instances of negative impacts on tourism are relatively rare. This does not imply that negative impacts cannot occur, but does point to the need to have high levels of certainty before concluding that a wind farm would have a negative impact on tourism. The available evidence in the GCU review suggests that instances where wind farms are most likely to result in negative

impacts are those where they are situated in areas with a clear wilderness quality with little or no signs of 'civilisation' in the form of infrastructure such as power lines, roads, etc. The research on wind farms is instructive for the proposed solar PV plant in that it shows that cases of negative impacts on tourism from significantly more visually imposing structures such as wind turbines have been rare.

The visual specialist study has found that the PV plant would be located in a relatively sensitive area which is rural in character, relatively remote and has very few structures impinging on the general sense of place. Farming homesteads dot the countryside at irregular intervals. Vegetation cover is defined as natural woodland and thicket / bushland, while large tracts of land, including parts of the farm where the proposed site is located, have been transformed (fallow land, old agricultural fields or overgrazed land) through agricultural or cattle farming practises (MetroGIS, 2010). The facility would be exposed to a relatively small and localised geographical area within the region due to (MetroGIS, 2010):

- » The small dimensions of the plant's components,
- » The relatively low height of its structures,
- » Its low-lying location in the landscape (close to a prominent drainage line), and
- » The high visual absorption capacity (VAC) of the natural vegetation cover in the area.

The visual specialist study notes that the PV plant would be visible within an area that incorporates various sensitive visual receptors that should ideally not be exposed to industrial style structures. In terms of visual exposure to roads that are used by tourists, the PV plant is not expected to be visible from any tarred roads. It would be visible from limited sections of the secondary gravel roads near the site (i.e. the D2747, D2416, and D579) (MetroGIS, 2010). These routes were driven as part of the tourism impact assessment process and the potential to see the site only intermittently for most stretches of the roads was confirmed. In addition, views of the site are not particularly close from these roads with the exception of the Melkrivier Road which passes closest to the site.

Although the visual specialist study recognised risks to tourism, it concluded that, "the PV plant is not envisaged to have a major negative visual impact on the existing activities and future tourism potential of the area and may in fact add to the plethora of attractions contained therein. The facility may be visible from certain stretches along the D579, D2416, D2747, and D1959 roads but the nature of recreational activities (game viewing, quad biking, arts and crafts viewing, etc.) is not likely to be significantly influenced" (MetroGIS, 2010).

Drawing on the visual assessment and direct observation of the site and surrounds, it seems most reasonable to conclude that the development would make a significant change to the current sense of place of the immediate surrounding area and would not be without tourism risks. However, one also needs to consider that the structures making up the PV plant would be relatively low-lying, the site's relatively low visual exposure potential and the high potential for screening and mitigation within the landscape. These factors indicate that it would be reasonable to expect medium risks to tourism without mitigation and low risks with mitigation.

Positive impacts

Positive impacts on tourism would stem from the potential attraction that the PV plant would introduce. Such facilities are certainly a rarity at a national scale and can create an interesting attraction that should appeal to tourists particularly if they are interested in renewable energy and sustainable living themes. This is not to say that tourists would visit the area specifically to see the PV facility (although this is a possibility). Rather, it seems likely that the facility could add to the overall tourist experience in the area particularly while it remains novel. Appreciation of the facility by tourists could take the form of visits via the planned visitor's centre or through viewing the facility whilst driving past or from other vantage points.

Aside from potential benefits through visiting and/or viewing the facility, it also has the potential to contribute to the tourism package on offer in the area through its potential to enhance the 'sustainable tourism' or 'eco-friendly' brand of the area. Numerous examples can be found of individual tourism establishments and wider tourism areas that have used initiatives such as renewable energy installations, recycling programmes, rehabilitation programmes, etc. to their advantage. These initiatives are commonly used to enhance general reputation and credibility. In some cases they are part of a focused strategy that actively markets high levels of eco-friendliness or sustainability.

With regard to the local use of solar PV for tourism initiatives, Aquila Safari Lodge near Touws River in the Western Cape recently installed a PV plant with a 60 kW capacity to supply its daytime power requirements. The lodge felt that the plant would enhance its image and give it a competitive edge as a long-haul destination as travellers become more concerned about their carbon footprint (Van der Merwe, 2010). In addition to the plant on the lodge, a larger 50 MW plant is being planned nearby with the potential to power some 100 000 homes in the area. Land for the project has been secured and the environmental impact assessment is proceeding (Van der Merwe, 2010).

The balance between positive and negative impacts

Considered as a whole, the key potential drivers of negative tourism impacts (primarily visual impacts) do not seem to be significant enough to provide any clear basis to conclude that the project would entail more than a low level of risk for tourism. With mitigation, it is considered possible that this risk would be off-set by the positive attraction and eco-friendly image enhancement provided by the project. It is therefore predicted that the net tourism impacts (i.e. positive and negative) associated with the project would be low negative to neutral with mitigation (see Table 5).

With reference to the construction phase, some disturbance and nuisance would be unavoidable. This would include the potential for increased dust and noise as well as increased social risks associated with a large workforce. Impacts should, however, be minimal provided the construction phase is well managed and the mitigation measures suggested by the other specialist studies forming part of the EIA are implemented.

Bear in mind that the balance between positives and negatives as well as the significance of tourism impacts are difficult to predict as they are primarily reliant on the perceptions of tourists some of whom may find that the project detracts from their experience and others who may not. Confidence in assessment is thus medium.

The no-development would have no impacts on tourism as it would maintain the status quo.

Table 5: Impact summary table – impacts on tourism

Nature: Impacts on the tourism potential of the wider area		
	Without mitigation	With mitigation
Extent	Regional (3)	Regional (3)
Duration	Long term (4)	Long term (4)
Magnitude	Medium (6)	Low to neutral (2)
Probability	Probable (3)	Probable (3)
Significance	39 (Medium)	27 (Low negative) to neutral
Status	Negative	Negative to neutral
Reversibility	High	High
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	
Mitigation: The measures recommended in other specialist reports and the EMP to minimise impacts on the surrounding physical environment (primarily the minimisation of visual and potential pollution-related impacts) and social environment would also minimise tourism impacts.		
Cumulative impacts: None		
Residual impacts: None		

Mitigation measures

- » Impacts on tourism are dependent on how the site is developed and managed to minimise negative impacts on the surrounding environment. The measures recommended in other specialist reports and the EMP to minimise impacts on the physical environment (primarily the minimisation of visual and potential pollution-related impacts) and the social environment would thus also minimise tourism impacts.
- » Once the visitor centre is established on the site, the proponent should publicise its existence widely in tourism circles and be open to the use of the PV plant in promotional material for the area.
- » The proponent should keep communication channels with neighbouring farmers open and consider the establishment of a local land owners' forum in which concerns and issues associated with the plant can be raised and dealt with pro-actively.

5.3.2 Impacts on tourism establishments near the site

Aside from concerns regarding potential impacts on the overall tourism potential of the area, concerns have also been raised regarding impacts on specific tourism

establishments nearby the site. These concerns focus on the farm Sterkstroom 105/4 to the north of the site and the farming unit consisting of Sterkstroom 103 and Schoongezicht 107 to the south and south east of the site (see Figure 3). This section focuses on impact on tourism associated with these properties.

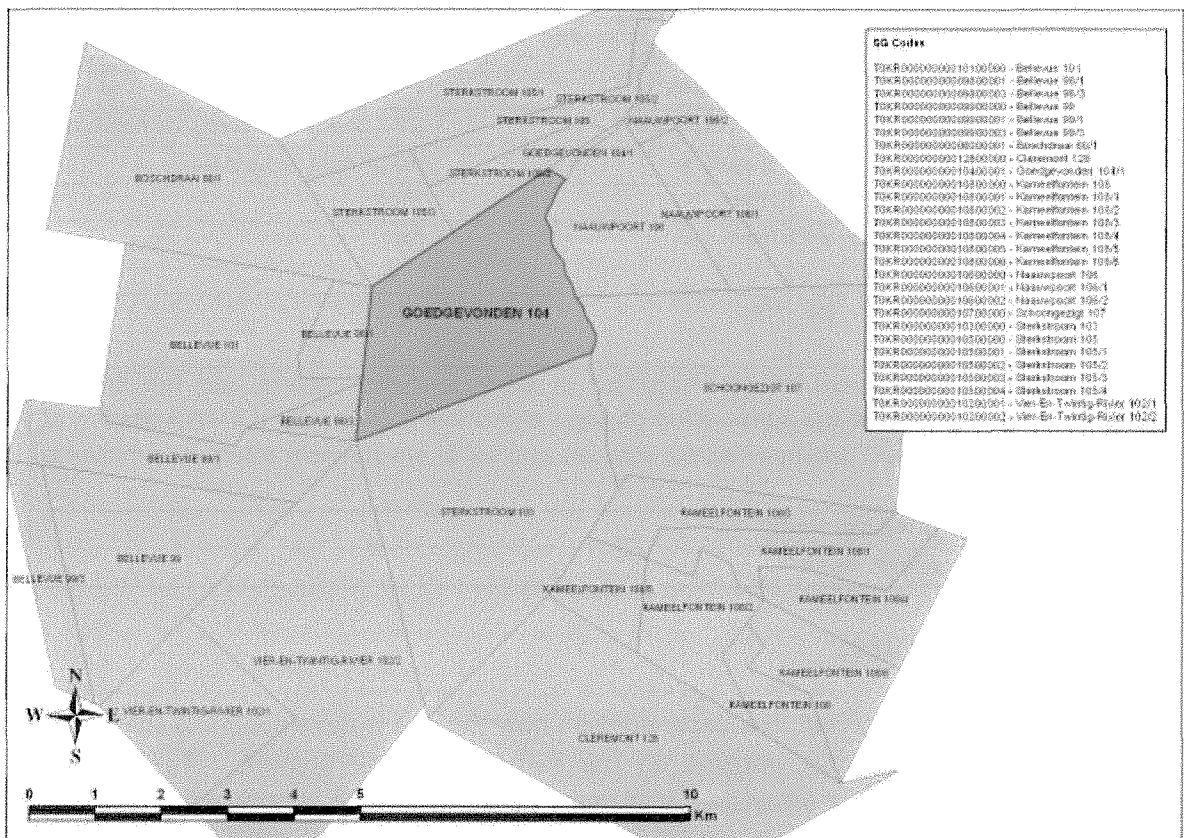


Figure 3: Farming units surrounding Goedgevonden 104 on which the Waterberg PV Plant would be established

Sterkstroom 105/4 is roughly 130 ha in extent and contains a mixture of tourism use and agriculture in the form of cattle rearing.⁵ The main dwelling on the farm has been converted over time into a lodge which can sleep up to 40 people in five medium-sized bedrooms, one large bedroom and one large loft area which sleeps large groups. The lodge currently operates under the name Matlapaning and relies almost exclusively on word of mouth and repeat visitors for business. Visitors are charged R300 per person per night and occupancy currently fluctuates between 40 and 60 days per year. Accommodation is offered on a self-catering basis and basic

⁵ All information relating to the operation of the farm and associated tourism facilities was obtained through an interview with the farm owner, Willie van Rooyen.

food stuffs and supplies are on sale at the lodge. Cleaning, gardening and maintenance is taken care of by two staff members.

With respect to future plans the owner of the lodge is planning to erect eight log cabins adjacent to the lodge in order to offer additional accommodation capacity and options.

The owner of Sterkstroom 103 has recently purchased the entire extent of the adjacent Schoongezicht 107 to form one farming unit of roughly 3 000 ha.⁶ This farm has high game farming and tourism potential given its size, predominantly natural vegetation, presence of game, natural features, and access to water. A key focus of operations on the farm is continued stocking for game farming purposes and tourism use. Current tourism activity on the farms is limited as the establishment of tourism accommodation facilities is being undertaken. The main dwelling on Schoongezicht 107 is being renovated into the Amber Brooke Lodge that would sleep eight people in the main house and up to 12 people in a separate bedroom/bungalow structure. The lodge would be relatively upmarket and would include the option of game viewing trips on a dedicated 4X4 vehicle. Aside from this lodge, the farming unit also contains two dwellings on Sterkstroom 103 – one for the owner and one for the farm manager.

With respect to future plans the owner plans to establish the main accommodation option on the farm in the form of an upmarket lodge area centred around the koppie in the south eastern quadrant of Schoongezicht 107. This site has been earmarked for the lodge primarily due to its panoramic views. The lodge will probably take the most common form associated with upmarket lodges – separate sleeping units connected to a central area containing a restaurant and other facilities such as a pool. Planning for the lodge has not reached the stage where its size has been determined. Based on averages in the area, however, it will probably be able to accommodate 30 – 60 people at a time.

Potential risks and opportunities associated with the PV plant on the tourism potential of Sterkstroom 105/4 and the Sterkstroom 103 / Schoongezicht 107 farming unit would stem from the same impacts as for the wider area discussed in the previous section. The key differences would arise from the potential for impacts to be of a higher intensity given the proximity of the farms to the proposed site. With regard to visual impacts, risks would be higher on Sterkstroom 105/4 given the elevated views over the PV plant site from the existing lodge and large parts of the western part of the property. The lodge would be roughly 1.2 km from the closest

⁶ All information relating to the operation of the farm and associated tourism facilities was obtained through interviews with the farm manager and owner, Rob and Mark Jurgens respectively.

edge of the site and the majority of the higher lying western part of the property would be between 0.8 km and 1.4 km from the site. On Sterkstroom 103 / Schoongezicht 107 the existing lodge would be roughly 1.8 km from the closest edge of the site. Due to low elevation and bush cover, the PV plant site would be visible from the road leading to the lodge, but not from the lodge itself. The site of the proposed lodge in the south eastern quadrant of Schoongezicht 107 would be elevated enough to see the site. Views of the PV plant site would be relatively distant from this vantage point, it being roughly 5 km away. The series of photos which follow (own photos and photos sourced from MetroGIS, 2010) show views of the proposed site from various vantage points on the farms with relevance from a tourism perspective.

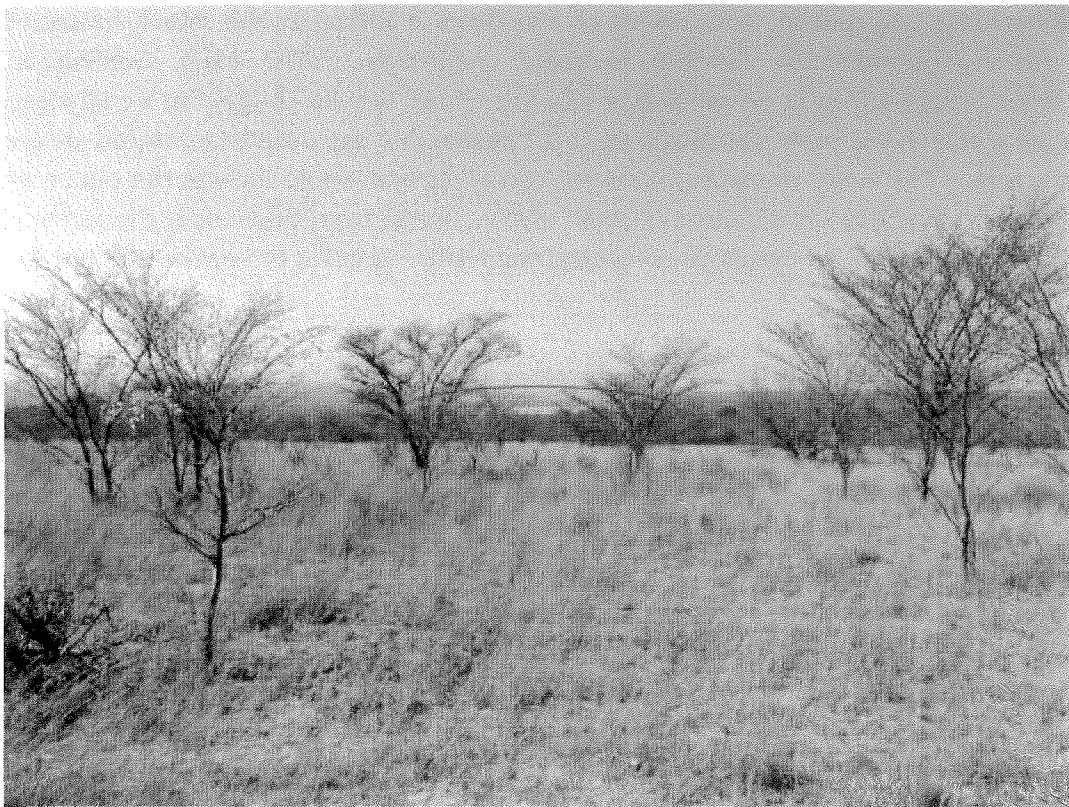


Figure 4: View of the site from nearby the existing lodge on Sterkstroom 105/4



Figure 5: View of the site looking from the north western boundary of the Farm Sterkstroom 105/4

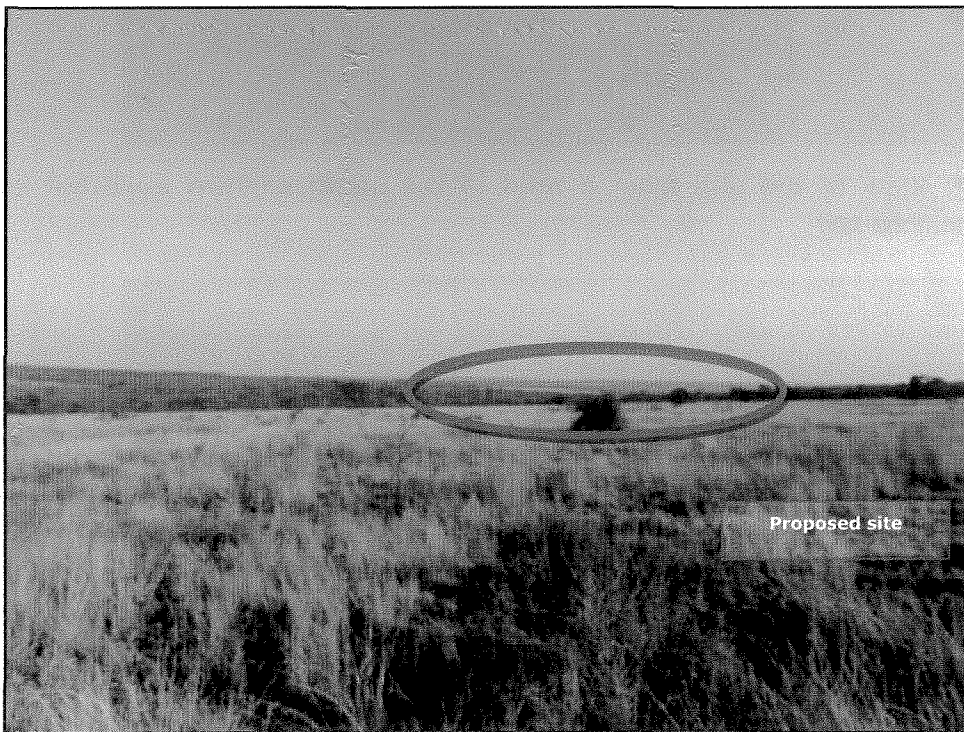


Figure 6: View of the site from the road leading to the existing lodge on Schoongezicht 107

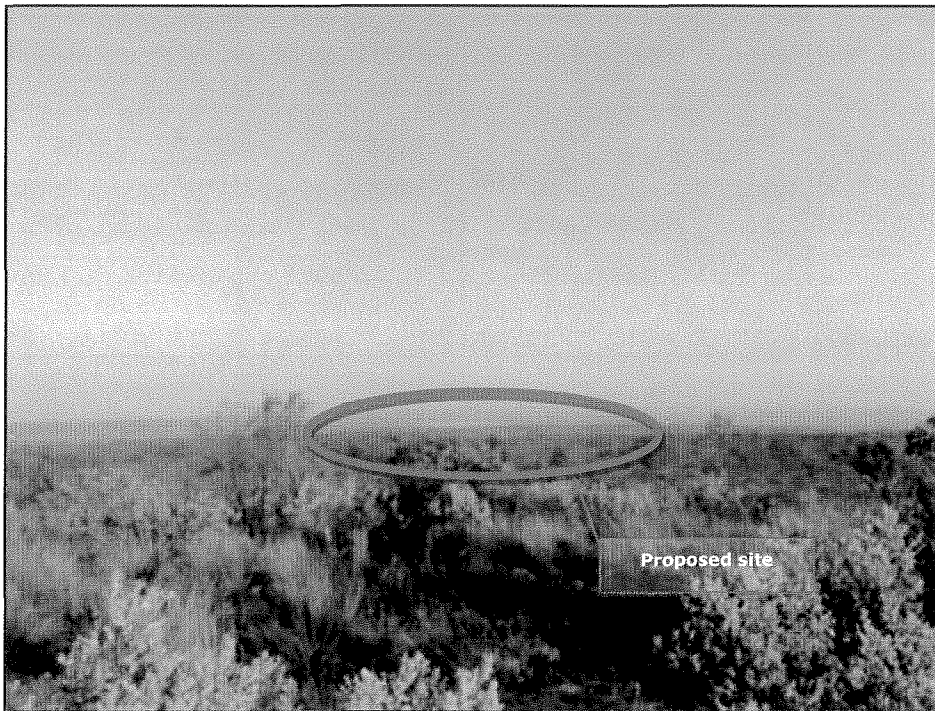


Figure 7: View of the site from a road in the south eastern quadrant of Schoongezicht 107



Figure 8: View of the site from the koppie in the south eastern quadrant of Schoongezicht 107 (proposed site for the location of a future lodge)



Figure 9: View of the site from a road along the farm boundary between Schoongezicht 107 and Naauwpoort 106



Figure 10: View of the site from a road close to the north western corner of Schoongezicht 107 nearest the site.

