Waterberg Photovoltaic Plant Environmental Impact Assessment: Economic Specialist Study

Final Report

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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.

Table of Contents

1 INTRODUCTION 1

1.1 Terms of reference 1
1.2 Approach and information sources 2
1.3 Assumptions and limitations 3
1.4 Expertise and declaration of independence 3

2 PROJECT DESCRIPTION AND SOURCE OF IMPACTS 4

2.1 Components of the facility and phasing 5

3 DESCRIPTION OF THE AFFECTED ECONOMIC ENVIRONMENT 6

3.1 Current land uses 6
3.2 Demographics 7
3.3 Employment 8
3.4 Income levels 11

4 IDENTIFICATION OF ISSUES 12

5 ASSESSMENT OF IMPACTS AND IDENTIFICATION OF MANAGEMENT ACTIONS 13

5.1 Compatibility or fit with policy and planning 13
5.1.1 Energy policy imperatives and the environment 13
5.1.2 Local energy security 16
5.1.3 Fit with local development and spatial planning 17
5.2 Financial viability and risks 19
5.3 Impacts on tourism 20
5.3.1 Impacts on overall tourism potential in the area 20
5.3.2 Impacts on tourism establishments near the site 25
5.4 Impacts on agriculture surrounding the site 32
5.5 Impacts on property values 34
5.5.1 Key determinants of property values in the area 34
5.5.2 Negative impacts 35
5.5.3 Neutral and positive impacts 35
5.5.4 Overall impacts 35
5.6 Impacts linked to expenditure on construction and operations 37
5.6.1 Construction phase impacts 37
5.6.2 Operational phase impacts 39
5.6.3 Indirect benefits 41
5.6.4 Opportunities associated with growing the solar sector 41
5.6.5 Overall impacts 41

6 CONCLUSION 44

7 ENVIRONMENTAL MANAGEMENT PLAN MEASURES 45

8 REFERENCES 47

9 APPENDIX 50

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 IMPACTS[1]

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.

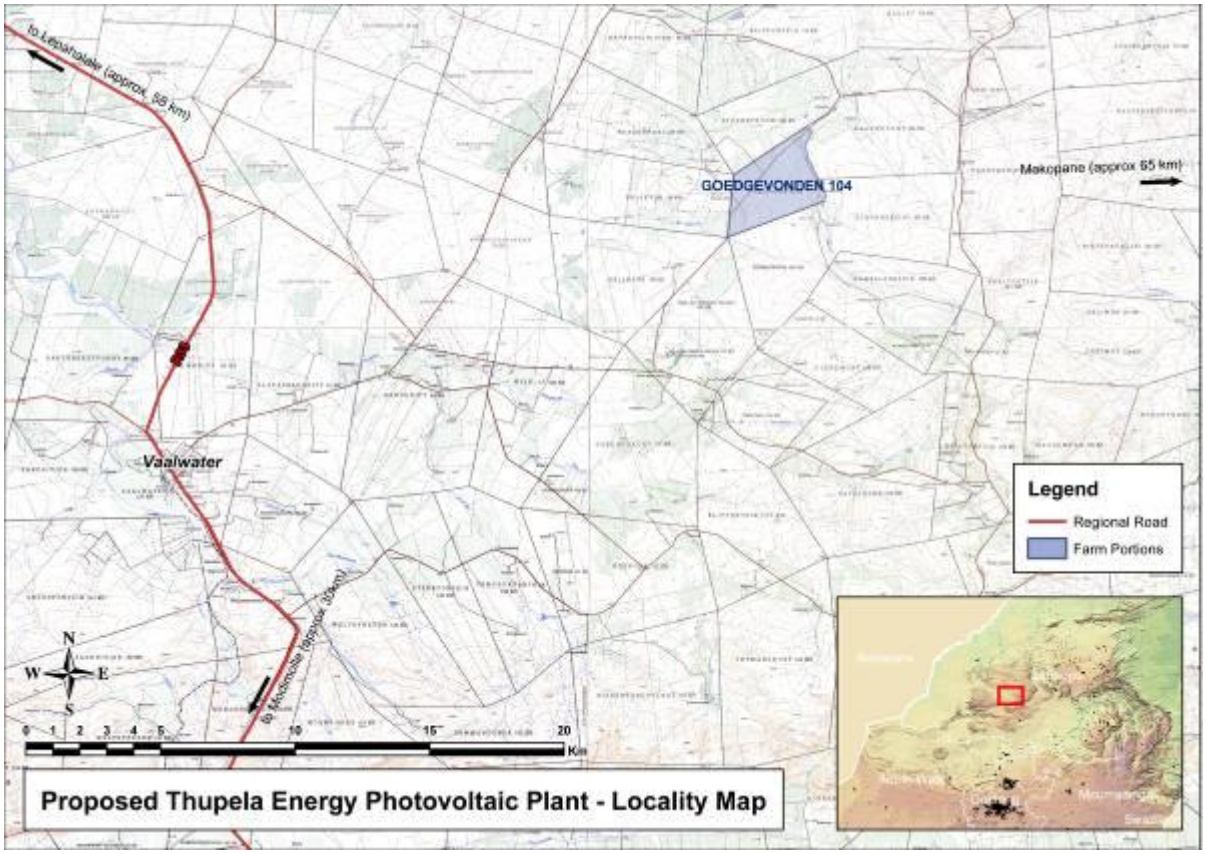


Figure 1: Location of the farm on which the Waterberg Photovoltaic Project would be established

