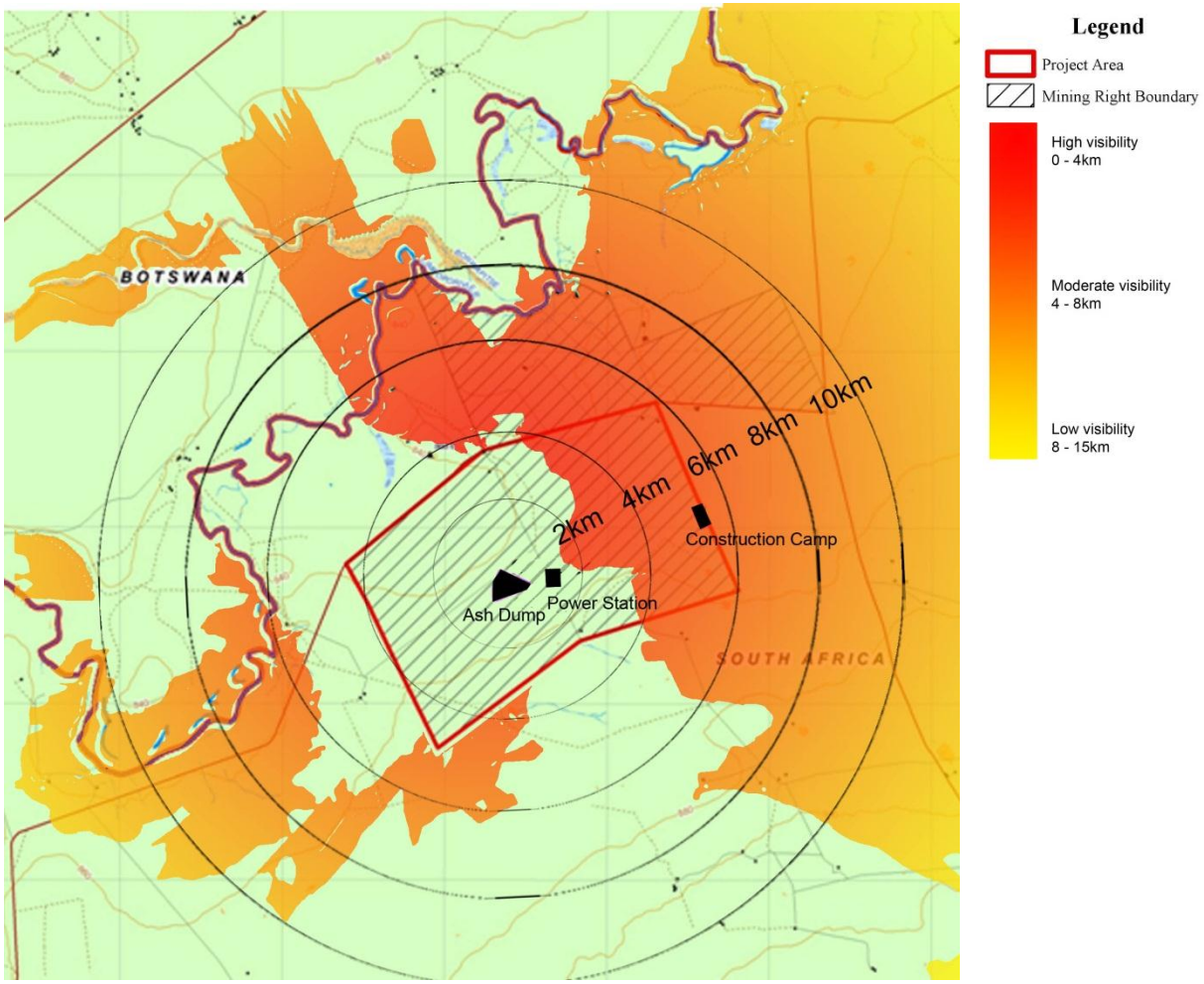


Figure 6-24: Ash Dump Viewshed analysis (worst case scenario)

The Power Station Visual Exposure and visibility will be far reaching, as seen from the Viewshed model in Figure 6-25. The height of the Stacks and the flat topography are both because of this. Vegetation screening will ameliorate the visual exposure of the Station, however the stacks are expected to still be visible.

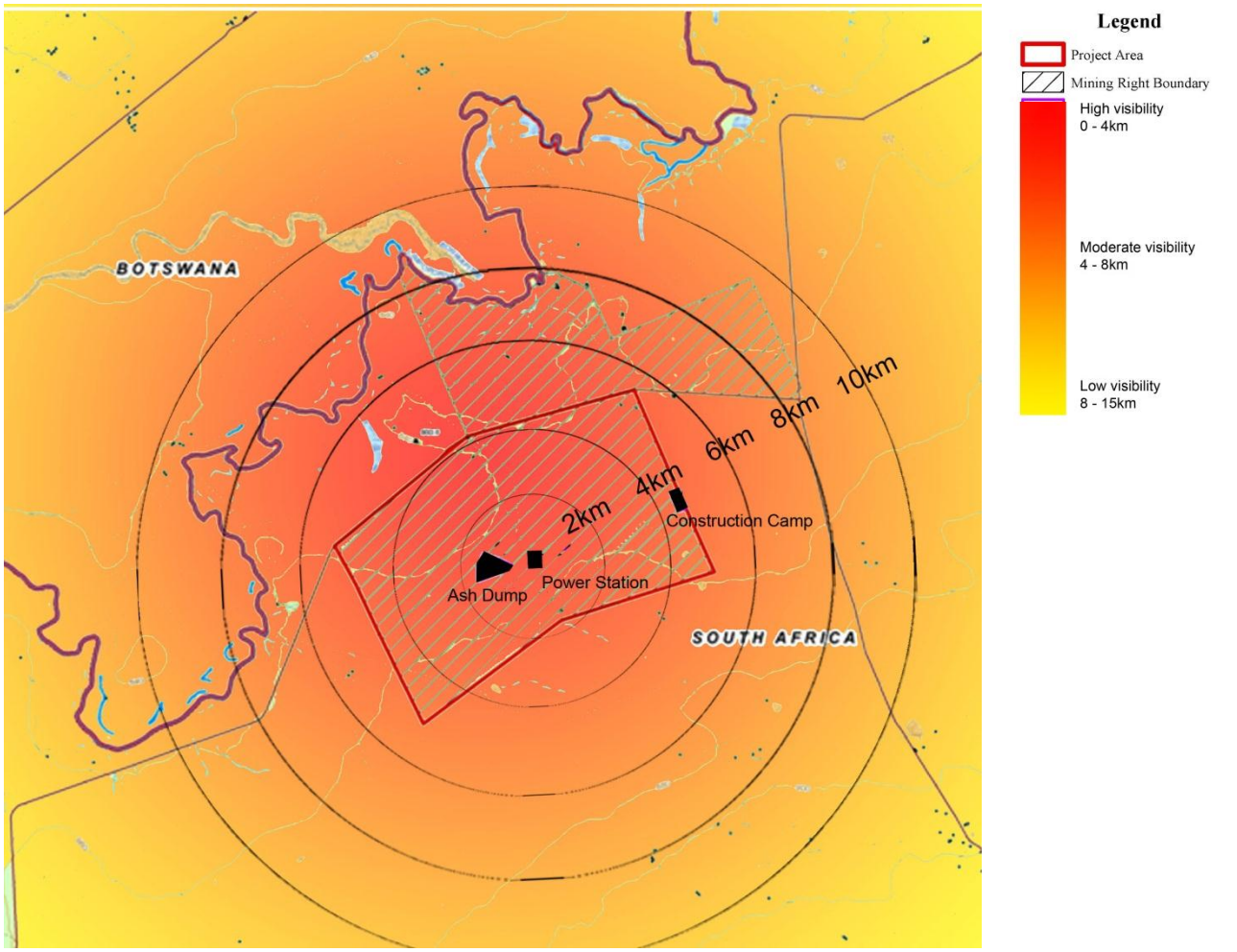


Figure 6-25: Power Station Viewshed Analysis (worst case scenario)

Table 6-11 summarises the Viewshed findings and rates the visual exposure of the various project components.

Table 6-11: Visibility of Project Components

Development component	Description of zone of influence	Visual exposure without vegetation	Visual exposure with vegetation
Ash Dump	Mining right area and farms immediately adjacent	Moderate to High	Moderate to Low
Temporary Construction Village	Mining right area and farms immediately adjacent	Moderate to High	Moderate to none after 2 years when it is removed.

Development component	Description of zone of influence	Visual exposure without vegetation	Visual exposure with vegetation
Power Station – Upper stack	Mining right area, farms adjacent, an area with approximately 10 – 15km radius	High	Moderate to High

6.11.3 Visual Sensitivity

6.11.3.1 Fence lines and roads

Following the analysis of the Viewshed models the site visit analysed the potential visual exposure of the development. This involved the potential visibility with the current land use and existing vegetation.

During the impact assessment the major roads which are used in the area were assessed. From the Viewshed it is expected that Power Station will be visible from areas on these roads, depending on vegetation height immediately adjacent to the road.

6.11.3.2 Road between Steenbokpan and Buffelspoort

The road lies west of the project area. It is possible that views of the power station will be visible when travelling along this route.

The secondary road which runs on the eastern side of the project area between Steenbokpan and Buffelspoort is regarded as sensitive due to the lack of vegetation and corridor effect allowing extended views. The vegetation adjacent to the road is vegetated uniformly with Bushveld at a height of approximately 7 – 9 m's. Thus it is estimated that the Ash Dump and Construction Camp will be completely screened by the vegetation. The Power Station Stacks will potentially be evident. The following images describe the location, existing views and a visual simulation of the Power Station Development within the view. Figure 6-26 illustrates the location of the road and the point at which a photograph was taken in order to describe the potential visibility along this route.

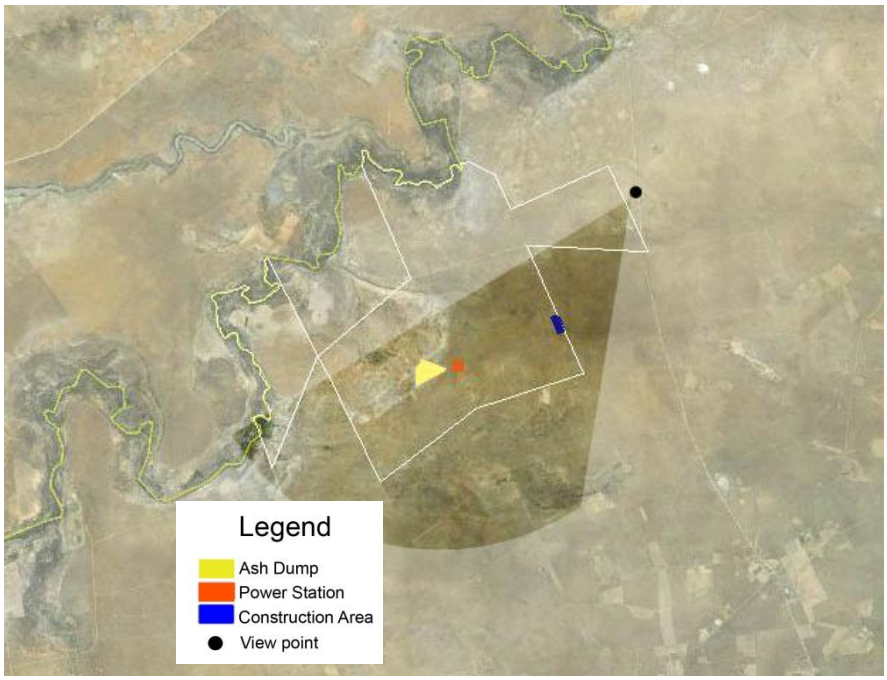


Figure 6-26: Map illustrating Sensitive Viewpoint A - view across project area

Figure 6-27: Existing View at Sensitive Viewpoint A from road between Steenbokpan and Buffelspoort

Figure 6-28: Visual Simulation illustrating potential visibility of development from Viewpoint A

6.11.3.3 Road between Steenbokpan and Buffelspoort (West of Project area)

The road between Steenbokpan and Buffelspoort which lies west of the project area is regarded as sensitive due to the lack of vegetation and corridor effect allowing extended views. It is possible that Views of the power station will be visible when travelling along this route.

Figure 6-29 illustrates the location of the road and the point at which a photograph was taken in order to describe the potential visibility along this route.

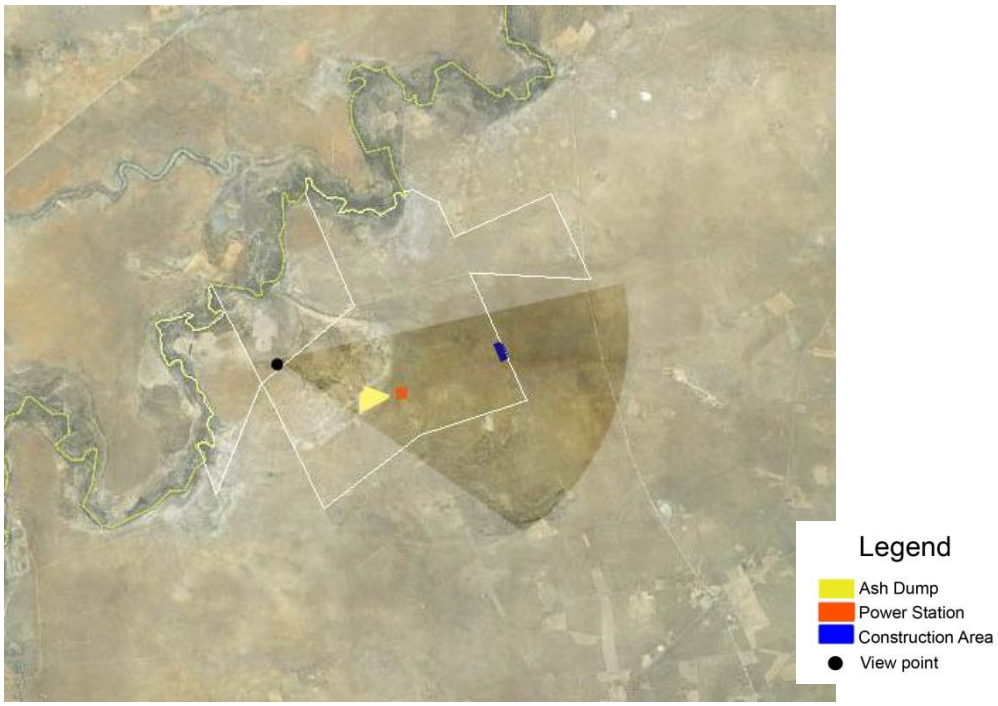


Figure 6-29: Map illustrating Sensitive Road and Viewpoint A

Figure 6-30: Existing View at Sensitive Viewpoint B from road between Steenbokpan and Buffelspoort illustrating area of visual impact of the development

Figure 6-31: Visual Simulation illustrating potential visibility of development from Sensitive viewpoint B

The visual impacts, as described in the visual simulation are not expected to be great. It is likely that motorists travelling along this route will not even be aware of the structure.

6.11.3.4 Sensitive Ridge line (North of Project area)

From the Viewshed it is obvious that the ridge line North of the project area would offer views of the Power Station. On site analysis of this area confirmed this. The entire ridge line will have views over the project area.

Added to this, the road which intersects the fault line/ridge area on the north western side of the project area will offer motorists extensive views across the project area as they travel west from Steenbokpan to Buffelspoort.

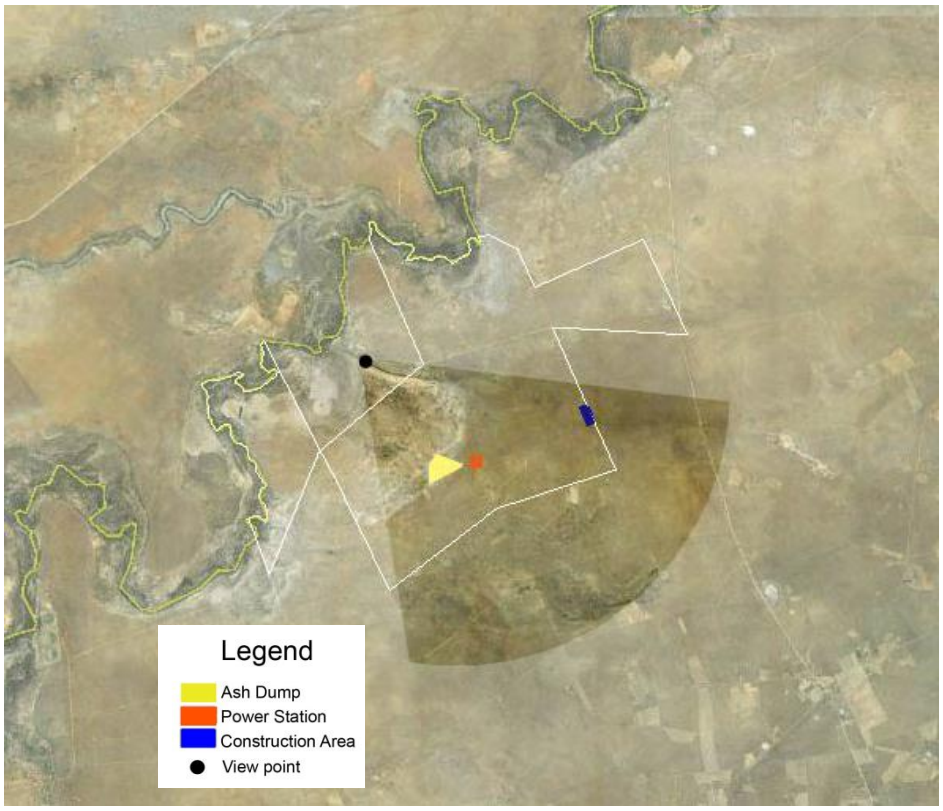


Figure 6-32: Map illustrating location of sensitive viewpoint C and the view across the project area

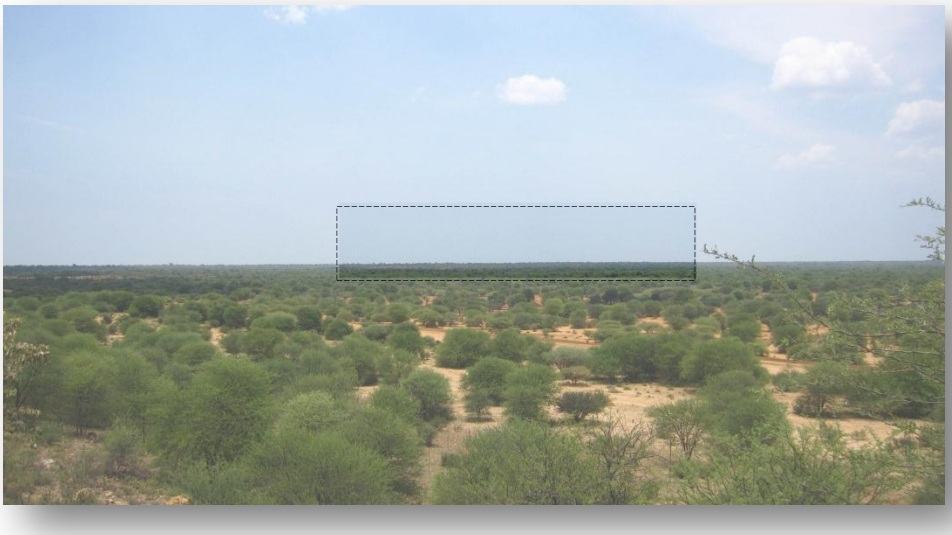


Figure 6-33: Existing view from road between Steenbokpan and Buffelspoort, illustrating area of visual impact of the development

Figure 6-34: Visual Simulation illustrating potential visibility of development

6.11.4 Visual Receptors within the landscape

Visual receptors will generally be found within the zone of 5 – 10km of the Power Station development. The Viewshed analysis described the zone of influence of the development.

6.11.4.1 Residents

In the greater area, the existing towns do not fall in the zone of greatest visual influence. The towns and their distance from the project are described in Table 6-12. Furthermore the Table estimates the possibility of visibility of the Power Station development by the towns within the development Viewshed The residents of both Dovedale and Steeenbokpan are not expected to see the development. According to the Viewshed analysis these towns should theoretically be able to see the development, however, the screening effect of the Bushveld vegetation will largely decrease this visual exposure.

Table 6-12: Visual Receptors; Distances of towns from the proposed Power Station Development

Name	Country	Type	Direct distance	Road distance	Direction	Possibility of views of the Power Station
Dovedale	Botswana	Settlement	13 km	54 km	N	Possible
Steenbokpan	South Africa	Settlement	11 km	17 km	SE	Possible

Name	Country	Type	Direct distance	Road distance	Direction	Possibility of views of the Power Station
Kudumatse	Botswana	Settlement	21 km	69 km	N	Unlikely
Stockpoort	South Africa	Settlement	21 km	28 km	NE	Unlikely
Mapashalela	Botswana	Settlement	28 km	42 km	W	Unlikely
Makwate	Botswana	Settlement	35 km	46 km	NE	Unlikely
Lephalale	South Africa	Major Town	56 km	67 km	E	Not possible

The few farm houses within 5 – 10km radius of the development will be able to see the 110M high stacks of the Power Station as described in Figure 6-35 and Table 6-13.

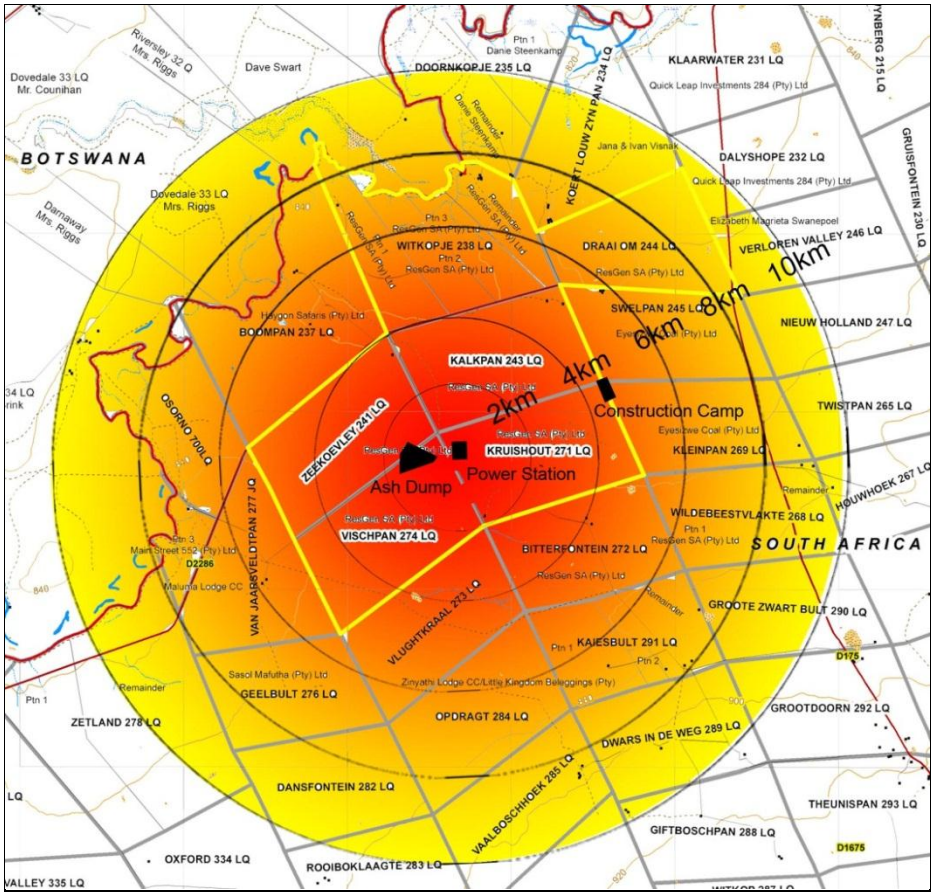


Figure 6-35: Receptors within the Zone of Influence of the Power Station

The Power Station will be largely screened by the existing vegetation, however the upper stacks will be visible when moving through the adjacent farm properties within 5 – 10 km radius.