Based on existing and potential tourism activities on the farms, the findings of the visual specialist study and observations during site visits to the properties, it is predicted that risks to tourism would be low to medium for the Sterkstroom 103 and Schoongezicht 107 farming unit and medium for Sterkstroom 105/4 without mitigation. The key reasons for greater risks to Sterkstroom 105/4 are:

- » The significantly greater overall visual exposure to the site associated with Sterkstroom 105/4.
- » The greater visual exposure from the lodge on Sterkstroom 105/4 when compared to the existing lodge and planned future lodge on Schoongezicht 107.
- » The smaller size of Sterkstroom 105/4 allowing for less flexibility in the siting of future tourism facilities.

To a greater degree than for the wider area, both farms would be in a position to use the PV plant as an eco-friendly marketing tool and an attraction for guest to visit which would counter negative impacts. The solar initiative at Aquila Safari Lodge shows that this is a possibility. It is, however, also recognised that the scale of the proposed PV plant on Goedgevonden would be larger than is ideal from the perspective of neighbouring tourism establishments.

With mitigation as outlined in Section 5.3.1, it is predicted that the net tourism impacts (i.e. positive and negative) associated with the project would be very low negative for the Sterkstroom 103 and Schoongezicht 107 farming unit and very low to low negative for Sterkstroom 105/4. Note that this finding assumes particularly diligent mitigation of visual impacts and high levels of management and control of worker, sub-contractors, and visitors access to the PV plant site along with behaviour on the site and in surrounding areas.

5.4 Impacts on agriculture surrounding the site

The soil survey (Paterson and Seabi, 2010) provides the necessary assessment to inform trade-offs related to the conversion of agricultural land on the PV plant site.

The site is also surrounded mostly by other farms which need to maintain their production levels in order to remain viable. As no significant pollution or other external factors have been identified for the PV plant, it is anticipated that all agricultural production and related activities will be able to continue as at present on neighbouring farms in the area. Impacts on these farms will thus be neutral from an agricultural production point of view with mitigation (see Table 6). Note that this assumes high levels of management and control of worker, sub-contractors, and visitors access to the site along with behaviour on the site and in surrounding areas.

With reference to the construction phase, some disturbance and nuisance would be unavoidable. This would include the potential for increased dust and noise as well as increased social risks associated with a large workforce. Impacts should, however, be minimal provided the construction phase is well managed and the mitigation measures suggested by the other specialist studies forming part of the EIA are implemented.

Table 6: Impact summary table – impacts on agriculture on surrounding farms

Nature: Impacts on agricultural activities on surrounding farms		
	Without mitigation	With mitigation
Extent	Local (2)	Local (2)
Duration	Long term (4)	Long term (4)
Magnitude	Low (3)	Neutral
Probability	Probable (3)	Probable (3)
Significance	27 (Medium)	Neutral
Status	Negative	Neutral
Reversibility	High	High
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	
Mitigation: The measures recommended in other specialist reports and the EMP to minimise impacts on the surrounding physical environment (primarily the minimisation of visual and potential pollution-related impacts) and social environment would also minimise impacts on surrounding agriculture.		
Cumulative impacts: None		
Residual impacts: None		

Mitigation measures

- » Impacts on agriculture are dependent on how the site is developed and managed to minimise negative environmental impacts. The measures recommended in other specialist reports and the EMP to minimise impacts on the surrounding physical environment (primarily the minimisation of visual and potential pollution-related impacts) and social environment would also minimise impacts on surrounding agriculture.
- » The proponent will need to apply high levels of management and control of worker, sub-contractors, and visitors access to the site along with behaviour on the site and in surrounding areas.

- » The proponent should keep communication channels with neighbouring farmers open and consider the establishment of a local land owners' forum in which concerns and issues associated with the plant can be raised and dealt with pro-actively.

5.5 Impacts on property values

Economic theory assumes that property values capture not only the physical characteristics and productive potential of properties, but also the environmental and social characteristics of their surroundings. The PV plant's environmental and social impacts, and especially its visual impacts, have the potential to be reflected in, or impact on property values. Note that impacts on property values generally reflect impacts on tourism and agriculture which were dealt with in previous sections. This obviates the need for significant further discussion in this section and should be borne in mind in order to avoid double counting of impacts.

5.5.1 Key determinants of property values in the area

In order to gauge the potential impacts of the proposed expansion on existing property values, the determinants or drivers of values in the area were first considered broadly. Property values in the area are driven by a number of factors. Chief among these are:

- » The biophysical productive potential of the land (be it for conventional agriculture or game farming) which is linked to soil, climate and the availability of water and other services such as roads, electricity, etc.
- » Existing tourism facilities and attractions along with the potential for the development of tourism facilities and attractions.
- » Ability of the land to support a pleasant lifestyle. These can include peace and quiet, visual appearance, presence, and reliability of services, pollution levels, etc.

The value associated with each property in the area is essentially determined by a unique combination of these key factors and other factors that may be of relevance. This applies both to the farms surrounding the site as well as those in the wider region.

5.5.2 Negative impacts

Negative impacts would be associated primarily with visual impacts and potential social risks stemming from the introduction of new workers and sub-contractors in the area. The likely nature and magnitude of these impacts have been discussed in the sections on tourism impacts and impacts on agriculture surrounding the site and are not repeated here.

Primarily as a consequence of the prediction of relatively minimal risks to tourism, it is deemed highly unlikely that there would be more than a low level of risk for property values in the area.

5.5.3 Neutral and positive impacts

It is not expected that the PV plant would impact on the productive potential of neighbouring farms as discussed in Section 5.4. The relatively significant portion of property values related to this value stream would thus be unaffected.

As mentioned in the assessment of tourism impacts, the PV plant would introduce a novel renewable energy facility to the area. This would result in tourism opportunities and opportunities to enhance the eco-friendly marketing of the area.

Positive impacts should also flow from better security of electricity supply discussed in Section 5.1.2. This potential benefit has been mentioned by the farming community who see erratic electricity supply as a constraint to development and, therefore, property values (T. Eloff, Sterkstroom 105/3, pers. com.).

5.5.4 Overall impacts

Impacts on property values in the wider local area and region have been given a very low negative to neutral impact significance rating with mitigation based on a consolidated consideration of impacts outlined above and those discussed in the section on the impacts on tourism and the impacts on agriculture on farms surrounding the site (see Table 7 below).

Risks to specific neighbouring properties are considered higher than for the wider region, but nevertheless manageable. With mitigation, it is predicted that the net property value impacts (i.e. positive and negative) associated with the project would be very low negative for the Sterkstroom 103 and Schoongezicht 107 farming unit and very low to low negative for Sterkstroom 105/4. As with impacts on tourism, it should be noted that this finding assumes particularly diligent mitigation of visual

impacts and high levels of management and control of worker, sub-contractors and visitors access to the PV plant site along with behaviour on the site and in surrounding areas.

Some disturbance and nuisance would be experienced during construction. This would include the potential for increased dust and noise as well as increased social risks associated with a large workforce. Impacts on property values should, however, be minimal in this phase with mitigation and good management and as the property market is likely to take its lead from permanent impacts and not temporary disturbances. Bear in mind that the significance of property value impacts are difficult to predict as they are primarily reliant on the, often differing, perceptions of buyers in the market. Confidence in assessment is thus medium.

The no-development alternative would not result in impacts on property as it would maintain the status quo.

Table 7: Impact summary table – impacts on property values

Nature: Impacts on property values in the areas surrounding the site		
	Without mitigation	With mitigation
Extent	Regional (3)	Regional (3)
Duration	Long term (4)	Long term (4)
Magnitude	Medium (6)	Low to neutral (2)
Probability	Probable (3)	Probable (3)
Significance	39 (Medium)	27 (Low) to neutral
Status	Negative	Negative to neutral
Reversibility	High	High
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	
Mitigation: The measures recommended in other specialist reports and the EMP to minimise impacts on the surrounding physical (primarily the minimisation of visual and potential pollution-related impacts) and social environment would also minimise impacts on property values.		
Cumulative impacts: None		
Residual impacts: None		

Mitigation measures

- » Impacts on property values are dependent on how the site is developed and managed to minimise negative environmental impacts. The measures

recommended in other specialist reports and the EMP to minimise impacts on the surrounding physical (primarily the minimisation of visual and potential pollution-related impacts) and social environment would also minimise impacts on property values..

5.6 Impacts linked to expenditure on construction and operations

The construction and operational phase of the project would both result in a positive spending injection into the area that would lead to increased economic activity best measured in terms of impacts on employment and associated incomes in the local area and region.

All new expenditures will lead to linked direct, indirect, and induced impacts on employment, income, and production. Taking employment as an example, impacts would be direct where people are employed directly on the project in question (e.g. jobs such as maintenance workers), indirect - where the direct expenditure associated with a project leads to jobs and incomes in other sectors (e.g. purchasing building materials maintains jobs in that sector) and induced where jobs are created due to the expenditure of employees and other consumers that gained from the project. Direct impacts are the most important of these three categories as they are the largest and more likely to impact on the local area. Their estimation also involves the lowest level of uncertainty. The quantification of indirect and induced impacts is a far less certain exercise due to uncertainty surrounding accurate multipliers particularly at a local and regional level. This uncertainty makes it inadvisable to quantify indirect employment unless an in-depth analysis is required. Potential direct employment and income impacts are consequently quantified here and likely indirect impacts are considered in a qualitative sense when providing overall impact ratings.

5.6.1 Construction phase impacts

Construction expenditure would constitute a positive injection of new investment. During the construction phase the civil and other construction, specialised industrial machinery and building construction sectors would benefit. The development would provide an injection for contractors and workers in the area that would in all likelihood purchase goods and services in Vaalwater and Modimolle.

Preliminary estimates indicate that a total of approximately R162 million would be spent on the entire construction phase including infrastructure and building construction and the installation of specialised machinery and equipment in the form of the PV panels and associated items (see Table 8). The majority of the technical

solar machinery and equipment would need to be imported as it is not currently available in South Arica. Notwithstanding the need for relatively high proportions of imports, the construction of the project represents a significant investment spread over roughly six months.

Table 8: Construction phase expenditure

Construction component	Cost/expenditure in 2010 rands	% of expenditure on imports	% of expenditure on businesses in the Modimolle municipal area
Civils and all buildings	R 2 500 000	0%	80%
Machinery & equipment	R 160 000 000	70%	10%
Total	R 162 500 000		

Employment during construction

In order to estimate direct temporary employment during construction, standard construction industry estimates for labour required were used. Bear in mind that the estimates are not to be regarded as highly accurate and are meant to give an indication of potential employment impacts. Table 9 outlines that roughly 126 jobs of six month duration would be associated with the entire construction phase with the majority of jobs in the low and medium skill sectors as expected. It is anticipated that approximately 112 of these jobs would be allocated to workers from the Modimolle municipal area.

Table 9: Estimated direct temporary employment during construction

Construction component	Number of workers				Duration of employment
	Highly skilled	Medium skilled	Low skilled	Total	
-Civils and Building	1	4	5	10	6 months
-Installation of machinery and equip	6	10	100	116	6 months
Total	7	14	105	126	

Household incomes linked to wages during construction

Direct household income impacts would flow from all wages paid during construction. These were estimated by multiplying the projected number of direct jobs associated with the project above by assumed average monthly salaries for each skill category (i.e. R3,500 for low skilled, R9,000 for medium skilled and R20,000 for highly skilled employees). Again, these estimates are to be treated as indicators. The results of this exercise, in Table 10 below, indicate that incomes flowing to workers from the Modimolle municipal area would sum to R2.6 million over 6 months. R800 000 would accrue to workers from the rest of the country over the same period.

Table 10: Direct household income per area during construction (2010 rands)

	Direct income during construction			
	High skill	Medium skill	Low skill	Total
Workers from the Modimolle municipal area	R 0	R 378 000	R 2 205 000	R 2 583 000
Worker from the rest of Limpopo	R 0	R 0	R 0	R 0
Workers from the rest of SA	R 420 000	R 378 000	R 0	R 798 000
Total	R 420 000	R 756 000	R 2 205 000	R 3 381 000

5.6.2 Operational phase impacts

Once established, the operation of the facility would result in direct and indirect economic opportunities. These would stem from expenditure on operations including expenditure on employees that would not otherwise have occurred particularly in the local area. Estimates of operational costs and where operational good and services would be sourced from are highly preliminary at this stage. It is anticipated that roughly R11 million would be spent annually on operations (Table 11). The Modimolle municipal area would benefit most from expenditure on salaries and a portion of engineering services and sundry supplies.

Table 11: Preliminary estimate of operational expenditure

Operational cost categories	Annual operational costs in 2010 rands	% of costs that would go to imports	% of costs that would go to suppliers in the Modimolle municipal area
Salaries and wages	R 4 500 000	0%	100%
Outsourced engineering services	R 1 000 000	50%	20%
Insurance	R 2 500 000	0%	0%
Admin, telcoms, legal and similar	R 1 000 000	0%	20%
Sundry supplies and expenses	R 2 000 000	80%	20%
Total	R 11 000 000		

Employment during operations

A key benefit of the project would be its potential to create permanent jobs with an emphasis on labour intense operational methods. It is expected that approximately 90 direct employment opportunities would be created by the project with the majority of these in low skill level positions (see Table 12). It is also anticipated that all of these jobs would be filled by people from the Modimolle municipal area with a focus on Vaalwater and Boschdraai.

The project would achieve a labour intensity of roughly 18 jobs per MW of capacity primarily thanks to the labour intensive operational protocol developed by the proponent. The labour intensity of the project is a significant benefit particularly when compared with other energy supply options. For example, Holm et al. (2008) quote an AGAMA Energy study which calculated average labour intensities in jobs per unit of installed capacity (i.e. MW) for selected energy sources as follows:

- » Coal – 1.7 to 3 jobs per MW
- » Nuclear – 0.3 jobs per MW
- » Wind – 4.8 jobs per MW
- » Landfill gas – 6 jobs per MW
- » Solar thermal – 5.9 jobs per MW

Table 12: Employment associated with activities on the site during operations

	Permanent employees			
	High skill	Medium skill	Low skill	Total
Anticipated % of workers from the Modimolle municipal area	0%	0%	100%	
Number from the Modimolle municipal area	-	-	85	85
Anticipated % of workers from the rest of Limpopo	0%	0%	0%	
Number from the rest of Limpopo	-	-	-	-
Anticipated % of workers from the rest of South Africa	100%	100%	0%	
Number from rest of South Africa	3	2	-	5
Anticipated % of foreign workers	0%	0%	0%	
Number from overseas	-	-	-	-
Total	3	2	85	90

5.6.3 Indirect benefits

Aside from these direct employment and income opportunities, the construction and operational expenditure on the project (detailed above) and the spending of those employed directly would result in positive indirect impacts on the local and regional economy. These impacts have the potential to be relatively significant and are also likely to grow over time as more staff, goods and services are sourced locally. As mentioned previously they are not quantified further here, but their likely magnitude is taken into account when assigning significance ratings to impacts.

5.6.4 Opportunities associated with growing the solar sector

The potential for the Waterberg PV Plant and other future projects to result in greater impacts on local economies and the South African economy as a whole is primarily dependent on economies of scale. Currently import content is necessarily high. However, if the solar programme grows in size (aided by projects such as the Waterberg PV Plant) it should provide opportunities for manufacturing and servicing at scale and the additional benefit that would flow from it.

5.6.5 Overall impacts

An assessment of the significance of the combined impacts of project-related expenditure on increased employment and incomes based on the findings above (both without and with mitigation measures) is presented in Table 13. Impacts with

mitigation would be of a medium significance during construction at a regional level given the size of the expenditure injection and the number of potential employment and income generation opportunities involved. New impacts during operations would be more significant and mostly of a local nature. They have been given a medium to high significance rating with mitigation.

The no-development would have no impact relative to these benefits as there would be no expenditure injection.

Table 13: Impact summary table – impacts associated with project expenditure

Nature: Positive economic impacts associated with project expenditure on the <u>construction</u> of the plant		
	Without mitigation	With mitigation
Extent	Regional (3)	Regional (3)
Duration	Very short term (1)	Very short term (1)
Magnitude	Low (4)	Low to moderate (5)
Probability	Probable (3)	Highly probable (4)
Significance	24 (Low)	36 (Medium)
Status	Positive	Positive
Reversibility	High	High
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	
Mitigation:		
» Set reasonable targets for use of local labour and maximise opportunities for the training of unskilled and skilled workers.		
» Use local sub-contractors where possible.		
» Explore ways to enhance local community benefits with a focus on broad-based BEE through mechanisms such as community shareholding schemes and trusts.		
Cumulative impacts: None		
Residual impacts: None		
Nature: Positive economic impacts associated with project expenditure on the <u>operation</u> of the plant		
	Without mitigation	With mitigation
Extent	Regional (3)	Regional (3)
Duration	Long term (4)	Long term (4)
Magnitude	Moderate (6)	Moderate to high (7)
Probability	Probable (3)	Highly probable (4)
Significance	39 (Medium)	56 (Medium)
Status	Positive	Positive
Reversibility	High	High

Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	
Mitigation: Same as for construction phase		
Cumulative impacts: None.		
Residual impacts: None.		

Mitigation measures

Mitigation in the form of benefit enhancement should focus on three areas:

- » Targets should preferably be set for how much local labour should be used based on the needs of the proponent and the availability of existing skills and people that are willing to undergo training. Opportunities for the training of unskilled and skilled workers from local communities should be maximized.
- » Local sub-contractors should be used where possible and contractors from outside the local area that tender for work should be required to meet targets for how many locals are given employment.
- » The proponent should continue, as is their stated intention, to explore ways to enhance local community benefits with a focus on broad-based BEE through mechanisms such as community shareholding schemes and trusts. At this preliminary stage, and in accordance with the relevant BEE legislation and guidelines, the proponent wishes to earmark 3% of turnover for use in community upliftment over and above that associated with expenditure injections into the area.

Putting into operation the first two measures is challenging and it is difficult to decide on appropriate targets and ensure they are reached. Broad targets are, however, necessary in order to focus minds and set goals that can be tracked. It is thus recommended that the proponent should draft proposals regarding targets with reasons for their choice. These should include targets for (1) the percentage of the total construction contract value that should go to local contractors and (2) the percentage of total labour requirement that should be met using local labour. It is important to recognise that the nature of the project dictates that large portions of skills, materials and other sub-contractors will have to come from outside the local area with a high portion of international imports. Any targets should reflect this, remain relatively broad and allow for adaptation if necessary. Partnership with local economic development authorities is strongly recommended.

6 CONCLUSION

When considering the overall quantifiable as well as qualitative costs and benefits of the project it is anticipated that the latter should be more prominent allowing for the achievement of a net benefit with mitigation. This implies that, with mitigation, the project would be desirable on balance from an economic impact perspective.

Benefits would be particularly prominent for the project proponents, land owners on the site and in the achievement of energy policy goals. The project would result in significant positive economic spin-offs for the local area and region primarily because of the labour intensive operational practices that would be associated with it. Local community trust beneficiaries and BEE participants are also expected to benefit once Thupela Energy has concluded suitable agreements as is their intention.

With respect to risks and negative impacts, these should prove manageable provided adequate mitigation is put in place much of which will revolve around optimal citing, visual screening, and management of contractors and staff. While risks to tourism and property value are present, they are considered acceptably low with mitigation particularly when compared with the potential benefits associated with the project. The achievement of a net benefit at a local scale surrounding the site would be particularly dependent on extensive mitigation as the key risks of the project would be felt at this scale.

7 ENVIRONMENTAL MANAGEMENT PLAN MEASURES

Mitigation measures proposed regarding impacts on tourism, surrounding agriculture, and property values draw from other specialist studies (visual and social) and the general provision of EMP (aimed at ensuring no or minimal off-site impacts) and are not repeated here. The table below summarises measures for inclusion in the EMP that focus on the enhancement of economic benefits outlined in Section 5.6.

OBJECTIVE: Maximisation of employment and income benefits with a focus on the local area and region	
Project component/s	Construction and operational phases
Potential Impact	Economic benefits in terms of employment and income would be lower without these mitigation measures.
Activity/risk source	Lack of interest in jobs or contracts on offer. To a lesser degree, lack of skills needed to fill employment positions.
Mitigation: Target/Objective	Maximisation of participation of local and regional residents in the project and its associated economic benefits.