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 in 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

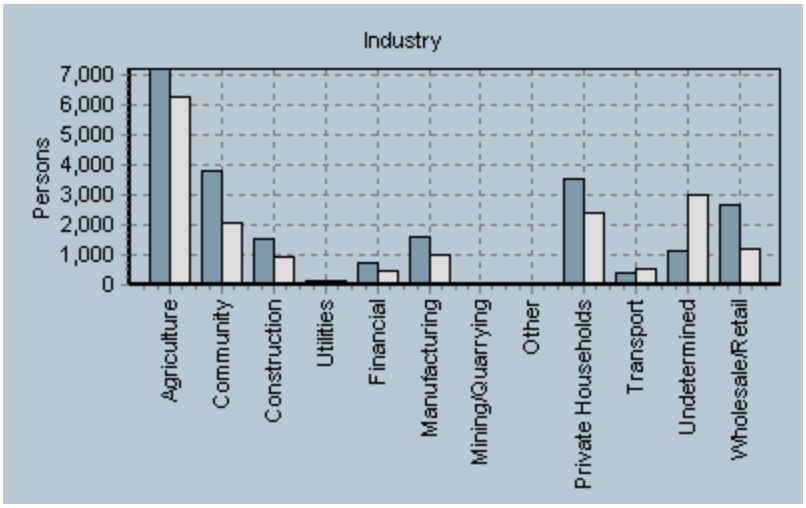
For the Modimolle Municipality and Waterberg District Municipal areas, the dominant sector in terms of employment provision is agriculture, hunting and forestry providing 31% and 24% of all employment opportunities respectively in these areas (see Table 3 below). Other important sectors in the Modimolle 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.

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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 fossils 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 CO^2 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 CO^2 emissions than to the world's GDP and on this score just about exactly equaled China in 2003 at 2.8 tonnes of CO^2 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 or 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 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.