Table 6-13: Visual receptors of the Power Station Development

Farm Number	Possibility of views of the Power Station
Kalkpan, Kruishout, Vichpan, Zeekoevley, Boompan	Likely
Vanjaarsveldpan, Geelbult, Vlughtekraal, Bitterfontein, Wildebeestvlakte, Kleinpan, Swelpan, Draaiom, Witkopje	Possible
Opdragt, Kaesbult, Dwars in die weg, Grooteswartbult, Grootdoorn, Twistpan, Houwhoek, Verloren valley, Klaarwater, Dalyshope, Nieuw Holland, Os Oorno	Unlikely

Recreators (Users of the area for various recreational purposes) within the area will be able to see the power station development however this will depend on their exact location. There are a fairly high number of tourists visiting the area.

Motorists travelling along the roads within the area will catch glimpses of the development. These views and viewpoints have been described above. There are not high numbers of motorists moving through this area.

Table 6-14: Summary table of sensitive landscapes and receptors

Visual receptors	Estimated Number of those affected	Sensitive Landscape with which receptors are associated with	Impact Value
Residents	Low	Immediate vicinity, Ridge lines and view corridors	Medium
Tourists	Medium	Immediate vicinity, Ridge lines and view corridors	Medium
Motorists	Medium to low	View corridors and sensitive view point B and C	Medium to low

6.11.5 Summary

The findings from the visual assessment are summarised in the form of questions answered.

- Will the new Power Station be visible, and if so, from where?

Yes, it will. The stacks will be visible from a distance of approximately 0 - 10 km's.

- The areas it will be visible from:
  - Openings in the Bushveld where vegetation does not obscure views across landscape;
  - Fences and roads which are perpendicular to development;
  - The ridge area;
- What will the new Power Station look like?

The Power Station will resemble a typical Coal Power Station, However the development will be smaller than Medupi and Kusile Power Stations. The image below illustrates the planned development.

Figure 6-36: Planned Power Station rendering (Within approximtely 5km radius of Power Station)

6.11.5.1 Will it change the views in the area?

Yes it will change the views in the area, however the visual impact will be ameliorated by the Bushveld vegetation. The views within and immediately surrounding the project area will change from being essentially natural, to one which incorporates industrial development.

6.11.5.2 Will it change the area? – Will the sense of place/scenery be affected?

Yes, it will change the area. The natural Bushveld character will be converted into a semi industrial area on site. The Bushveld vegetation and animal life will remain, however the area will have more human presence than before. There will be an increase in traffic, there will be an increased number of people to the area, there will be more activity in general in the area

6.12 Archaeology

The study area has been surveyed during at least two previous Phase 1 Archaeological Impact Assessments conducted for the Boikarabelo Coal Mine (which inludes within its footprint the area proposed for the power station), and also assessed during a Phase 2 Archaeological Mitigation project. These reports are available on request.

The information from these three studies have been reviewed and collated to inform this Heritage Statement for the power station. Where applicable, identified heritage resources have been overlaid on the project design and layout and impacts reassessed to take into account additional impacts. Significance rankings provided in the previous studies have been used in this Heritage Statement.

6.12.1 Results and discussion

Based on the three previous surveys done in the area (Fourie 2010, Nel 2011, Nel 2012) no heritage resources were identified in the proposed power station footprint. However, 27 sites were identified in the preceding surveys. The distances of these sites relative to the perimeter of the proposed power station are as follows:

Table 6-15: Archaeology sites

Distance in meters	Site number
0 – 1000	None
1000 – 1500	Site 11
1500 – 2000	Sites 009/010
2000 – 2500	Sites 012/013, 017, 018/019
2500 – 3000	Site 014
>3000	Sites 001, 002, 003, 004, 015/016, 020, 021/022 and 27

Of these, 10 were further assessed in October 2011 through archaeological mitigation. These sites included 003, 009/010, 011, 012/013, 014, 015/016, 017, 018/019, 020, and 021/022. Five sites (011, 009/010, 014, 012/013, and 021/022) were further assessed during a second phase of mitigation during May 2012 to July 2012.

The recommendations provided in the Phase 2 Archaeological Mitigation report regarding chance find procedures of archaeological sites and human remains should apply to this report. The comments and permits obtained from SAHRA is attached in Appendix L.

6.12.2 Findings

Based on the previous three studies, no visible heritage resources occur in the power station footprint. Nevertheless, the Phase 2 Archaeological Mitigation project (Nel 2012) did show that the expected archaeological sites in the project area are ephemeral with very low visibility. There may thus be similar sites in the power station footprint.

However, other studies (Van der Walt 2009, Fourie 2010, Nel 2011, Nel 2012) indicated that the physical environment within which the power station will be situated may not have been conducive for archaeological occupation.

Furthermore, no evidence of historic or contemporary settlement in the power station footprint area was found or is known, minimising chance finds for historic to recent burial grounds and graves.

Plan 17

Boikarabelo Power Station

Archaeological Sites

27°6'0"E 27°7'0"E 27°8'0"E 27°9'0"E 27°10'0"E

23°34'0"S 23°35'0"S 23°36'0"S 23°37'0"S 23°38'0"S

Site 26 Site 6 Site 4 Site 1 Site 27 Site 3 Site 20 Site 22 Site 21 Gate Site Site 17 Site 18 Site 19 Site 14 Site 11 Site 10 Site 16 Site 15 Site 12 Site 13

Borrow Area Ba3 Borrow Area Ba2 Soft Soils Dump Opencast Pit Open Pit Admin Complex PCD Sewage Treatment Plant Explosives Magazine Airstrip Training Centre Offices Sewage Treatment Plant Change House Temporary Construction Village Clean Water Dam Overburden Stockpile PCD Plant Area Discard Dump PCD Substation Clean Water Dam Future Discard Dump Coal Stockpile Top Soils Dump Ash Dump Power Station

Legend

- Project Area
- Archaeological Sites
- 50m Buffer of Unmapped Sites
- Extent of Mapped Sites
- Predicted Floodline 1:100

Mine Plan

- Conveyor
- Drain
- Explosives Magazine Blastline
- Pipeline
- Power Line
- Railway Line
- Road
- Sewage
- Slurry Line
- Plant
- Airstrip
- Ash Dump
- Blast Line
- Borrow Area
- Buildings
- Clean Water Dam
- Coal Stockpile
- Discard Dump
- Explosives Magazine
- Future Discard Dump
- Offices
- Opencast Pit
- Overburden Stockpile
- PCD
- Plant Area
- Power Station
- Sewage Treatment Plant
- Substation
- Temporary Construction Village
- Water Storage Tanks
- Soft Soils Dump
- Top Soils Dump

resource generation

DIGBY WELLS ENVIRONMENTAL

www.digbywells.com

Projection: Transverse Mercator
Datum: Hartebeesthoek 1994
Central Meridian: 27°E

Ref #: scc.RES1065.201207.108
Revision Number: 2
Date: 03/09/2012

N

0 0.25 0.5 1 1.5

Kilometres

1:33 000

6.13 Traffic

BKS (Pty) Ltd was requested by Digby Wells to evaluate the expected traffic impact of the proposed Boikarabelo Mine on the surrounding road network and also to evaluate the expected pavement impact of the additional heavy vehicles on the road network, This has been used for the power station project as it fall within the mine area. The traffic review completed by BKS is attached in Appendix M.

6.13.1 Status quo road network and traffic volumes

The road network surrounding the proposed mine consists of gravel roads catering for low peak hour and daily traffic volumes. Considering the layout of the surrounding road network specific attention should be given to the Lephalale / Steenbokpan intersection. This intersection is located approximately 50km east of the town of Ellisras/Lephalale and approximately 17km south of Koert Louw Zyn Pan is a paved, 2-way stop controlled intersection.

It is situated in close proximity to a residential area with the Bosveld Bottlestore, Pub and Grill approximately 100m from the intersection.

Figure 6-37: Steenbokpan Lephalahe intersection

In general the road condition in the vicinity of this intersection is good. The link to Lephalale is paved while the road to Stockpoort is a gravel road. The typical peak hour traffic volumes at this intersection are in the order of 50 vehicles per hour with some pedestrian activity

A traffic count was undertaken at the Steenbokpan intersection and the traffic count shows that this intersection is not a busy intersection and that there is an even continual use of the intersection.

Table 6-16: Steenbokpan intersection traffic count.

Steenbokpan Intersection Traffic Count							
Morning Survey 06H10 - 06H40 (30min)							
Cars	Trucks	Mini Buses	Buses	Bicycle	Motorcycle	Other	Total
11	2	2	0	3	0	3	21
Mid-day Survey 12H30 - 13H00 (30min)							
Cars	Trucks	Mini Buses	Buses	Bicycle	Motorcycle	Other	Total
16	0	0	0	1	0	8	25
Afternoon Survey 17H15 - 17H45 (30min)							
Cars	Trucks	Mini Buses	Buses	Bicycle	Motorcycle	Other	Total
15	1	2	0	4	0	9	31

It is evident that the roads that will be affected by the proposed project are currently only used by people that live in the area or have a determined reason for being in the area. Through the establishment of development in this area it will result in the occurrence of new trips, which did not utilise the road network prior to the development. As the road network is upgraded and improved it may also result in diverted trips, which are diversions from normal routes in order to utilise the improved road network. With more road traffic expected in the area due to the proposed development it will have a significant impact on the road network especially in the construction phase of the Boikarabelo Coal Mine. There will be a marginal additional impact arising from the power station development.

6.14 Socio-Economic Environment

This section focuses on the socio-economic standing of the area in which the proposed Boikarabelo Power Station project falls within, namely Ward4 of the Waterberg District Municipality within the Lephalale Local Municipality. A Social Impact Assessment was completed for the proposed project which includes information for both the District and Local Municipality together with more site specific information. Please refer to the Social Impact Assessment Report attached in Appendix N for more supporting information

6.14.1 Administrative structure

The constitution states that the South African government is comprised of a national, provincial and local sphere. These three spheres are distinctive, interdependent and interrelated. The proposed project is located within the Limpopo Province of South Africa and falls within Waterberg District Municipality and Lephalale Local Municipality Limpopo Government under administration.

6.14.1.1 Waterberg District Municipality

The Waterberg Municipality consists of six local municipalities, namely Mogalakwena, Lephalale, Bela- Bela, Modimolle, Thabazimbi and Mookgopong. The powers and functions of the municipality are outlined in section 156 of the Constitution, section 8 of the Municipal Systems Act and section 86 of the structures act. (Lephalale IDP 2009 - 2010).

District Municipalities' core function is the promotion of intergovernmental relations for better provision of service delivery within Local Municipalities. The establishment of municipal Intergovernmental relations (IGR) forums within the district has positive yields but still with some challenges to accelerate service delivery (Waterberg Municipality, 2010-2011).

- Identified issues and challenges include:
- Limited participation of other spheres of government in municipal planning processes;
- Inadequate linkage of different priorities of other spheres of government by municipalities and vice versa; and
- Inadequate participation of the District Municipality in sector department strategic planning sessions to influence priorities to address service delivery challenges.

The Waterberg IDP (2010-2011) noted that efficient implementation of development is compromised by limited financial and human resources capacity, unavailability of institutional plans, limited options to retain skilled and technical staff members and the limited implementation of section 78 processes to transfer powers and functions (Waterberg Municipality, 2010-2011).

6.14.1.2 Lephalale Local Municipality

Lephalale Municipality came into being on 6 December 2006 and was formed by an amalgamation of two municipalities, namely the Ellisras/Marapong Transitional Local Council and Ellisras/Tswelopele Transitional Local Council. Local government is no longer a function of national or provincial government, but is a sphere of government in its own right.

In terms of the Waterberg IDP (2010-2011) local government does not have the powers and functions over the range of services that communities would expect them to have. These powers and functions are the responsibility of other spheres of government. While planning for such services should be integrated into the IDP, the process is highly dependent on the cooperation, commitment and involvement of provinces and national government in municipal processes.

6.14.1.3 Ward Councils

The Municipal Structure Act requires municipalities to establish ward committees as agents of communities with the main purpose of bridging the gap between communities and municipalities. There are 74 ward committees within the District Municipality. The project area and proposed project is located within ward 4 of Lephalale Municipality whilst Lephalale Town and Marapong are located within wards 2 and 3 of Lephalale Municipality. In 2010 the councillor for ward 4 was Sophie Matlou. After municipal elections in 2011, a new councillor for ward 4 was elected, Frans Magwai. It is the role of the ward councillor to communicate information and decisions at a municipal level to communities.

6.14.2 Human Settlement

6.14.2.1 Steenbokpan

There are various activities taking place at the Steenbokpan area. These include a wholesaler, pub and restaurant, a shop, the co-operative hall, and the village of Lesedi, which contains a clinic, crèche, old age home, and a community hall.

The area consists of the farm Steenbokpan 295 LQ and various other farms. These lands are privately owned; except for the land upon which Lesedi is located – it is owned by the Lephalale Municipality. Steenbokpan operates as a community of land owners, also taking into account that they formed the Steenbokpan Farmers Association and the Steenbokpan Environmental Forum. Interests of land owners differ in relation to the expansion of mining and power generation in the broader area. Game farmers are concerned that this expansion will negatively impact the bushveld experience; and business owners look forward to expanding their operations to meet the demands of these industries.

6.14.2.2 Lesedi Village

The Lesedi Village was established out of a need for greater security of tenure amongst farmworkers on Steenbokpan and surrounding farms. The survey conducted in Lesedi Village indicated that most residents (94%) live there year-round. The remainder of the population reside in Village for periods ranging from three, six, to nine months per year, with 1% of those being non-resident visitors. All respondents indicated that they are of South African nationality, which is surprising given that the area is in close proximity to the Botswana border.

The investigation showed reports from farm workers who claimed they were forced off the land on which they had been living for many years. Reasons for this claim are due largely to the land being sold to new owners who reportedly did not approve of the farm workers continuing to reside on the property. Discussions with farmers who made the decision to sell their property; Digby Wells was informed that the primary motivation for selling was due to the perceived pressure from encroaching mining activity. Farmers noted that mining negatively impacts their nature-based tourism activities, altering the sense of place and interfering with the bushveld experience. Similarly, farmers cited concerns about potential

safety risks, given the large numbers of people that are expected to enter the area once the mining construction is underway.

As a result of the above-mentioned farm sales, it was noted that several displaced and dissatisfied farm dwellers moved to Marapong, which is 40km from Steenbokpan, although no precise figure could be provided. The Lephalale Local Municipality became aware of the problem and responded by purchasing land in the Steenbokpan area in order to establish an agri-village there. This would enable farm dwellers to remain in the area. They would have land to live on and be able to rebuild their livelihoods through agriculture. The area (now called Lesedi Village) was and still is zoned for agriculture and is in the process of being zoned for human settlement. The Municipality was unsuccessful in purchasing additional land in the vicinity for agricultural production. In addition, water supply proved to be a problem. Therefore, instead of trying to establish an agri-village, the Municipality put in place plans to develop a human settlement. They have allocated funding for low cost housing and are in the process of zoning the area for residential purposes.

With existing and proposed mining developments in the area, and the resultant negative impact they are expected to have on air quality, it was reported that the Municipality is considering moving Lesedi Village to an area approximately 25km away. It is claimed that air quality studies conducted by one of the mines show that air quality in this new area is safer for human health than the Steenbokpan area (pers. comm. Mr Frans Mabotja, Integrated Development Planning Officer, Lephalale Local Municipality, 27 February 2012). According to the air quality studies, using dispersion modelling, conducted by Digby Wells, dust pollution created by the Boikarabelo Mine will not reach as far as Steenbokpan area. It should also be noted that all local municipalities in the Waterberg District Municipality have been declared air quality priority areas under the Air Quality Act of 2004. In addition, the Draft Waterberg District Environmental Management Framework (2010) identified power generation as the main contributing source to PM_{10} emissions (68%) in the District[3]. The report also noted that power generation is the main contributing source to SO_2 and NO_2 emissions in the District, contributing to 95% and 93% respectively. While it cannot be confirmed at this stage whether the cumulative impact of mining and power generation in the Steenbokpan area will necessitate the need for relocation, it should be noted that it is situated in a municipality where future air quality sensitivity is a concern.

In discussions with the Local Economic Development Officer for Lephalale Local Municipality, Mr John Maake on 2 March 2012, he indicated that Sasol is awaiting the outcome of a mining right application in the vicinity of Steenbokpan, and, should it be successful, Sasol will relocate residents of Lesedi Village. This was made known to the Municipality in January 2011 when the two parties visited Steenbokpan together. This information needs to be verified and the role of the Lephalale Municipality and Sasol needs to be clarified.

[3] It is likely that this figure is overstated due to several mines not providing their emissions data.

Mr Maake further added that developments in the Steenbokpan area are on hold because of the mining development that may take place there. The Local Municipality therefore has no plans currently to upgrade the infrastructure and services available in Steenbokpan, including Lesedi.

6.14.2.3 Farm Dwellers

The Digby Wells SIA team interviewed several farm workers living on the project site and surrounding farms. Some of those interviewed work on the farms while others are too old to work but continue to live there. Some have been living and working on the farms for approximately 40 years, having developed only basic farming skills and domestic skills such as cooking and cleaning. For them, starting a new life elsewhere and having to find work would be a considerable challenge considering they are of retirement age. Others are newer farm employees and more open to change but also with low skills levels.

It appears that the younger farm dwellers are more excited about employment prospects at the mine and the opportunity to have livelihoods other than farming.

When asked about alternative places to live they indicated living with family members or moving to Steenbokpan. Some would ideally like to move with the land owners, should their property be sold.

6.14.3 Population Demographics

This section describes the population characteristics within the relevant municipalities and project area. This will assist in understanding the dynamics of these populations and how they may be affected by the proposed project.

6.14.3.1 Population Size

6.14.3.1.1 District and Local Municipalities

According to Statistics South Africa, Waterberg Municipality's population was estimated to be approximately 596,104 in 2007. The Waterberg IDP (2010-2011) estimates a current population of 638,460 (based on 1996 projections). The breakdown of the District Municipality's population in 2007 according to local municipalities is shown in Table 6-17.

Table 6-17: Population Statistics for Waterberg District, 2007

Local Municipality	Estimated Population	Percent of District Population (%)
Bela-Bela	55,850	9
Lephalale	80,142	13
Modimolle	52,604	9
Mogalakwena	330,645	55

Local Municipality	Estimated Population	Percent of District Population (%)
Mookgophong	16,817	3
Thabazimbi	60,044	10
Total Population	596,104	100
Source: Waterberg IDP, 2010-2011 (taken from Statistics South Africa Community Survey 2007)		

The largest town in the Lephalale Municipal area is Lephalale which consists of 42% of the local municipal population and comprises the largest central economic node in the municipality (Lephalale Local Municipality, http://www.lephalale.com). Other towns in the broader area are Steenbokpan and Stockpoort, both identified by the local municipality as potential service growth nodes. Steenbokpan is located to the west of the project area, while Stockpoort is located to the north at the Stockpoort border post between South Africa and Botswana.

According to Statistics SA Census (2001), the population of Lephalale Municipality was approximately 96,000 in 2001, representing negative growth of approximately 16% between 2001 and 2007. The Lephalale Municipality's IDP estimated a population increase to approximately 121,144 by 2010, which will see population growth of over 50% in just three years. The population growth is expected to occur mainly in the urban areas of Lephalale town and surrounds. This is the second largest population in the Waterberg District. It is estimated that the average household size is four people, with approximately 26,256 households in the Lephalale Municipality.

6.14.3.1.2 Local and Project Area

As mentioned before, the proposed project is located in ward 4 of the Lephalale Local Municipality. According to the Lephalale Local Municipality (2009/2010), the population of ward 4 was approximately 3,044 in 2007. The population diversity in the project area is low and comprises of farm labourers, managers and owners living on the land. In many cases the owners do not live on the land permanently and some do not have any farm workers. The population of Lesedi Village is estimated to be about 1,000 people.

6.14.4 Economic Overview

Economic growth and development is an important aspect to employment and an improvement in living standards. Agriculture, mining, tourism and manufacturing are the main drivers of the Limpopo Provincial economy (Limpopo Province Growth and Development Strategy). The Waterberg Municipality has both comparative and competitive advantages in agriculture, mining and tourism and the Limpopo Provincial Growth Development Strategy focuses on economic development for the Waterberg Municipality on

meat production, mining, energy and tourism sectors (Waterberg Municipality, 2010-2011). Similarly mining, energy/electricity, agriculture and tourism are main contributors to the Lephalale Municipality's economy.

There is no information on the economy of ward 4 or the project area, however, the land use within the project area is predominantly either game or cattle farming or a combination of both, as shown in Figure 6-38. Tourism is also one of the main economic activities within the project area as many of the farms used for game also undertake eco-tourism activities. There are also other farms involved in hospitality and not directly related to game farming e.g. restaurants and accommodation.

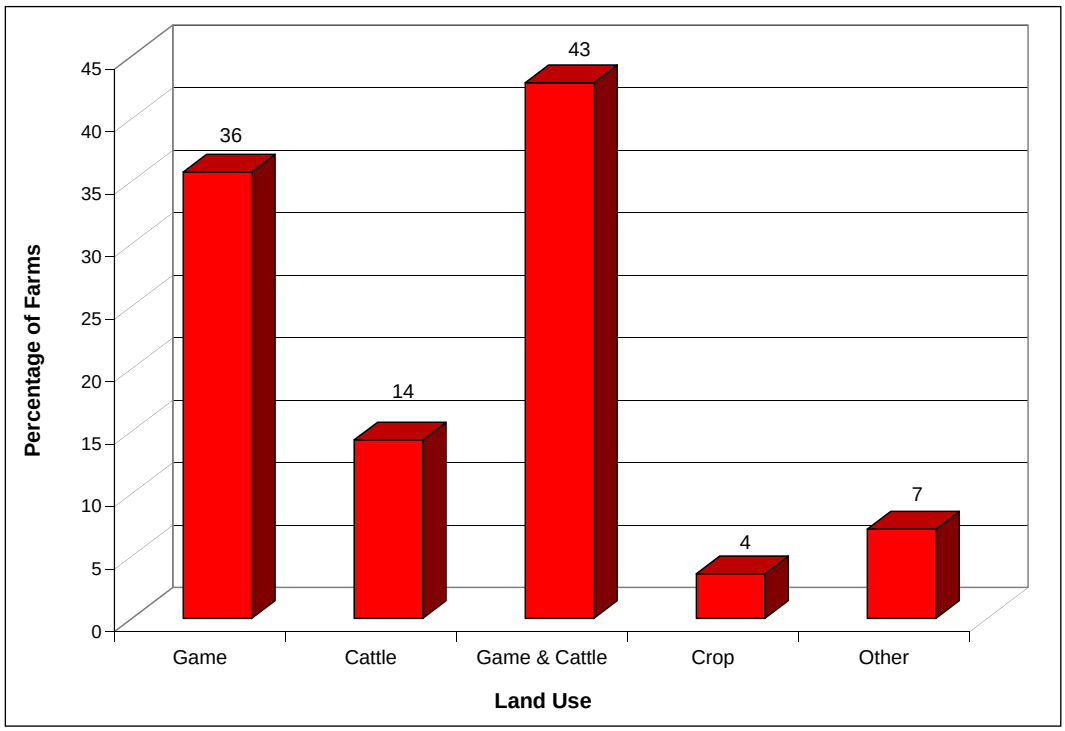


Figure 6-38: Land use activities within Project Area

6.14.4.1 Mining

The Waterberg District holds more than 40% of the national coal resources (Limpopo Growth and Development Strategy, 2009). According to the Limpopo Growth and Development Strategy (2009) the Waterberg Coal Field has over 50 billion tonnes of resources and approximately 12.5 billion tons can be mined through open pit or open cast methods. The Limpopo Growth and Development Strategy (2009) also noted that at five times the current rate of production from open pit mining of the Waterberg Coalfield, the resource could sustain extraction for 125 years.