Mitigation: Action/control	Responsibility	Timeframe
<p>Targets should preferably be set for how much local labour should be used based on the needs of the proponent and the availability of existing skills and people that are willing to undergo training. Opportunities for the training of unskilled and skilled workers from local communities should be maximized.</p> <p>Local sub-contractors should be used where possible and contractors from outside the local area that tender for work should be required to meet targets for how many locals are given employment.</p> <p>The proponent should continue, as is their stated intention, to explore ways to enhance local community benefits with a focus on broad-based BEE through mechanisms such as community shareholding schemes and trusts. At this preliminary stage, and in accordance with</p>	<p>Proponent in close co-operation with local economic development authorities</p>	<p>Start with developing details for measures as soon as funding for the project is secured.</p> <p>Construction phase measures implemented prior to and during the construction phase.</p> <p>Operational phase measures implemented prior to and during operations.</p>

the relevant BEE legislation and guidelines, the proponent wishes to earmark 3% of turnover for use in community upliftment over and above that associated with expenditure injections into the area.

Performance Indicator

The proponent should draft proposals regarding targets with reasons for their choice. These should include targets for (1) the percentage of the total construction contract value that should go to local contractors and (2) the percentage of total labour requirement that should be met using local labour. It is important to recognise that the nature of the project dictates that large portions of skills, materials and other sub-contractors will have to come from outside the local area with a high portion of international imports. Any targets should reflect this, remain relatively broad and allow for adaptation if necessary. Partnership with local economic development authorities is strongly recommended in setting targets.

Monitoring

A monitoring system for the applicant to implement should be devised once targets have been set in collaboration with local economic development authorities. Monitoring during construction should be every 2 months given its short duration. Monitoring during operations should be every 6 months.

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9 APPENDIX

Appendix 1: Impact rating methodology supplied by Savannah Environmental

The EIA report must include:

- » an indication of the methodology used in determining the significance of potential environmental impacts
- » a description of all environmental issues that were identified during the environmental impact assessment process
- » an assessment of the significance of direct, indirect and cumulative impacts in terms of the following criteria:
 - * the *nature* of the impact, which shall include a description of what causes the effect, what will be affected and how it will be affected
 - * the *extent* of the impact, indicating whether the impact will be local (limited to the immediate area or site of development), regional, national or international
 - * the *duration* of the impact, indicating whether the lifetime of the impact will be of a short-term duration (0–5 years), medium-term (5–15 years), long-term (> 15 years, where the impact will cease after the operational life of the activity) or permanent
 - * the *probability* of the impact, describing the likelihood of the impact actually occurring, indicated as improbable (low likelihood), probable (distinct possibility), highly probable (most likely), or definite (impact will occur regardless of any preventative measures)
 - * the *severity/beneficial scale*, indicating whether the impact will be very severe/beneficial (a permanent change which cannot be mitigated/permanent and significant benefit, with no real alternative to achieving this benefit), severe/beneficial (long-term impact that could be mitigated/long-term benefit), moderately severe/beneficial (medium- to long-term impact that could be mitigated/ medium- to long-term benefit), slight or have no effect
 - * the *significance*, which shall be determined through a synthesis of the characteristics described above and can be assessed as low, medium or high
 - * the *status*, which will be described as either positive, negative or neutral
 - * the *degree* to which the impact can be reversed
 - * the *degree* to which the impact may cause irreplaceable loss of resources
 - * the *degree* to which the impact can be *mitigated*
- » a description and comparative assessment of all alternatives identified during the environmental impact assessment process

- » recommendations regarding practical mitigation measures for potentially significant impacts, *for inclusion in the Environmental Management Plan (EMP)*
- » an indication of the extent to which the issue could be addressed by the adoption of mitigation measures
- » a description of any assumptions, uncertainties and gaps in knowledge
- » an environmental impact statement which contains:
 - * a summary of the key findings of the environmental impact assessment;
 - * an assessment of the positive and negative implications of the proposed activity (one alternative only in EIA phase);
 - * a comparative assessment of the positive and negative implications of identified alternatives

Assessment of Impacts

Direct, indirect and cumulative impacts of the issues identified through the scoping study, as well as all other issues identified in the EIA phase must be assessed in terms of the following criteria:

- » The **nature**, which shall include a description of what causes the effect, what will be affected and how it will be affected.
- » The **extent**, wherein it will be indicated whether the impact will be local (limited to the immediate area or site of development) or regional, and a value between 1 and 5 will be assigned as appropriate (with 1 being low and 5 being high):
- » The **duration**, wherein it will be indicated whether:
 - * the lifetime of the impact will be of a very short duration (0–1 years) – assigned a score of 1;
 - * the lifetime of the impact will be of a short duration (2-5 years) - assigned a score of 2;
 - * medium-term (5–15 years) – assigned a score of 3;
 - * long term (> 15 years) - assigned a score of 4; or
 - * permanent - assigned a score of 5;
- » The **magnitude**, quantified on a scale from 0-10, where 0 is small and will have no effect on the environment, 2 is minor and will not result in an impact on processes, 4 is low and will cause a slight impact on processes, 6 is moderate and will result in processes continuing but in a modified way, 8 is high (processes are altered to the extent that they temporarily cease), and 10 is very high and results in complete destruction of patterns and permanent cessation of processes.
- » The **probability of occurrence**, which shall describe the likelihood of the impact actually occurring. Probability will be estimated on a scale of 1–5, where 1 is very improbable (probably will not happen), 2 is improbable (some possibility,

but low likelihood), 3 is probable (distinct possibility), 4 is highly probable (most likely) and 5 is definite (impact will occur regardless of any prevention measures).

- » the **significance**, which shall be determined through a synthesis of the characteristics described above and can be assessed as low, medium or high; and
- » the **status**, which will be described as either positive, negative or neutral.
- » the degree to which the impact can be reversed.
- » the degree to which the impact may cause irreplaceable loss of resources.
- » the *degree* to which the impact can be *mitigated*.

The **significance** is calculated by combining the criteria in the following formula:

$$S = (E+D+M)P$$

S = Significance weighting

E = Extent

D = Duration

M = Magnitude

P = Probability

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

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

**Appendix L:
Draft Environmental Management
Plan**

PROPOSED WATERBERG PHOTOVOLTAIC PLANT & ASSOCIATED INFRASTRUCTURE LIMPOPO PROVINCE

CONSTRUCTION & OPERATION DRAFT ENVIRONMENTAL MANAGEMENT PLAN (EMP) FOR THE WATERBERG PHOTOVOLTAIC PLANT

Submitted as part of the Draft EIA Report
October 2010

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PROJECT DETAILS

DEA Reference No.	:	12/12/20/1913
Title	:	Environmental Impact Assessment Process Draft Environmental Management Plan: Proposed Waterberg Photovoltaic Plant & Associated Infrastructure on a site near Vaalwater, Limpopo Province
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DEFINITIONS AND TERMINOLOGY

Alternatives: Alternatives are different means of meeting the general purpose and need of a proposed activity. Alternatives may include location or site alternatives, activity alternatives, process or technology alternatives, temporal alternatives or the 'do nothing' alternative.

Cumulative impacts: Impacts that result from the incremental impact of the proposed activity on a common resource when added to the impacts of other past, present or reasonably foreseeable future activities (e.g. discharges of nutrients and heated water to a river that combine to cause algal bloom and subsequent loss of dissolved oxygen that is greater than the additive impacts of each pollutant). Cumulative impacts can occur from the collective impacts of individual minor actions over a period and can include both direct and indirect impacts.

Direct impacts: Impacts that are caused directly by the activity and generally occur at the same time and at the place of the activity (e.g. noise generated by blasting operations on the site of the activity). These impacts are usually associated with the construction, operation or maintenance of an activity and are generally obvious and quantifiable

'Do nothing' alternative: The 'do nothing' alternative is the option of not undertaking the proposed activity or any of its alternatives. The 'do nothing' alternative also provides the baseline against which the impacts of other alternatives should be compared.

Endangered species: Taxa in danger of extinction and whose survival is unlikely if the causal factors continue operating. Included here are taxa whose numbers of individuals have been reduced to a critical level or whose habitats have been so drastically reduced that they are deemed to be in immediate danger of extinction.

Endemic: An "endemic" is a species that grows in a particular area (is endemic to that region) and has a restricted distribution. It is only found in a particular place. Whether something is endemic or not depends on the geographical boundaries of the area in question and the area can be defined at different scales.

Environment: the surroundings within which humans exist and that are made up of:

- i. the land, water and atmosphere of the earth;
- ii. micro-organisms, plant and animal life;
- iii. any part or combination of (i) and (ii) and the interrelationships among and between them; and

- iv. the physical, chemical, aesthetic and cultural properties and conditions of the foregoing that influence human health and well-being.

Environmental impact: An action or series of actions that have an effect on the environment.

Environmental impact assessment: Environmental Impact Assessment (EIA), as defined in the NEMA EIA Regulations and in relation to an application to which scoping must be applied, means the process of collecting, organising, analysing, interpreting and communicating information that is relevant to the consideration of that application.

Environmental management: Ensuring that environmental concerns are included in all stages of development, so that development is sustainable and does not exceed the carrying capacity of the environment.

Environmental management plan: An operational plan that organises and co-ordinates mitigation, rehabilitation and monitoring measures in order to guide the implementation of a proposal and its ongoing maintenance after implementation.

Heritage: That which is inherited and forms part of the National Estate (Historical places, objects, fossils as defined by the National Heritage Resources Act of 2000).

Indigenous: All biological organisms that occurred naturally within the study area prior to 1800

Indirect impacts: Indirect or induced changes that may occur as a result of the activity (e.g. the reduction of water in a stream that supply water to a reservoir that supply water to the activity). These types of impacts include all the potential impacts that do not manifest immediately when the activity is undertaken or which occur at a different place as a result of the activity.

Interested and affected party: Individuals or groups concerned with or affected by an activity and its consequences. These include the authorities, local communities, investors, work force, consumers, environmental interest groups, and the public.

Kyoto protocol: The Kyoto Protocol calls for developed countries to reduce their green house gas emissions during the commitment period (2008 - 2012) by 5.2% compared to 1990 levels. Developing countries, like South Africa, do not have a limit on their emissions.

National integrated resource plan: Commissioned by NERSA in response to the National Energy Policy's objective relating to affordable energy services, in order to provide a long-term, cost-effective resource plan for meeting electricity demand, which is

consistent with reliable electricity supply and environmental, social, and economic policies.

Photovoltaic cell: Semiconductors which absorb solar radiation to produce electricity

Photovoltaic effect: Electricity can be generated using photovoltaic panels (semiconductors) which are comprised of individual photovoltaic cells that absorb solar energy to produce electricity. The absorbed solar radiation excites the electrons inside the cells and produces what is referred to as the Photovoltaic Effect.

Rare species: Taxa with small world populations that are not at present Endangered or Vulnerable, but are at risk as some unexpected threat could easily cause a critical decline. These taxa are usually localised within restricted geographical areas or habitats or are thinly scattered over a more extensive range. This category was termed Critically Rare by Hall and Veldhuis (1985) to distinguish it from the more generally used word "rare."

Red data species: Species listed in terms of the International Union for Conservation of Nature and Natural Resources (IUCN) Red List of Threatened Species, and/or in terms of the South African Red Data list. In terms of the South African Red Data list, species are classified as being extinct, endangered, vulnerable, rare, indeterminate, insufficiently known or not threatened (see other definitions within this glossary).

Renewable energy feed-in tariff: REFITs are used to promote renewable energy and have been adopted in over 36 countries worldwide. The establishment of the REFIT in South Africa provides the opportunity for an increased contribution towards the sustained growth of the renewable energy sector, and to promote competitiveness between renewable and conventional energies in the medium and long-term. Under the National Energy Regulator Act (Act No. 40 of 2004), the Electricity Regulation Act (Act No. 4 of 2006), and all subsequent relevant amendment acts, the National Energy Regulator of South Africa (NERSA) has the mandate to determine the prices at and conditions under which electricity must be supplied by licence.

Significant impact: An impact that by its magnitude, duration, intensity, or probability of occurrence may have a notable effect on one or more aspects of the environment.

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Appendix A: Guideline for integrated management of construction waste

Appendix B: Specifications for earthworks

PURPOSE & OBJECTIVES OF THE EMP

CHAPTER 1

An Environmental Management Plan (EMP) is defined as "an environmental management tool used to ensure that undue or reasonably avoidable adverse impacts of the construction, operation and decommissioning of a project are prevented or mitigated, and that the positive benefits of the projects are enhanced"¹. The objective of this EMP is to provide consistent information and guidance for implementing the management and monitoring measures established in the permitting process and help achieve environmental policy goals. The purpose of an EMP is to help ensure continuous improvement of environmental performance, reducing negative impacts and enhancing positive effects during the construction and operation of the facility. An effective EMP is concerned with both the immediate outcome as well as the long-term impacts of the project.

The EMP provides specific environmental guidance for the construction and operation phases of a project, and is intended to manage and mitigate construction and operation activities so that unnecessary or preventable environmental impacts do not result. These impacts range from those incurred during start up (site clearing and site establishment) through those incurred during the construction activities themselves (erosion, noise, dust) to those incurred during site remediation (soil stabilisation, revegetation) and operation.

The EMP has been developed as a set of environmental specifications (i.e. principles of environmental management for the proposed Waterberg Photovoltaic Plant), which are appropriately contextualised to provide clear guidance in terms of the on-site implementation of these specifications (i.e. on-site contextualisation is provided through the inclusion of various monitoring and implementation. During its lifecycle, projects journey through four distinctive phases. The EMP is accordingly separated into measures dealing with the various project phases.

The EMP has the following objectives:

- » To outline mitigation measures and environmental specifications which are required to be implemented for the planning, construction, rehabilitation, and operation phases of the project in order to minimise the extent of environmental impacts, and to manage environmental impacts associated with the PV plant.

¹ Provincial Government Western Cape, Department of Environmental Affairs and Development Planning: *Guideline for Environmental Management Plans*. 2005

- » To ensure that the construction and operation phases do not result in undue or reasonably avoidable adverse environmental impacts, and ensure that any potential environmental benefits are enhanced.
- » To identify entities who will be responsible for the implementation of the measures and outline functions and responsibilities.
- » To propose mechanisms and frequency for monitoring compliance, and preventing long-term or permanent environmental degradation.
- » To facilitate appropriate and proactive responses to unforeseen events or changes in project implementation that was not considered in the EIA process.

The mitigation measures identified within the Environmental Impact Assessment process are systematically addressed in the EMP, ensuring the minimisation of adverse environmental impacts to an acceptable level.

Thupela Energy must ensure that the implementation of the project complies with the requirements of any environmental authorisations and permits, and obligations emanating from other relevant environmental legislation. This obligation is partly met through the development and the implementation of the EMP through its integration into the contract documentation. Since this EMP is part of the EIA process undertaken for the proposed Waterberg Photovoltaic Plant, it is important that this document be read in conjunction with the Scoping Report (July 2010) and EIA Report (November 2010), as well as the Environmental Authorisation (once issued). This will contextualise the EMP and enable a thorough understanding of its role and purpose in the integrated environmental management process. This EMP for construction and operation activities has been compiled in accordance with Section 34 of the EIA Regulations and will be further developed in terms of specific requirements listed in any authorisations issued for the proposed project.

To achieve effective environmental management, it is important that Contractors are aware of the responsibilities in terms of the relevant environmental legislation and the contents of this EMP. The Contractor is responsible for informing employees and sub-contractors of their environmental obligations in terms of the environmental specifications, and for ensuring that employees are adequately experienced and properly trained in order to execute the works in a manner that will minimise environmental impacts. The Contractor's obligations in this regard include the following:

- » Ensuring that employees have a basic understanding of the key environmental features of the construction site and the surrounding environment.
- » Ensuring that a copy of the EMP is readily available on-site, and that all site staff are aware of the location and have access to the document. Employees will be familiar with the requirements of the EMP and the environmental specifications as they apply to the construction of the facility.

- » Ensuring that, prior to commencing any site works, all employees and sub-contractors have attended an Environmental Awareness Training course. The course must provide the site staff with an appreciation of the project's environmental requirements, and how they are to be implemented.
- » Providing basic training in the identification of archaeological sites/objects, and protected flora and fauna that may be encountered on/off the site.
- » Ensuring awareness of any other environmental matters, which are deemed necessary by the ECO.

The EMP is a dynamic document, which must be updated when required. It is considered critical that this draft EMP be updated to include site-specific information and specifications as required. This will ensure that the construction and operation activities are planned and implemented considering sensitive environmental features.

PROJECT DETAILS

CHAPTER 2

Thupela Energy is proposing the establishment of a commercial solar energy facility on a site located approximately 24 km north-east of the town of Vaalwater in the Limpopo Province (refer to Figure 1.1). This is to be known as the Waterberg Photovoltaic Plant. From an extensive site identification process undertaken by Thupela Energy, an area which falls within the Modimolle Local Municipality between Vaalwater and Vier-en-Twintig Riviere has been identified for consideration within an Environmental Impact Assessment (EIA) process.

The proposed facility will comprise an array of tracking photovoltaic (PV) panels and ancillary infrastructure to be constructed over an area of approximately 20 ha (and not more than 30 ha) within the broader study area of 50 ha. The facility is proposed to be constructed over a single phase of approximately six - nine months, and will have a maximum generating capacity of up to 5 MW. The facility is intended to be operated as a commercial power generating facility and would include the following infrastructure.

- » The **PV panels** will be placed on mounts, which will be sited a certain distance away from each other to allow sufficient room to mitigate shading issues. The electrical output from individual panels will be summed, initially into "strings," then further summed, and changed to AC power using inverters. The panel mounts will be secured into the ground by the use of concrete feet.
- » A **switching station** of approximately 4 m x 4 m will be established for the "turn in" to Eskom's existing Mink power line which crosses the site. It has been determined through preliminary discussions with Eskom that this line has capacity to receive the power from the proposed facility. A switching station is a smaller version of a substation and contains a single transformer to step up the generated power into a voltage suitable for the existing power line (i.e. 22 kV in this case).
- » An **extraction point** and **low volume water supply pipeline** from an existing on-site borehole will be established for occasional cleaning of the PV panels and for general, limited water use at the kitchen, crèche, and visitors centre.
- » **Access roads** within the site will be established for the purposes of construction and limited maintenance activities.
- » Workshop, laydown and storage areas
- » A visitor's centre, crèche and kitchen/dining utilising a water-less sanitation system²

² A system of this nature does not utilise water and reduces the waste to approximately 10 % of the original volume through a process of dehydration. This water-less method is preferred due to the proximity of the Melk River which runs east of the site and the rural nature of the site which would render extensive plumbing impractical.

The site proposed for the Waterberg Photovoltaic Plant area falls within the Modimolle Local Municipality, which falls under the Waterberg District Municipality of the Limpopo Province. The plant is proposed on Portion 2 of the Farm Goedgevonden KR 104.

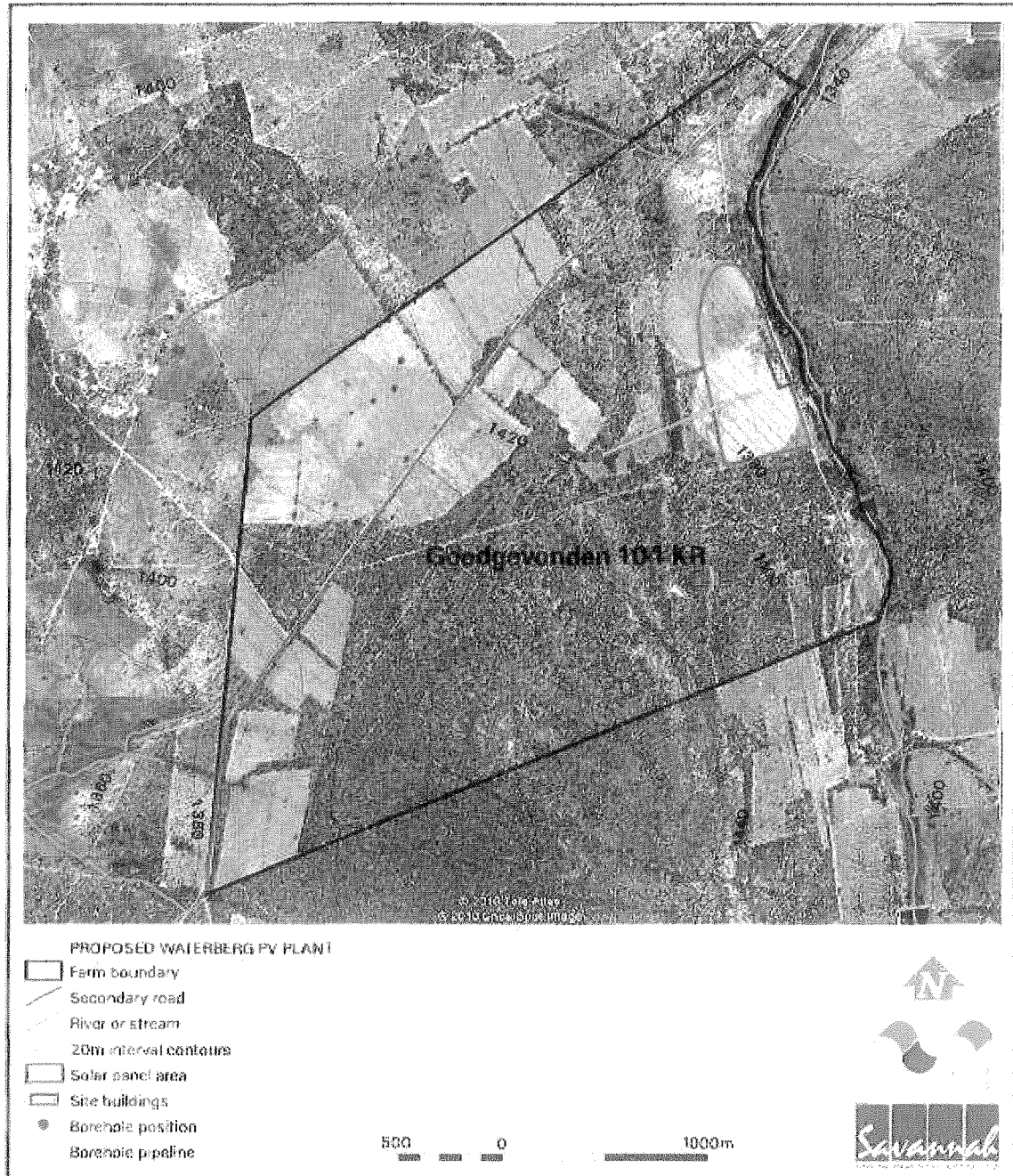


Figure 2.1: Locality map showing the proposed layout

In terms of the findings of the EIA Report, various planning, construction, and operation-related environmental impacts were identified, including:

- » Disturbance to sense of place, visual aesthetics

- » Soil disturbance and erosion
- » Socio-economic impacts
- » Road and traffic related impacts

No absolute no go areas have been identified for the proposed photovoltaic plant. In addition, as the facility is located within a previously cultivated area of the property under investigation, no impacts on biodiversity were identified.