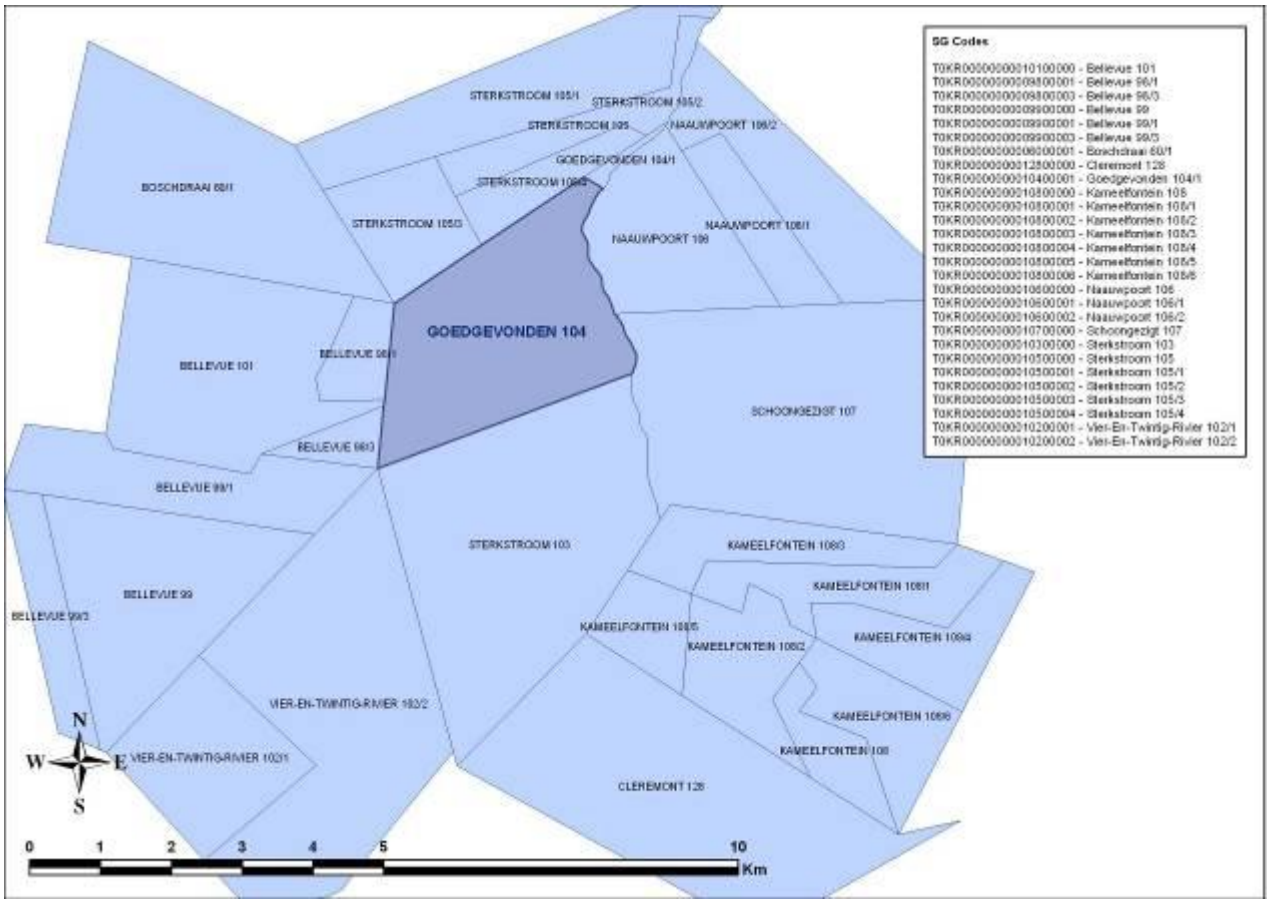

Figure 3: Farming units surrounding Goedgevonden 104 on which the Waterberg PV Plant would be established

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

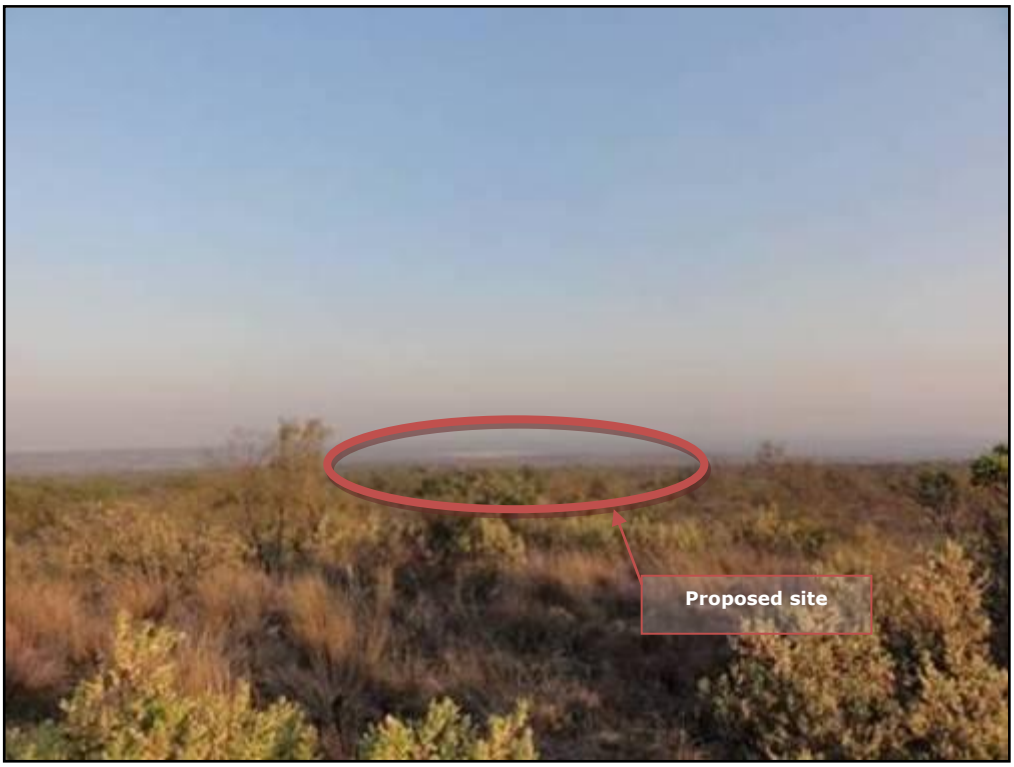

Figure 7: View of the site from a road in the south eastern quadrant of Schoongezicht 107

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

	Number of workers				Duration of employment
	Highly skilled	Medium skilled	Low skilled	Total	
Construction component					
-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 engeneering 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**
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	Proponent in close co-operation with local economic development authorities	Start with developing details for measures as soon as funding for the project is secured. Construction phase measures implemented prior to and during the construction phase. Operational phase measures implemented prior to and during operations.

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).