The mining industry in the Waterberg municipal area contributes to the economic development on a local and provincial level (Waterberg Municipality, 2010/2011). The development of the Medupi Power Station, which is anticipated to start feeding electricity into the national grid by 2013, has increased the demand for coal The development of the

Medupi Power Station requires an expansion of the existing Grootegeluk Coal Mine and associated beneficiation plant. It is envisaged that the Boikarabelo Coal Mine will provide coal directly to the Medupi Power Station.

According to the Lephalale IDP 2011/12, the contribution of the mining and quarrying sector to Gross Value Added (GVA)[4] in Lephalale Municipality is 30% or R1,200 million. This is the largest contribution of any sector in the Municipality. Mining is expected to grow, with a number of companies exploring mining options within the Lephalale Municipal area and therefore the mining contribution to the economy is likely to grow within the next few years. The Limpopo Growth and Development Strategy (2009) noted potential for a new coal mine, coal to liquids plant and a new 4,200 megawatt power station to be developed in 2014. These plans have not yet been approved. There are also the expectations for more mining development by 2020 in the form of another coal mine and power station (Limpopo Growth and Development Strategy, 2009). These could further enhance the mining contribution to the economy and see greater diversification of the economy.

Given the decline in coal production in the Witbank Coal Field, there is an imperative to develop the Waterberg Coal Field for power generation and for coal exports.

6.14.4.2 Agriculture

The Waterberg Municipality contributes almost 30% of the Limpopo Province's agricultural activity and provides a diverse range of agricultural produce including crops, fruit, vegetables and livestock. Agriculture contributes over 4% of the District Gross Geographic Product (GGP) and it employs around 21% of the labour force of the district (Waterberg Municipality, 2009-2010).

The Waterberg IDP (2009-2010) noted that agricultural activities are influenced by water shortages and dramatic changes in the commodity prices. Crops such as cotton, tobacco, maize and sorghum have been affected by low international prices and production has decreased substantially, resulting in negative financial and employment impacts. Other crops like sunflower, wheat, soya beans, groundnuts and paprika are all internationally traded commodities and thus sensitive to the Rand/US dollar exchange rate.

In an attempt to alleviate some of the problems that the agricultural industry faces, various programmes have been developed and successfully implemented by all levels of government, agricultural groups and financial institutions.

Agriculture is the third largest contributor to Lephalale Municpiality's economy. In general the area is regarded as arid and by its nature very sensitive for the availability of secure water resources. Irrigation is limited to the Mokolo, Palala and Limpopo River catchment areas and to a lesser extent, the Mogalakwena River.

[4] GVA is a measure in economics of the value of goods and services produced in an area, industry or sector of an economy. In national accounts GVA is output minus intermediate consumption.

Due to the scarcity of water sources, only 4% of land is used for crop agriculture,. Approximately 57% of land within the project area is used for cattle farming (of which 43% were mixed cattle and game). Similarly game farming is undertaken on approximately 79% of farms within the project area (of which 43% were mixed cattle and game farms.

6.14.4.3 Tourism

Apart from mining and agriculture, tourism is a large contributor to the economy of the Limpopo Province and key contributor towards prosperity and conservation of natural and cultural heritage resources. In 2007, the manager of the tourism department of the Lephalale Local Municipality stated that tourism contributed approximately R4.1 million towards the local economy, primarily due to the large number of hunting enthusiasts and foreign tourists who visit this area. The Waterberg region is a prominent ecotourism destination in South Africa, attracting large numbers of tourists to its scenic surroundings, bushveld and water sources, with approximately 6,000 square kilometres of the Waterberg being designated as a conservation area. The Waterberg region is also rich in historical and cultural heritage, containing various rock art, geological and archaeological sites (Waterberg Tourism, 2008), although no rock art was identified within the project area. According to the Waterberg IDP (2009-2010), the current tourism facilities and activities are of significance for the development of the local economy.

Ecotourism and nature tourism are also the most important sectors in the Lephalale tourism industry, which has substantially increased over the past 16 years due to effective marketing and development. These sectors have historically served as sources of employment for local communities and will continue to do so, as long as the tourism industry is able to persist.

Tourism is viewed as an important economic contributor by landowners interviewed within and surrounding the proposed project area, with tourism activities undertaken by approximately 71% of these land owners (not including Resgen), as identified by Digby Wells. Mostly these activities relate to game farming and game hunting, making up a significant portion of tourism activities within the project area. Approximately 85% of farms involved in tourism activities include game hunting as an option. Other tourism activities include restaurants, camping, hiking and eco-tourism. Tourism within the wider Waterberg region relies on its natural scenic characteristics and the rural nature of the area. Additional detail on tourism in the project area is available in the Tourism Assessment Report for the Boikarabelo Coal Mine Project (Digby Wells, 2010).

6.14.4.4 Electricity

Matimba Power Station, obtaining coal from the Grootegeluk coal mine, is located within the Lehalale Municipality. The Medupi Power Station is currently being constructed within Lephalale Municipality and will comprise six units with a total installed capacity of 4,800MW and, once complete, will be the fourth largest coal-fired plant and the biggest dry-cooled power station in the world.

6.14.5 Informal or Secondary Economy

The informal economy or the informal sector is linked to the formal economy, however, is not counted in the country's GDP. The Waterberg IDP (2010-2011) noted that the informal economy is composed of unskilled and marginalized people who cannot find work in the formal economy.

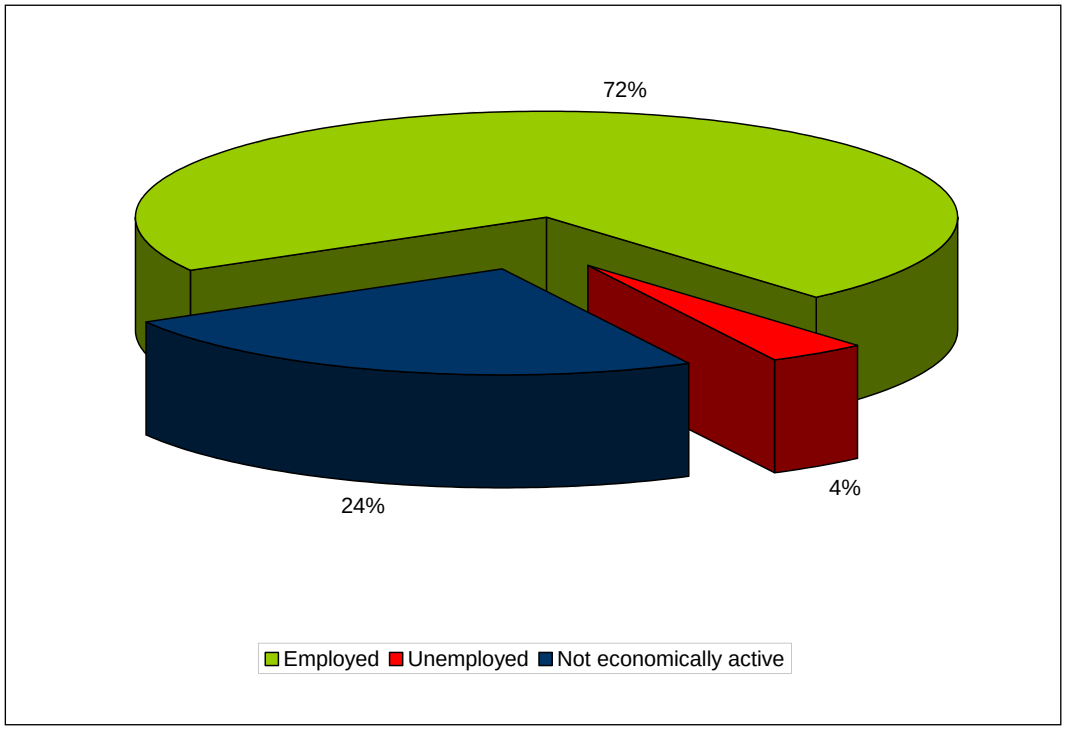
According to local informants, there are seven tuck shops in Lesedi Village. Two of the shops are owned by a local black farmer (landowner). These shops operate from brick housing structures. The remaining five shops are run from residents' tin houses. According to a local informant, there are no other businesses operating in the village. Residents go to Lephalale Town to buy groceries and other household items.

6.14.6 Employment

This section explores the employment and unemployment situation of the district and local municipalities and the local area. It also provides an overview of the types of skills available and the level of employment.

6.14.6.1 Employment and Unemployment

There is no Statistic South Africa data at a ward level for 2007 and therefore the information provided in this section relies on 2001 information. It is likely that this information has changed over the 11 years since the survey; however, it provides an indication of the employment ratio within this ward. As shown in Figure 6-39 the Ward 4 employment statistics for 2001 were very different to the district and local municipality employment rates, with only 4% of Ward 4's population unemployed. Since the majority of Ward 4 is agricultural and game farming land, those living on these farms will be land owners, farm managers, farm workers and the family of farm workers, which explains the high employment rates in comparison to the district and local rates. Approximately a quarter of Ward 4's potential labour force was not economically active in 2001. It is possible that these were family members of land owners, farm managers or farm workers who are supported by their spouses.



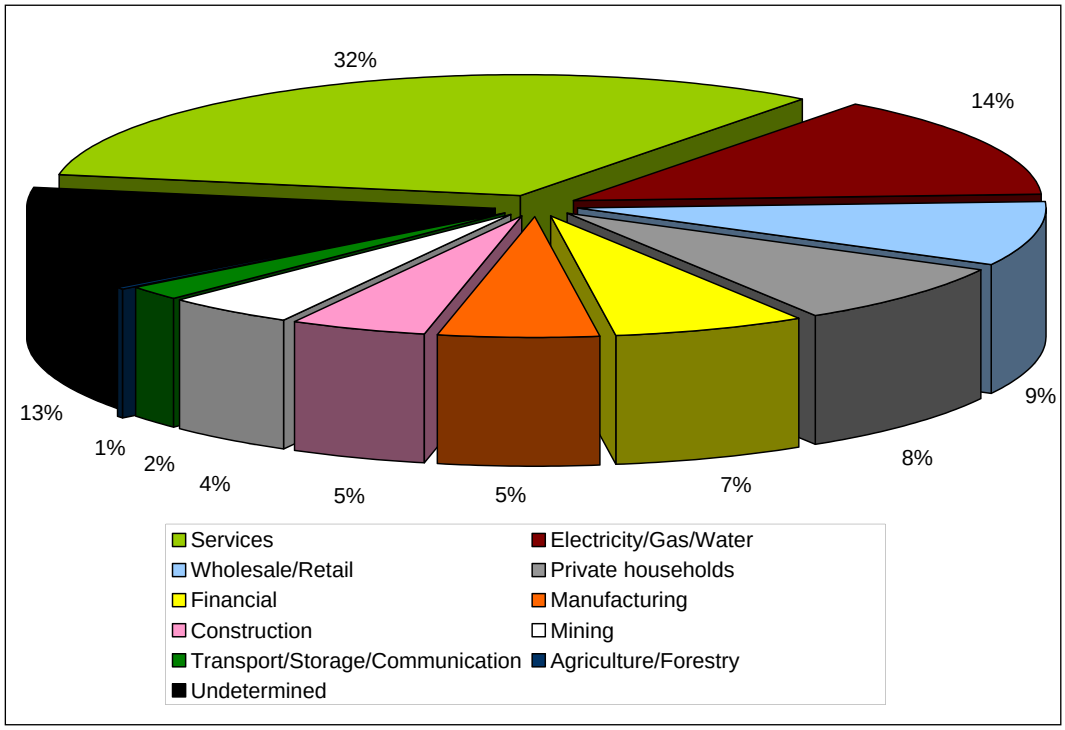
Source: Statistics South Africa, Census 2001 (Ward Profile, 2003)

Figure 6-39: Employment Status for Ward 4 Lephalale Municipality's Population, 2001

The survey conducted in 2012 as part of this study indicated that 53% of respondents at Lesedi Village are unemployed and 11% have wage employment. Domestic work and gardening was selected by 22% of respondents and only 3% selected farming. When enquiring about the low percentage of farming employment, respondents perceive it to be due to farm owners retaining employees that have farming or gaming skills rather than those that are less skilled. This would occur when farm owners are faced with having to retrench employees.

6.14.7 Employment Sectors

Similar to the Lephalale Municipal area the employment sectors for ward 4 are varied. Figure 6-40 shows the employment sectors for Ward 4 in 2001. The service sector was the largest sector employer at approximately 32%, followed by the electricity sector at 14%. The service sector incorporated community, social and personal services. This may also have included tourism as many of the farms within the project area were involved in tourism activities. Given the large number of farms and agricultural activities within ward 4 it is surprising that agriculture was the lowest sector employer in the ward at the time of the survey. As Matimba Power Station is located in close proximity to ward 4 this must have an effect on the high percentage of respondents who were working in the electricity sector.



Source: Statistics South Africa, Census 2001 (Ward Profiles, 2003)

Figure 6-40: Employment Sectors for Ward 4 of Lephalale Municipality, 2001

In the project area employment was dominated by the tourism industry and agricultural industries. This is likely to have changed in the intervening years.

6.14.8 Education and Skills Levels

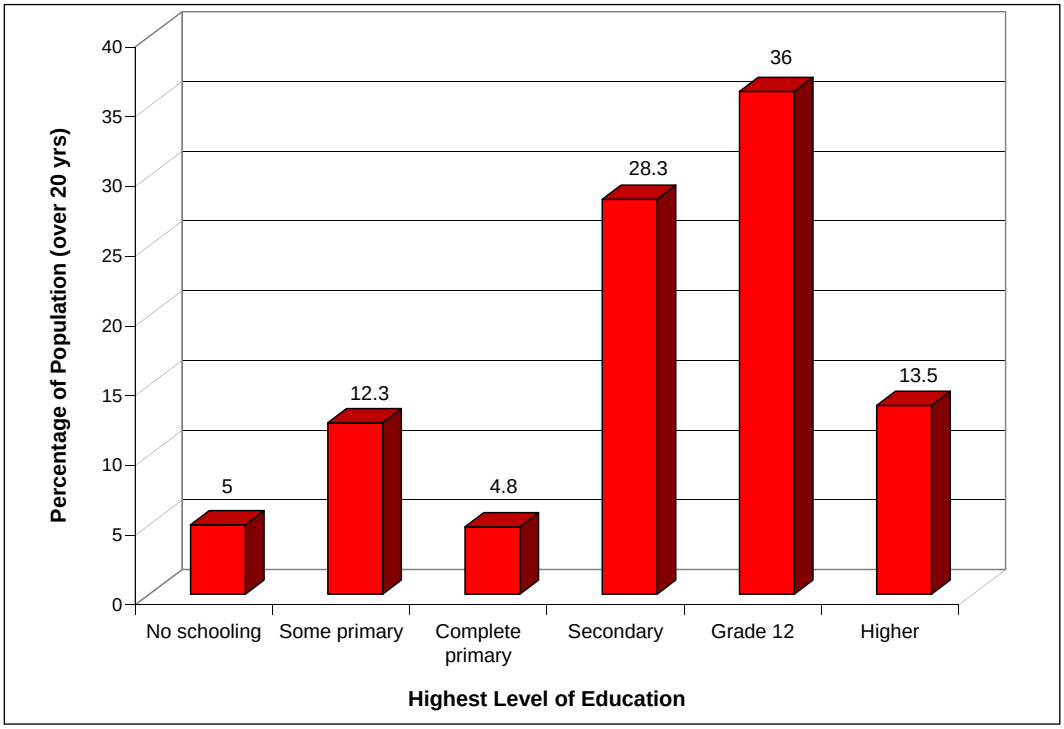
This section outlines the education levels of the population within the district and local municipalities as well as those of ward 4. The highest education levels for all those over 20 years of age provide us with an understanding of potential education and skills of the labour force and therefore their adaptability to find jobs in various sectors. As there is no detailed information on skills levels for the municipalities or ward 4, skills levels are derived from the education levels and types of occupations people are involved in.

The education levels within ward 4 are much higher than those of Lephalale Municipality, as shown in Figure 6-41. There was only a small percentage of the population (5%) who had no formal education in 2001 and almost half of the population (49.5%) had completed their Grade 12/matriculation. This is substantially higher than Waterberg and Lephalale Municipalities. More than double the percentage of the municipalities have completed a tertiary level education within ward 4.

The majority of people in the project area are employed at the game farms and therefore not typical rural settlements which would normally rely on government schools. As these people are employed they have financial means to send their children to school. Although the education levels within ward 4 are much higher than those of the district or local municipalities, half of the population have not completed a Grade 12/matriculation and only

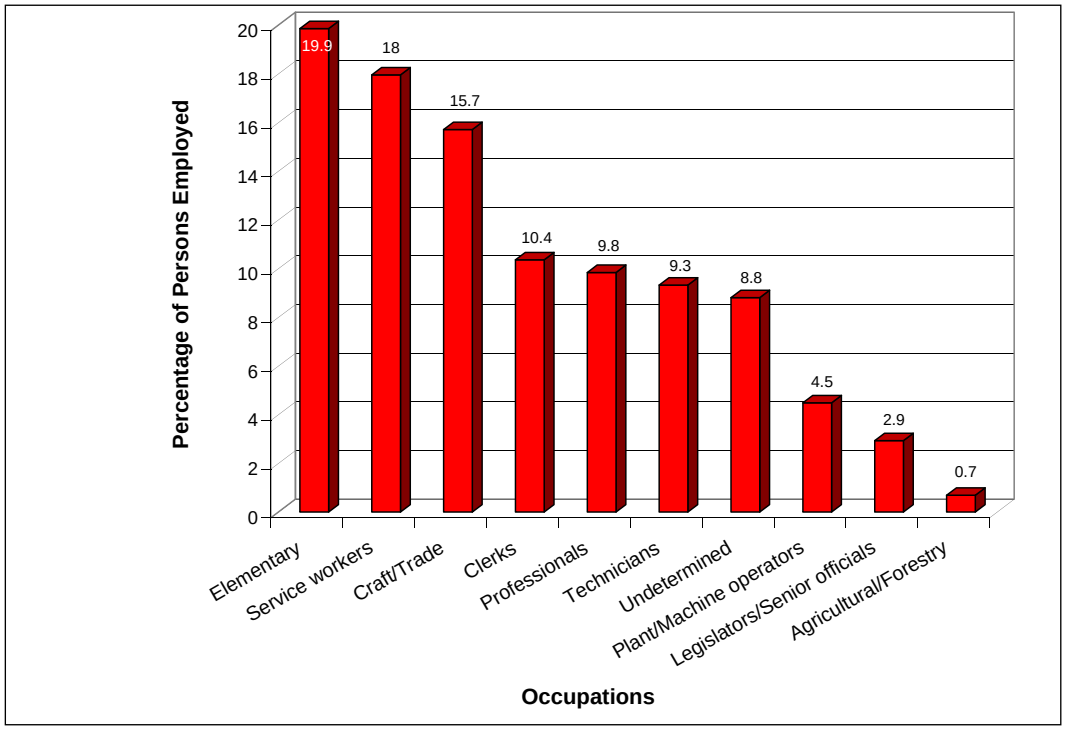
13.5% have completed their tertiary education. This means that 86.5% of Ward 4 population will be unable to find employment in the highly skilled sector or potentially even the semi-skilled sector. This information is reflected in the different occupations undertaken within Ward 4, as shown in Source: Statistics South Africa, Census 2001 (Ward Profiles, 2003)

The most common occupation (19.9%) is in the elementary occupations which is generally unskilled labour. This is followed by service workers (18%) and craft/trade occupations (15.7%), all of which are within the unskilled or semi-skilled categories. Only a small percentage of the population have skilled occupations such as professionals (9.8%) and legislators/senior officials (2.9%) which reflect the relatively low levels of tertiary education within Ward 4. The agricultural sector has the lowest percentage of occupations (0.7%) which is similar to the low employment within this sector. Due to the number of farms in this area, it would be expected that there were more people in an agricultural occupation however many agricultural or farm labourers may fit into the elementary occupation.



Source: Statistics South Africa, Census 2001 (Ward Profiles, 2003) *for all population over age of 20 years

Figure 6-41: Education Levels for Ward 4 of Lephalale Municipality, 2001 *



Source: Statistics South Africa, Census 2001 (Ward Profiles, 2003)

Figure 6-42*:* Occupations for Ward 4 of Lephalale Municipality, 2001

Children from Lesedi Village and the surrounding farms attend Lerekhureng Combined School, which teaches grades one to nine and is four kilometres outside the Village. For grades ten to twelve children have to go to Marapong Phegelelo High School in Lephalale Town. There is a crèche in Lesedi that operates on meagre school fees of R50 per month per child. This money is used to buy food for the children. Twenty-eight children are currently registered at the school and it is run by a volunteer from Lesedi Village.

Figure 6-43 highlights that the majority of the Village population (60%) has some form of secondary education; be it complete or incomplete, and nearly one third has only primary school education. These high percentages are likely due to the population being very young and not yet old enough to have completed secondary school. This is higher than the ward level, district and local municipality levels. Tertiary education, however, is lacking, with only 3% attending college. This limits the employment opportunities available to residents of Lesedi Village.

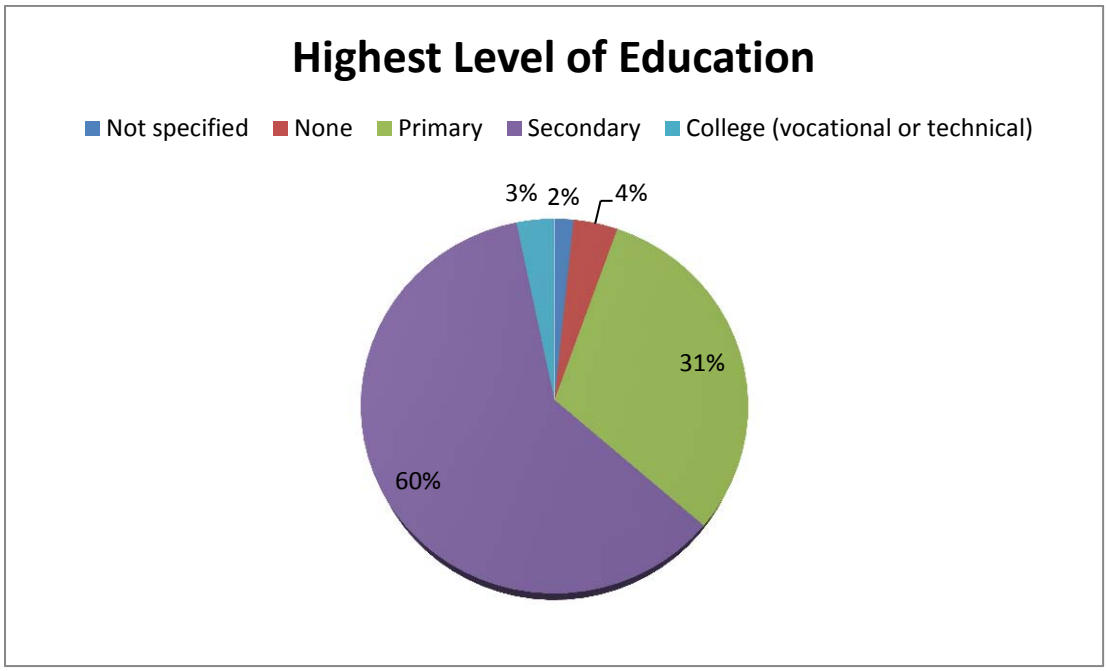


Figure 6-43*:* Highest Level of Education in Lesedi

6.14.9 Infrastructure and Social Services

By the end of 2005, Lephalale Town (comprising of the former Ellisras, Onverwacht and Marapong) had approximately 5,000 erven. Of these erven, 2,615 were located in Lephalale and Onverwacht and approximately 2,385 erven were located in Marapong.