The EMP has been developed based on the findings of the EIA, and must be implemented to protect sensitive on-site and off-site features through controlling construction and operation activities that could have a detrimental effect on the environment, and through avoiding or minimising potential impacts.

2.1 Activities and Components associated with the Waterberg Photovoltaic Plant

The main activities/components associated with the Waterberg Photovoltaic Plant are detailed in Table 2.1.

Table 2.1: Activities Associated with Planning, Construction, Operation and Decommissioning of the Facility

Main Activity/Project Component	Components of Activity	Details
Planning		
Conduct technical surveys	<ul style="list-style-type: none"> » Geotechnical survey by geotechnical engineer: » Site survey and confirmation of the infrastructure micro-siting footprint » Survey of pipe line route 	<ul style="list-style-type: none"> » All surveys are to be undertaken prior to initiating construction.
Construction		
Upgrade of access roads to the site	<ul style="list-style-type: none"> » Upgrade external access/haul roads to the site (i.e. gravel track leading to the facility), if required 	<ul style="list-style-type: none"> » The proposed internal access roads will be comprised of gravel tracks or compacted rock-fill with a layer of higher quality surfacing stone on top. Should the latter be required, the strength and durability properties of the rock strata at the proposed site would need to be assessed during the geotechnical surveys. » Existing external access roads will be upgraded in advance of any components being delivered to site (i.e. the gravel track leading to the facility).
Undertake site preparation	<ul style="list-style-type: none"> » Site establishment of offices/workshop with ablutions and stores, contractors yards » Establishment of internal access roads (permanent and temporary roads) » Clearance of vegetation at the infrastructure footprints (i.e. the visitor's centre, the kitchen/dining facilities, the workshops/storerooms, the crèche, as well as the administrative/security offices) » Shallow excavations for foundations 	<ul style="list-style-type: none"> » These activities will require the stripping of topsoil, which will need to be appropriately stockpiled for use in rehabilitation.

Main Activity/Project Component	Components of Activity	Details
Construct infrastructure foundations	<ul style="list-style-type: none"> » A complete interconnected, re-enforced, 'raft' foundation is constructed on which the buildings can sit (final dimensions to be defined by geotechnical survey of the site) » Concrete foundations will be constructed for the 'feet' of the PV panels. 	<ul style="list-style-type: none"> » The raft is positioned typically no more than 30 cm deep into the sand. » Foundation holes for the PV panels will be mechanically excavated to a depth of approximately 30 - 50 cm. The concrete foundation will be poured and will then be left for up to a week to cure. » Aggregate and cement to be transported from the closest centre to the development, with the establishment of small designated concrete batching areas close to the activities.
Transport of components and equipment to site	<ul style="list-style-type: none"> » Trucks will be used to transport all components to site: <ul style="list-style-type: none"> * The normal civil engineering construction equipment for the civil works (e.g. excavators, trucks, graders, compaction equipment, cement mixers, etc.). * The components required for the establishment of the switching station (including the inverters) * Components required for the establishment of the switching station (including cabling) * Ready-mix cement trucks for the PV panel foundations/feet 	<ul style="list-style-type: none"> » The individual components are unlikely to be classified as abnormal loads in terms of the Road Traffic Act (Act No. 29 of 1989) by virtue of their limited dimensions (i.e. length and weight). » The equipment will be transported to the site using appropriate National and Provincial routes, and the dedicated access/haul road to the site itself.
Establishment of PV panels	<ul style="list-style-type: none"> » The electrical output of the PV panels mounts will be summed, initially into "strings," then further summed, and changed to AC power using inverters. 	<ul style="list-style-type: none"> » The PV panels mounts will be sited a certain distance away from each other to allow sufficient room to mitigate shading issues. The panel mounts will be secured into the ground by the use of concrete feet
Construct switching station and ancillary infrastructure	<ul style="list-style-type: none"> » Switching station » Visitor's Centre 	<ul style="list-style-type: none"> » A temporary construction area is needed for containers, toilets, and equipment.

Main Activity/Project Component	Components of Activity	Details
	<ul style="list-style-type: none"> » Workshop, storage areas, administrative and security facilities 	<ul style="list-style-type: none"> » Permanent operational buildings include the Visitor's Centre (i.e. 10 m x 20 m), ablution facilities (4 m x 5 m), workshop (6 m x 8 m), storage areas (6 m x 8 m), administrative, and security facilities (6 m x 10 m), kitchen and dining facilities (10 m x 15 m) and a crèche (6 m x 8 m).
<p>Connection of PV panels to the switching station</p>	<ul style="list-style-type: none"> » The PV panels will be connected to the switching station via underground cabling (where practical) 	<ul style="list-style-type: none"> » The installation of these underground cables will require the excavation of trenches of approximately 30 cm deep within which they can then be laid. The underground cables will be planned to follow the internal access roads, as far as possible.
<p>Connect switching station to the grid</p>	<ul style="list-style-type: none"> » The generated power that is stepped up in the switching station will then be evacuated to the Mink power line. 	<ul style="list-style-type: none"> » The power line will be isolated along the existing Eskom line, and a new line of approximately 10 m will be connected from the transmission line to the switching station. This will allow for the evacuation of power into the line and extraction of power out of the line in both directions.
<p>Undertake site rehabilitation</p>	<ul style="list-style-type: none"> » Remove all construction equipment from the site » Rehabilitation of temporarily disturbed areas where practical and reasonable 	<ul style="list-style-type: none"> » On full commissioning of the facility (or a phase thereof), any access points to the site which are not required during the operation phase will be closed and prepared for rehabilitation.
Operation		
<p>Operation</p>	<ul style="list-style-type: none"> » PV panels » Associated infrastructure (i.e. Visitor's Centre and kitchen/dining facilities) 	<ul style="list-style-type: none"> » The operational phase is proposed to run for a period of approximately 30 - 50 years. » During this time a full time security, maintenance, supervision, and monitoring teams will be required on site. » The PV plant will be operational during daylight hours only but not under circumstances of mechanical breakdown, extreme weather conditions, or maintenance activities. » No energy storage mechanisms (i.e. batteries) which would allow for continued generation at night or on cloudy days are proposed.
<p>Maintenance & Security</p>	<ul style="list-style-type: none"> » Maintenance during the life cycle of 	<ul style="list-style-type: none"> » The panels will be cleaned during the night whereby large dusters

Main Activity/Project Component	Components of Activity	Details
	the facility would include emergency repairs, routine panel maintenance, and cleaning. » 24 hour security » Kitchen/dining facilities » Visitor's centre	or compressed air would be used. When necessary, the panels would have to be cleaned with water. » Security measures on site would involve infra red cameras and CCTV monitoring, a minimum of three security personnel on site (full-time) and security back-up from a larger armed security organisation. » The canteen facility proposed would be a small facility where food can be prepared for the personnel. » The primary aim of the visitors centre would be educational with the following activities anticipated to take place: » A tour of the site and the opportunity to experience the operation of the facility » An audio visual display focusing on the construction and operation of the facility and solar power and climate change in general » An opportunity to manipulate a solar panel and experience the generation of electricity » Visitors would have the opportunity to buy and/or even make their own souvenirs which use solar power to take with them
Decommissioning		
Site preparation	» Preparation of the site » Mobilisation of construction equipment	» Depending on the economics of the development following the operational period, the plant will either be decommissioned or the operational phase will be extended. If it is deemed financially viable to continue, existing components would be disassembled and replaced with more appropriate technology/ infrastructure available at that time. However, if the decision is made to decommission the facility the following activities will form part of the project scope.
Disassemble panels	» The panels will be disassembled and replaced	» The components of the plant will be disassembled and removed. Thereafter they will be reused and recycled (where possible) or

Main Activity/Project Component	Components of Activity	Details
		disposed of in accordance with regulatory requirements.

STRUCTURE OF THIS EMP

CHAPTER 3

The first two chapters provide background to the EMP and the proposed project. The chapters which follow consider the:

- » Planning and design activities
- » Construction activities
- » Operation activities
- » Decommissioning activities

These chapters set out the procedures necessary for Thupela Energy to achieve environmental compliance. For each of the phases of implementation for the plant project, an over-arching environmental **goal** is stated. In order to meet this goal, a number of **objectives** are listed. The management programme has been structured in table format in order to show the links between the goals for each phase and their associated objectives, activities/risk sources, mitigation actions monitoring requirements and performance indicators. A specific environmental management programme table has been established for each environmental objective. The information provided within the EMP table for each objective is illustrated below:

OBJECTIVE: Description of the objective, which is necessary in order to meet the overall goals; these take into account the findings of the environmental impact assessment specialist studies

Project component/s	List of project components affecting the objective, i.e.: <ul style="list-style-type: none"> » PV panels » Access roads » Switching station » Ancillary infrastructure 		
Potential Impact	Brief description of potential environmental impact if objective is not met		
Activity/risk source	Description of activities which could impact on achieving objective		
Mitigation: Target/Objective	Description of the target; include quantitative measures and/or dates of completion		
Mitigation: Action/control	Responsibility	Timeframe	
List specific action(s) required to meet the mitigation target/objective described above.	Who is responsible for the measures	Time periods for implementation	of measures
Performance	Description of key indicator(s) that track progress/indicate the		

Indicator	effectiveness of the management plan.
Monitoring	Mechanisms for monitoring compliance; the key monitoring actions required to check whether the objectives are being achieved, taking into consideration responsibility, frequency, methods and reporting

The objectives and EMP tables are required to be reviewed and possibly modified whenever changes, such as the following, occur:

- » Planned activities change (i.e. in terms of the components and/or layout of the facility).
- » Modification to or addition to environmental objectives and targets.
- » Relevant legal or other requirements are changed or introduced.
- » Significant progress has been made on achieving an objective or target such that it should be re-examined to determine if it is still relevant, should be modified, etc.

3.1. Project Team

This draft EMP was compiled by:

	Name	Company
EMP Compilers:	Tammy Kruger	Savannah Environmental
	Jo-Anne Thomas	Savannah Environmental
Specialists:	Iain Paton – geology, erosion potential	Outeniqua Geotechnical Services cc
	Lourens du Plessis - visual	MetroGIS
	Ingrid Snyman - social	Batho Earth
	Hugo van Zyl – socio-economic	Independent Economic Researchers
	Garry Paterson – agricultural potential	Agricultural Research Council
	Bruce White - roads	Bigen Africa Services
	Johnny van Schalkwyk - heritage	

The Savannah Environmental team have extensive knowledge and experience in environmental impact assessment and environmental management, having been involved in EIA processes over the past ten (10) years. They have managed and drafted Environmental Management Plans for other power generation projects throughout South Africa, including numerous renewable energy facilities.

MANAGEMENT PLAN FOR THE PHOTOVOLTAIC PLANT: PLANNING & DESIGN

CHAPTER 4

4.1. Goal for Planning and Design

Overall Goal for Planning and Design: Undertake the planning and design phase of the photovoltaic plant in a way that:

- » Ensures that the design of the facility responds to the identified environmental constraints and opportunities.
- » Ensures that adequate regard has been taken of any landowner concerns and that these are appropriately addressed through design and planning (where appropriate).
- » Ensures that the best environmental options are selected for the project, including the power line alignment and substation sites.
- » Enables the photovoltaic plant construction activities to be undertaken without significant disruption to other land uses in the area.

In order to meet this goal, the following objectives have been identified, together with necessary actions and monitoring requirements.

4.2. Objectives

OBJECTIVE: Ensure the facility design responds to the identified environmental constraints and opportunities

From the specialist investigations undertaken for the proposed photovoltaic plant development site, no absolute 'no go' areas were identified. However, in terms of environmental constraints/opportunities the following applies:

- » *The visual absorption capacity* of the natural vegetation may allow for the mitigation of potential visual impacts. Similarly, it may be assumed that receptor sites exposed to visual impact may mitigate this impact by planting a vegetation screen similar in form and density to the natural vegetation of the receiving environment. It should be noted, however, that this measure will only be effective if the screen is planted *in close proximity to the receptor*. This means that the visual impact must be screened at the property which is experiencing the impact, rather than at the development site itself.

- » The impact of vehicles on the existing gravel roads during construction may result in the further deterioration should the correct remedial and maintenance measures not be applied.

Project component/s	Project components affecting the objective: <ul style="list-style-type: none"> » PV panels and ancillary infrastructure » Existing gravel access roads
Potential Impact	<ul style="list-style-type: none"> » Design fails to respond optimally to the identified environmental considerations
Activities/risk sources	<ul style="list-style-type: none"> » Positioning of panels and » Utilisation of existing gravel access roads
Mitigation: Target/Objective	<ul style="list-style-type: none"> » To ensure that the design of the facility responds to the identified environmental constraints and opportunities

Mitigation: Action/control	Responsibility	Timeframe
Consider design level mitigation measures recommended by the specialists, especially with respect to visual aesthetics, as detailed within the EIA report and relevant appendices. These recommendations are to be supplemented by information collected during the pre-construction surveys.	Engineering Design Consultant Thupela Energy	Tender Design & Design Review Stage
Rehabilitation of external access roads to be carefully planned to minimise the impacted area and prevent unnecessary further degradation.	Local roads authorities and Thupela Energy	Design phase
A detailed geotechnical investigation is required for the design phase.	Thupela Energy	Design phase
Compile a comprehensive stormwater management plan for hard surfaces as part of the final design of the project.	Thupela Energy	Design phase
Access roads within the site to be carefully planned and constructed to minimise the impacted area and prevent unnecessary excavation, placement, and compaction of soil.	Engineer	Pre-construction and Construction
Balance technical and financial considerations against environmental constraints and opportunities in finalising the design of key elements.	Thupela Energy	Tender Design & Design Review Stage

Performance Indicator	<ul style="list-style-type: none"> » Design meets objectives and does not degrade the environment » Design and layouts respond to the mitigation measures and recommendations in the EIA report.
Monitoring	<ul style="list-style-type: none"> » Ensure that the design implemented meets the objectives and mitigation measures in the EIA report through review of the design by the Project Manager, and ECO prior to the commencement of construction.

**Performance
Indicator**

- » External access roads are not degraded as a result of the construction or operation of the facility.
- » Visual impacts during the operation phase are mitigated through the effective placement of the facility within the site (i.e. with respect to surrounding vegetation) and using screening.

Monitoring

- » Ensure that the design implemented meets the objectives and mitigation measures in the EIA report through review of the design by the Project Manager, and the ECO prior to the commencement of construction.

MANAGEMENT PLAN FOR THE PHOTOVOLTAIC PLANT: CONSTRUCTION

CHAPTER 5

5.1. Overall Goal for Construction

Overall Goal for Construction: Undertake the construction phase of the photovoltaic plant in a way that:

- » Ensures that construction activities are properly managed in respect of environmental aspects and impacts.
- » Enables the construction activities to be undertaken without significant disruption to other land uses in the area, in particular concerning farming practices, traffic and road use, and effects on local residents.

5.2. Institutional Arrangements: Roles and Responsibilities for the Construction Phase

As the Proponent, Thupela Energy must ensure that the implementation of the photovoltaic plant complies with the requirements of all environmental authorisations and permits, and obligations emanating from other relevant environmental legislation. This obligation is partly met through the development of the EMP, and the implementation of the EMP through its integration into the contract documentation. Thupela Energy will retain various key roles and responsibilities during the construction of the photovoltaic plant. These are outlined below.

OBJECTIVE: To establish clear reporting, communication and responsibilities in relation to environmental incident

Formal responsibilities are necessary to ensure that key procedures are executed. Specific responsibilities of the Project Manager; Site Manager; Safety, Health and Environment Representative; Environmental Control Officer and Contractor for the construction phase of this project are as detailed below.

The **Project Manager** will:

- » Ensure of all specifications and legal constraints specifically concerning the environment are highlighted to the Contractor(s) so that they are aware of these.
- » Ensure that Thupela Energy and its Contractor(s) are made aware of all stipulations within the EMP.

- » Ensure that the EMP is correctly implemented throughout the project by means of site inspections and meetings. This will be documented as part of the site meeting minutes.
- » Be fully conversant with the Environmental Impact Assessment for the project, the EMP, the conditions of the Environmental Authorisation (once issued), and all relevant environmental legislation.

The **Site Manager** (Thupela Energy's On-site Representative) will:

- » Be fully knowledgeable with the contents of the Environmental Impact Assessment.
- » Be fully knowledgeable with the contents and conditions of the Environmental Authorisation (once issued).
- » Be fully knowledgeable with the contents of the Environmental Management Plan.
- » Be fully knowledgeable with the contents of all relevant environmental legislation, and ensure compliance with these.
- » Have overall responsibility of the EMP and its implementation.
- » Conduct audits to ensure compliance to the EMP.
- » Ensure there is communication with the Project Manager, the Environmental Control Officer, and relevant discipline Engineers on matters concerning the environment.
- » Ensure that no actions are taken which will harm or may indirectly cause harm to the environment, and take steps to prevent pollution on the site.
- » Confine activities to the demarcated construction site.

The **Environmental Control Officer** (ECO) will be responsible for monitoring, reviewing, and verifying compliance by the Contractor with the environmental specification. Accordingly, the ECO will:

- » Be fully knowledgeable with the contents with the Environmental Impact Assessment.
- » Be fully knowledgeable with the contents with the conditions of the Environmental Authorisation (once issued).
- » Be fully knowledgeable with the contents with the Environmental Management Plan.
- » Be fully knowledgeable with the contents with all relevant environmental legislation, and ensure compliance with them.
- » Ensure that the contents of this document are communicated to the Contractor site staff and that the Site Manager and Contractor are constantly made aware of the contents through discussion.
- » Ensure that the compliance of the EMP is monitored through regular and comprehensive inspection of the site and surrounding areas.
- » Ensure that if the EMP conditions or specifications are not followed then appropriate measures are undertaken to address this.
- » Monitoring and verification must be implemented to ensure that environmental impacts are kept to a minimum, as far as possible.

- » Ensure that the Site Manager has input into the review and acceptance of construction methods and method statements.
- » Ensure that activities on site comply with all relevant environmental legislation.
- » Ensure that a removal is ordered of any person(s) and/or equipment responsible for any contravention of the specifications of the EMP.
- » Ensure that the compilation of progress reports for submission to the Project Manager, with input from the Site Manager, takes place on a regular basis, including a final post-construction audit.
- » Ensure that there is communication with the Site Manager regarding the monitoring of the site.
- » Ensure that any non-compliance or remedial measures that need to be applied are reported.

Contractors and Service Providers: All contractors (including sub-contractors and staff) and service providers are ultimately responsible for:

- » Ensuring adherence to the environmental management specifications.
- » Ensuring that Method Statements are submitted to the Site Manager (and ECO) for approval before any work is undertaken. Any lack of adherence to this will be considered as non-compliance to the specifications of the EMP.
- » Ensuring that any instructions issued by the Site Manager on the advice of the ECO are adhered to.
- » Ensuring that a report is tabled at each site meeting, which will document all incidents that have occurred during the period before the site meeting.
- » Ensuring that a register is kept in the site office, which lists all transgressions issued by the ECO.
- » Ensuring that a register of all public complaints is maintained.
- » Ensuring that all employees, including those of sub-contractors receive training before the commencement of construction in order that they can constructively contribute towards the successful implementation of the EMP (i.e. ensure their staff are appropriately trained as to the environmental obligations).

5.3. Objectives

In order to meet this goal, the following objectives have been identified, together with necessary actions and monitoring requirements.

OBJECTIVE: Site establishment and securing the site

Site establishment is the first activity which is to be undertaken within the construction phase. The Contractor must take all reasonable measures to ensure the safety of the public in the surrounding area. Where the public could be exposed to danger by any of

the works or site activities, the Contractor must, as appropriate, provide suitable flagmen, barriers and/or warning signs in English, Afrikaans and any other relevant local languages, all to the approval of the Site Manager.

Project component/s	Project components affecting the objective: » PV panels and ancillary infrastructure » Existing gravel access roads substations
Potential Impact	» Hazards to landowners and public » Security of materials
Activities/risk sources	» Open excavations/diggings (foundations and cable trenches) » Movement of construction vehicles in the area and on-site
Mitigation:	» To secure the site against unauthorised entry
Target/Objective	» To protect members of the public/landowners/residents

Mitigation: Action/control	Responsibility	Timeframe
Secure site, working areas and excavations in an appropriate manner, as agreed with the Environmental Control Officer.	Contractor	Erection: during site establishment Maintenance: for duration of Contract
Where necessary to control access, fence and secure area.	Contractor	Erection: during site establishment Maintenance: for duration of Contract
Fence and secure Contractor's equipment camp.	Contractor	Erection: during site establishment Maintenance: for duration of Contract
Identify disturbance areas and restrict construction activity to these areas	Environmental Control Officer (ECO)/Contractor	Pre-construction and Construction
Establish the necessary ablution facilities with chemical toilets. Provide adequate sanitary facilities and ablutions for construction workers (1 toilet per every 15 workers) at appropriate locations on site.	Contractor	Erection: during site establishment Maintenance: for duration of Contract
Ablution or sanitary facilities should not be located within 100 m from a 1:100 year flood line including water courses, wetlands or within a horizontal distance	Contractor	During site establishment, construction and

Mitigation: Action/control	Responsibility	Timeframe
of less than 100 m, whichever is applicable		maintenance
Supply adequate numbers of waste collection bins in appropriate locations on the site where construction is being undertaken.	Contractor	Erection: during site establishment Maintenance: for duration of Contract within a particular area

Performance Indicator	<ul style="list-style-type: none"> » No unnecessary environmental impacts associated with site established » Site is secure and there is no unauthorised entry » No members of the public/ landowners injured
Monitoring	<ul style="list-style-type: none"> » An incident reporting system will be used to record non-conformances to the EMP » ECO to monitor all construction areas on a continuous basis until all construction is completed; immediate report backs to site manager in terms of non-conformances recorded.

OBJECTIVE: Maximise local employment and business opportunities associated with the construction phase

Employment opportunities could be created during the construction phase as a large part of the construction activities would entail manual labour such as the erection of the fence, creation of fire breaks, cable laying, and mount installation. Other construction activities would include manual labour associated with the construction of building structures (i.e. visitors centre, crèche, and kitchen). Specialist contractors would be responsible for the installation of the inverters and associated electronics.

In total approximately fifty (50) construction workers would be on site on average, increasing to approximately one hundred and twenty six (126) construction workers during the peak construction period. It is therefore fair to state that at least fifty construction workers could be employed for the average length of the construction period (six months), but that this figure could increase for shorter periods. Additional security personnel would be appointed from the start of the construction process.

The unemployment rate in the study area is approximately 22% and recent studies undertaken by the Waterberg Biosphere Reserve indicate an unemployment rate of the 2008 school leavers in the area as 73%. There are therefore various individuals in the area in search of employment, even if the opportunities are only temporary. As indicated above it is also foreseen that it would be possible to make use of local labour for a large section of the construction activities. Opportunities for SMMEs to be

considered for some of the construction activities also exist. Employment of locals and the involvement of local SMMEs would enhance the social benefits associated with the project. Failure to involve the local population, emerging contractors, and SMMEs during construction could lead to negative attitude formation against the proposed project and the project proponent.

Infrastructural development type projects usually create expectations that numerous job opportunities for the local community members will be generated. This perception is even more so in cases where the implementation and construction is actually taking place in close proximity to rural settlements. Unrealistic expectations concerning job creation should thus be guarded against.

Project component/s	Construction and establishment activities associated with the establishment of the photovoltaic plant, including infrastructure etc.
Potential Impact	The opportunities and benefits associated with the creation of local employment and business should be maximised.
Activities/risk sources	Contractors who make use of their own labour thereby reducing the employment and business opportunities for locals.
Mitigation: Target/Objective	Thupela Energy, in discussions with the Modimolle Local Municipality, should aim to employ a maximum number of the low-skilled workers from the local area where possible. This should also be made a requirement for all contractors.

Mitigation: Action/control	Responsibility	Timeframe
Employment of local community members (e.g. source labour from Boschdraai and Leseding or the immediate environment) should be undertaken where possible.	Thupela Energy, Modimolle Local Municipality & Contractor	Pre-Construction
An equitable process should be promoted whereby locals and previously disadvantaged individuals (women) are taken into account.	Modimolle Local Municipality & Thupela Energy	Pre-Construction
Create conditions that are conducive for the involvement of entrepreneurs, small businesses, and SMMEs during the construction process.	Modimolle Local Municipality, Thupela Energy & Contractor	Pre-Construction
Tender documentation should contain guidelines for the involvement of labour, entrepreneurs, businesses, and SMMEs from the local sector.	Thupela Energy & Contractor	Pre-Construction
A local labour desk should be set-up (if not already established) in the beneficiary communities to co-	Modimolle Local	Pre-Construction

Mitigation: Action/control	Responsibility	Timeframe
ordinate the process of involving local labour.	Municipality & Contractor	
Communication efforts concerning job creation opportunities should refrain from creating unrealistic expectations.	Thupela Energy	Pre-Construction

Performance Indicator	<ul style="list-style-type: none"> » Job opportunities, especially of low skilled positions, are primarily awarded to members of local communities. » Locals and previously disadvantaged individuals (women) are taken into account during the hiring process. » SMMEs are awarded with contracts during the construction phase. » Labour, entrepreneurs, businesses, and SMMEs from the local sector are awarded with jobs, based on requirements in the Tender Documentation. » The involvement of local labour is promoted and runs efficiently using a local labour desk in the Boschdraai and Leseding Communities. » Reports are not made from members of the local communities regarding unrealistic employment opportunities.
Monitoring	<ul style="list-style-type: none"> » ECO must monitor indicators listed above to ensure that they have been met for the construction phase.

OBJECTIVE: Address economic inequities within the study area

Economic inequities refers to the degree to which employment opportunities created by the proposed project match the actual job skills present in the local communities or the unemployed sector. Education levels in the study area and status of the educational facilities give a clear indication of the unskilled labour force within and surrounding the study area. As a result a large part of the population in the Modimolle Local Municipality and the study area are employed in semi-skilled and unskilled positions (approximately 53%). Detailed skills of the Boschdraai and Leseding residents were not readily available, but based on information sourced concerning the sectors in which most of the adult population in the study area is employed in. Based on the existing occupations, one could conclude that unskilled and semi-skilled labour could, thus, be sourced from the residents of Boschdraai and Leseding, and possibly from the immediate environment.

Project component/s	Semi-skilled and unskilled employment opportunities
Potential Impact	The opportunities and benefits associated with the creation of local employment and business could be maximised as it is anticipated that locals have the necessary skills (semi-skilled and unskilled levels) to be

	employed.
Activity/risk source	Unavailability of locals with the required skills resulting in locals not being employed and labour is sourced from outside the MLM area.
Mitigation: Target/Objective	Thupela Energy, in discussions with the Modimolle Local Municipality, should aim to employ a maximum number of the low-skilled workers from the local area where possible. Should the necessary skills not be readily available, skills training and capacity building should be undertaken.

Mitigation: Action/control	Responsibility	Timeframe
A broad-based approach should be followed to identify and involve relevant organisations in identifying people whose skills may correspond with the job specifications.	Thupela Energy	Pre-Construction
In cases for the semi-skilled jobs, where the relevant skills do not exist, training should be provided to willing local community members to enable them to fill the positions.	Thupela Energy and Contractor	Construction Phase

Performance Indicator	<ul style="list-style-type: none"> » Job opportunities, especially of low skilled positions, are primarily awarded to members of local communities. » Skills training and capacity building initiatives are developed and implemented (possibly in cooperation with similar initiatives undertaken by the Waterberg Biosphere Reserve). » Local SMME's and/or entrepreneurs should be awarded the opportunity to become involved in the tender process.
Monitoring	<ul style="list-style-type: none"> » Independent ECO must monitor indicators listed above to ensure that they have been implemented.

OBJECTIVE: Enhance capacity building and skills development within the local communities

Capacity building and skills training during the construction phase will range from training labourers in assembly and installation of panel mounts through to more advanced skills, such as electrical wiring. Capacity building and skills training would thus have the greatest impact if the skills would be transferable to other types of construction or electricity generation related projects.

Project component/s	<ul style="list-style-type: none"> » PV plant and associated infrastructure
Potential Impact	<ul style="list-style-type: none"> » Positive contribution to the capacity of individuals involved with the project, and equipping them with transferable skills
Activity/risk source	<ul style="list-style-type: none"> » Inefficient training or lack of capacity building and skills training
Mitigation:	<ul style="list-style-type: none"> » Capacity building and skills training during the construction phase to

Target/Objective range from training labours in assembly and installation of panel mounts through to more advanced skills, such as electrical wiring.

Mitigation: Action/control	Responsibility	Timeframe
In cases for the semi-skilled jobs, where the relevant skills do not exist, training should be provided to willing local community members to enable them to fill the positions.	Thupela Energy and Contractors	Pre-Construction and Construction
Capacity building initiatives could link in with the planned capacity building and skills training initiatives to be undertaken as part of the Waterberg Biosphere Reserve's outreach programmes.	Thupela Energy	Construction
Contributing funds for the initiation phase of the Waterberg Biosphere Reserve's Skills Training Facilitation Project.	Thupela Energy	Construction and Operational
Create conditions that are conducive for the involvement of entrepreneurs, small businesses, and SMMEs during the construction process.	Thupela Energy and Contractors	Construction

Performance Indicator	» A Skills Development Plan should be developed. This plan should concentrate on the transfer of skills to employees to increase their capacity and to equip them with alternative skills should they wish to be employed elsewhere.
Monitoring	» ECO must monitor indicators listed above to ensure that they have been implemented.

OBJECTIVE: Minimise the impact of the inflow of an outside workforce and job seekers into the study area

It is estimated that an average number of fifty (50) construction workers would be required on site on a daily basis. During peak construction periods this could increase to approximately one hundred (100) workers. No construction workers would be housed on site and no construction camp for accommodation purposes would be built. Due to the size of the construction workforce, the impacts associated with the inflow of temporary workers to the area could result in various negative impacts on the surrounding property owners and possibly on local communities. The negative social impacts associated with the inflow of workers are expected to manifest predominantly during the peak periods of the construction phase of the project. The intensity would depend on whether local labour would be used and the actual percentage of workers that would be from the local labour pool.

Even if limited numbers of additional outsiders (from other provinces) or foreigners come to the area in search of employment, it is possible that the small number of

outsiders and foreigners already present in the area could come into conflict with the local community members in search of employment. The inflow of jobseekers (foreigners or locals) to the site is thus anticipated to occur and could even materialise prior to the construction phase when people become aware of the proposed project. The majority of negative social impacts associated with the inflow of jobseekers are usually experienced if the jobseekers, especially those not originally from the area, remain in the area for long periods or even after construction has stopped. This could result in added pressure on the existing infrastructure and services and even in an increase in crime levels and conflict between locals and the jobseekers.

Project component/s	» PV plant and associated infrastructure
Potential Impact	» The inflow of outsiders and jobseekers could result in negative impacts on the surrounding property owners and local communities, and could even lead to conflict between the locals and these outsiders.
Activity/risk source	» Outside workforce and jobseekers come into conflict with locals, their presence leads to environmental pollution, and possibility of them remaining in the area after construction has ceased. This would put additional pressure on the existing infrastructure and services.
Mitigation: Target/Objective	» Limit the number of outsiders employed and put pro-active measures in place to deal with possible jobseekers.

Mitigation: Action/control	Responsibility	Timeframe
Local labourers should be employed where possible.	Contractor	Pre-Construction
Local labourers should remain at their existing residences and no workers can be allowed on site during night time. No workers should thus be accommodated on site at night.	Contractor	Construction
Maintain normal working hours.	Contractor	Construction
Before construction commences, representatives from the Modimolle Local Municipality, community leaders, community-based organisations and the surrounding property owners, should be informed of the details of the contractors, size of the workforce and construction schedules.	Thupela Energy	Pre-Construction
Construction workers should be easily identifiable by wearing uniforms and even identity tags.	Contractor Environmental Control Officer	Construction
Local community organisations and policing forums / neighbourhood watches must be informed of the presence of the outside workforce.	Thupela Energy	Pre-Construction
Care should be taken to avoid conflict between the local communities and the "outside" workforce.	Thupela Energy	Construction

Mitigation: Action/control	Responsibility	Timeframe
Sufficient water and sanitation facilities should be provided for the workers on site during the construction period.	Contractor	Construction
The construction site should be properly managed to avoid any environmental pollution (due to inadequate water and waste infrastructure and services) and littering.	Environmental Control Officer & Contractor	Construction
Informal vending stations should not be allowed on or near the construction site. Construction workers should preferably receive daily meals and beverages to avoid the need for a vending station.	Contractors	Construction
Information distributed as part of the existing HIV/Aids awareness campaigns should again be focused on and communicated to the local workforce.	Thupela Energy & Contractors	Construction
Develop a transparent communication and recruitment process to minimise the influx of jobseekers to the area.	Thupela Energy, local leaders and the Modimolle Local Municipality	Pre-construction
The recruitment process and the use of contractors should be clearly communicated to the local communities.	Thupela Energy	Pre-construction
Maximise the use of local labour and contractors where possible by developing a strategy to involve local labour in the construction process.	Thupela Energy and Contractor	Pre-construction & Construction
The communication strategy should ensure that unrealistic employment expectations are not created.	Thupela Energy	Pre-construction & Construction
A representative of Thupela Energy or its EPC partner could attend community meetings arranged within the various wards to discuss the employment and recruitment process.	Thupela Energy	Pre-construction

Performance

Indicator

- » Reports are not made from members of the local communities regarding unrealistic employment opportunities.
- » Sound environmental management of construction site.

Monitoring

- » Thupela Energy and or appointed ECO must monitor indicators listed above to ensure that they have been implemented.

OBJECTIVE: To minimise traffic related impacts

Construction vehicles (e.g. excavators or bulldozers) would be stored on site and movement of these vehicles between the construction site and source areas would be kept to the minimum. A large number of delivery vehicles (large trucks of some being between 20 to 30 tons) would have to access the site for the delivery of the mounts, panels, and electrical equipment. The number of vehicles is estimated at a minimum of 150 trucks and a maximum of 200 trucks for the duration of the construction period which would result in approximately two heavy vehicles per day. The frequency of the trips cannot yet be determined. The construction related vehicles would most probably make use of the tarred Modimolle-Vaalwater Road (R33) and the tarred Vaalwater-Melkrivier Road (R518) and then turn-off onto the Sterkstroom or Vier-en-Twintig-Riviere gravel roads to access the site.

The impact on the safety of other road users, as well as pedestrians (especially children) could materialise near the access road to the farm Boschdraai (from the Sterkstroom gravel road) where approximately 350 individuals reside.

Other social impacts refer to the effect of an increase in heavy traffic on the surface of the gravel roads. It is anticipated that the large number of construction vehicles would have an impact on the gravel roads which could last for a couple of years. If locals from Boschdraai (app. 8 km from the proposed site) and Leseding (app. 25 km from the proposed site) would be employed during the construction period, they would be transported from their existing residences to the site and back on a daily basis. This would result in an additional increase in heavy vehicles (e.g. buses) on the local roads. Concerns in this regard again relate to the safety of other road users and pedestrians, but also to the impact of the increase in traffic on the surfaces of the local roads.

Any access to properties surrounding the proposed site is not expected to be affected during the construction phase. Property owners that have to pass the construction site to access their farms would thus have continuous access to their properties. Noise and dust impacts and possible delays when property owners have to wait to pass heavy vehicles on the local access road would be particularly intrusive to the surrounding property owners of the farms Schoongezicht KR 107 and Sterkstroom KR 103.

Project component/s	» External access road
Potential Impact	» Impact of heavy construction vehicles on road surfaces, and possible increased risk in accidents
Activities/risk sources	» Construction vehicle movement

Mitigation: » Minimise the impact of the increase in heavy vehicles on existing
Target/Objective infrastructure, property owners, and road users.

Mitigation: Action/control	Responsibility	Timeframe
Meetings with affected residents should be arranged before construction commences. During these meetings, the contractor's plans, procedures and schedules, as well as the anticipated intrusion impacts should be clarified. Appropriate management and mitigation measures should be agreed to.	Thupela Energy and Environmental Control Officer	Pre-Construction
Residents of the farms Schoongezicht KR 107 and Sterkstroom KR 103 should be allowed access to their properties at all times.	Contractor	Construction
The movement of construction vehicles through the local area should be limited to off-peak periods (if possible) to minimise adverse impacts on the movement of pedestrians (individuals walking to and from work and schoolchildren) and to a lesser extent on private vehicular traffic.	Contractor	Construction
Signs should be erected at strategic locations throughout the area, warning residents, and visitors about the hazards around the construction site and the presence of heavy vehicles.	Contractor	Construction
Strict vehicle safety standards should be implemented and monitored.	Contractor & Environmental Control Officer	Construction
Construction vehicles should keep to the speed limits.	Contractor & Environmental Control Officer	Construction
The local gravel access roads should be graded during the construction phase (possibly every six months) to limit the degradation of the road surface.	Thupela Energy	Construction

Performance Indicator

- » Vehicles keeping to the speed limits, no incidences of speeding are noted.
- » Vehicles are in good working order and safety standards are implemented
- » Local residents and road users are aware of vehicle movements and schedules
- » Property owners (e.g. of the farms Schoongezicht KR 107 and Sterkstroom KR 103) have access to their properties at all times.
- » No traffic related accidents are experienced.
- » Complaints of residents are not received (e.g. concerning the speeding of heavy vehicles).

Monitoring

- » The independent appointed ECO must monitor indicators listed above to ensure that they have been implemented.

OBJECTIVE: To minimise the potential impact on safety and security

Even though no construction workers are expected to be accommodated on site, an inflow of workers could, as a worst case scenario and irrespective of the size of the workforce, pose some security risks. Criminals could also use the opportunity due to "outsiders" being in the area to undertake their criminal activities. Materials and goods would be stored on site in some type of storage facility for the duration of the construction period, and this in itself can lure criminals to the area. Safety of individuals residing in the area and animals, especially rare game species such as rhinoceros, sable antelope, buffalo, and so forth remain of concern. The negative impacts associated with the inflow of workers could, however, be limited should a local labour force be used. The crime rates are said to be low in the Modimolle Local Municipality area and the proposed project should thus avoid any actions that could increase the risk of criminal activity.

Safety at and around the construction site should be ensured by limiting any fire risks, fencing off the construction area to avoid unauthorised access of especially school children and by employing security personnel. In this regard, the project proponent indicated that it is planned to establish a fire capability on site from the start of the construction phase, which could include a fire fighter and individual man pack sprayers. Permanent security personnel would be on site for the duration of the construction period.

Construction related accidents are also always a concern when construction activities are undertaken. Local doctors and ambulance facilities for accidents would be used and it is anticipated that there would be sufficient capacity for minor emergencies. Major emergencies could be problematic as the nearest hospital is located at Modimolle, but due to the type of activities undertaken, major emergencies are unlikely to occur.

Project component/s	» PV facility and associated infrastructure
Potential Impact	» Outside workers are involved in criminal activities and/or fires occur.
Activities/risk sources	» Safety of individuals and animals are at risk.
Mitigation: Target/Objective	» Employment of local labour should be maximised and strict security measures should be implemented at the construction site.

Mitigation: Action/control	Responsibility	Timeframe
Employing local community members could minimise the potential for criminal activity or perceived perception of an increase in criminal activity due to the	Contractor	Pre-Construction

Mitigation: Action/control	Responsibility	Timeframe
presence of an outside workforce.		
Screening of workers that apply for work could be useful to lessen perceived negative perceptions about the outside workforce.	Contractor	Pre-Construction
Construction workers should be easily identifiable by wearing uniforms and even identity tags.	Contractor	Construction
Local community organisations and policing forums must be informed of the presence of the outside workforce.	Thupela Energy	Construction
Care should be taken to avoid conflict between the local communities and the "outside" workforce by arranging meetings with local community leaders.	Thupela Energy and Contractor	Pre-Construction and Construction
The property owners surrounding the construction area should be involved during the construction process by communicating the construction schedule and movement of workers with these representatives.	Thupela Energy and Environmental Control Officer	Pre-Construction and Construction
Property owners and their workers, as well as local communities (e.g. Boschdraai due to their location to the site) and their community structures should be motivated to be involved in crime prevention and by reporting crimes.	Thupela Energy	All phases of project
The construction site should be fenced and access to the area controlled.	Thupela Energy and Contractor	All phases of project
Security personnel should be aware of the possibility of animal theft and poaching and should be able to identify possible criminal elements and/or criminal activities in this regard.	Thupela Energy and Contractor	Construction
Procedures and measures to prevent, and in worst cases, attend to fires should be developed in consultation with the surrounding property owners	Thupela Energy	Pre-Construction and when required

Performance

Indicator

- » No criminal activities are reported.
- » No fires occur.
- » No incidences are reported between the local communities and the "outside" workforce.