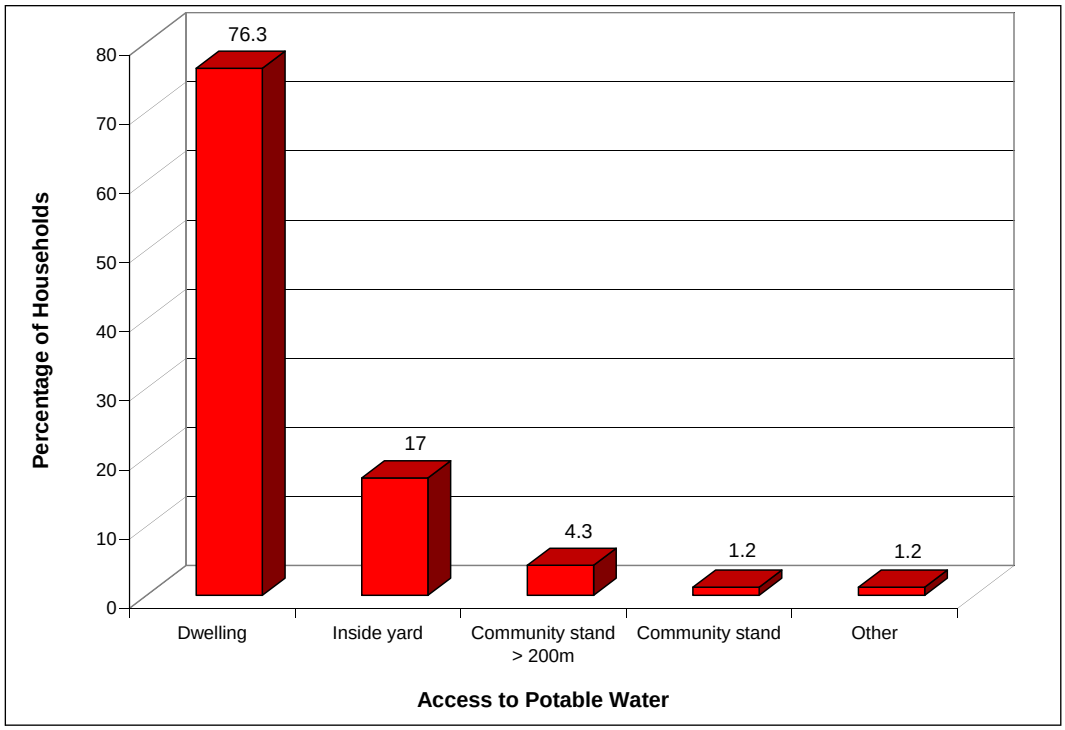
Some of the above mentioned developments will have a significant impact on the growth of the town. The construction of Medupi Power Station and the associated expansion of the Grootegeluk Coal Mine will result in doubling of the number of erven in Lephalale by 2016, even if none of the other developments materialize. From 2012 onwards, the potential growth will differ significantly, depending on which scenario actually realizes. The growth of Lephalale Town and potential developments will require an expansion of the current infrastructure to service the town. Current municipal planning focuses on infrastructure requirements to meet this anticipated growth (Lephalale Municipality, 2009-2010).

According to the Lephalale SDF (2009) there are approximately 34 ‘scattered’ settlements within the local municipal area which have low population levels. This form of spatial distribution is not conducive to cost effective service provision and therefore these rural areas often do not have adequate services delivery. These settlements are also often home to high unemployment and poverty levels.

6.14.10 Water Services

Figure 6-44 shows the access to water services within ward 4 of Lephalale Municipality. The percentage of households with access to water within their dwellings was much higher than that of the local municipality as a whole. The percentage of households who made use of standpipes was also much lower than that of the local municipality at approximately 5.5%

with only 5.5% of households without access to RDP standard water services compared to 19% for the Lephalale Municipality. This means that compared to the local municipality, ward 4 has better access to water services. In many cases this may be due to privately owned farms and game lodges making use of borehole water and developing their own infrastructure.



Source: Statistics South Africa, Census 2001 (Ward Profiles, 2003)

Figure 6-44: Water Access within the Ward 4 of Lephalale Municipality, 2001

Within the proposed project area the predominant source of water recorded for both domestic purposes and livestock are boreholes, as shown in Figure 6-45, with very little being purchased from retailers (shops). Only a much smaller percentage of households use water from rivers or springs. Of the land owners/farmers interviewed within the project area, approximately 25% noted that there is water quality concerns mainly related to the “salty” nature of the water. Fewer landowners/farmers were concerned about problems with water quantity, however, 18% of respondents mentioned either concerns of drought or falling water tables and borehole yields..

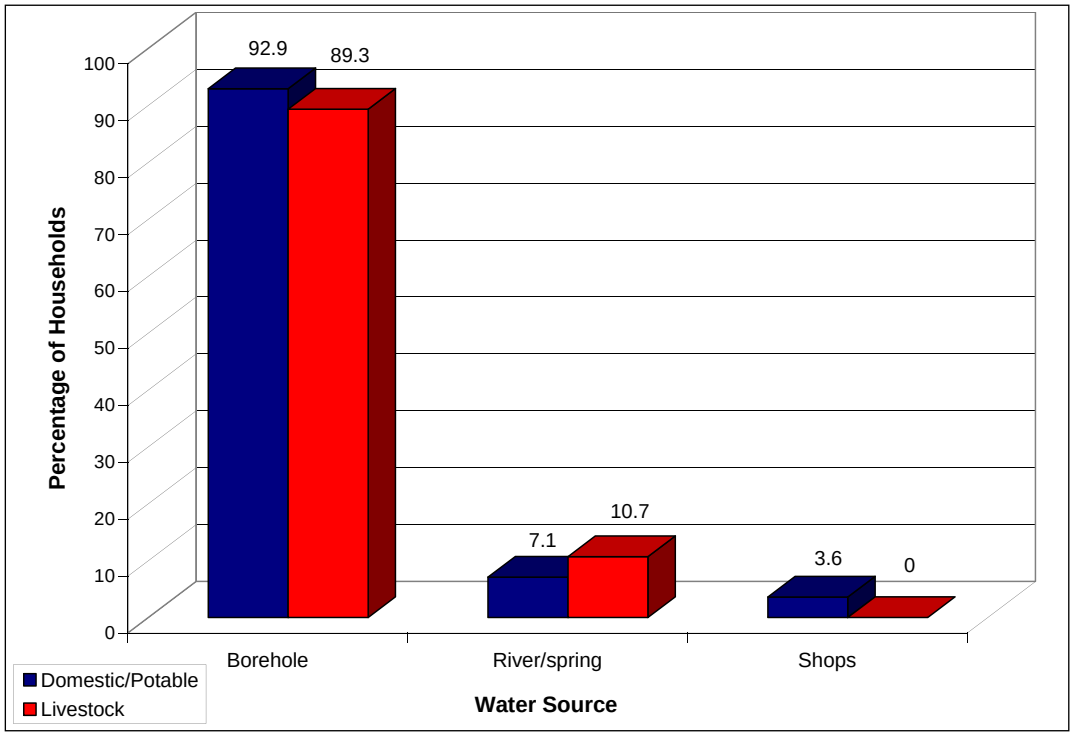
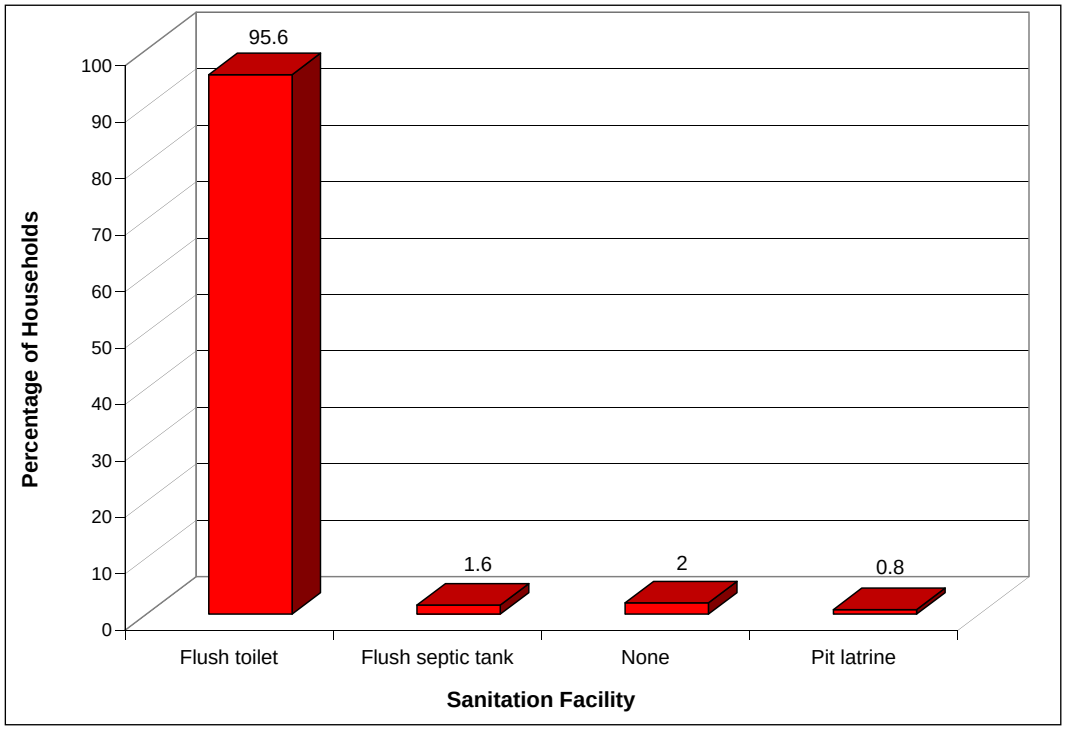


Figure 6-45: Water Source within the Project Area, 2010

At Lesedi Village water provision is mainly by means of municipal standpipes inside households' yards (60%), with a few households using borehole water (27%). Seven per cent reported getting water from a neighbour.

6.14.11 Sanitation Services

Ward 4 of Lephalale Municipality has a high level of sanitation provision with approximately 95.6% of households with flush toilets in 2001, as shown Figure 6-46. Only 2% of households had no sanitation facility and 0.8% used pit latrines. It is likely that those households without sanitation facilities or those that use pit latrines are in less formal settlements such as those in Lesedi.



Source: Statistics South Africa, Census 2001 (Ward Profiles, 2003)

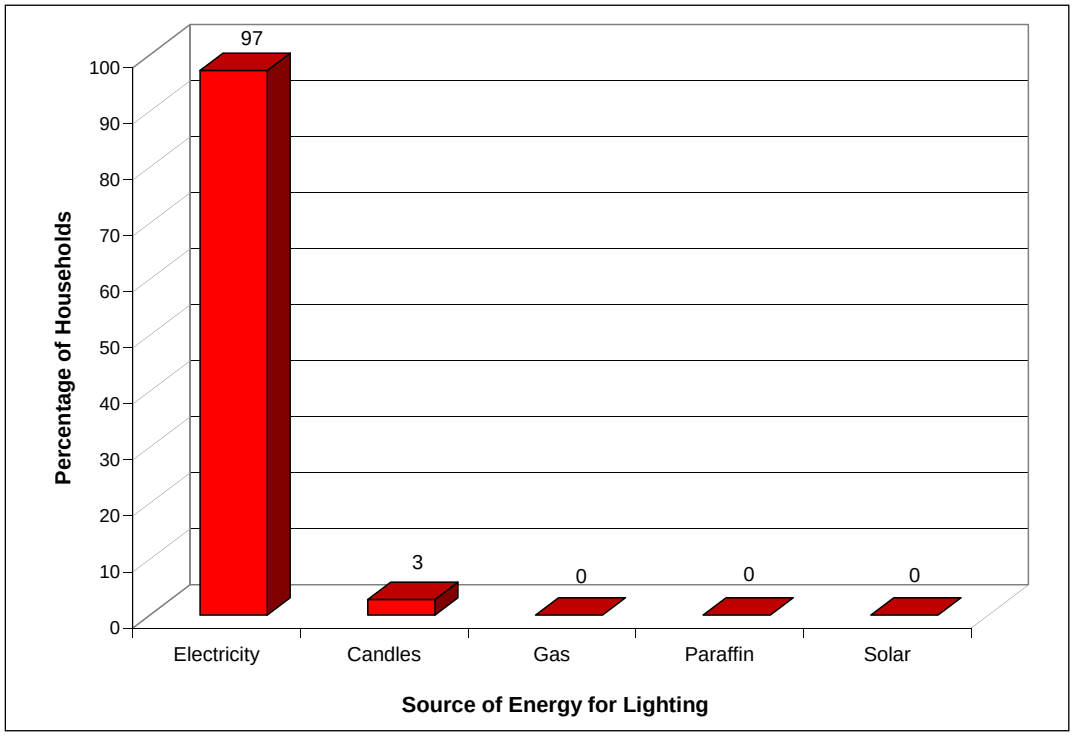
Figure 6-46: Sanitation Facilities within Ward 4 of Lephalale Municipality, 2001

Nearly half the households in Lesedi Village have ventilation improved pit latrines (VIPs) that were supplied by the Lephalale Municipality while most others have pit latrines.

The Lephalale Municipality collects refuse in Lesedi Village on a weekly basis from each household and leaves a rubbish bag behind for waste to be stored for the next collection. Seven per cent of respondents indicated that they burn the refuse themselves. It was surprising to note how clean and litter-free the village was during a one-day visit to the area.

6.14.12 Electricity

Statistics South Africa 2001 information for Ward 4 of Lephalale Municipality shows that approximately 97% of households used electricity as their main source of lighting, as shown in Figure 6-47 As there was a large increase in electricity distribution within the local municipality between 2001 and 2007, it is possible that this backlog in ward 4 has further been reduced since 2001.



Source: Statistics South Africa, Census 2001 (Ward Profiles, 2003)

Figure 6-47: Energy Source for Lighting within Ward 4 of Lephalale Municipality, 2001.

None of the houses in Lesedi Village were noted to have electricity. Those that indicated electricity as a type of fuel may be using an illicit connection or one in another area. The main sources of energy used for lighting in the Village are paraffin, wood (outdoor lighting) and candles, while the main source of energy for cooking is wood.

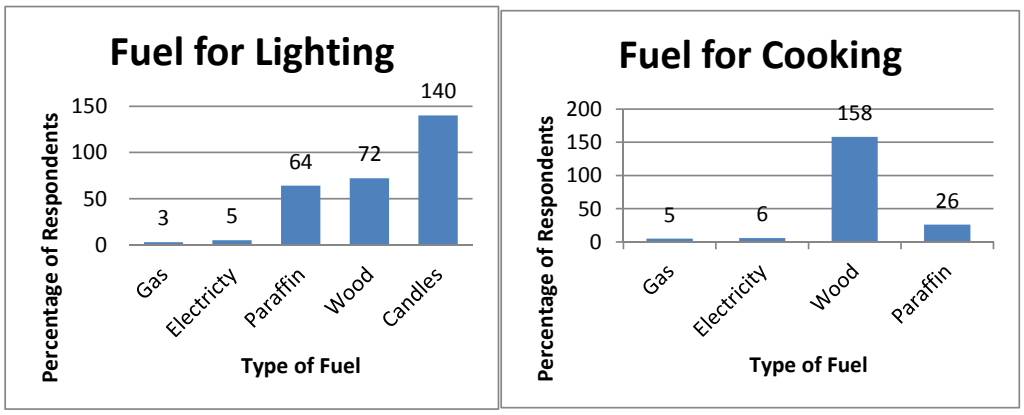


Figure 6-48: Fuel for Cooking and Lighting at Lesedi

6.14.13 Roads and Transport

There is no ward level information on road quality from Statistics South Africa.

Figure 6-49 shows the views of respondents within the project area on the quality of the regional and local roads they use. Approximately 70% of respondents noted that the quality

of roads was either very poor or poor and only 13% thought roads they used were good. Many respondents who stated the roads were poor or very poor thought the quality had worsened recently. Some respondents attributed this to the presence of mining companies using the roads (although this is possibly a personal perception, since there has been no major increase in that activity).

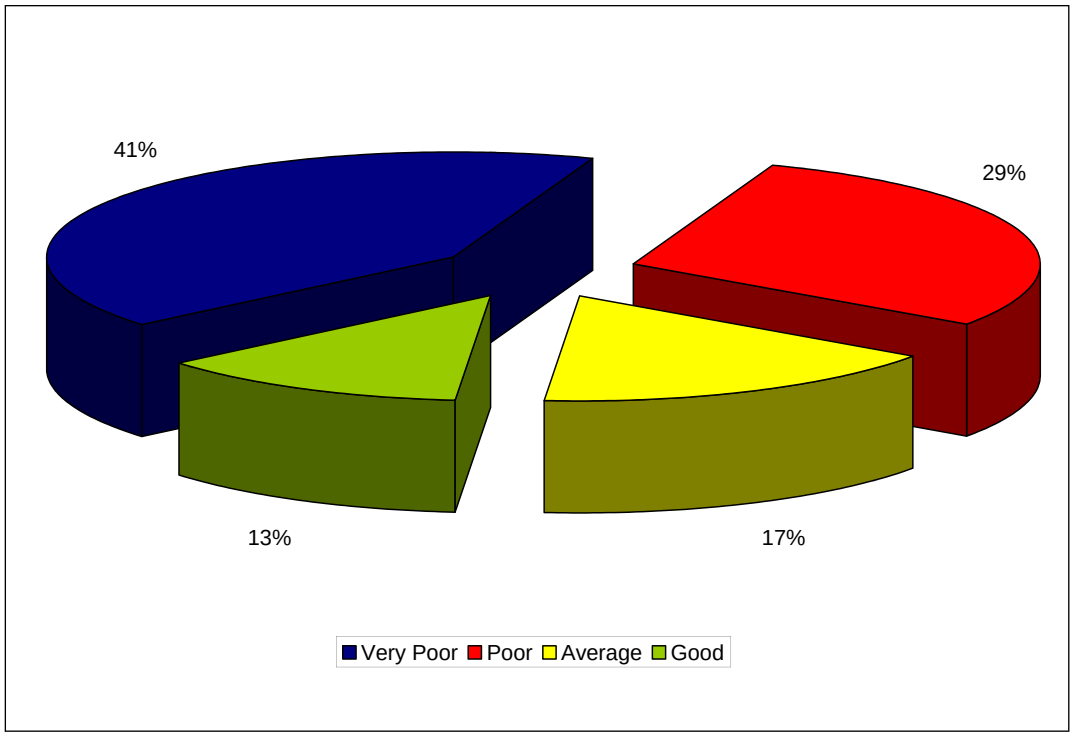


Figure 6-49: Respondents Views on Local and Regional Road Quality within the Project Area.

The Steenbokpan Development Committee stated that the main form of transport for those living at the settlement are minibus taxi's, however these are expensive and a return trip into Lephalale Town cost R60 at the time of the survey in 2010.

6.14.14 Education

The closest tertiary education facilities to the project area are those located in Lephalale Town namely the Lephalale FET College and the Hlalong Centre.

6.14.15 Health

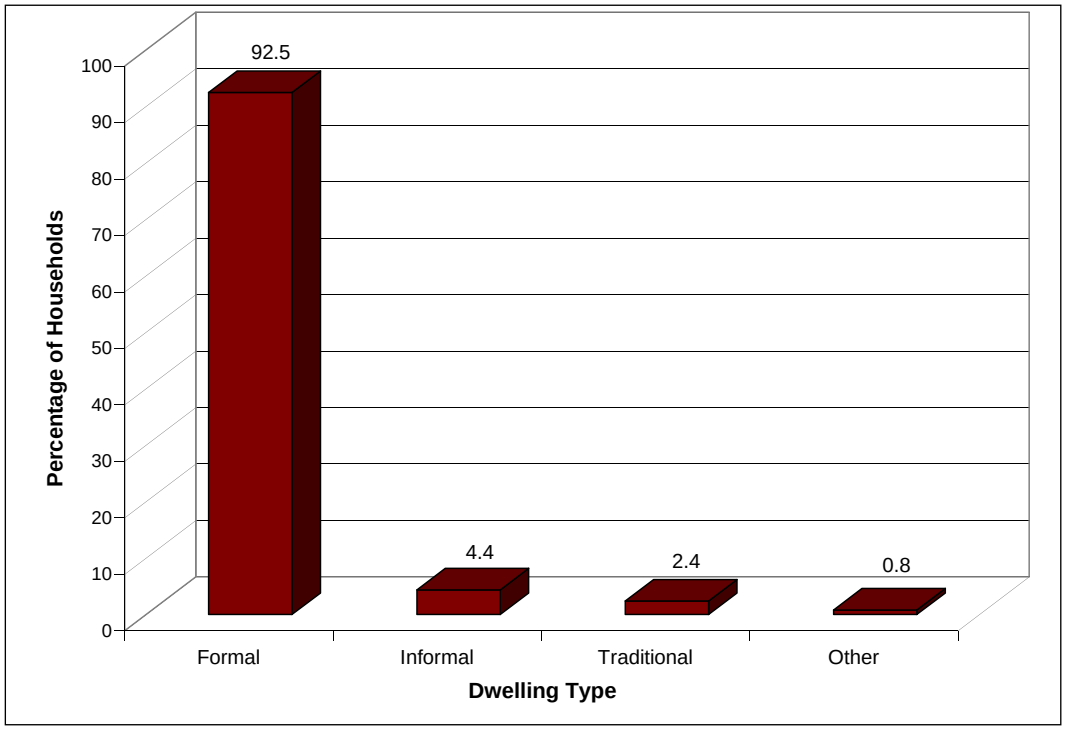
The closest hospitals to the project area are the three located within Lephalale Town. There is a mobile clinic that visits Steenbokpan settlement on a weekly basis; however the Steenbokpan Development Committee and local respondents noted that there was no set schedule for the clinic to visit Steenbokpan.

One of the old buildings in Lesedi Village is used as a clinic and is staffed by two nurses (Figure 6-50).

Figure 6-50: Clinic in Lesedi Village.

6.14.16 Housing

Figure 6-51 shows the dwelling types within ward 4 of Lephalale Municipality in 2001. The majority of households had formal housing with only 6.8% of dwellings constructed from either informal or traditional materials. As the settlement of Steenbokpan has been growing in recent years, due mainly to the influx of job seekers and farm workers evicted from farms, it is likely that the percentage of informal housing within the ward has increased since 2001.



Source: Statistics South Africa, 2001 Census (Ward Profiles, 2003)

Figure 6-51: Dwelling Types for Ward 4 of Lephalale Municipality, 2001.

The settlement of Steenbokpan is located in the grounds of an old school. Housing is predominantly informal and households use zinc, wood and other materials to develop shacks, as shown below

Figure 6-52: Housing within Lesedi Village.

The Lephalale Municipality IDP (2009-2010) noted that Steenbokpan has an estimated housing demand of between 300 to 454 units. At the time of the IDP compilation, the

National DEA had approved 180 housing units at Steenbokpan with a further 170 awaiting approval. However, the Lephalale SDF (2009) noted that since the potential development of the Sasol Mafutha project and the possibility of two power stations, the farm Steenbokpan and surrounds may not be suitable for development. The layout of houses and associated structures in Lesedi Village is fairly neat. The yards are tidy and most have gardens. The tin houses are neatly built. One of the buildings that is used as a community hall and crèche is poorly maintained. There is an old age home in the village that used to be a school. Government funds the old age home.

6.14.17 Concluding statement

The economic benefits of the Boikarabelo Power Station Project will be incremental to those for the Boikarabelo Project as a whole. The benefits will be felt both locally and throughout the Province. The procurement of goods and services throughout the life of the Project will provide medium to long term income for businesses. Although employment at the Power Station is likely to be minimal, employment at a regional or provincial level is viewed as a positive impact of the Boikarabelo Project as a whole. It is recommended that the skills available in the project area be assessed in order to determine the level of local eligibility for employment at the power station. Relevant training programmes should be put in place to enable local residents to participate in employment at the power station. Given the lifespan of the power station and associated mine (longer than 30 years), this will be a worthwhile investment.