Monitoring

- » Thupela Energy, local policing forum and or appointed ECO must monitor indicators listed above to ensure that they have been implemented.

OBJECTIVE: Noise control

Various construction activities would be taking place during the development of the facility and there exists a risk that some of these activities could have a noise impact on surrounding residents.

Project component/s	<ul style="list-style-type: none"> » Construction of infrastructure » Movement of vehicles » Activities of construction crews
Potential Impact	<ul style="list-style-type: none"> » Increased noise levels at potentially sensitive receptors
Activity/risk source	<ul style="list-style-type: none"> » Any noisy construction activities
Mitigation: Target/Objective	<ul style="list-style-type: none"> » Minimise the generation of a disturbing or nuisance noises, where possible » Ensure acceptable noise levels at surrounding stakeholders and potentially sensitive receptors. » Ensuring compliance with Noise Control Regulations

Mitigation: Action/control	Responsibility	Timeframe
Establish a line of communication and notify all stakeholders and potentially sensitive receptors of the means of registering any issues, complaints, or comments.	Environmental Control Officer	All phases of project
Ensure that all construction equipment is maintained and fitted with the required noise abatement equipment.	Environmental Control Officer	Weekly inspection
Where possible, construction work should be undertaken during normal working hours (06h00 – 18h00), from Monday to Saturday. If agreements can be reached (in writing) with the surrounding (within a 1,000m distance) potentially sensitive receptors, these working hours can be extended.	Contractor	As required

Performance Indicator	<ul style="list-style-type: none"> » No noise complaints are registered.
Monitoring	<ul style="list-style-type: none"> » N/A

OBJECTIVE: Management of dust and emissions to air

During the construction phase, limited gaseous or particulate emissions are anticipated from exhaust emissions from construction vehicles and equipment on-site, as well as vehicle entrained dust from the movement of vehicles on the main and internal access roads.

Project component/s	Construction and establishment activities associated with the establishment of the photovoltaic plan and associated infrastructure.
Potential Impact	<ul style="list-style-type: none"> » Dust and particulates from vehicle movement to and on-site, foundation excavation, road construction activities, road maintenance activities, temporary stockpiles, and vegetation clearing affecting the surrounding residents and visibility. » Release of minor amounts of air pollutants (for example NO₂, CO and SO₂) from vehicles and construction equipment.
Activities/risk sources	<ul style="list-style-type: none"> » Clearing of vegetation and topsoil » Excavation, grading, scraping » Transport of materials, equipment and components on internal access roads » Re-entrainment of deposited dust by vehicle movements » Wind erosion from topsoil and spoil stockpiles and unsealed roads and surfaces » Fuel burning vehicle engines
Mitigation: Target/Objective	<ul style="list-style-type: none"> » To ensure emissions from all vehicles are minimised, where possible, for the duration of the construction phase » To minimise nuisance to the community from dust emissions and to comply with workplace health and safety requirements for the duration of the construction phase

Mitigation: Action/control	Responsibility	Timeframe
Roads must be maintained to a manner that will ensure that dust from road or vehicle sources is not visibly excessive. Ensure that damage to roads is repaired on completion of construction phase.	Contractor	Site establishment; Construction
Appropriate dust suppressant must be applied on all exposed areas and stockpiles as required to minimise/control airborne dust.	Contractor	Duration of contract
Haul vehicles moving outside the construction site carrying material that can be wind-blown must be covered with tarpaulins.	Contractor	Duration of contract
Speed of construction vehicles must be restricted, as defined by the ECO.	Contractor ECO	Duration of contract
Disturbed areas must be re-vegetated as soon as	Contractor	Completion of

Mitigation: Action/control	Responsibility	Timeframe
practicable once construction is completed in an area.		Construction
Construction vehicles and equipment must be maintained in a road-worthy condition at all times.	Contractor	Duration of contract
If monitoring results or complaints indicate inadequate performance against the criteria indicated, then the source of the problem must be identified, and existing procedures or equipment modified to ensure the problem is rectified.	Contractor	Duration of contract

Performance Indicator	<ul style="list-style-type: none"> » No complaints from affected residents or community regarding dust or vehicle emissions. » Dust suppression measures implemented for all heavy vehicles that require such measures during the construction phase. » Drivers made aware of the potential safety issues and enforcement of strict speed limits when they are employed. » Road worthy certificates in place for all heavy vehicles at outset of construction phase and up-dated on a monthly basis.
Monitoring	<p>Monitoring must be undertaken to ensure emissions are not exceeding the prescribed levels via the following methods:</p> <ul style="list-style-type: none"> » Visual daily inspections of dust generation by construction activities throughout the construction phase. » Immediate reporting by personnel of any potential or actual issues with nuisance dust or emissions to the Site Manager. » A complaints register must be maintained, in which any complaints from residents/the community will be logged. Complaints will be investigated and, where appropriate, acted upon. » An incident reporting system must be used to record non-conformances to the EMP.

OBJECTIVE: Control the establishment and spread of alien invasive plants

Project Component/s	» Any infrastructure or activity that will result in disturbance
Potential Impact	» Invasion of natural vegetation surrounding the site by declared weeds or invasive alien species
Activities/Risk Sources	» Construction, environmental management
Mitigation: Target/Objective	» There is a target of no alien plants within project control area during the construction and operation phases

Mitigation: Action/Control	Responsibility	Timeframe
Avoid creating conditions in which alien plants may become established:	Contractor	Construction and operational

Mitigation: Action/Control	Responsibility	Timeframe
» Rehabilitate disturbed areas as quickly as possible		phase
» Do not import soil from areas with alien plants		
Establish an ongoing monitoring programme to detect and quantify any alien species that may become established and identify the problem species (as per Conservation of Agricultural Resources Act)	Contractor	Construction and operational phase
Immediately control any alien plants that become established using registered control methods	Contractor	Construction & operational phase

Performance Indicator	» For each alien species: number of plants and aerial cover of plants within project area and immediate surroundings
Monitoring	<ul style="list-style-type: none"> » Ongoing monitoring of area by ECO during construction » Ongoing monitoring of area by environmental manager during operation » Annual audit of project area and immediate surroundings by qualified botanist » If any alien invasive species are detected then the distribution of these should be mapped (GPS co-ordinates of plants or concentrations of plants), number of individuals (whole site or per unit area), age and/or size classes of plants and aerial cover of plants » The results should be interpreted in terms of the risk posed to sensitive habitats within and surrounding the project area » The environmental manager should be responsible for driving this process » Reporting frequency depends on legal compliance framework

OBJECTIVE: To avoid and or minimise the potential risk of increased veld fires during the construction phase

The vegetation in the study area may be at risk of fire. The increased presence of people on the site could increase the risk of veld fires, particularly in the dry season.

Project component/s	Construction and establishment activities associated with the establishment of the photovoltaic plant and associated infrastructure
Potential Impact	Veld fires can pose a personal safety risk to local farmers and communities, and their homes, crops, livestock and farm infrastructure, such as gates and fences.
Activities/risk sources	The presence of construction workers and their activities on the site can increase the risk of veld fires.
Mitigation: Target/Objective	To avoid and or minimise the potential risk of veld fires on local communities and their livelihoods.

Mitigation: Action/control	Responsibility	Timeframe
Establish fire breaks	Contractor	Pre-Construction
Ensure that open fires on the site for cooking or heating are not allowed except in designated areas.	Thupela Energy and Contractor	Duration of construction
Provide adequate fire fighting equipment onsite.	Thupela Energy & Contractor	Duration of construction
Provide fire-fighting training to selected construction staff.	Contractor	Duration of construction
Compensate farmers / community members at full market related replacement cost for any proven losses, such as livestock, damage to infrastructure etc for losses associated with fires resulting from negligence or non-compliance.	Contractor	As required

Performance Indicator	<ul style="list-style-type: none"> » Designated areas for fires identified on site at the outset of the construction phase. » Fire fighting equipment and training provided before the construction phase commences.
Monitoring	<ul style="list-style-type: none"> » Appointed ECO must monitor indicators listed above to ensure that they have been met for the construction phase.

OBJECTIVE: Control runoff and soil erosion & degradation

The soil resource on the site needs to be conserved as far as possible to minimise the cumulative impact on the local environment. A set of strictly adhered to mitigation measures are required to effectively limit the impact on the environment. The disturbance areas where human impact is likely are the focus of the mitigation measures laid out below.

Project component/s	<ul style="list-style-type: none"> » PV panels » Access roads » Sealed surfaces (e.g. roofs, concrete surfaces, compacted road surfaces, paved roads, / areas) » All other infrastructure
Potential Impact	<ul style="list-style-type: none"> » Degradation of soil » Degradation of local geology » Soil erosion
Activities/risk sources	<ul style="list-style-type: none"> » Water and wind erosion of cleared and excavated areas » Excavation, mixing, dumping, stockpiling and compaction of soil » Concentrated discharge of water from construction activity » Site preparation and earthworks » Foundations or plant equipment installation

Mitigation: Target/Objective	» Mobile construction equipment movement on site
	» Minimise degradation of rock and soil by construction activity
	» Conserve topsoil by stockpiling and re-using in disturbance areas
	» Minimise erosion of soil from site during construction
	» Minimise deposition of soil into drainage lines

Mitigation: Action/control	Responsibility	Timeframe
Identify disturbance areas and restrict construction activity to these areas	Environmental Control Officer/Contractor	Pre-construction and Construction
Access roads to be carefully planned and constructed to minimise the impacted area and prevent unnecessary excavation, placement, and compaction of soil.	Engineer/ Environmental Control Officer	Pre-construction and Construction
Erosion features must be immediately stabilised with appropriate erosion control measures, if they develop	Contractor	Construction
Stockpile topsoil for re-use in rehabilitation phase. Maintain stockpile shape and protect from erosion. Limit the height of stockpiles as far as possible to reduce compaction.	Contractor	During site establishment and any activity related to earthworks as well as the duration of construction
Rehabilitate any disturbed areas immediately after construction in that area is complete in order to stabilise landscapes.	Contractor	Post-construction
Any stockpiles must be protected against wind and water erosion (e.g. surrounded by shade cloth fences or damped down on a regular basis).	Contractor	Duration of contract
Erosion control measures: Run-off attenuation on slopes (sand bags, logs), silt fences, stormwater catch-pits, shade nets, or temporary mulching over denuded areas.	Contractor/ Environmental Control Officer	Erection: Before construction Maintenance: Duration of contract
Vehicular traffic must be controlled during construction, confining access and roadways, where possible, to proposed or existing road alignments.	Contractor	Duration of contract
As far as possible, access to the facility construction site should be restricted to a single access point.	Contractor	Duration of contract
Internal access roads should be kept to a minimum. Use existing roads wherever possible.	Contractor	During site establishment
Movement of vehicles on-site is to be on approved and formalised access roads only, which shall be adequately maintained throughout construction.	Contractor	Duration of contract

Mitigation: Action/control	Responsibility	Timeframe
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Where temporary tracks are required these are to be ripped and rehabilitated as soon use of the track in an area is no longer required.

Performance Indicator	<ul style="list-style-type: none"> » Acceptable level of soil erosion around site, as approved by Environmental Control Officer » Acceptable level of increased siltation in drainage lines, as approved by Environmental Control Officer » Acceptable level of soil degradation, as approved by Environmental Control Officer » Acceptable state of excavations, as approved by Environmental Control Officer » No activity in restricted areas 	
Monitoring	<ul style="list-style-type: none"> » Ongoing monitoring of area by Environmental Control Officer during construction » Weekly inspections of the site by Environmental Control Officer » An incident reporting system will record non-conformances 	

OBJECTIVE: Protection of sites of heritage value / fossil resources

No heritage/archaeological sites have been identified on the site. However, it is possible that sites will be uncovered during excavation activities associated with construction. If at any stage during the construction phase any semblance of a fossil is observed, it would be vital to stop the work immediately and report this occurrence to the South African Heritage Resources Association and/or a professional palaeontologist as soon as possible so that appropriate mitigation measures can be implemented. Generally fossils can be removed quickly and would therefore not delay or hinder construction operations.

Project component/s	<ul style="list-style-type: none"> » PV panels » Access roads » All other infrastructure
Potential Impact	<ul style="list-style-type: none"> » Heritage objects or artefacts found on site are inappropriately managed or destroyed » Disturbance to fossil resources
Activity/risk source	<ul style="list-style-type: none"> » Site preparation and earthworks » Foundations or plant equipment installation » Mobile construction equipment movement on site
Mitigation: Target/Objective	<ul style="list-style-type: none"> » To ensure that any heritage objects found on site are treated appropriately and in accordance with the relevant legislation

Mitigation: Action/control	Responsibility	Timeframe
If a heritage object is found, work in that area must be stopped immediately, and appropriate specialists brought in to assess to site, notify the administering authority of the item/site, and undertake due/required processes.	Thupela Energy /Contractor in consultation with Specialist	Duration of contract

Performance Indicator	<ul style="list-style-type: none"> » Zero disturbance outside of designated work areas. » All heritage items located are dealt with as per the legislative guidelines. » A record is kept of all instances of accidental disturbance of heritage material, as well as post construction review of impacts on landscape context.
Monitoring	<ul style="list-style-type: none"> » Supervision of all clearing and earthworks by the Environmental Control Officer throughout construction phase

OBJECTIVE: Minimisation of visual impacts associated with construction

The construction phase of a project is potentially the phase that causes the most disturbances. During this time there will be a noticeable increase in heavy vehicles utilising the roads to the development site that may cause, at the very least, a visual nuisance to other road users and landowners in the area.

Project component/s	<ul style="list-style-type: none"> » PV panels » Access roads » All other infrastructure
Potential Impact	<ul style="list-style-type: none"> » Temporary visual intrusion
Activity/risk source	<ul style="list-style-type: none"> » Transportation of components to the site » Construction activities on-site » The potential scarring of the landscape due to the creation of new access roads/tracks or the unnecessary removal of vegetation
Mitigation: Target/Objective	<ul style="list-style-type: none"> » Minimise contrast with surrounding environment and visibility of the construction activities to people in the area

Mitigation: Action/control	Responsibility	Timeframe
Adopt responsible construction practices aimed at containing the construction activities to specifically demarcated areas thereby limiting the removal of natural vegetation to the minimum.	Contractor	Duration of contract
The activities and movement of construction workers and construction site vehicles will be restricted to the immediate construction site.	Contractor	Construction

Mitigation: Action/control	Responsibility	Timeframe
Limit access to the construction sites along existing access roads.	Contractor	Construction
The general appearance of construction activities, and construction equipment camps, will be maintained by means of the timely removal of rubble and disused construction materials.	Contractor	Construction
Clearance of vegetation within the development footprint will be minimised in order to minimise long-term visual disturbance, and rehabilitation efforts undertaken.	Contractor	Duration of contract
Implement an environmentally responsive planning approach to roads to limit cut and fill requirements.	Thupela Energy Contractor	Pre-construction Construction
Rehabilitate all disturbed areas, including cut and fill slopes to acceptable visual standards.	Contractor	Post-construction

Performance Indicator	» No complaints regarding visual intrusion associated with construction activities
Monitoring	<ul style="list-style-type: none"> » Ensure that mitigation measures are implemented during construction to minimise visual impacts on surrounding communities » An incident reporting system will be used to record non-conformances to the EMP

OBJECTIVE: Traffic management and transportation of equipment and materials to site

The construction phase of the project will be the most significant in terms of generating traffic impacts; resulting from the transport of equipment, materials and construction crews to the site and the return of the vehicles after delivery of materials. Potential impacts associated with transportation and access relate to works within the site boundary (i.e. the photovoltaic plant and ancillary infrastructure).

Project component/s	» Gravel Roads D973, D2416, and D2747
Potential Impact	<ul style="list-style-type: none"> » Risk of accidents » Contribute to the prevailing sub-standard road conditions » Deterioration of road conditions (both surfaced and gravel road) due to the load frequency and the current condition of the gravel roads
Activity/risk source	<ul style="list-style-type: none"> » Transportation of project components to site » Site preparation and earthworks » Foundations or plant equipment installation » Mobile construction equipment movement on-site » If the present conditions are left untreated the road will be unsafe for

Mitigation: Target/Objective	<p>the transportation of people and materials</p> <ul style="list-style-type: none"> » To minimise impact of traffic associated with the construction of the facility on local traffic » To minimise potential for negative interaction between pedestrians or sensitive users and traffic associated with the facility construction » To minimise impacts on road surfaces » To ensure all vehicles are roadworthy and all materials/equipment are carried appropriately and within any imposed permit/licence conditions » The roads need immediate remedial measure to repair and improve their riding conditions » Furthermore a maintenance programme needs to be implemented to mitigate the recurrence of these conditions
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Mitigation: Action/control	Responsibility	Timeframe
A designated access (or accesses) to the proposed site must be created to ensure safe entry and exit.	Contractor	Pre-construction
No deviation from approved access routes within the site must be allowed.	Contractor	Duration of contract
Appropriate road management strategies must be implemented on external and internal roads with all employees and contractors required to abide by standard road and safety procedures.	Contractor (or appointed transportation contractor)	Pre-construction
Times for arrival and departure of heavy vehicles must be co-ordinated to minimise congestion.	Contractor	Duration of contract
Any traffic delays because of construction traffic must be co-ordinated with the appropriate authorities.	Contractor	Duration of contract
Signage must be established at appropriate points warning of turning traffic and the construction site (all signage to be in accordance with prescribed standards).	Contractor	Duration of contract
Appropriate maintenance of all vehicles must be ensured.	Contractor	Duration of contract
All vehicles travelling on public roads must adhere to the specified speed limits and all drivers must be in possession of an appropriate valid driver's license.	Contractor	Duration of contract
Keep hard road surfaces as narrow as possible.	Contractor	Duration of contract
Improve road drainage, blade roads to remove corrugation, add gravel wearing course. Implement maintenance programme for period of construction	Part local user/roads authorities and Thupela Energy	Pre-Construction and construction

Performance Indicator	<ul style="list-style-type: none"> » No traffic incidents involving Thupela Energy personnel or appointed contractors » Appropriate signage in place
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	<ul style="list-style-type: none"> » No complaints resulting from road surface deterioration or driver negligence associated with construction of the photovoltaic plant
Monitoring	<ul style="list-style-type: none"> » Visual monitoring of dust produced by traffic movement » Visual monitoring of traffic control measures to ensure they are effective » A complaints register will be maintained, in which any complaints from the community will be logged. Complaints will be investigated and, if appropriate, acted upon » An incident reporting system will be used to record non-conformances to the EMP

OBJECTIVE: Appropriate handling and storage of chemicals, hazardous substances and waste

The construction phase of the photovoltaic plant may involve the storage and handling of a variety of chemicals including adhesives, abrasives, oils and lubricants, paints and solvents. The main wastes expected to be generated by the construction of the facility and will include general solid waste, hazardous waste and liquid waste.