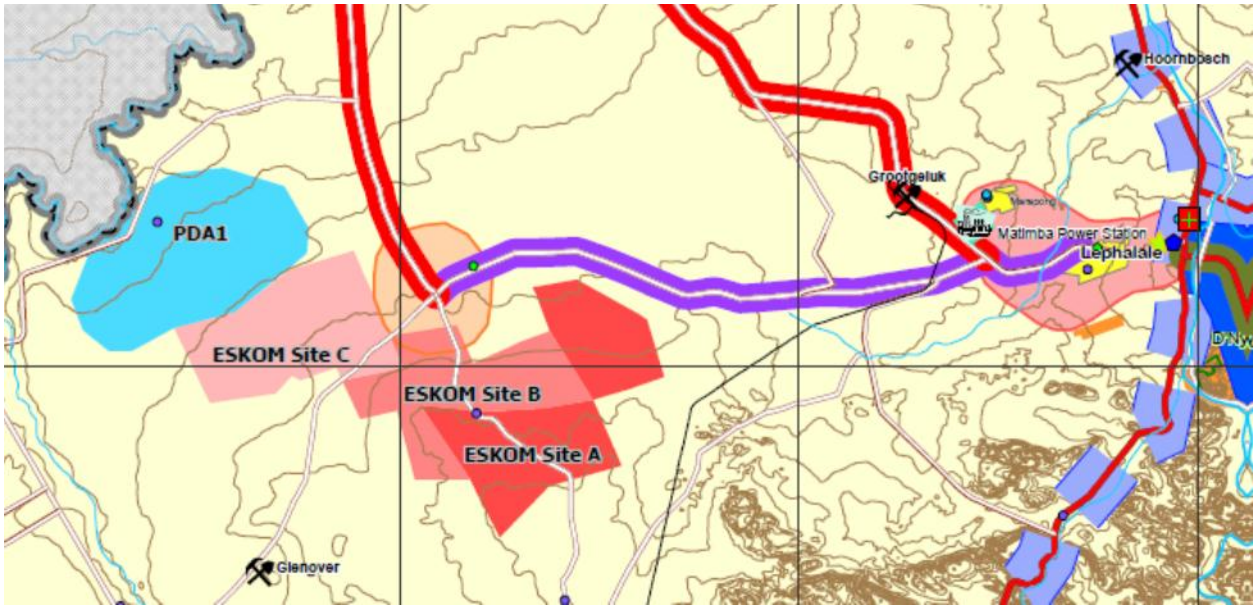
The implementation of the Boikarabelo Project, including the power station, will have an effect on vulnerable groups living in the project area. The most vulnerable groups are farm workers (those living on farms and those that have been evicted), youth, and the elderly. A large portion of these groups are unemployed and most, if not all, do not own land. Their skills levels pertaining to the mining industry are generally low, making them largely ineligible for employment at the power station. Any negative impacts to these groups must therefore be carefully mitigated or avoided so as not to exacerbate their vulnerability. Households that are impacted should be better off by the time the Project shuts down, rather than worse off. Failure to improve the lives of vulnerable groups may lead to an exponential increase in social ills as more land will be purchased for mining and power generation activities causing more farmworkers to become displaced.

6.15 Spatial Development

6.15.1 Potential development areas

The Lephalale Local Municipality has formulated a Spatial Development Framework (SDF) for the municipally area (2009/2010). The SDF is one of Integrated Development Plans sector plans to facilitate and integrate development in the area. Lephalale is currently seen as a growth node of national importance. With the identification of possible projects that may occur in the area, the triangle between the nodes of Steenbokpan, Stockpoort and Lephalahle will be spatially re-defined.

A Potential Development Area (PDA1), which has been regarded as the Steenbokpan node has been identified and has been illustrated on Figure 6-53 (snap shot from Map 4 of the SDF).



Source: Lephalale SDF, 2009

Figure 6-53: Potential development area – Steenbokpan node (Lephalale SDF, 2009).

PDA1 is part of an area that has been earmarked as a mining zone. Due to the current energy demand and the international demand for coal products the Waterberg Coal Field is expected to become the centre stage for much development. Certain development considerations need to be conceded in order to support this industrial growth. PDA1 is designated to accommodate developments of this nature, such as industrial parks and residential developments which are linked to operations in the area (Lephalale SDF, 2009).

The area of PDA1 borders the proposed Boikarabelo Coal Mine project area. The development of PDA1 will provide supporting services to the proposed mining operation.

In accordance to the SDF the following development principles need to considered when assessing such developments (Lephalale SDF, 2009):

- Do not build on mineral resources/deposits as it sterilizes national resource.
- Create industrial hubs or corridors close to coal such that costs of moving coal are not restrictive to further economic development of the area.
- Manage commuting distances of employees.
- Place residential towns out of the prevailing wind direction from industrial hubs so that the town do not restrict further growth, and to ensure healthy living areas.
- Place residential towns away from main coal and industrial hubs, thus creating noise and dust buffers.

- Try to concentrate servitudes for logistic channels, water and electricity infrastructure to limit environmental impact.

The SDF is a formulated document which needs to be considered by the developer as well as the governmental authoritative body to ensure the integration of land use development throughout the municipal area.

6.15.2 Waterberg Environmental Management Framework

An Environmental Management Framework (EMF) has been developed for the Waterberg District (2010). This needs to be taken into consideration by both applicants and governing authorities when undertaking and reviewing a proposed project.

Within the EMF the mining industry has been included as a specific management zone. This is due to mining been seen as the cornerstone of the economy of the district as it currently accounts for more than 50% of the GDP of the district. It is therefore an important industry for the development of the district of the medium to long term.

In accordance to the management zones included in the EMF, Zone 4 is the mining focus area (Plan 17). The EMF states that this zone represents areas where significant mineral resources of strategic national importance occur within largely natural environments. The proposed Boikarabelo Coal Mine and Power Station falls within this zone.

The following following desired state has been outlined in the EMF for Zone 4:

- ***Water utilization***: Larger scale water utilisation will be necessary to support mining and industrial activities in this zone. Activities cannot proceed unless the necessary water allocations and permits are in place.
- ***Water quality***: Water quality in this zone should not be allowed to deteriorate. Legislation to protect water quality and prevent pollution should be strictly enforced. Heavy penalties should be imposed on pollution caused by mining and industry.
- ***Conservation:*** Conservation of natural habitat should be the primary focus of required buffer areas around mining and industrial sites. Preference should be given to catering for threatened species that may occur in this zone.
- ***Agriculture:*** Agriculture is not desired in this zone. Existing agricultural activities may continue provided that such activities are not expanded.
- ***Game and cattle farming***: Game and cattle farming should be the default activity in parts of the zone that are not used for mining or industrial purposes.
- ***Service infrastructure:*** Service infrastructure should be sufficient to support both mining and other developments in the area. Transport infrastructure is of particular importance. A strategy for the transport of coal out of the Waterberg District, by rail or by road should be carefully planned. The current infrastructure is insufficient. Service infrastructure development in the area should also cater for the influx of people associated with the new developments in these zones.

- ***Solid waste disposal:*** All solid waste should be discarded at permitted solid waste sites. Sufficient permitted solid waste disposal sites should be established at key locations to deal with the waste generated in this zone. Strict enforcement and proper management at such sites is necessary to minimize negative impact. Recycling collection points should be encouraged wherever possible.
- ***Sewage treatment and disposal:*** Sewage treatment plants and disposal sites capable of properly dealing with the sewage and waste water generated in the area is necessary to prevent pollution of rivers and streams.
- ***Employment:*** Employment in the zone should be focussed on providing opportunities for local unemployed people. This should go hand in hand with appropriate education and training.
- ***Housing:*** Housing the area should preferably be concentrated in urban areas where the benefits of high densities can be exploited in respect to education facilities, health care facilities and the efficient provision of municipal services.

The EMF further includes activities which are preferable, compatible and undesirable within this zone:

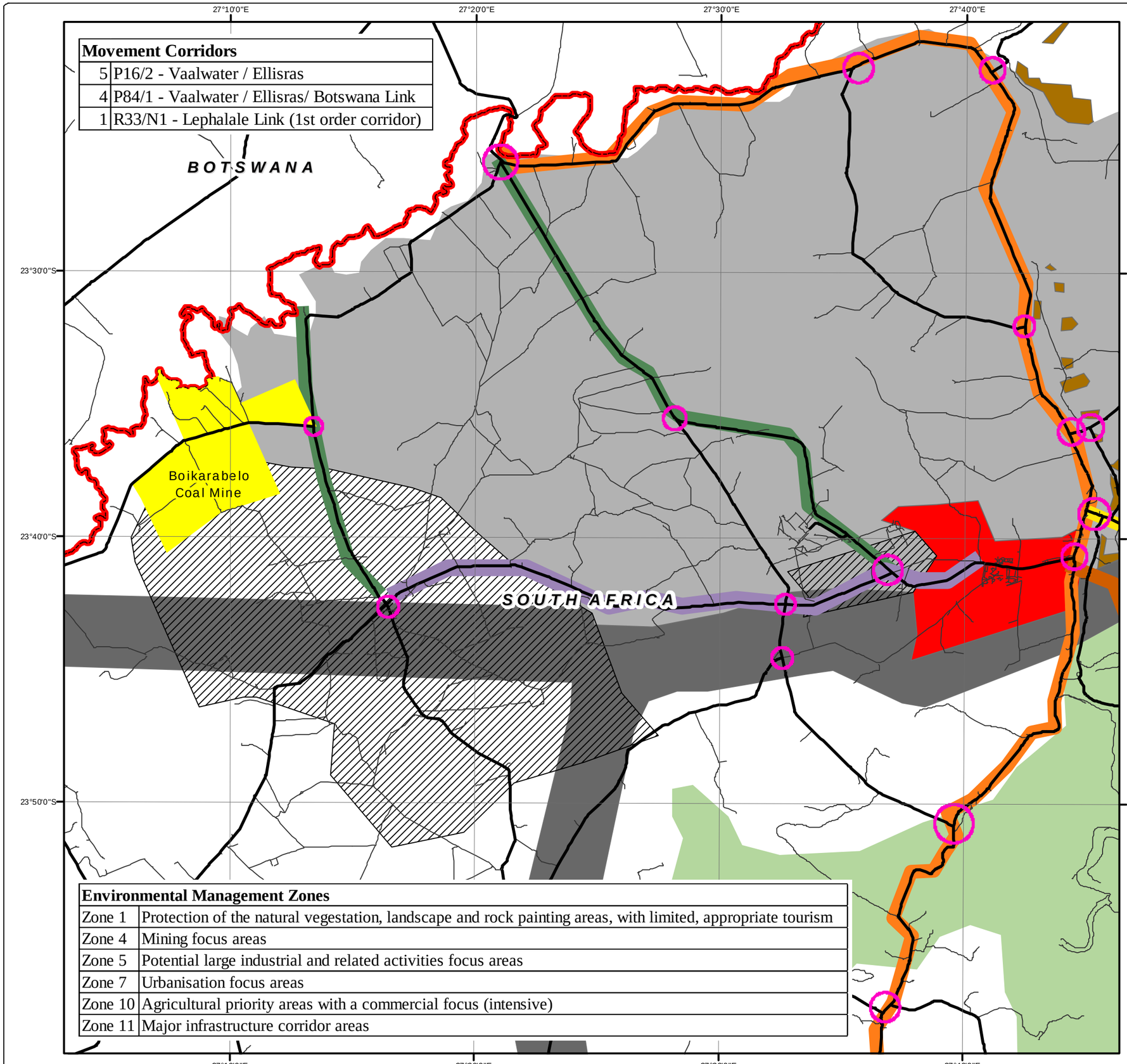
- ***Preferred activities:*** · Mining of minerals; · Industrial activities that are directly associated with mining provided that it is accommodated in such a manner that they do not restrict or constrain potential mineral exploitation; and · Roads and railway infrastructure that is necessary for the safe and proper transportation of mineral products and people.
- ***Compatible activities:*** · Existing farming activities; · Keeping of game and/or cattle for commercial purposes in a responsible manner that makes sustainable use of the natural vegetation cover of the area in parts where mining is not possible or where mining will only become a factor in the medium to long term; and · Tourism facilities on disturbed land, including hunting lodges (indigenous vegetation should not be removed) in parts where mining is not possible or where mining will only become a factor in the medium to long term.
- ***Undesirable activities:*** · Any activity that sterilises the potential to exploit a mineral resource in the area

Plan 18

Boikarabelo Power Station

Boikarabelo Power Station and the Waterberg EMF

Movement Corridors	
5	P16/2 - Vaalwater / Ellisras
4	P84/1 - Vaalwater / Ellisras/ Botswana Link
1	R33/N1 - Lephalale Link (1st order corridor)



Environmental Management Zones	
Zone 1	Protection of the natural vegetation, landscape and rock painting areas, with limited, appropriate tourism
Zone 4	Mining focus areas
Zone 5	Potential large industrial and related activities focus areas
Zone 7	Urbanisation focus areas
Zone 10	Agricultural priority areas with a commercial focus (intensive)
Zone 11	Major infrastructure corridor areas

Legend

- Boikarabelo Coal Mine
- Minor Route
- Secondary / Main Route
- Major Intersections
- International Boundary

Spatial Development Framework

- Industrial Corridor
- Movement Corridor 1 & Tourism and Logistic
- Movement Corridor 4
- Movement Corridor 5
- Road Upgrade - Upgrade to Tare

Environmental Management Zones

- Zone 1
- Zone 4
- Zone 5
- Zone 7
- Zone 10
- Zone 11

resource generation

DIGBY WELLS ENVIRONMENTAL

www.digbywells.com

Projection: Transverse Mercator
Datum: Hartebeesthoek 1994
Central Meridian: 27°E

Ref #: scc.RES1065.201207.109
Revision Number: 1
Date: 24/07/2012

N

0 2.5 5 10 15

Kilometres

1:270 000

6.16 Sustainability

Sustainability generally refers to three main spheres of development including social justice, environmental integrity and economic efficiency. Sustainable development can be defined as 'development that meets the needs of the present, without compromising the ability of future generations to meet their own needs' (Brundtland Commission, 1987). This implies that true sustainable development in business must consider not just the financial 'bottom line' of prosperity and profit of the specific project, but also environmental quality and social equity in the geographical proximity of a project area.

This Sustainability Assessment report was completed with the aim of evaluating potential impacts of mining developments on the land use and subsequent sustainability of the existing nature-based tourism industry in the Waterberg region, with specific focus on the hunting and game farming industries in the integrated Boikarabelo Project area. This assessment also evaluates the values and potential of existing land uses in the project area in the context of proposed industrial development to ensure long term sustainable development for the area. In essence, this study aims to evaluate viable options for supporting integrated cooperation and coexistence between the mining industry and game farming and hunting in the project area. The complete report is attached in Appendix O.

6.16.1 Land values in the Bushveld and Waterberg District

The proposed Boikarabelo Power Station is located in the footprint area of the existing mining right area of the integrated Boikarabelo Coal Mine project area, which is situated in the Waterberg District and forms part of the Bushveld region of the Limpopo Province. The Waterberg region has rich cultural heritage such as the history of the Basotho, Tswana, Bapedi and the early Voortrekkers. There are also a number of protected areas within the Waterberg District, including Marakele National Park, Entabeni Nature Reserve, D'nyala Nature Reserve and Doorndraai Dam Nature Reserve, amongst others. Some of these have been incorporated into the UNESCO Waterberg Biosphere Reserve. In the Waterberg District, the mining sector is one of the largest contributors to regional GDP. Several towns in the district are located in the mineral-rich Bushveld Igneous Complex. The Waterberg District also features the riches of the Waterberg coal fields, iron ore (at Thabazimbi) and tin and platinum at Mookgophong.

The area around Mokopane is one of the richest agricultural zones in South Africa, producing wheat, tobacco, cotton, beef, maize and peanuts. The hot springs of Bela-Bela establishes it as a popular tourism destination and the district now offers many luxury golf estates and residential developments.

The majority of hunting establishments and game farms are located in the Waterberg District and Bushveld region (Saayman *et al*, 2011). The focus of land use in the study area is thus on game farming, which generates revenue through hunting and other nature-based tourism activities such as hiking, birding, game viewing and lodging (Mmamabula-Delta Response Document, 2007). The Waterberg District has shown an above average growth in land value as result of game farming. Economically, game farms have been a sound investment, with

the values of these properties increasing by more than 100% over the last five to 10 years; in some prime areas this increase has been as high as 500%. Factors contributing to this increase in value of game farms have been the demand for farms from overseas investors and the tremendous growth in the tourist industry in South Africa (Game Farms in Africa, 2011). Based on the high tourism demands and favourable conditions for game farming, the total estimated land value per game farm in the Waterberg and Bushveld region is high. The market value of a game farm is not determined, as with other farms, by its profitability potential but by supply and demand. A game farm within two hours from the city with good scenery (mountainous, vegetation, big five territory and river or dam) and sound infrastructure (game fenced, cattle installations removed, decent accommodation, roads, game settled) will have a higher value. Currently, as with farms within the project area which may have an underlying resource are seen to have a higher value in relation to those in the area that hold no resources.

As calculated by Wildlife-Campus in Figure 6-54 the estimated land value of game ranch land values in the Bushveld area is higher than the values of the Grasslands, Kalahari and Karoo (Wildlife Campus in association with ABSA Bank, 2009). Land use and tourism trends are generally focussed on environmental resources and natural attractions that add to the nature-based tourism value of the area. The overall tourism value of an area can be based on the holistic combination of natural, economic and social values contained in the area (Gamefarm.net, 2011). Even though the mining sector still contributes the most revenue to the Gross Domestic Product (GDP) of the Waterberg District, the land value of game farms in this region is very high and host potential for sustainable economic contributions.

	Ranch size		
Ecological region	Small sized	Medium sized	Large sized
Grassland	1.2	3.6	4.6
Lowveld	13.3	43.2	60.0
Bushveld	5.9	18.0	23.6
Kalahari	1.5	4.8	6.4
Karoo	1.3	4.1	5.5

Figure 6-54: Estimated land values of game ranch land values in the Bushveld area (figures valued in Million South African Rand)

From Figure 6-54, it is evident that the price of land in the Bushveld area is high in economic value. The average sized farm (ranch) is estimated at R18 000 000 for the Bushveld region. The game farming industry in the Waterberg area is a holistic and integrated industry that is dependent on the environment to maintain and sustain its income. There are additional activities and services offered that generate income such as game viewing, hiking, accommodation and tourism services.

Additional income and costs associated with hunting services and activities generally include hunting fees (hunter and one professional hunters priced estimated between R1,500 - R2, 735, per person per day), accommodation (anything between R500 – R2,000 per person per night) and tourism activities (helicopter rides, hiking, birding and game drives estimated between R200 – R2, 000 per activity). To hunt an impala in the Lephalale municipal area, the price range would be between R 1,000.00 and R3, 000.00, with an average cost of R1,088.89. A hunting catalogue for May 2011 indicated that the price to hunt a giraffe in 2011 is estimated at R 21, 290.00. The costs of hunting rare game can reach prices over R1 million. Larger game farms tend to generate higher income (Master-Q Research, 2008). In addition to the high economical values of land in the Bushveld region, it is also clear that the tourism industry in this area is highly valued. This confirms that land use and tourism trends are generally focussed on environmental resources and natural attractions that add to the holistic nature-based tourism value of the area.

To determine if the integrated land values of in the Waterberg District are also applicable to the land closer to the project area, five randomly selected farms near Lephalale were selected and evaluated according to its economic value. These farms were selected from anonymous realty and estate agents with experience in the area. This search was conducted to determine the average property values for five examples of game farms (as prototypes) in the regional proximity of the proposed project area. These results confirmed that game farms in the Ellisras and surrounding project area are highly valued, as illustrated in Table 6-18 with an average land value estimated at R 9,000 – R 11,000 per hectare.

Table 6-18: Examples of property values of game farms in Waterberg region

Property details in Limpopo	Property values
Ellisras/Marken: Size 700 ha, Thatch roof, Rooms 4, Bathrooms 2, Solar panel at one borehole, Meat processing room, coldroom. Tractor included, Kudu, Impala, Black-faced impala, Red hartebeest, Blue wildebeest, Blesbuck , Zebra's, Eland and small game	R 10,500,000 (RSA Rand)
34 km north of Ellisras: Size 2150 ha, newly built lodge with 3 x on - suite chalets, kitchen, open plan living, dining room and bar area. Slaughtering facility with coldroom and 2 storerooms, 300 ha breeding camp with electric fence, Game: Impala, Kudu, Eland, Blesbock, Blue wildebeest, Red hartebeest, Zebra, Gemsbock, Waterbuck and small game	R 18,200,000 (RSA Rand)
Marken: Size 1535 ha, House: with 5 bedrooms and beautiful, neat finishes, Fencing: Neat game fence and more than enough roads, Game: 180 Impala,50 Kudu,50 Waterbuck,40 Red Hartebeest,30 Blue Wildebeest,20 Gemsbuck11 Giraffe,10 Zebra,8 Eland; Water: 5 bore holes	R 11,000,000 (RSA Rand)

Property details in Limpopo	Property values
Lephalale region: Consist of 2 portions, Portion 1: 603ha & Portion 2: 628 ha, Total size = 1231 ha, Fenced for wild on both portions; Double story thatched roof family home on one portion of the farm - 2 bed, 2 bath, open plan kitchen and living area, walk in cold room and pantry, 2 balconies with 2 patio's; farmhouse and a guesthouse next to the Limpopo river located on other portion. Airplane hangar and 2 stores (30 x 30 m² & 12 x 18 m²). Landing strips on both portions. 13 ha is irrigated (Lucerne/sugar cane). Game includes Kudu, Impala, Bushbuck, Waterbuck, 400 Nyalas & Buffalo, 50 Sable (Swartwitpens).	R 19,000,000 (RSA Rand)
Ellisras: Size 352 ha, topography flat. Fenced (cattle and game), Game include Kudu and Impala; Water infrastructure: 3 boreholes 2 equipped. Four bedroom house 450 m^2. Big veranda 2 bathrooms, Carport and slaughter room.	R 3,300,000 (RSA Rand)

Based on the results in Table 6-18 above, game farms in the Waterberg District are evidently highly valued and the economic value of the Bushveld is considered prime interest. After a general site assessment of the integrated Boikarabelo project area, including the proposed Boikarabelo Power Station area, it was determined that existing land use in this project area is also focussed on nature-based tourism such as hunting, game farming, hiking, bird watching, game viewing, catering and lodging. Similar to the game farms listed in this section, the properties located in the footprint of the integrated Boikarabelo project area are highly valued.

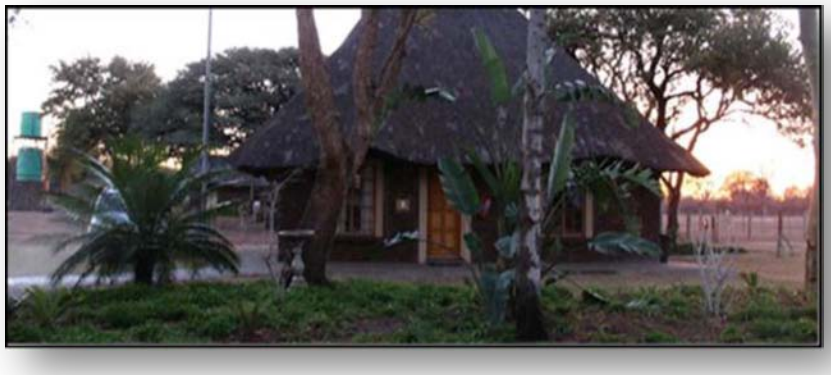


Figure 6-55: Zinyathi Lodge on Vlugtkraal is an example of one of the successful game farms in the geographical proximity of the integrated Boikarabelo project area

6.16.2 Sustainability discussions

Based on the results from the assessment of potential cumulative impacts resulting from the Boikarabelo Power Station and the Boikarabelo Coal Mine on existing land users and uses, it was found that approximately 53% of the farms assessed in the area surrounding the integrated Boikarabelo project area have the potential to continue with existing land uses or contain prospects to develop additional nature-based tourism businesses. As illustrated in Figure 6-56, the sustainability rating for these farms is high, which implies that the likelihood of existing nature-based tourism industries and land uses on these farms continuing with their business during construction and operation of the mine and power station is relatively high.

According to the current mine plan, a combined percentage of 47% of the farms that were assessed in the integrated Boikarabelo project area will be negatively or directly affected and not likely to continue with existing land use after mining commences in the project area. The impacts on these farms were rated as medium-high and highly significant with a sustainability rating of medium or low. This implies that the nature-based tourism activities

and/or existing land use on these farms are less likely to continue with existing business during construction and operation of the mine and power station.

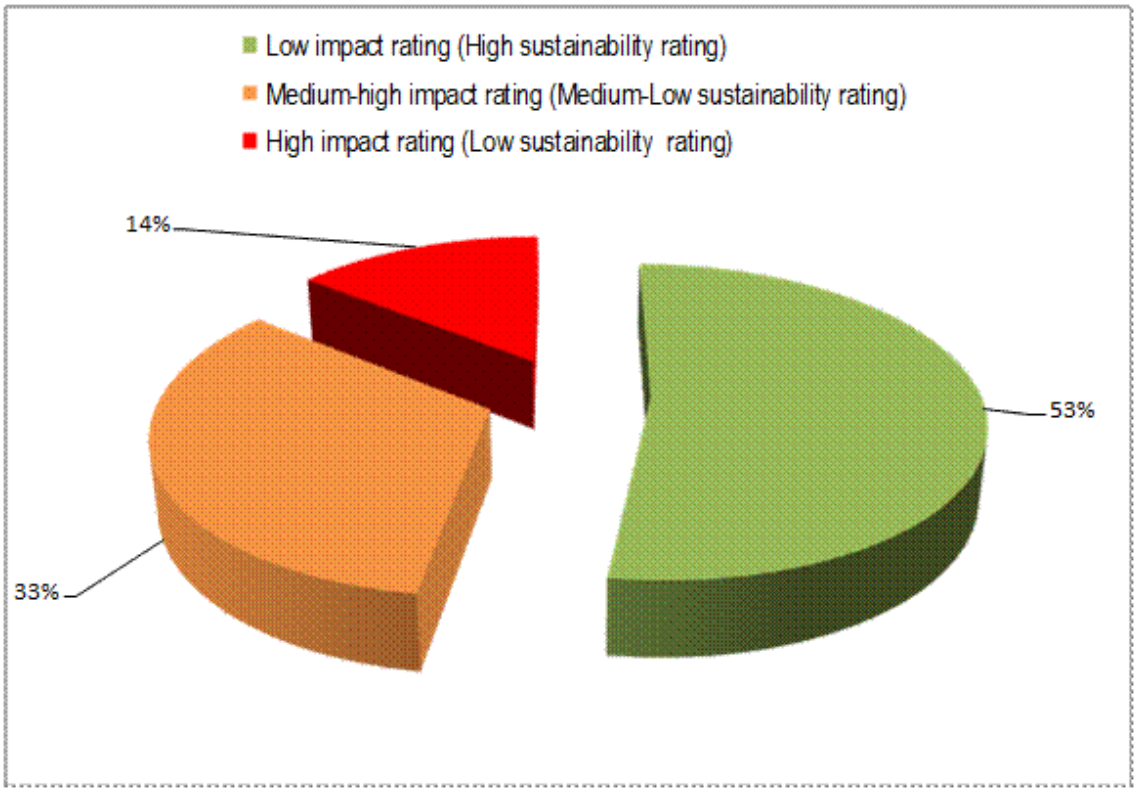


Figure 6-56: Schematic presentation of sustainability results

6.16.2.1 Regional Development trends

In 2005, it was reported that the Waterberg Coalfield has vast potential to become the most significant mining and industrial centre in South Africa (Jeffrey, 2005). The vast resources of the Waterberg Coalfield are currently considered suitable for replacing future dwindling coal exports from other coalfields, as well as supplying additional energy requirements. The Waterberg Coalfield is ultimately expected to replace the Central Basin (the coalfields around Witbank and Middelburg). With increased demands for business development and the development of coal mines, the area would also require additional infrastructure, support structures and support services. After a site visit to the integrated project area, it seems that current development trends in the Waterberg District reflects the increasing demand for industrial and residential development as well as increasing business interest in this region. Various residential developments are advertised along the roads of Lephalale and vast amounts of construction material and trucks are moving into the area. A Local Economic Development study conducted in 2009 that was initiated by the Lephalale Municipality predicted that Lephalale would double its inhabitants to 54 000 by 2013. Exxaro Resources Limited announced that it will be constructing almost 800 environmentally-friendly homes in Lephalale for use by employees required as part of the expansion of its Grootegeluk mine. The Grootegeluk Medupi Expansion Project (GMEP) is a major Exxaro growth project to

increase mine production and supply 14, 6 million tonnes per annum of power station coal to Eskom's Medupi power station in terms of a 40-year agreement. The notion of accelerated economic growth is contained in the objectives of its sustainable development vision in the Lephalale region, as illustrated in Figure 6-57.

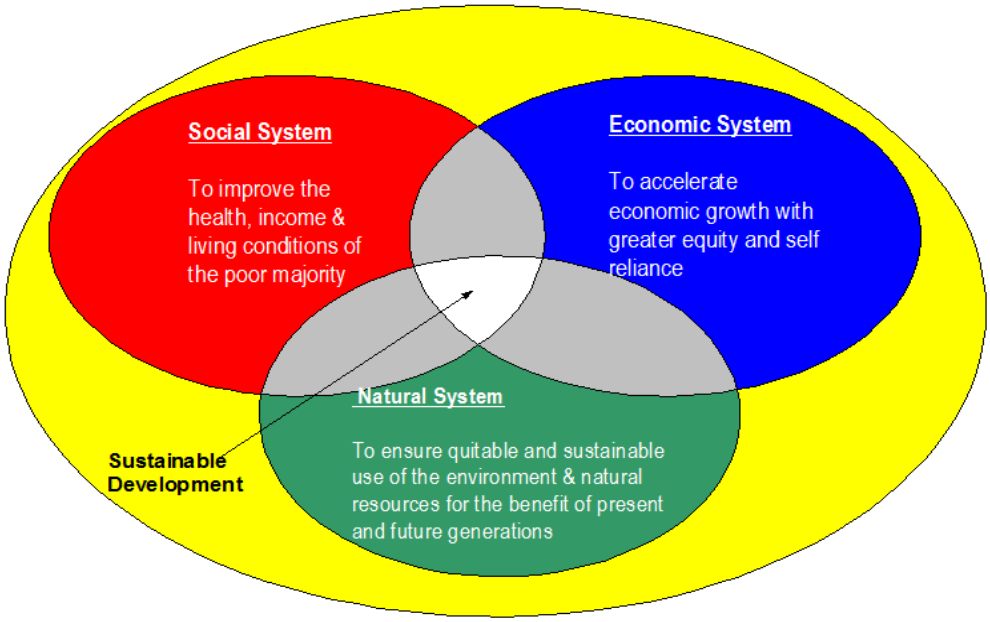


Figure 6-57: Sustainable development aim of the Lephalale Economic Development Company

Additional roads, water, sanitation, housing, health care and education would be required if proposed developments proceed. The upgrade of the R33 which links Lephalale to Modimolle and the N2 highway, the construction of new roads serving industrial areas, additional reservoirs and pipelines, increased water treatment capacity, housing and a clinic forms part of reactive development to manage the increased demand and development. A new high school will be built opposite Laerskool Bosveld Primary and the Lephalale Municipality will spend millions in servicing and upgrading switch gears at existing power sub-stations and will look at securing funding for a new power sub-station. Upgrades are planned for various sewerage pump stations, the sewerage system and the storm water systems. With rapidly growing economic and industrial development, Lephalale faces not only major socio-economic challenges as the town becomes one of the fastest growing in South Africa, but also various environmental challenges (Raats, 2011).

Lephalale is situated on the periphery of the internationally-recognised Waterberg Biosphere Reserve which contains a range of protected areas and game and nature reserves. The status, which has been conferred by the United Nations, means that environmental protection must be regarded as paramount in socio-economic development in the area. Lephalale itself is surrounded by some 250 game farms and ecotourism resorts (Trade Invest, 2006). Reflecting the attitude of current investors, Grootegeluk general manager Joe

Meyer told a conference this mine is keenly aware that it operates alongside a biosphere and will strictly enforce environmental controls during its expansion. This type of effective and considerate cooperation between the mining industry and nature-based tourism industry will be crucial for the potential sustainable development of the Waterberg District.

6.16.2.2 Sustainability context

In accordance with the EMF of the Waterberg District, there are a number of significant sustainability criteria that need to be considered for all types of development in the Waterberg District. These criteria have been listed in Table 6-19. With reference to this table, the mining industry (middle column) and the game farming and hunting industry (right column) were evaluated in terms of their compliance with these sustainability criteria (left column).

From Table 6-19, it is evident that coal mining is not considered the most sustainable development in the region. This is partially due to the non-renewable nature of coal and intrusive mining activities (Environomics, 2010). Even though mining provides much needed employment opportunities and economic development, nature-based tourism (game farming and hunting) is considered more sustainable in the long term. Any industrial development that does not comply with environmental integrity will lead to the aesthetical degradation and reduction of the area's tourism potential, which may in turn limit future tourism potential and types of land use opportunities. It is therefore of crucial importance to consider potential strategies for establishing cooperation and communication between the mining developments such as the Boikarabelo Power Station, the Boikarabelo Coal Mine and the tourism industry to ensure long term sustainable development.

Table 6-19: General sustainability assessment of mining versus game farming

Sustainability criteria	Mining	Game farming and hunting
The project must ensure the adequate and appropriate protection of biodiversity in the district.	Non-compliant (Medium –long term) Coal extraction involves intrusive mining activities that cause negative impacts on the environment and biodiversity such as vegetation clearing, habitat loss, soil disturbance, decrease of air quality and water quality. In addition, coal resources are non-renewable. Certain mitigation and monitoring measures can; however, be implemented to ensure impacts are minimised to	Compliant (long term) – Game farming and regulated hunting is based on conservation principles, maintenance of biodiversity and a healthy environment. Hunting plays a major role in generating the necessary revenues on which holistic wildlife management depends. Conservation of land and biodiversity is thus a secondary benefit of hunting and game farming. Nature reserves and game reserves in the Waterberg District ensure the adequate and

Sustainability criteria	Mining	Game farming and hunting
	avoid the complete loss of biodiversity.	appropriate protection of biodiversity.
The project must ensure a continued and even increased income for the district and especially its poor communities.	Compliant (short term) – For the total Boikarabelo Project, a total of 735 additional employees will be employed by 2016. Adult education, training and skills development will be implemented as outlined in the Social and Labour Plan (SLP). The majority of employees will be sourced from the local population in the Lephalale Municipal area. The life of mine is greater than 30 years and retrenchments will be required during decommissioning and closure.	Compliant (long term) – Lodges and tourism institutions provide employment for local communities through tour guiding, hunting, catering. Secondary businesses are supported through taxidermy, consumables, curios and maintenance services. It is estimated that game farms employ more than 100,000 workers and their extended families. Game farming and hunting provide no significant opportunities fortraining and education, The wider tourism sector, including catering, hospitality, tourism management, hunting, taxidermist training and tour guiding, may offer more opportunities.
The project must provide for increased levels of employment and better types of employment.		
The project must provide incentives for the establishment of a more balanced population structure especially in respect to the age, health and general prosperity of the population.	Compliant (long term) – Enhancement of individuals will be attained in the mine sponsored Local Economic Development (LED) initiatives. The aim of LED projects is to create economic development initiatives that stimulate the small business sector and contribute toward sustainable commercial opportunities. Potential projects identified for the LED programme include an agricultural project, brickmaking and a waste treatment project. Revenues created by mining provide income to local	Compliant (long term) – In line with the Environmental Management Framework of the Waterberg District, improved tourism development will create a “Waterberg brand”, supported by government that promotes the area as a whole. Educational programmes will be developed and implemented in the district to make people aware of the importance of tourism in the area and ways they can contribute to make it a success. This will include skill development and tour guide training, which may lead to sustained education and job creation. Conservation and hunting

Sustainability criteria	Mining	Game farming and hunting
	municipalities and national departments.	permit fees generate an income for the Limpopo DEA.

6.16.3 Concluding statement

The aim of this Sustainability Assessment was to evaluate opportunities to ensure long term sustainable development of the Waterberg District, with specific focus on the Boikarabelo Power Station located in the integrated Boikarabelo project area. It is expected that the construction and operation of the proposed power station may have a number of negative impacts on the existing nature-based tourism industry in the project area such as impacts on soil, vegetation and natural resources that may result in decreased tourism values and subsequently a decline in tourism demand. However, if subsidised conservation is supported by the Boikarabelo Power Station together with the Boikarabelo Coal Mine, existing game farming and nature-based tourism can be supported and continue in the area.

In South Africa, there are a number of examples of operational mines that border National Parks, such as the Phalaborwa Mining Company (PMC) Tshikondeni Coal Mine (bordering on Kruger Park) and Impala Platinum (in close proximity to Pilansberg National Park). There are also some mines near Pilansberg that have been rehabilitated that are now part of the Pilansberg-Madikwe corridor. This proves that subsidised conservation offers the mining industry with a viable opportunity to coexist and cooperate with existing land uses, game farming and conservation. Proposed mining developments should be cautious of proceeding in potential conflicting interest to sustainable nature-based tourism industries in the Waterberg District and should rather embrace the principles of subsidised conservation and integrated self-sustaining tourism development. By using the Manketti Strategy as an example, it is possible that the mining industry can support existing land use and game farming and hunting in the integrated Boikarabelo project area. Existing sustainable nature-based tourism industries in the project area must be supported so that they can function independently from the mining industry after decommissioning and closure.

Integrated self-sustaining nature-based tourism developments will be beneficial to both public and private partners. It can present mining companies with the opportunity to develop and enhance their corporate responsibility index and simultaneously contribute towards local social and environmental development such as employment in the tourism sector, training and environmental awareness opportunities for students and scholars, conservation and local socio-economic development. Integrated planning with other mining companies will also ensure that cumulative impacts are minimised and mitigated. As part of the flora management plan of the Boikarabelo Coal Project, some plants will be saved and relocated and others will be replaced.

The primary long term goal is to create an integrated self-sustaining nature-based tourism industry in the Waterberg area that includes game lodges, hunting activities, abattoir, tour

guiding, environmental education and training and game auctions, amongst others, in areas where current and future mining takes place. Conditional on the effective implementation of the Environmental Management Plan (EMP), monitoring plans and communication between stakeholders, the Boikarabelo Power Station project can support and promote a sustainable legacy in the Waterberg District.

7 ENVIRONMENTAL IMPACT ASSESSMENT

7.1 Project Activities

The main activities which will be undertaken through the construction and operation of the power station were identified. When the power station is decommissioned, the decommissioning activities will be in line with those of the Boikarabelo Coal Mine as it will be undertaken concurrently. The life of operation is dependent on the requirements for power generation of the mine and future surrounding activities.

Table 7-1 is a summary of the main activities that will be undertaken onsite and that have been considered in terms of the impact assessment and the management programme

Table 7-1: Main project activities

Activity	Associated Activities
Construction	
1. Employment	
2. Site Development	Site Clearing
	Topsoil removal and stockpiling
	On site vehicle movement
	Development of access roads
3. Infrastructure Construction	Transportation of infrastructure to site
	Infrastructure storage on site
	Infrastructure assembly and construction including: Ash dump/ construction camp/power station/overhead lines/ pipelines/ storage areas/ water management infrastructure
4. Use of construction camp (temporary)	This will only be utilised for this stage and

Activity	Associated Activities
	removed thereafter.
Operation	
5. 45MW/260MW Power Plant	Utilisation of generators for start-up/backup
6. Demineralisation water treatment plant and storage dam	
7. Ash dump	Including transfer of ash via conveyor from the power station to the dump area
8. Dirty water management system	Directing dirty water into mine dirty water system for reuse
9. Coal supply stockpile	Stockpiling of coal for burning
10. Limestone stockpile	Stockpiling of lime for utilisation
11. Sewage handling	Package plant
12. Waste management	General waste prior to transfer to mine waste handling facility and used turbine oil

7.2 Methodology

In order to clarify the purpose and limitations of the impact assessment methodology, it is necessary to address the issue of subjectivity in the assessment of the significance of environmental impacts. Even though Digby Wells, and the majority of EIA practitioners, propose a numerical methodology for impact assessment, one has to accept that the process of environmental significance determination is inherently subjective. The weight assigned to each factor of a potential impact, and also the design of the rating process itself, is based on the values and perception of risk of members of the assessment team, as well as that of the I&APs and authorities who provide input into the process. Whereas the determination of the spatial scale and the duration of impacts are to some extent amenable to scientific enquiry, the severity value assigned to impacts is highly dependent on the perceptions and values of all involved.

It is for this reason that it is crucial that all EIAs make reference to the environmental and socio-economic context of the proposed activity in order to reach an acceptable rating of the significance of impacts. Similarly, the perception of the probability of an impact occurring is

dependent on previous experience, perceptions, aversion to risk and availability of information.

The impact rating process is designed to provide a numerical rating of the various environmental impacts identified by use of the Input-Output model. As discussed above, it has to be stressed that the purpose of the EIA process is not to provide an incontrovertible rating of the significance of various aspects, but rather to provide a structured, traceable and defendable methodology of rating the relative significance of impacts in a specific context. This gives the project proponent a greater understanding of the impacts of his project and the issues which need to be addressed by mitigation and also give the regulators information on which to base their decisions.

The equations and calculations were derived using Aucamp (2009).

The significance rating process follows the established impact/risk assessment formula:

The significance rating process follows the established impact/risk assessment formula:

Where

Significance = Consequence x Probability

Consequence = Severity + Spatial Scale + Duration

And

Probability = Likelihood of an impact occurring

The matrix calculates the rating out of 147, whereby Severity, Spatial Scale, duration and probability are each rated out of seven as indicated in Table 7-2.

Impacts are rated prior to mitigation and again after consideration of the mitigation measure proposed in the EMP. The significance of an impact is then determined and categorised into one of four categories, as indicated in Table 7-2, which is extracted from Table 7-3.

Table 7-2: Significance rating

Rating	Severity	Spatial scale	Duration	Probability
7	Very significant impact on the environment. Irreparable damage to highly valued species, habitat or eco system. Persistent severe damage.	International The effect will occur across international borders	Permanent: No Mitigation No mitigation measures of natural process will reduce the impact after implementation.	Certain/ Definite. The impact will occur regardless of the implementation of any preventative or corrective actions.
6	Significant impact on highly valued species, habitat or ecosystem.	National Will affect the entire country	Permanent: Mitigation Mitigation measures of natural process will reduce the impact.	Almost certain/Highly probable It is most likely that the impact will occur.
5	Very serious, long-term environmental impairment of ecosystem function that may take several years to rehabilitate	Province/ Region Will affect the entire province or region	Project Life The impact will cease after the operational life span of the project.	Likely The impact may occur.
4	Serious medium term environmental effects. Environmental damage can be reversed in less than a year	Municipal Area Will affect the whole municipal area	Long term 6-15 years	Probable Has occurred here or elsewhere and could therefore occur.

Rating	Severity	Spatial scale	Duration	Probability
3	Moderate, short-term effects but not affecting ecosystem function. Rehabilitation requires intervention of external specialists and can be done in less than a month.	Local Local extending only as far as the development site area	Medium term 1-5 years	Unlikely Has not happened yet but could happen once in the lifetime of the project, therefore there is a possibility that the impact will occur.
2	Minor effects on biological or physical environment. Environmental damage can be rehabilitated internally with/ without help of external consultants.	Limited Limited to the site and its immediate surroundings	Short term Less than 1 year	Rare/ improbable Conceivable, but only in extreme circumstances and/ or has not happened during lifetime of the project but has happened elsewhere. The possibility of the impact materialising is very low as a result of design, historic experience or implementation of adequate mitigation measures
1	Limited damage to minimal area of low significance, (eg ad hoc spills within plant area). Will have no impact on the environment.	Very limited Limited to specific isolated parts of the site.	Immediate Less than 1 month	Highly unlikely/None Expected never to happen.

Table 7-3: Probability Consequence Matrix

Significance		Consequence (severity + scale + duration)								
		1	3	5	7	9	11	15	18	21
Probability / Likelihood	1	1	3	5	7	9	11	15	18	21
	2	2	6	10	14	18	22	30	36	42
	3	3	9	15	21	27	33	45	54	63
	4	4	12	20	28	36	44	60	72	84
	5	5	15	25	35	45	55	75	90	105
	6	6	18	30	42	54	66	90	108	126
	7	7	21	35	49	63	77	105	126	147

Management actions have been assigned for all impacts, irrespective of significance, but the scale of significance serves to focus attention and resources on critical environmental impacts.

7.3 Impact Summary

The following is a summary of the most significant impacts of the proposed Boikarabelo Power Station. The complete Impact Matrix is attached in Appendix P.

7.4 Impact Identification

7.4.1 Topography

Negative impacts change the topography from the current topography to the post-development topography. Neutral impacts assist to minimise the long term effects of the negative impacts on the topography. Positive impacts do not occur as the topography cannot be returned to a state better than the current topography.

7.4.1.1 Construction Phase

The construction phase is characterised by site development and infrastructure construction. This includes site clearing, topsoil removal and stockpiling, development of access roads, development of the power station and the associated infrastructure; and the development of the ash dump. This phase will have negative impacts on the topography. This power station and associated infrastructure is relatively small-scale and will only have a moderate impact on the topography. The ash dump will have a significant negative effect on the topography.

Activity 2: Site development

Site development will change the topography of the study area. Site clearing and the associated removal of vegetation will expose the soil and soil erosion could occur. The topography will change in areas where the topsoil is removed and in areas where the topsoil is stockpiled. Vehicular activity on site will damage the surface of the roads and therefore change the topography. Development of access roads will change the topography by adding features to the surface. The impact is seen of *minor* significance

Activity 3: Infrastructure construction

Vehicular activity for transportation of infrastructure to site will damage the surface of roads and therefore change the topography. Construction equipment and storage on site will temporarily change the topography of the study area. This change will be reversed when construction is complete. Infrastructure assembly and construction will add features to the surface and therefore change the topography of the study area. The construction of water management features will change surface water flow thereby changing the topography. The impact is seen as *moderate* significance.

7.4.1.2 Operational phase

The operational phase is characterised by operation of the power station and associated infrastructure, operation of the dirty water management system, storage of coal and limestone and operational use of the ash dump. The operation of the power station will not impact on the topography. The use of dirty water management systems will change the surface water flow of the study area and surrounds therefore negatively impacting on the topography. The stockpiling of coal and limestone will have a negative impact on the topography. The ash dump will significantly change the surface of the study area and will have a significant negative impact on the topography. The coal and limestone stockpiles and the ash dump will change the drainage lines and affect surface water flow.

Activity 3: Ash dump

Operational use of the ash dump will change the topography of the study area. As ash is added to the ash dump, the shape and size of the ash dump will change therefore changing the topography. The impact is seen of *moderate* significance.

Activity 4: Dirty water management system

The use of dirty water management systems will change the surface water flow of the study area and surrounds and therefore impact on the topography. The impact is seen of *moderate* significance.

7.4.1.3 Decommissioning

During decommissioning of the operation it will be essential to establish a topographical plan in order to establish what the final topography will be. During the rehabilitation process it could result in either the lowering or heightening of areas. Depending on whether areas are heightened or lowered then that natural topography it will result in associated impacts which

will need to be managed. If such alteration in the topography occurs it will result it will impact on the success of achieving the desired land capability during the post closure phase

7.4.2 Soil and land capability

7.4.2.1 Construction phase

Activity 2: Site Development

The stripping of top and sub-soil means total destruction of the natural occurring soil horizons. Soils that have been stripped can never be replaced in their original state due to the alteration of physical, chemical and biological soil properties during removal and stockpiling. Stockpiling influences soil properties negatively while the duration of the soil stockpiling in addition, causes soil deterioration, especially soil biological quality.