Project component/s	Storage and handling of chemicals, hazardous substances and waste
Potential Impact	<ul style="list-style-type: none"> » Release of contaminated water from contact with spilled chemicals » Generation of contaminated wastes from used chemical containers » Inefficient use of resources resulting in excessive waste generation » Pollution of the surrounding environment through inappropriate waste management practices » Litter or contamination of the site or water through poor waste management practices » Pollution of water and soil resources
Activity/risk source	<ul style="list-style-type: none"> » PV panel construction activities » Building construction activities » Packaging and other construction wastes » Hydrocarbon use and storage » Spoil material from excavation, earthworks and site preparation
Mitigation: Target/Objective	<ul style="list-style-type: none"> » Ensure that the storage and handling of chemicals and hydrocarbons on-site does not cause pollution to the environment or harm to persons » Ensure that the storage and maintenance of machinery on-site does not cause pollution of the environment or harm to persons » Comply with waste management guidelines » Minimise production of waste » Ensure appropriate waste handling, storage and disposal » Avoid environmental harm from waste disposal

Mitigation: Action/control	Responsibility	Timeframe
Spill kits must be made available on-site for the clean-up of spills and leaks of contaminants.	Contractor	Duration of contract
Corrective action must be undertaken immediately if a complaint is made, or potential/actual leak or spill of polluting substance identified. This includes stopping the contaminant from further escaping, cleaning up the affected environment as much as practically possible and implementing preventive measures.	Contractor	Duration of contract
In the event of a major spill or leak of contaminants, the relevant administering authority must be immediately notified as per the notification of emergencies/incidents.	Contractor	Duration of contract
Spilled cement must be cleaned up as soon as possible and disposed of at a suitably licensed waste disposal site.	Contractor	Duration of contract
Soil contaminated/ polluted as a result of a major spill must be removed from the site and disposed of at a licensed hazardous waste disposal facility. Soils contaminated/ polluted through minor spills can be treated on site provided they are contained and have not penetrated the soil surface.	Contractor	Duration of contract
Routine servicing and maintenance of vehicles must not take place on-site outside of designated areas (except for emergencies or large cranes which cannot be moved off-site). If repairs of vehicles must take place on site, an appropriate drip tray must be used to contain any fuel or oils.	Contractor	Duration of contract
All stored fuels to be maintained within a bunded area and on a sealed surface.	Contractor	Duration of contract
Fuel storage areas must be inspected regularly to ensure bund stability, integrity, and function.	Contractor ECO	Duration of contract
Construction machinery must be stored in an appropriately sealed area.	Contractor	Duration of contract
The storage of flammable and combustible liquids such as oils will be in designated areas which are appropriately bunded, and stored in compliance with MSDS files.	Contractor	Duration of contract
Any storage and disposal permits/approvals which may be required must be obtained, and the conditions attached to such permits and approvals will be compiled with.	Contractor	Duration of contract
Transport of all hazardous substances must be in accordance with the relevant legislation and regulations.	Contractor	Duration of contract

Construction contractors must provide specific detailed waste management method statements to deal with all waste streams.	Contractor	Pre-construction	
Specific areas must be designated on-site for the temporary management of various waste streams, i.e. general refuse, construction waste (wood and metal scrap), and contaminated waste. Location of such areas must seek to minimise the potential for impact on the surrounding environment, including prevention of contaminated runoff, seepage, and vermin control.	Contractor	Duration of contract	
Where possible, construction and general wastes on-site must be reused or recycled. Bins and skips must be available on-site for collection, separation, and storage of waste streams (such as wood, metals, general refuse etc).	Contractor	Duration of contract	
Disposal of waste must be in accordance with relevant legislative requirements, including the use of licensed contractors.	Contractor	Duration of contract	
No waste may be buried or burnt on site	Contractor	Duration of contract	
Hydrocarbon waste must be contained and stored in sealed containers within an appropriately bunded area.	Contractor	Duration of contract	
Waste and surplus dangerous goods must be kept to a minimum and must be transported by approved waste transporters to sites designated for their disposal.	Contractor	Duration of contract	
Documentation (waste manifest) must be maintained detailing the quantity, nature, and fate of any regulated waste. Waste disposal records must be available for review at any time.	Contractor	Duration of contract	
The sediment control and water quality structures used on-site must be monitored and maintained in an operational state at all times.	Contractor	Duration of contract	
Upon the completion of construction, the area must be cleared of potentially polluting materials.	Contractor	Completion of construction	

Performance Indicator

- » No chemical spills outside of designated storage areas
- » No water or soil contamination by spills
- » No complaints received regarding waste on site or indiscriminate dumping
- » Internal site audits ensuring that waste segregation, recycling and reuse is occurring appropriately
- » Provision of all appropriate waste manifests for all waste streams

Monitoring

- » Observation and supervision of chemical storage and handling practices and vehicle maintenance throughout construction phase
- » A complaints register must be maintained, in which any complaints from the community will be logged. Complaints will be investigated

	<p>and, if appropriate, acted upon</p> <ul style="list-style-type: none"> » Observation and supervision of waste management practices throughout construction phase » Waste collection to be monitored on a regular basis » Waste documentation completed » A complaints register will be maintained, in which any complaints from the community will be logged. Complaints will be investigated and, if appropriate, acted upon » An incident reporting system will be used to record non-conformances to the EMP
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OBJECTIVE: Ensure disciplined conduct of on-site contractors and workers

In order to minimise impacts on the surrounding environment, Contractors must be required to adopt a certain Code of Conduct and commit to restricting construction activities to areas within the development footprint. Contractors and their sub-contractors must be familiar with the conditions of the Environmental Authorisation (once issued), the EIA Report, and this EMP, as well as the requirements of all relevant environmental legislation.

Project component/s	» All components and activities occurring during the construction phase
Potential Impact	<ul style="list-style-type: none"> » Pollution/contamination of the environment » Disturbance to the environment
Activity/risk source	» Contractors are not aware of the requirements of the EMP, leading to unnecessary impacts on the surrounding environment
Mitigation: Target/Objective	» To ensure appropriate management of actions by on-site personnel in order to minimise impacts to the surrounding environment

Mitigation: Action/control	Responsibility	Timeframe
The terms of this EMP and the Environmental Authorisation (once issued) will be included in all tender documentation and Contractors contracts.	Thupela Energy	Tender process
An Environmental Control Officer must be permanently on site throughout the cable laying, and foundation construction periods, and at other times should visit the site at least once a week.	Thupela Energy	Duration of construction
Contractors must use chemical toilets/ablution facilities situated at designated areas of the site; no abluting will be permitted outside the designated area. These facilities must be regularly serviced by appropriate contractors.	Contractor (and sub-contractor/s)	Duration of contract

Mitigation: Action/control	Responsibility	Timeframe
Cooking/meals must take place in a designated area; no firewood or kindling may be gathered from the site or surrounds.	Contractor (and sub-contractor/s)	Duration of contract
All litter must be deposited in a clearly marked, closed, animal-proof disposal bin in the construction area; particular attention needs to be paid to food waste.	Contractor (and sub-contractor/s)	Duration of contract
No one other than the Environmental Control Officer or personnel authorised by said individual may disturb flora or fauna outside of the demarcated construction area/s.	Contractor (and sub-contractor/s)	Duration of contract
Contractors appointed by Thupela Energy must ensure that all workers are informed at the outset of the construction phase of the conditions contained on the Code of Conduct, specifically consequences of stock theft and trespassing on adjacent farms.	Contractor (and sub-contractor/s)	Construction
On completion of the construction phase all construction workers must be transported back to their place of origin within two days of their contract ending. The costs of transportation must be borne by the contractor	Contractor (and sub-contractor/s)	Construction

Performance Indicator

- » Compliance with specified conditions of Environmental Authorisation, (once issued), EIA report and EMP
- » No complaints regarding contractor behaviour or habits
- » Code of Conduct drafted before commencement of construction phase.
- » Briefing session with construction workers held at outset of construction phase

Monitoring

- » Observation and supervision of Contractor practices throughout construction phase.
- » A complaints register will be maintained, in which any complaints from the community will be logged. Complaints will be investigated and, if appropriate, acted upon
- » An incident reporting system will be used to record non-conformances to the EMP

5.4. Detailing Method Statements

OBJECTIVE: Ensure all construction activities/practices/procedures are undertaken with the appropriate level of environmental awareness to minimise environmental risk, in line with the specifications of the EMP.

The environmental specifications are required to be underpinned by a series of Method Statements, within which the Contractors and Service Providers are required to outline how any identified environmental risks will practically be mitigated and managed for the duration of the contract, and how specifications within this EMP will be met. That is, the Contractor will be required to describe how specified requirements will be achieved through the submission of written Method Statements to the Site Manager (and ECO).

A Method Statement is defined as "a written submission by the Contractor in response to the environmental specification or a request by the Site Manager, setting out the plant, materials, labour and method the Contractor proposes using to conduct an activity, in such detail that the Site Manager is able to assess whether the Contractor's proposal is in accordance with the Specifications and/or will produce results in accordance with the Specifications". The Method Statement must cover applicable details with regard to:

- » Construction procedures
- » Materials and equipment to be used
- » Getting the equipment to and from site
- » How the equipment/material will be moved while on-site
- » How and where material will be stored
- » The containment (or action to be taken if containment is not possible) of leaks or spills of any liquid or material that may occur
- » Timing and location of activities
- » Compliance/non-compliance with the Specifications, and
- » Any other information deemed necessary by the Site Manager.

The Contractor may not commence the activity covered by the Method Statement until it has been approved, except in the case of emergency activities and then only with the consent of the Site Manager. Approval of the Method Statement will not absolve the Contractor from their obligations or responsibilities in terms of their contract.

5.5. Awareness and Competence: Construction Phase of the Waterberg Photovoltaic Plant

OBJECTIVE: Ensure all construction personnel have the appropriate level of environmental awareness and competence to ensure continued environmental due diligence and on-going minimisation of environmental harm.

To achieve effective environmental management, it is important that Contractors are aware of the responsibilities in terms of the relevant environmental legislation and the contents of this EMP. The Contractor is responsible for informing employees and sub-contractors of their environmental obligations in terms of the environmental specifications, and for ensuring that employees are adequately experienced and properly trained in order to execute the works in a manner that will minimise environmental impacts. The Contractors obligations in this regard include the following:

- » Employees must have a basic understanding of the key environmental features of the construction site and the surrounding environment.
- » Ensuring that a copy of the EMP is readily available on-site, and that all site staff are aware of the location and have access to the document. Employees will be familiar with the requirements of the EMP and the environmental specifications as they apply to the construction of the facility.
- » Ensuring that, prior to commencing any site works, all employees and sub-contractors have attended an Environmental Awareness Training course. The course must provide the site staff with an appreciation of the project's environmental requirements, and how they are to be implemented.
- » Basic training in the identification of archaeological sites/objects, paleontological sites, and protected flora and fauna that may be encountered on the site.
- » Awareness of any other environmental matters, which are deemed necessary by the ECO.
- » Ensuring that appropriate communication tools are used to outline the environmental "do's" and "don'ts" (as per the environmental awareness training course) to employees.
- » Records must be kept of those that have completed the relevant training.
- » Refresher sessions must be held to ensure the contractor's staff are aware of their environmental obligations.

5.6. Monitoring Programme: Construction Phase of the Waterberg Photovoltaic Plant

OBJECTIVE: Monitor the performance of the control strategies employed against environmental objectives and standards.

A monitoring programme must be in place not only to ensure conformance with the EMP, but also to monitor any environmental issues and impacts which have not been accounted for in the EMP that are, or could result in significant environmental impacts for which corrective action is required. The period and frequency of monitoring will be stipulated by the Environmental Authorisation (once issued). Where this is not clearly dictated, Thupela Energy will determine and stipulate the period and frequency of monitoring required in consultation with relevant stakeholders and authorities. The Project Manager will ensure that the monitoring is conducted and reported.

The aim of the monitoring and auditing process would be to routinely monitor the implementation of the specified environmental specifications, in order to:

- » Monitor and audit compliance with the prescriptive and procedural terms of the environmental specifications
- » Ensure adequate and appropriate interventions to address non-compliance
- » Ensure adequate and appropriate interventions to address environmental degradation
- » Provide a mechanism for the lodging and resolution of public complaints
- » Ensure appropriate and adequate record keeping related to environmental compliance
- » Determine the effectiveness of the environmental specifications and recommend the requisite changes and updates based on audit outcomes, in order to enhance the efficacy of environmental management on site
- » Aid communication and feedback to authorities and stakeholders.

The Environmental Control Officer will ensure compliance with the EMP, and will conduct monitoring activities. The Environmental Control Officer must have the appropriate experience and qualifications to undertake the necessary tasks. The Environmental Control Officer will report non-compliances to the Site Manager and/or any other monitoring body stipulated by the regulating authorities.

**MANAGEMENT PLAN FOR THE PHOTOVOLTAIC PLANT:
REHABILITATION OF DISTURBED AREAS**

CHAPTER 6

6.1. Overall Goal for the Rehabilitation of Disturbed Areas

Overall Goal for the Rehabilitation of Disturbed Areas: Undertake the rehabilitation measures in a way that:

- » Ensures rehabilitation of disturbed areas following the execution of the works, such that residual environmental impacts are remediated or curtailed

6.2. Objectives

In order to meet this goal, the following objective, actions and monitoring requirements are relevant:

OBJECTIVE: Ensure appropriate rehabilitation of disturbed areas following any executions such that residual environmental impacts are remediated or curtailed

Areas requiring rehabilitation will include all areas disturbed during the construction phase and that are not required for regular maintenance operations. Rehabilitation should be undertaken in an area as soon as possible after the completion of construction activities within that area.

Project component/s	<ul style="list-style-type: none"> » Photovoltaic plant » Access roads (i.e. those not required for operation and maintenance)
Potential Impact	<ul style="list-style-type: none"> » Environmental integrity of site undermined resulting in reduced visual aesthetics, erosion, compromised land capability and the requirement for on-going management intervention
Activity/risk source	<ul style="list-style-type: none"> » Temporary access roads/tracks » Other disturbed areas/footprints
Mitigation: Target/Objective	<ul style="list-style-type: none"> » Ensure and encourage site rehabilitation of disturbed areas » Ensure that the site is appropriately rehabilitated following the execution of the works, such that residual environmental impacts (including erosion) are remediated or curtailed

Mitigation: Action/control	Responsibility	Timeframe
All temporary facilities, equipment, and waste materials must be removed from site as soon as practically possible after construction is complete.	Contractor	Following execution of the works

Mitigation: Action/control	Responsibility	Timeframe
All temporary fencing and danger tape must be removed once the construction phase has been completed.	Contractor	Following completion of construction activities in an area
Necessary drainage works and anti-erosion measures must be installed, where required, to minimise loss of topsoil and control erosion.	Contractor	Following completion of construction activities in an area
Disturbed areas must be rehabilitated/re-vegetated with appropriate natural vegetation and/or local seed mix. Re-use of native/indigenous plant species removed from disturbance areas in the rehabilitation phase.	Contractor in consultation with rehabilitation specialist	Following completion of construction activities in an area
Re-vegetated areas may have to be protected from wind erosion and maintained until an acceptable plant cover has been achieved.	Thupela Energy in consultation with rehabilitation specialist	Post-rehabilitation
Ongoing alien plant monitoring and removal must be undertaken on all areas of natural vegetation on an annual basis.	Thupela Energy in consultation with rehabilitation specialist	Post-rehabilitation

Performance Indicator	<ul style="list-style-type: none"> » All portions of site, including construction equipment camp and working areas, cleared of equipment and temporary facilities » Topsoil replaced on all areas and stabilised » Disturbed areas rehabilitated and acceptable plant cover achieved on rehabilitated sites » Completed site free of erosion and alien invasive plants
Monitoring	<ul style="list-style-type: none"> » On-going inspection of rehabilitated areas in order to determine effectiveness of rehabilitation measures implemented » On-going alien plant monitoring and removal should be undertaken on an annual basis

**MANAGEMENT PLAN FOR THE PHOTOVOLTAIC PLANT:
 OPERATION**

CHAPTER 7

7.1. Overall Goal for Operation

Overall Goal for Operation: To ensure that the operation of the photovoltaic plant does not have unforeseen impacts on the environment and to ensure that all impacts are monitored and the necessary corrective action taken in all cases. In order to address this goal, it is necessary to operate the photovoltaic plant in a way that:

- » Ensures that operation activities are properly managed in respect of environmental aspects and impacts.
- » Enables the operation activities are undertaken without significant disruption to other land uses in the area, in particular with regard to farming practices, traffic and road use, and effects on local residents and other receptors in terms of visual impacts.

7.2. Objectives

In order to meet this goal, the following objectives have been identified, together with necessary actions and monitoring requirements.

OBJECTIVE: Maintenance of rehabilitated areas

In order to ensure the long-term environmental integrity of the site following construction, maintenance the areas rehabilitated post-construction must be undertaken until these areas have successfully re-established. Fire breaks should be established, where appropriate, to limit both incoming and outgoing veld fires.

Project component/s	» Photovoltaic plant (i.e. including access roads and ancillary buildings)
Potential Impact	» Environmental integrity of site undermined resulting in reduced visual aesthetics, erosion, compromised land capability and the requirement for on-going management intervention
Activity/risk source	» Foundations » Access roads » Other disturbed areas
Mitigation: Target/Objective	» Ensure and encourage site rehabilitation of disturbed areas

Mitigation: Action/control	Responsibility	Timeframe
Fire breaks should be established, where appropriate.	Thupela Energy	Duration of contract
Appoint an environmental manager during operation whose duty it will be to minimise impacts on surrounding sensitive habitats.	Thupela Energy	Operation
Performance Indicator	» Successful rehabilitation of disturbed areas	
Monitoring	» On-going alien plant monitoring and removal should be undertaken on an annual basis	

OBJECTIVE: Minimisation of visual impacts

The placement of the photovoltaic plant and its associated structures will have a visual impact on the natural scenic resources of this region. The natural and relatively unspoiled views surrounding the PV plant will be transformed for the entire operational lifespan (approximately 30 years) of the plant. The area potentially affected by the proposed development is generally seen as having a high scenic value and the proposed PV plant is expected to form a noticeable contrast within this predominantly natural and agricultural region.

There are not many options as to the mitigation of the visual impact of the facility. Although the functional design of the structures cannot be changed in order to reduce visual impacts, it is proposed that the standard height of the units be set at 3 – 4 m and that a 6 m height should only be used on exception where absolutely necessary. This will reduce the facility's visual intrusion and increase the vegetations' ability to mask the facility. Receptor sites exposed to visual impact may mitigate this impact by planting a vegetation screen similar in form and density to the natural vegetation of the receiving environment. This measure will only be effective if the screen is planted *in close proximity to the receptor*. This means that the visual impact must be screened at the property which is experiencing the impact, rather than at the development site itself. It is recommended that the visual screen be planned and specified by a planning professional in order to maximise the screening benefit. In addition, it is imperative that the species of plants utilised be ecologically appropriate for the natural environment.

Project component/s	» Photovoltaic plant (i.e. including associated buildings)
Potential Impact	» The viewing of the photovoltaic plant by observers on or near the site
Activity/risk	The viewing of the above mentioned by observers on or near the site

source

Mitigation:

Target/Objective

- » Minimise potential for visual impact
- » Minimise contrast with surrounding environment and visibility of the PV panels and infrastructure associated with the facility to humans
- » The containment of night lighting in order to eliminate the risk of additional night-time visual impacts.

Mitigation: Action/control

Responsibility

Timeframe

Ensure that proper planning is undertaken regarding the placement of lighting structures, should they be deemed necessary	Thupela Energy	Construction, Operation and maintenance
A lighting engineer must be consulted to assist in the planning and placement of light fixtures in order to reduce visual impacts associated with glare and light trespass.	Thupela Energy	Erection and maintenance
Maintain the general appearance of the facility in an aesthetically pleasing way.	Thupela Energy	Operation and maintenance
Undertake regular maintenance of light fixtures.	Thupela Energy	Operation and maintenance
Limit access to the photovoltaic plant site, and along existing access roads.	Thupela Energy	Operation and maintenance
Avoid the unnecessary removal of vegetation (during both construction and operational phases) along existing access roads.	Thupela Energy	Operation and maintenance

Performance

Indicator

Monitoring

- » Minimised visual intrusion on surrounding areas
- » The effective containment of the light
- » The monitoring of the condition and functioning of the light fixtures during the operational phase of the project.

OBJECTIVE: Appropriate handling and management of hazardous substances and waste

The operation of the photovoltaic plant may involve the generation of limited waste products. The main wastes expected to be generated by the operation activities includes general solid waste, hazardous waste and liquid waste.

Project

component/s

Potential Impact

Activity/risk

- » PV facility and buildings associated with the facility
- » Inefficient use of resources resulting in excessive waste generation
- » Litter or contamination of the site or water through poor waste management practices
- » Kitchen and dining facilities

source	<ul style="list-style-type: none"> » Visitor's Centre » Crèche » PV panels
Mitigation: Target/Objective	<ul style="list-style-type: none"> » To comply with waste management guidelines » To minimise production of waste » To ensure appropriate waste disposal » To avoid environmental harm from waste disposal

Mitigation: Action/control	Responsibility	Timeframe
Hazardous substances must be stored in sealed containers within a clearly demarcated designated area.	Thupela Energy	Operation
Storage areas for hazardous substances must be appropriately sealed and banded.	Thupela Energy	Operation
All structures and/or components replaced during maintenance activities must be appropriately disposed of at an appropriately licensed waste disposal site or sold to a recycling merchant for recycling.	Thupela Energy	Operation
Care must be taken to ensure that spillage of oils and other hazardous substances are limited during maintenance. Handling of these materials should take place within an appropriately sealed and banded area. Should any accidental spillage take place, it will be cleaned up according to specified standards regarding bioremediation.	Thupela Energy	Operation and maintenance
Waste handling, collection, and disposal operations must be managed and controlled by a waste management contractor.	Thupela Energy /waste management contractor	Operation
Used oils and chemicals: <ul style="list-style-type: none"> » Appropriate disposal must be arranged with a licensed facility in consultation with the administering authority. » Waste must be stored and handled according to the relevant legislation and regulations. 	Thupela Energy	Operation
It must be ensured that volumes of any hazardous waste stored on site do not exceed 30m ³ . Should this volume be exceeded, a waste license will be required to be obtained.	Thupela Energy	Operation
General waste must be recycled where possible or disposed of at an appropriately licensed landfill.	Contractor	Operation
Hazardous waste (including hydrocarbons) and general waste must be stored and disposed of separately.	Thupela Energy	Operation
Hazardous waste must be disposed of at an	Contractor	Operation

Mitigation: Action/control	Responsibility	Timeframe
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appropriately licensed landfill.