7.4.2.2 Operational phase

Activity 8: Waste Management

Poor management of waste can result in soil contamination. Due to the expected low volumes of waste generated by the power station the probability of contamination via hydrocarbons is low. Spillage of general waste such as the ash could unnecessarily impact on the soil, however as ash will be stored in a prepared area and transported via convetour this the probability of such an impact would be low.

7.4.3 Flora and fauna

7.4.3.1 Construction phase

During the construction phase the majority of the negative impacts expected to occur with the construction of such a facility will occur, however this impact is seen to be minimal as the area would have already been disturbed by the construction of the mining operation surrounding the power station.

Activity 2: Site Development

Topsoil removal and vegetation removal will result in complete loss of habitat at all three sites assessed. The existing vegetation will be removed to facilitate the construction of the ash dump, Power Station and construction area and other related infrastructure.

The partial degradation of natural vegetation and habitat for animal life has already taken place within the surrounding environment due to current land use practices however, the destruction of the areas with undisturbed natural savanna will result in the permanent reduction of natural habitat of reptiles, birds, frogs, insects and mammals present within these areas. The grassland and surrounding vegetation offers habitat to certain birds, reptiles, frogs, insects and mammals that could be present. The impact will be site specific in extent with impacts likely to occur on site. The severity of the impact for the Boikarabelo Project as a whole was determined to be serious, but the impact for power station is incremental.

Activity 3: Infrastructure Construction

Construction will involve increased activity on site. This will involve transportation of materials to site and infrastructure assembly and construction at the three sites assessed. Increased activity will result in disturbance of the natural environment. Increased human activity, dust generated by vehicular movement, noise and pollution will cause further disturbance and damage to the areas of focus and their immediate surrounds. The use of the existing informal roads which will result in further exposure of non-vegetated areas increasing the potential for erosion and sedimentation during rainfall periods. The increase in vehicle numbers will also increase the potential of spillages and leaks from operating vehicles which will have a negative impact on vegetation growth and even rehabilitation. Dust created during activity could have a detrimental effect on plant evapotranspiration. Noise will disturb animal activity. This activity is considered to be on going through the life of operation and long term in duration and also local with regards to extent of impacts. The severity of the impact was determined to be moderate to high.

Activity 4: Use of Construction Camp

The use of the construction camp will not be long term, however the impacts will be similar to these of Activity 3 - Increased human activity, dust generated by vehicular movement, noise and pollution will cause further disturbance and damage to the areas of focus and their immediate surrounds. Vehicle use will increase the potential of spillages and leaks from operating vehicles which will have a negative impact on vegetation growth and even rehabilitation. Dust created during activity could have a detrimental effect on plant evapotranspiration. Noise will disturb animal activity. This activity is considered to be short term and therefore the severity of the impact was determined to be moderate.

7.4.3.2 Operation

Activity 1: Power Plant

Use of generators

Generators will create a noise disturbance. This will have a negative effect on the surrounding wildlife.

Activity 3: Ash Dump

The location of the ash dump is in an area of poor ecological health. The ash dump construction and operation will mean that the habitat will be completely removed and destroyed in this area. The effect will be a loss of remaining biodiversity and a loss in the ecosystem services provided by this portion of bushveld. Impacts of the ash on the surrounding area are not yet known since the ash is still to be classified. The severity of this impact is regarded to be moderate.

7.4.3.3 Decommissioning

The decommissioning activities of the power plant when it is decommissioned will be in line with that of the mine as it will be undertaken concurrently. The life of operation is dependent on the requirements for power generation of the mine and future surrounding activities.

7.4.4 Hydrology

The project site is located within the Matlabas catchment (A41E) of the Limpopo River WMA, where there are limited water resources and the Limpopo River serves as a main source of water. There are no significant dams in this catchment, and the surface water resources are marginal due to the erratic surface water flow. Therefore the surface water quality is likely to be influenced in general by:

- Mining and industrial operations;
- Diffuse pollution from agricultural activities, and
- Pollution from human settlements in urban, rural and informal areas.

The major surface water risks within the catchment are:

- Formation of AMD and subsequent increase in TDS (especially SO_4) and heavy metals in solution;
- Siltation of streams and deterioration of in stream conditions;
- The contamination of the limited surface runoff by the mining activities, could affect the clean groundwater resources, which form the bulk of water use in this catchment, and
- There could be high positive impact by restoring the runoff to the catchment during the post closure phase of mining once all rehabilitation is complete and pre-mining conditions are restored.

7.4.4.1 Construction phase

During the site development access roads will be constructed resulting in increased soil erodibility and dust formation. This could potentially cause siltation of the surface water resources due to the dust deposition in valleys (such as non-perennial streams, pans and wetlands) that may occur in and around the greater Boikarabelo Project area. Furthermore the hard area used for construction would be isolated by means of topsoil berms that are vegetated reducing the impacts to surface water resources. The construction vehicles could impact negatively on surface water resources should there be spillage (e.g. an overturned truck) of hydrocarbon containing material. Small spillages of hydrocarbon containing material would not be significant as an impact but could prove significant over time by accumulation.

The removal of topsoil will increase the erosion potential of the soil, thereby leading to siltation and consequent reduction of the volume of water in the catchment area.

The construction of storm water diversion berms will lead to the diversion in the flow of runoff, thereby affecting quantities reporting to the catchment. This activity will also result in the separation of clean and dirty water thereby preventing contamination of the clean water resources. The stockpiling of topsoil will increase the possibility of siltation from erosion and dust deposition thereby leading reduction in the volume of water reporting to the catchment area.

7.4.4.2 Operational phase

Hydrocarbon contamination of the surface water resources may be caused by diesel and oil spillages. The impacts associated with hydrocarbon contamination range from pollution of dirty water which could be re-used, to infiltration of the groundwater system.

The placement and management of the coal stockpiles can impact on the surface water if the stockpiles are not placed on hard park area and isolated by means of trenches to contain the dirty water associated with them and diversion berms to allow the clean water to report to the clean catchment.

Operation of the ash dump may impact on the water quality if not located in isolation away from clean water resources, with drainage systems to capture seepage and prevent its mobilization into the soil and subsequently into the groundwater system, with channels to divert dirty runoff to the mine dirty water management system.

Storage of hazardous waste can result in the contamination of surface water resources through waste material falling onto surface water resources seepage, leakages or spillages from the hazardous waste storage and removal.

The improper operation of sewage facilities may result in contamination of the clean water resources in the catchment area, thereby reducing the quality of the water.

7.4.4.3 Decommissioning

The removal of power station infrastructure post mining activities should be undertaken during the dry season preferably. Typical impacts on the surface water resources could include:

- Storm water runoff leading to siltation;
- Contamination of clean water from leakage or seepage of waste material, and
- Hydrocarbon contamination from vehicular activity.

7.4.5 Hydrogeology

7.4.5.1 Construction phase

No impact on the groundwater quantity is expected during the construction of the process plant so long as the activities are taking place above the water table. If a construction area is low-lying and is below the water table, filling of the low-lying area with soil is recommended

as part of the site clearing to ensure that the operation takes place above the groundwater table.

However, diesel or other organic fluids and inorganic solvents might be spilled on the ground surface, or leak from surface or underground storage tanks. This could have the potential of impacting the groundwater quality negatively. As the water table in the project area is fairly deep, however, it is unlikely that the spilled organic compounds will reach the groundwater and contamination will be restricted to the unsaturated zone.

Depending on the degree of a spillage, the impact of the process plant on the groundwater quality is expected to be low.

7.4.5.2 Operational phase

Seepage from the ash disposal site and coal stockyards could potentially influence the groundwater quality in the underlying aquifers during the operation phase and as such the significance is rated as high (before mitigation).

Organic solvents, diesel or other organic fluids may also be spilled on the ground surface or leak from storage tanks during the operation of the process plant. Unlike the construction phase, this could occur over a longer period of time and could have the potential of impacting the environment negatively. Although the depth of the water table in the project area is fairly deep, if the release of contaminants takes place over a prolonged period of time they could reach the groundwater or contaminate a considerable position of the unsaturated part of the subsurface. Due to the high temperature of the area and volatile nature of the organic compounds, the vapour plume of the contaminants could be large as compared to the areal extent of the process plant.

7.4.5.3 Decommissioning phase

The closure phase is characterised by the decommissioning of the power plant and dewatering programmes.

All decommissioning activities at the power plant are expected to take place above the water table and will have low environmental significance. Due to the relatively short period of the decommissioning phase, any spillage of hydrocarbons on this stage is expected to volatilise even before reaching the groundwater.

7.4.5.4 Post-closure phase

No environmental impact is expected from hydrocarbon releases after the plant closure. However, residual impacts in the form of contamination from spillage incidents during the operational phase may still exist and continuous monitoring during the post-closure phase is important.

Seepage from the ash dump will continue even after mine closure and can have a high impact on the environment. However, the impacts are expected to decrease overtime as the amount of salts within the ash will decrease with the decommissioning of the ash disposal. A

pozzolanic layer may also form on top of the ash dams, thus minimising infiltration from rainfall.

7.4.6 Noise

To assess whether the noise from the proposed power station will impact on the relevant receptors the inverse square law is used, which states that the intensity of sound is inversely proportional to the square of the distance from the source (F.Alton Everst. 1994). The inverse square law concludes that for every doubling of distance away from the noise source the sound decreases by 6dB. The formula used to calculate the SPL at a known distance away from a noise source is:

Lp(R2) = Lp(R1) – 20 log 10 (R2/R1)

Where:

Lp (R1) = Sound Pressure Level at the initial location

Lp (R2) = Sound Pressure Level at the new location

R1 = distance from the noise source to the initial location

R2 = distance from the noise source to the new location

An increase of about 8−10 dBA is required before the sound subjectively appears to be significantly louder (Brüel & Kjær, 2001).

7.4.6.1 Construction phase

It is assumed that construction activities will only take place during daylight hours. The following activities during the construction phase are identified as possible noise sources and may impact on the ambient noise level of the area:

- Site development:
  - Site clearing;
  - Topsoil removal and stockpiling;
  - Construction of ash disposal facility;
  - On-site vehicle movement; and
  - Development of access roads.
- Infrastructure construction:
  - Transportation of material to site; and
  - Infrastructure assembly.

The construction machinery will be a source of continuous noise throughout the construction phase.

Table 7-4 represents the typical noise levels generated by a construction site

Table 7-4: Typical noise levels generated by a construction site

Noise source	Typical operational noise level at given offset (dBA)							
	100m	250m	500m	800m	1000m	1500m	2000m	2500m
Construction site	64	56	49	44	41	36	32	29

Calculations using the inverse square law, to predict what the noise levels will be at the relevant receptors can be seen in Table 7-5. According to the predicted noise levels of the construction machinery will not measure above the SANS 10103:2008 noise limit guidelines for rural or residential areas at the relevant receptors. The predicted noise levels will also not measure above the baseline levels at each relevant receptor, therefore the noise from the construction machinery will not impact on the relevant receptors during the construction with regards to annoyance or impeding speech communication.

Table 7-5: Calculated increase in the ambient noise level for the construction phase

Sampling Point	Baseline noise measurement dBA (Daytime).	Distance from proposed power station (m)	Activity	Calculated noise level from activity at specific receptor dBA (Daytime).	Difference between calculated and baseline ambient noise level dBA (Daytime).
RGN1	40	5700	Construction machinery	22	NA
RGN2	40	6000	Construction machinery	21	NA
RGN3	40	5000	Construction machinery	23	NA
RGN4	40	3700	Construction machinery	29	NA

7.4.6.2 Operational phase

The equipment which will be responsible for the power generating activities will be a source of continuous noise throughout the operational phase. Table 7-6 represents the predicted noise levels generated by the power station.

Table 7-6: Predicted noise levels generated by the power station.

Noise source	Predicted operational noise level at given offset (dBA)					
	100m	200m	400m	800m	1600m	3200m
Construction site	55	49	43	37	31	25

Calculations using the inverse square law, to predict what the noise levels will be at the relevant receptors can be seen in Table 7-7. According to the predicted noise levels of the power station will not measure above the SANS 10103:2008 noise limit guidelines for rural or residential areas at the relevant receptors. The predicted noise levels will also not measure above the baseline levels at each relevant receptor, therefore the noise will not impact on the relevant receptors during the operational phase with regards to annoyance or impeding speech communication.

Table 7-7: Calculated increase in the ambient noise level for the operational phase.

Sampling Point	Baseline noise measurement dBA (Daytime / Night time).	Distance from proposed power station (m)	Activity	Calculated noise level from activity at specific receptor dBA (Daytime / Night time).	Difference between calculated and baseline ambient noise level dBA (Daytime / Night time).
RGN1	40 / 30	5700	Power Generation	20 / 20	NA
RGN2	40 / 30	6000	Power Generation	21 / 21	NA
RGN3	40 / 30	5000	Power Generation	23 / 23	NA
RGN4	40 / 30	3700	Power Generation	26 / 26	NA

According to the findings it can be seen that the noise emanating from the activities during the construction and operational phase will not measure above the existing baseline levels as well as the SANS guideline levels (for rural districts). The proposed power station is also located within the existing mining right area of the proposed Boikarabelo Coal Mine, thus situated within an existing industrial zoned area. The noise levels emitted into the immediate area, would therefore have to comply with the SANS guideline limits for industrial districts

7.4.7 Visual

This describes the change in the visual character of the landscape due to the physical presence of the development. The impact can be described as moderate to high.

7.4.7.1 Construction phase

Activity 2: Site development

With the clearing of the natural vegetation the landscape will become more visible. Trees and Bushveld which formerly screened views will be removed thus enhancing visibility. Construction materials, activity and infrastructure will be increasingly visible.

Activity 3: Infrastructure Construction

The development of infrastructure including access roads, transportation and traffic associated with labour machinery and other materials, earthwork, excavation and other construction phase activities associated with erecting the power station stacks will affect the visual receiving environment for all route and substation options.

Activity 4: Use of Construction Camp

The activity and construction associated with the construction camp use will affect the visual receiving environment however, this will be for a limited period only.

There are very few, if any, mitigation measures that can be carried out to mitigate the visual impacts experienced by the environment during construction phase; labour and building materials need to be transported on suitable roads and the erection of towers along the route chosen will need to be carried out to specific standards so the means for doing these things cannot be changed.

7.4.7.2 Operational phase

Activity 5 & 7: Power Station & Ash Dump

The receiving environment will be negatively affected by the presence of the ash dump & stack. The landscape character will be altered, the overall visual resource of the areas will be reduced and the receptors will be able to see the development. The landscape character will be changed from natural Bushveld to semi - industrial. This is expected to be a significant impact.

Again, as with the construction phase, there are no mitigation measures that will make a substantial difference to how the maintenance is carried out and, consequently, how the receiving visual environment will be affected. Maintenance requires travel to and from the transmission lines and substation and this will be defined by the most suitable road/route.

7.4.8 Decommissioning

The visual impact will decrease during the decommissioning phase as the power station will be removed. In the event that the ash dump is not reused, the vegetation of the dump will assist with the blending of it with the surrounding environment. The decommissioning activities will have a positive effect on the visual aesthetics of the area.

7.4.9 Air Quality

7.4.9.1 Results and Discussion - Preamble

All relevant averaging periods were modelled for pollutants of concern. In order to present the results in as succinct a manner as possible some averaging periods have not been included in the maps herein where it is clear that the ambient limits are not transgressed. In all instances the worst case scenario has been presented to demonstrate the highest predicted impact.

It is important to note that highest period-averages (i.e. highest hourly-average and highest 24-hour-average) presented in the maps are indicative of the highest expected concentrations for the period-average for the modelled year at each position in the modelled domain, and must not be interpreted as being representative of general conditions. The intent of the maps is to conservatively present the worst case scenario for those averaging periods.

Frequency of Exceedance (FOE) maps indicate the number of times in a year that a limit is predicted to be exceeded for a particular period-average.

It is important to note that the ambient limits applied are those for 2015 which are more stringent than the limits which currently apply. Also note that emissions modelled do not take into account the legislated requirement for all listed activities to meet the GN 248:2010 emission limits by 31 March 2015, the background emissions are thus conservatively high if considering post 2015 impacts. SO_2 emissions from the Matimba power station already meet the 2015 emission standards.

Overall the results indicated the ambient concentration impacts from the proposed power plant are limited to the site boundary for the emissions regime modelled. The PM_{10} FOE exceedances resulting from entrainment of the mine's unpaved roads are mostly limited to the site boundaries and the main artery road to the site. Emissions from background sources are predicted to have a significant impact on ambient SO_2 concentrations at the site and surrounds, thus constraining the ambient headspace available for impact of emissions from the proposed plant.

7.4.9.2 Preamble Nitrous Oxides

It must be noted that NO_x represents all oxides of nitrogen species. NO_x gases are comprised of chemical species other than NO_2 which is typically in the order of only 5-10% of NO_x emitted from combustion sources. The primary NO_x constituent of these off gases is typically NO (approximately 90% to 95%). NO will eventually be oxidised to NO_2 in the atmosphere, and the rate of conversion is dictated by the kinetics of reaction in the atmosphere. The downwind concentration of NO_2 from the source is thus generally over-estimated by assuming that all NO_x emissions are NO_2 (various sources – Cooper et al, Yu et al, Hori et al). The implication is that the modelled results have over predicted the NO_2 ambient concentration and the true ambient concentration (for both the existing and future expansion scenarios) of NO_2 is significantly less than that which has been predicted and likely to be well within the limits stipulated for NO_2 ambient concentration (as per GN 1210: 2009). FOE maps are not presented for NO_x as the ambient standard is for NO_2.

7.4.9.3 Proposed Power Generation

The impacts of emissions from the proposed power plant alone are considered here. There are 5 proposed locations for the power plant. The proposed plant will meet the emission limits for a new plant in terms of subcategory 1.1 of GN 248:2010. It can be seen from the modelled predictions that the impact of the plant is not expected to be significant outside of

the site boundaries. There are no exceedances of the ambient air quality limits outside the site boundary. Predicted exceedances of SO_2 and NO_x 1-hr averages are limited to the site and are well within the allowable FOE. There are no predicted exceedances of the 24-hr and annual ambient air quality limits. Annual emissions were not plotted as they showed no exceedances for the area of interest.

7.4.9.3.1 PM_{10}

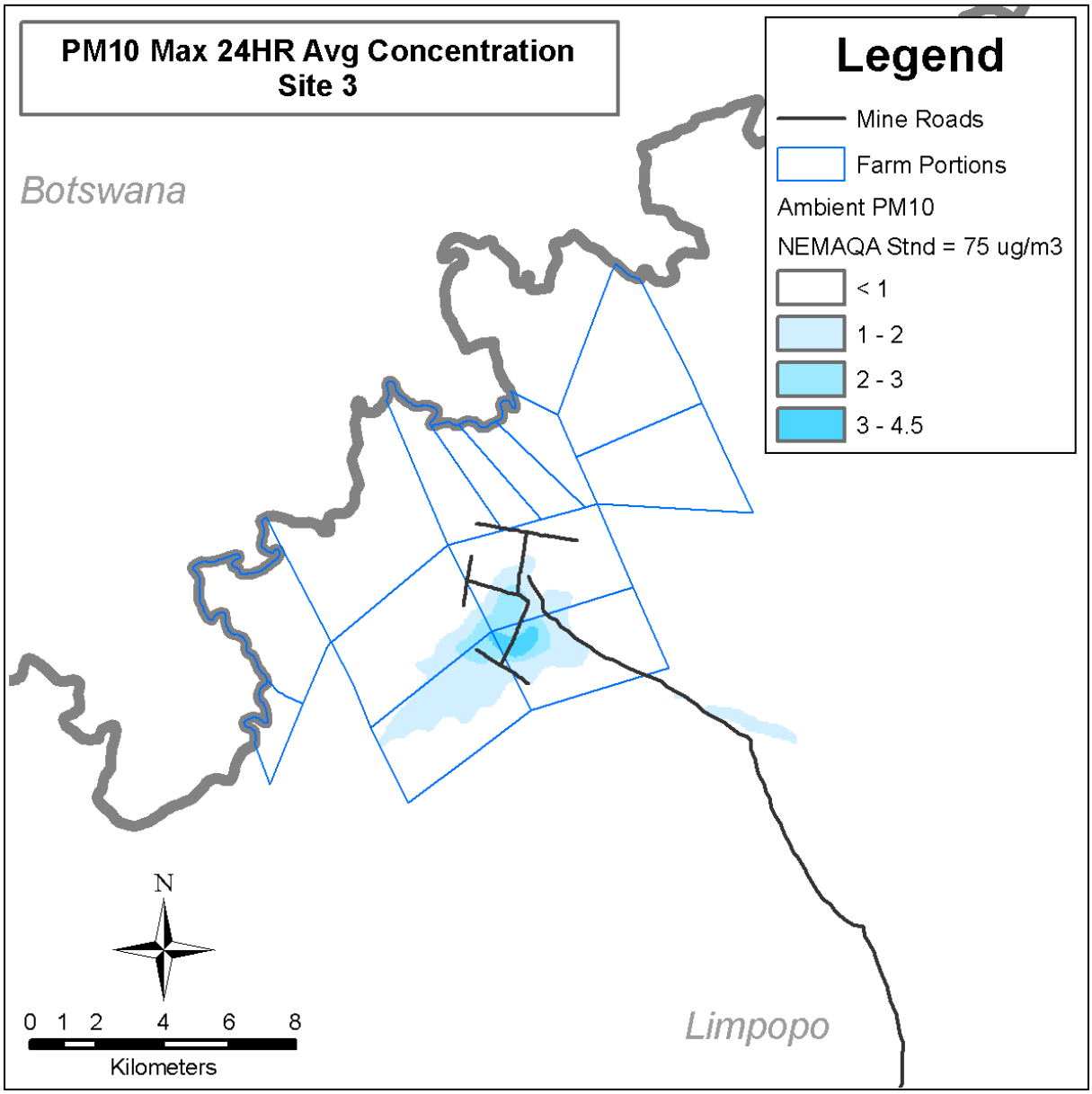


Figure 7-1: Maximum 24 hour average PM_{10} ambient concentrations from the proposed power generation

No exceedances of PM_{10} ambient concentration limits are predicted, onsite or offsite, from the proposed plant.