Disposal of waste must be in accordance with relevant legislative requirements, including the use of licensed contractors.	Thupela Energy	Operation
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Performance Indicator

- » No complaints received regarding waste on site or indiscriminate dumping
- » Internal site audits identifying that waste segregation recycling and reuse is occurring appropriately
- » Provision of all appropriate waste manifests
- » No contamination of soil or water

Monitoring

- » Waste collection must be monitored on a regular basis.
- » Waste documentation must be completed and available for inspection on request
- » An incidents/complaints register must be maintained, in which any complaints from the community must be logged. Complaints must be investigated and, if appropriate, acted upon
- » Regular reports on exact quantities of all waste streams exiting the site must be compiled by the waste management contractor. All appropriate waste disposal certificates accompany the monthly reports.

OBJECTIVE: Maximise local employment and business opportunities associated with the operation phase

Approximately ninety (90) individuals could be employed with approximately forty (40) people on site at any given time, apart from the security personnel. One shift would be undertaken per day, but the security personnel would cover three shifts per day. A team of around thirty (30) panel operators will be on site from just pre-dawn to just pre-dusk every day. They will work in teams, with a supervisor, turning panel mounts. The canteen that would serve basic food and beverages to the workers would be run by approximately two (2) individuals.

Night maintenance would predominantly consist of panel cleaning. This will principally be done without water, either with big dusters or compressed air. Occasionally dirt would have to be removed with water cleaning. A small team (i.e. 2 to 3 individuals) will work across the site cleaning one panel each at a time.

Therefore, long-term direct job opportunities for locals exist. Secondary employment opportunities for locals would refer to the security personnel and catering services. The farm Boschdraai hosts two villages with a total of 350 residents or approximately 50

families. Those falling within the working age category and who are currently unemployed (especially young unemployed school leavers), could thus secure permanent employment at the PV facility. There would also be a further opportunity for individuals from Leseding and the entire MLM area to be employed.

Project component/s	» Operation of the photovoltaic plant and associated infrastructure (i.e. kitchen and dining facilities, crèche, visitor's centre, administration and security offices, and workshops.
Potential Impact	» The opportunities and benefits associated with the creation of local employment and business should be maximised.
Activities/risk sources	» Locals are not employed where the local skills exist.
Mitigation: Target/Objective	» Maximise the appointment of local employees.

Mitigation: Action/control	Responsibility	Timeframe
Employees should be sourced from Ward 3 and Ward 1 of the MLM, and then from the wider area.	Thupela Energy	Operation
Consider training and capacity building programmes to lessen the skills disparity	Thupela Energy	Construction and Operation
The skill requirements should be communicated to the local community leaders and community based organisations	Thupela Energy	Construction and Operation
Make use of local recruitment agencies or other relevant community based organisations to obtain a list of jobseekers	Thupela Energy	Construction and Operation
An equitable process whereby minorities and previously disadvantaged individuals (women) are taken into account should be implemented.	Thupela Energy	Construction and Operation

Performance Indicator	<ul style="list-style-type: none"> » An employee list should be drawn up indicating the percentage of locals employed. » A Skills Development Plan should be developed. This plan should concentrate on the transfer of skills to employees to increase their capacity and to equip them with alternative skills should they wish to be employed elsewhere. » For each employee a career path should be developed to put mechanisms in place which allows employees to progress from lower skilled working levels to higher skilled and possibly management levels.
Monitoring	» Thupela Energy should be able to demonstrate that the above indicators are implemented.

OBJECTIVE: Address economic inequities within the study area

Economic inequities refers to the degree to which employment opportunities created by the proposed project match the actual job skills present in the local communities or the unemployed sector. The following positions would be available:

- » General Manager: 1
- » Production supervisor: 1
- » Technical manager (overseeing the technical aspects of the site, mostly high power electrical skills): 1
- » Technical assistants: 2
- » Security personnel: 18
- » Mount and panel operators (unskilled labourers): 57
- » Cooks: 2 and cleaning and administrative personnel: 2

The majority of skills therefore required for the operation and management of the facility fall within the unskilled to semi-skilled category. Some highly skilled personnel would also be required.

Through training and skills development, the proposed project would provide employees from the local community with transferable skills and could thus result in the overall improvement of the quality of life of those involved.

The visitors centre in itself, which would have a strong educational focus, would assist in local capacity building as it would:

- » Assist with the social upliftment of local communities through site visits and educational tours undertaken by local school children and/or tourists; and
- » Assist in creating awareness concerning renewable energy sources in general.

Project component/s	» PV plants and associated infrastructure
Potential Impact	» The opportunities and benefits associated with the creation of local employment and business could be maximised as it is anticipated that locals have the necessary skills to be employed
Activity/risk source	» Unavailability of locals with the required skills resulting in locals not being employed and employees be sourced from outside the MLM area
Mitigation: Target/Objective	» Thupela Energy, in discussions with the Modimolle Local Municipality, should aim to employ a maximum number of employees from the local area where possible. Should the necessary skills not be readily available, skills training and capacity building should be undertaken

Mitigation: Action/control	Responsibility	Timeframe
A broad-based approach should be followed to identify and involve relevant community based organisations and/or local recruitment agencies which could assist the main contractor in identifying people whose skills may correspond with the job specifications.	Thupela Energy	Pre-operation and operation
In cases for the middle to lower skilled jobs, where the relevant skills do not exist, training should be provided to willing local community members to enable them to fill the positions.	Thupela Energy	Pre-operation and operation
Capacity building initiatives could link in with the planned capacity building and skills training initiatives to be undertaken as part of the Waterberg Biosphere Reserve's outreach programmes.	Thupela Energy	Operation
As part of Thupela Energy's social responsibility it could consider contributing funds for the initiation phase of the Waterberg Biosphere Reserve's Skills Training Facilitation Project.	Thupela Energy	Operation

Performance Indicator	<ul style="list-style-type: none"> » Job opportunities are primarily awarded to members of local communities. » Skills training and capacity building initiatives are developed and implemented (possibly in cooperation with similar initiatives undertaken by the Waterberg Biosphere Reserve). » Local SMME's and/or entrepreneurs should be awarded the opportunity to become involved in the tender process for operational activities (e.g. catering / security)
Monitoring	<ul style="list-style-type: none"> » Thupela Energy should be able to demonstrate that the above indicators are implemented.

OBJECTIVE: Enhance capacity building and skills development within the local communities

During the operational phase, further individually tailor-made training programmes would be embarked upon which would be undertaken in association with accredited training operators. Employees will be given paid leave to attend, and attendance will be seen as part of their work, and thus compulsory.

Should employees leave the facility in search of work elsewhere in the field they would be equipped with portable skills. With the cooperation of accredited training facilities, Thupela Energy would facilitate the process whereby they assist employees in finding work elsewhere (if required).

Capacity building and skills training would thus have the greatest impact if the skills would be transferable to other type of construction or electricity generation related projects.

The visitor's centre would have a strong educational and awareness creation focus. Exposure to large numbers of schoolchildren would also enhance the capacity building initiatives of the facility.

Project component/s	Capacity building and skills training undertaken during the operational phase.
Potential Impact	Positive contribution to the capacity of individuals involved with the project, and equipping them with transferable skills
Activity/risk source	Inefficient training or lack of capacity building and skills training
Mitigation: Target/Objective	Capacity building and skills training should be continuously undertaken during the operational phase of the project.

Mitigation: Action/control	Responsibility	Timeframe
Capacity building initiatives could link in with the planned capacity building and skills training initiatives to be undertaken as part of the Waterberg Biosphere Reserve's outreach programmes.	Thupela Energy	Operation
As part of Thupela Energy's social responsibility it could consider contributing funds for the initiation phase of the Waterberg Biosphere Reserve's Skills Training Facilitation Project.	Thupela Energy	Operation
The project proponent and contractors should create conditions that are conducive for the involvement of entrepreneurs, small businesses, and SMME's during the operational phase.	Thupela Energy and Contractors	Operation
The project proponent should invest in improving the quality of life of employees and their families through the provision of capacity building and skills training programmes	Thupela Energy	Operation
School excursions to the visitors centre should be arranged between the project proponent and local school representatives	Thupela Energy	Operation

Performance Indicator	<ul style="list-style-type: none"> » A Skills Development Plan should be developed. This plan should concentrate on the transfer of skills to employees to increase their capacity and to equip them with alternative skills should they wish to be employed elsewhere. » For each employee a career path should be developed to put mechanisms in place which allows employees to progress from lower
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	skilled working levels to higher skilled and possibly management levels.
	» School children should be invited to visit the visitors centre on a regular basis.
Monitoring	» Thupela Energy should be able to demonstrate that the above indicators are implemented.

OBJECTIVE: Promote local procurement

Apart from the technical components it is expected that some local procurement of goods, materials and services could occur which would result in positive economic spin-offs. This aspect, however, would be dependent on the outcome of the tender process. The impact of the project on the procurement of local businesses and previously Historically Disadvantaged South Africans (HDSAs) can therefore not be determined at this stage. It is, however recommended that the project proponent commits itself to involving locals (HDSAs and SMMEs) in the procurement of capital goods, consumables and services, if these are locally available. Local procurement could result in indirect economic spin-offs and benefits such as increased income, and expansion of other local economic sectors.

Project component/s	» Local procurement of goods, materials, and services could occur.
Potential Impact	» Potential positive economic spin-offs, increased income, and expansion of other local economic sectors.
Activity/risk source	» No procurement of local goods, materials, and services due to unavailability of those in the area.
Mitigation: Target/Objective	» Maximise the use of local goods, materials, and services.

Mitigation: Action/control	Responsibility	Timeframe
Where possible, local sourcing of materials to assist in providing more economic and employment opportunities for the local people	Thupela Energy	Operation

Performance Indicator	» Local procurement of goods, materials, and services do take place.
Monitoring	» Thupela Energy should be able to demonstrate that they have aimed to achieve the above indicators as far as possible.

OBJECTIVE: Minimise the potential impact on surrounding landowners

This aspect refers to the possible impact of the photovoltaic plant and associated activities undertaken on site on the following:

- » The daily living and movement patterns of the surrounding property owners
- » Surrounding land-uses
- » Guest farms, guest houses, and accommodation facilities.

Only one of the neighbouring property owners (Vier-en-Twintig-Riviere KR 102/2) is currently operating a formal privately owned guest farm. The PV facility is not in close proximity to the dwellings on this property. Kudu Lodge is on the farm Goedgevonden KR 104 and therefore does not qualify as neighbouring property. The property owners consulted, however, indicated that various "lodges" are planned on the different properties. It thus seems as if there is a move to extend their existing tourism facilities to cater for national and international tourists.

Once operational, the impact on the daily living and movement patterns of neighbouring residents is expected to be minimal and intermittent (e.g. the increase in traffic to and from site). It is not anticipated that any activities undertaken as part of the operation and maintenance of the photovoltaic plant would negatively affect the surrounding property owners' daily living patterns. They would thus be able to continue their game or cattle farming practices without interference from the facility.

Furthermore, it is *not* anticipated that the presence and visual impact of the photovoltaic plant, even though it could affect the visitor's sense of place, would result in less visitors coming to the area. The negative impact on the surrounding property owners with regards to the operation and management of their farms as "guest farms" with accommodation facilities is thus rated as moderate and expected to be responsive to mitigation.

Project component/s	» Possible negative impacts of activities undertaken on site on the activities of surrounding property owners.
Potential Impact	» Possible impact on game and cattle farming practices, as well as on the operation of guest accommodation facilities
Activity/risk source	» Increase in traffic to and from site could affect daily living and movement patterns of surrounding residents. Visual impact of facility
Mitigation:	» Effective management of the facility
Target/Objective	» Mitigation of visual impact as far as possible

Mitigation: Action/control	Responsibility	Timeframe
Effective management of the facility and visitor's centre to avoid any environmental pollution focusing on water, waste and sanitation infrastructure and services, and limiting any increase in noise levels (due to visitors) and so forth	Thupela Energy	Operation
Performance Indicator	<ul style="list-style-type: none"> » Tourism related facilities are functioning normally without interference from facility's activities » No environmental pollution occur (waste, water and sanitation related) » No noise pollution occur 	
Monitoring	<ul style="list-style-type: none"> » Thupela Energy should be able to demonstrate that facility is well managed without environmental pollution 	

OBJECTIVE: Minimise the potential impact on traffic patterns

The traffic impacts associated with the operation of the facility refers to the transportation of workers to and from the site, deliveries to the canteen, as well as to the visitors coming to the visitors centre. It has been estimated that approximately seven vehicles would be travelling to and from the site per day.

As it is anticipated that local labour would be used, and that the forty daily employees would be transported from Boschdraai/Leseding/Vaalwater to the site and back. At this stage it is planned to use one or two buses for this purpose.

These trips could result in limited intermittent noise and dust pollution, as well as safety risks associated with speeding on the local gravel roads. The Sea Para School on the gravel road has been closed but should this facility open again speeding should be intensely mitigated in this area.

Deliveries to the canteen would generate one additional trip every two to three days. The above trips and this increase in traffic are not seen to result in severe negative impacts. The main impact in this regard would rather be the trips undertaken to the visitors centre. At this stage the number and frequency of such trips cannot be finalised although it is anticipated that it would be one bus at a time. It can thus only be concluded that the additional traffic in this regard would have an intermittent and limited negative impact on the surrounding property owners and road users.

Impact on access to properties is not expected to be affected during the operational phase. The road leading to the site (turn off from Naauwpoort /Vier-en-Twintig Riviere /

Olievenfontein Road) would still be available to the property owners of the farm Sterkstroom KR 103 and Schoongezigt KR 107 to use to access the respective farms.

Project component/s	» Transportation of workers to and from site on a daily basis
Potential Impact	» Impact of increase in vehicles on road surfaces, and possible increased risk in accidents
Activity/risk source	» Vehicle movement impacting on daily living and movement patterns of residents in the area, and especially the surrounding property owners
Mitigation: Target/Objective	» Minimise the impact of the increase traffic on existing infrastructure, property owners and road users

Mitigation: Action/control	Responsibility	Timeframe
Speeding on the local roads should be avoided for safety reasons and for dust creation.	Thupela Energy	Operation
The access road to the site could be upgraded to accommodate additional traffic volumes, as well as to create some safe viewing areas where passing motorists could stop to view the facility to limit the risk of accidents	Thupela Energy	Operation
Signage along the local roads should be put up to direct visitors to the facility to limit the risk of accidents	Thupela Energy	Operation

Performance Indicator	<ul style="list-style-type: none"> » Vehicles keeping to the speed limits » Vehicles are in good working order and safety standards are implemented » No increase in traffic related accidents are experienced. » Complaints of residents are not received (e.g. concerning the speeding of vehicles associated with the operation of the facility).
Monitoring	» Thupela Energy must monitor indicators listed above and should be able to demonstrate that the mitigation measures are implemented.

OBJECTIVE: Minimise the potential impact on safety and security

It is not anticipated that the proposed facility would result in severe safety and security impacts. Should children or other individuals gain unauthorised access to the site it could, however, create safety risks. The site should thus be properly fenced and access controlled and managed by security guards to avoid such a situation. Security

will be based on-site on a permanent basis which would assist in mitigating visible impact.

Regarding the concerns of property owners concerning illegal poaching of game on the surrounding properties remain an issue which is difficult to mitigate. An inflow of people to an area creates an opportunity for criminal elements.

The fire fighting services in the district and Modimolle Local Municipality is currently understaffed and there is a need for additional personnel in the Vaalwater area. As the proposed facility could increase the risk of fires, it would be useful if attention could be given to the provision of some kind of fire fighting and emergency services on site to attend to any possible emergencies in the study area. The applicant has indicated their willingness to have some form of fire fighting capacity in the area that would be available for fire fighting in the wider area. The details and practical operations would thus be finalised as part of the final planning phases and operational aspects.

Project component/s	» PV plant
Potential Impact	» Increased safety and security risks due to presence of facility
Activity/risk source	» Insufficient fencing of the site and perceptions of increased criminal activity in the area. Increased risk of fires and operational accidents.
Mitigation: Target/Objective	» Minimise the safety and security risks

Mitigation: Action/control	Responsibility	Timeframe
The site should be properly fenced.	Thupela Energy	Operation
Fire fighting and emergency services should be available on site.	Thupela Energy	Operation
Schoolchildren visiting the visitors centre should be supervised at all times to avoid accidents.	Thupela Energy	Operation
Normal operational safety guidelines should be adhered to.	Thupela Energy	Operation
Security personnel should be aware of the possibility of animal theft and poaching and should be able to identify possible criminal elements and/or criminal activities in this regard.	Thupela Energy & security personnel	Operation
Procedures and measures to prevent, and in worst cases, attend to fires should be developed in consultation with the surrounding property owners.	Thupela Energy & surrounding property owners	Operation

Performance Indicator	» The site is properly fenced.
	» Security personnel are on site on a continuous basis.
	» Fire fighting equipment and vehicles are available on site
	» A fire emergency plan is put in place

	» Fire breaks are in place
	» Normal operational safety guidelines are implemented
Monitoring	» Thupela Energy must monitor indicators listed above and should be able to demonstrate that the mitigation measures are implemented.

OBJECTIVE: Minimise the potential for noise pollution

Due to the rural characteristics of the area, existing noise levels are anticipated to be low. Noise generating sources could relate to:

- » The number of workers that would be on site on a daily basis
- » The influx of visitors to the proposed development
- » Vehicle movement
- » Maintenance to be undertaken at night, especially due to the even lower ambient noise levels experienced at night
- » Some instances where lawn mowers could be used to mow the grass between the panels instead of being the responsibility of the sheep grazing in between the panels

Dwellings in close proximity to the area are limited and the closest sensitive receptors are on the surrounding farms which in some cases could be approximately 1 km or further away from the facility. From a social observation it is perceived that there could be limited intermittent noise impact on Kudu Lodge on the farm Goedgevonden KR 104 and possibly on the other farms surrounding the property. This noise impact could be irritating, but is not anticipated to be socially disruptive.

Project component/s	» Possible noise pollution
Potential Impact	» Possible noise pollution due to operations at site
Activity/risk source	» Increase in ambient noise impacting on daily living patterns of surrounding residents
Mitigation: Target/Objective	» Limit noise pollution

Mitigation: Action/control	Responsibility	Timeframe
Employees should understand that excessive noise could be problematic and should thus attend to this issue in a sensitive manner.	Thupela Energy	Operation
The use of lawnmowers should be kept to the minimum.	Thupela Energy	Operation
Schoolchildren should be supervised at all times to try to keep noise levels to a minimum.	Thupela Energy	Operation

Monitoring

- » No increase in noise is experienced by surrounding property owners.
- » No complaints concerning the noise levels on site are received from surrounding property owners.

Thupela Energy must monitor indicators listed above and should be able to demonstrate that the mitigation measures are implemented.

**MANAGEMENT PLAN FOR THE PHOTOVOLTAIC PLANT:
 DECOMMISSIONING**

CHAPTER 8

Depending on the economics of the development following the operational period, the plant will either be decommissioned or the operational phase will be extended. If it is deemed financially viable to continue, existing components would be disassembled and replaced with more appropriate technology/ infrastructure available at that time. However, if the decision is made to decommission the facility the following activities will form part of the project scope.

8.1. Site Preparation

Site preparation activities will include confirming the integrity of the access to the site to accommodate the required decommissioning equipment.

8.2 Disassemble and Replace Existing PV Panels

The components of the plant will be disassembled and removed. Thereafter they will be reused and recycled (where possible) or disposed of in accordance with regulatory requirements.

OBJECTIVE: To avoid and or minimise the potential impacts associated with the decommissioning phase.

Project component/s	» Decommissioning phase of the photovoltaic plant.
Potential Impact	» Decommissioning will result in job losses, which in turn can result in a number of social impacts, such as reduced quality of life, stress, depression etc. However, the number of people affected (~30) is relatively small. Decommissioning is also similar to the construction phase in that it will also create temporary employment opportunities.
Activity/risk source	» Decommissioning of the photovoltaic plant.
Mitigation: Target/Objective	» To avoid and or minimise the potential social impacts associated with decommissioning phase of the photovoltaic plant.

Mitigation: Action/control	Responsibility	Timeframe
Thupela Energy should ensure that retrenchment packages are provided for all staff that stand to lose their jobs when the facility is decommissioned	Thupela Energy	At decommissioning.

Action/control	Responsibility	Timeframe
<p>Retrenchments should comply with South African Labour legislation of the day.</p>		
<p>Thupela Energy should establish an Environmental Rehabilitation Trust Fund to cover the costs of decommissioning and rehabilitation of disturbed areas. The Trust Fund should be funded by a percentage of the revenue generated from the sale of energy to the national grid over the 25-30 year operational life of the facility. The rationale for the establishment of a Rehabilitation Trust Fund is linked to the experiences with the mining sector in South Africa and failure of many mining companies to allocate sufficient funds during the operational phase to cover the costs of rehabilitation and closure.</p>	<p>Thupela Energy</p>	<p>At decommissioning.</p>
<p>Performance Indicator</p>	<p>South African Labour legislation at the relevant time.</p>	
<p>Monitoring</p>	<p>Retrenchments should comply with South African Labour legislation of the day.</p>	

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