7.4.9.3.2 SO_2

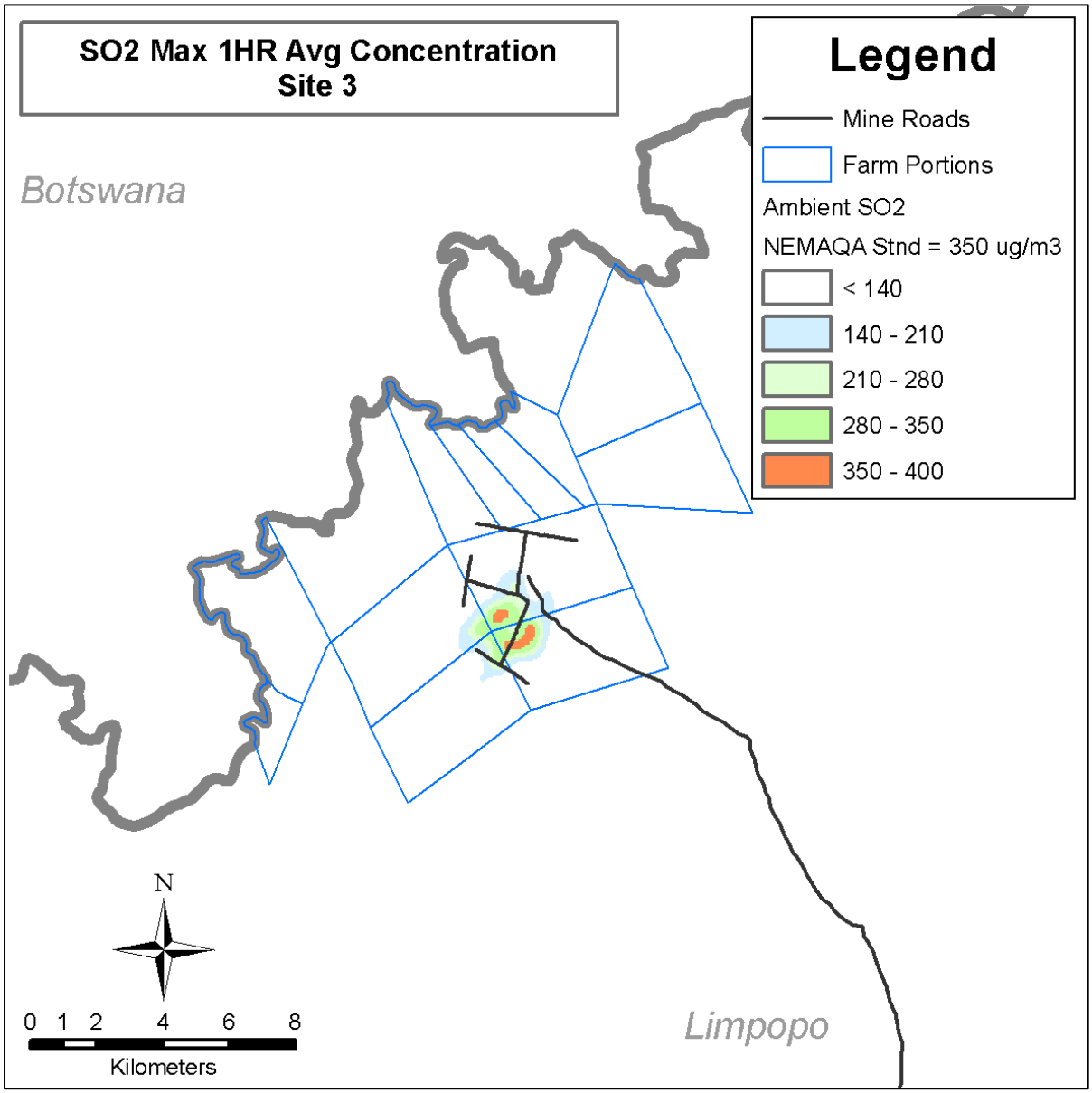


Figure 7-2: Maximum 1 hour average SO_2 ambient concentrations from the proposed power generation

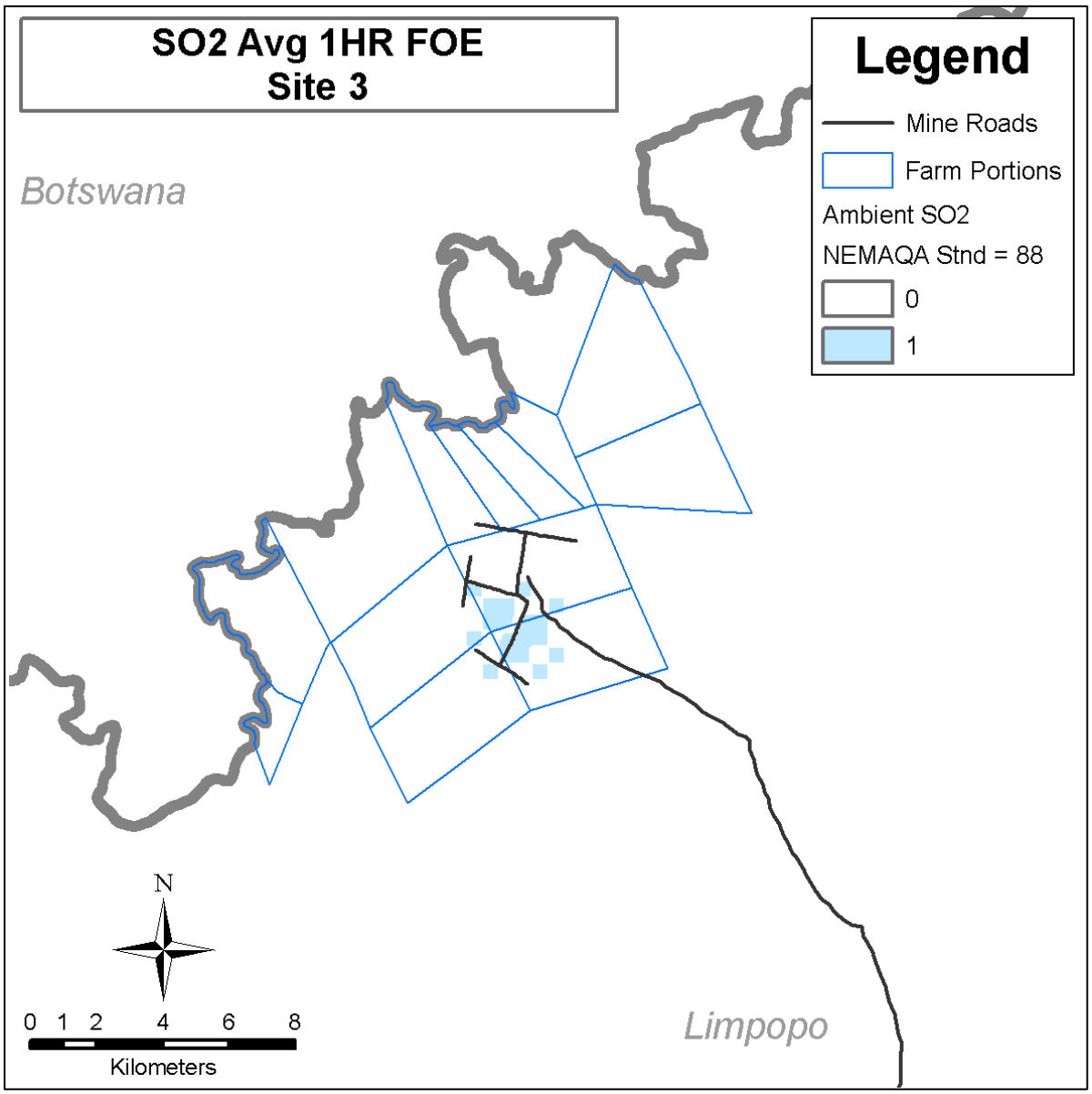


Figure 7-3: Frequency of exceedances of the maximum 24 hour average SO_2 ambient concentration limits from the proposed power generation

While there are some SO_2 ambient limit exceedances predicted due to emissions from the proposed plant these are contained within the site boundaries. Maximum frequency of exceedance is well below the standard limit of 88.

7.4.9.3.3 NO_x

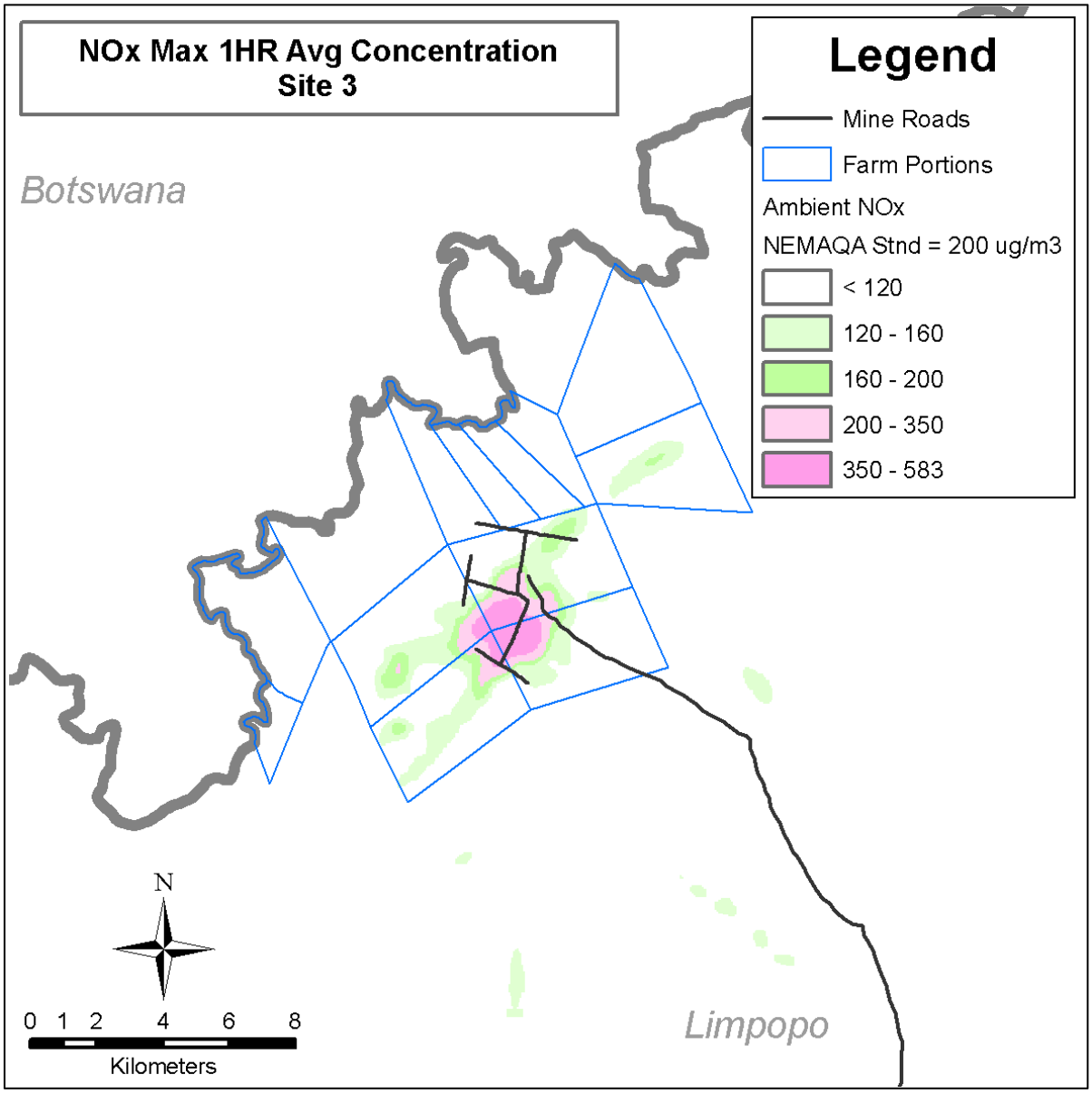


Figure 7-4: Maximum 1 hour average NO_x ambient concentrations from the proposed power generation

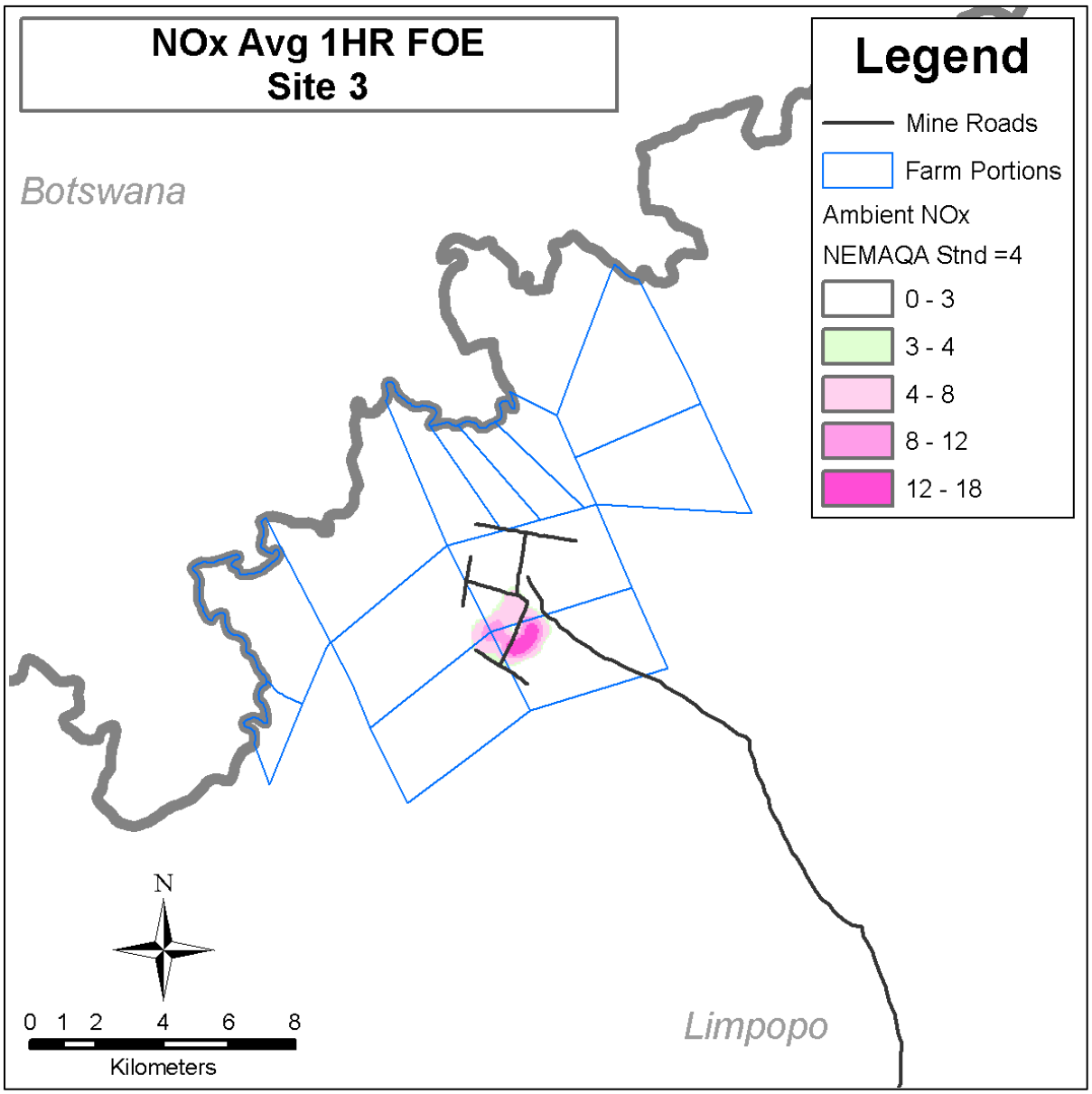


Figure 7-5: Frequency of exceedances of the maximum 1 hour average NO_x ambient concentration limits from background sources

As with the SO_2, the proposed plant is expected to cause exceedances of NO_x ambient concentration limits but limited to within the site boundaries. Maximum frequency of exceedance is 18, well below the standard limit of 88. This, coupled with the fact that only a very small fraction of NO_x is present as NO_2, the ambient impact of NO_x emissions do not look like it will be of great concern.

7.4.9.4 Baseline

The primary pollutant of significance from the mining operations, as relates to the proposed power plant, is PM_{10}. There are no reported potentially significant sources of SO_2 and NO_x from the site.

The baseline emissions consist of the road emissions from the Boikarabelo mine works which are expected to be the most significant contributor to the overall PM_{10} impact from the mining operations. It was assumed that 90% palliation is applied to the unpaved roads.

Exceedances of the PM_{10} 24-hr FOE limits are largely contained within the site, however exceedances are also predicted for the primary road joining the mine to the Railway siding area for the Lephalale railway line. Annual emissions were not plotted as they showed no exceedances for the area of interest.

7.4.9.4.1 PM_{10}

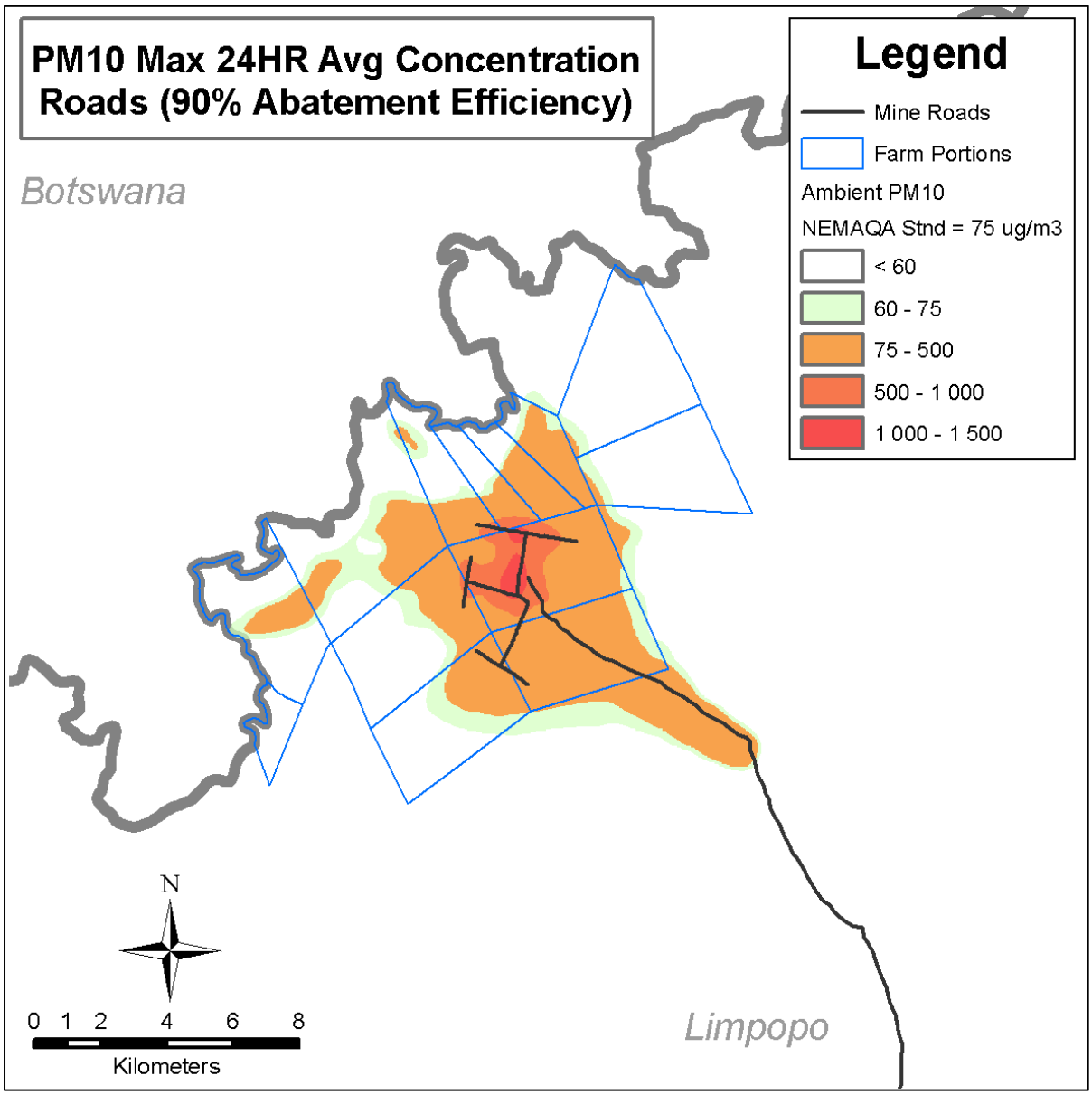


Figure 7-6: Maximum 24 hour average PM_{10} ambient concentrations from unpaved road sources

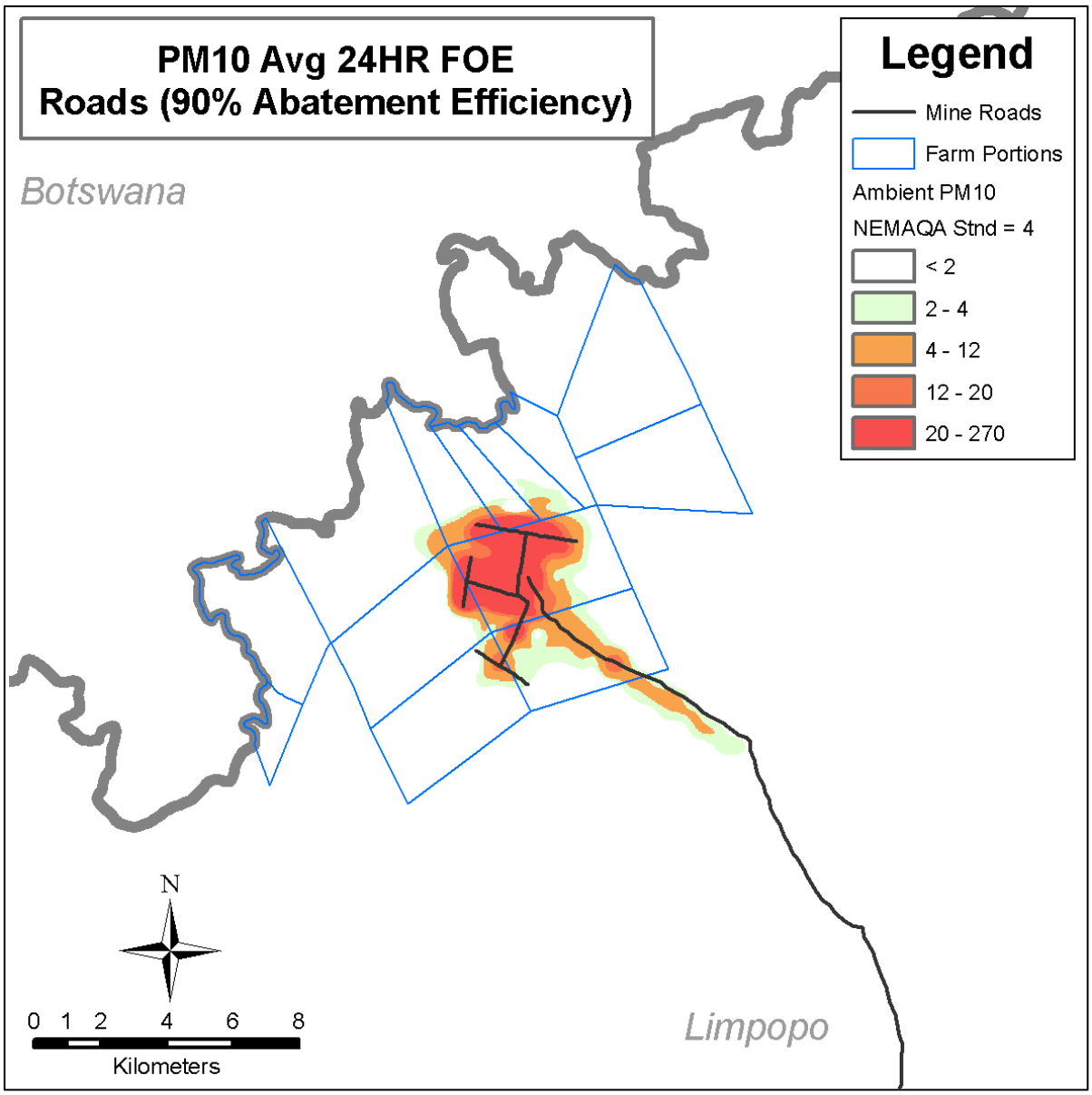


Figure 7-7: Frequency of exceedances of the maximum 24 hour average PM_{10} ambient concentration limits from unpaved road sources

7.4.9.5 Background

Modelled Background SO_2 emissions have a significant impact on local ambient SO_2 concentrations (particularly in relation to the ambient hourly averaging limits). Modelled PM_{10} and NO_x from background sources are well within the ambient air quality limits in the area of interest.

All frequencies of exceedance for ambient SO_2, NO_x, and PM_{10} concentrations within the area of interest are however below the regulated limits. Annual emissions were not plotted as they showed no exceedances for the area of interest.

This influence will be greatly reduced with the implementation of the 2020 emission requirements for existing sources.

7.4.9.5.1 SO_2

Modelled results indicate significant ambient 1hr-average SO_2 concentrations in proximity to the proposed plant location. The ambient limit for SO_2 is exceeded within the mine boundary; however the highest frequency of exceedance in the area of interest is 12, which is below the limit of 88 allowable exceedances per annum.

Modelled results indicate significant ambient 24hr-average SO_2 concentrations in proximity to the site, however the ambient 24-hr limit for SO_2 is not exceeded at the site.

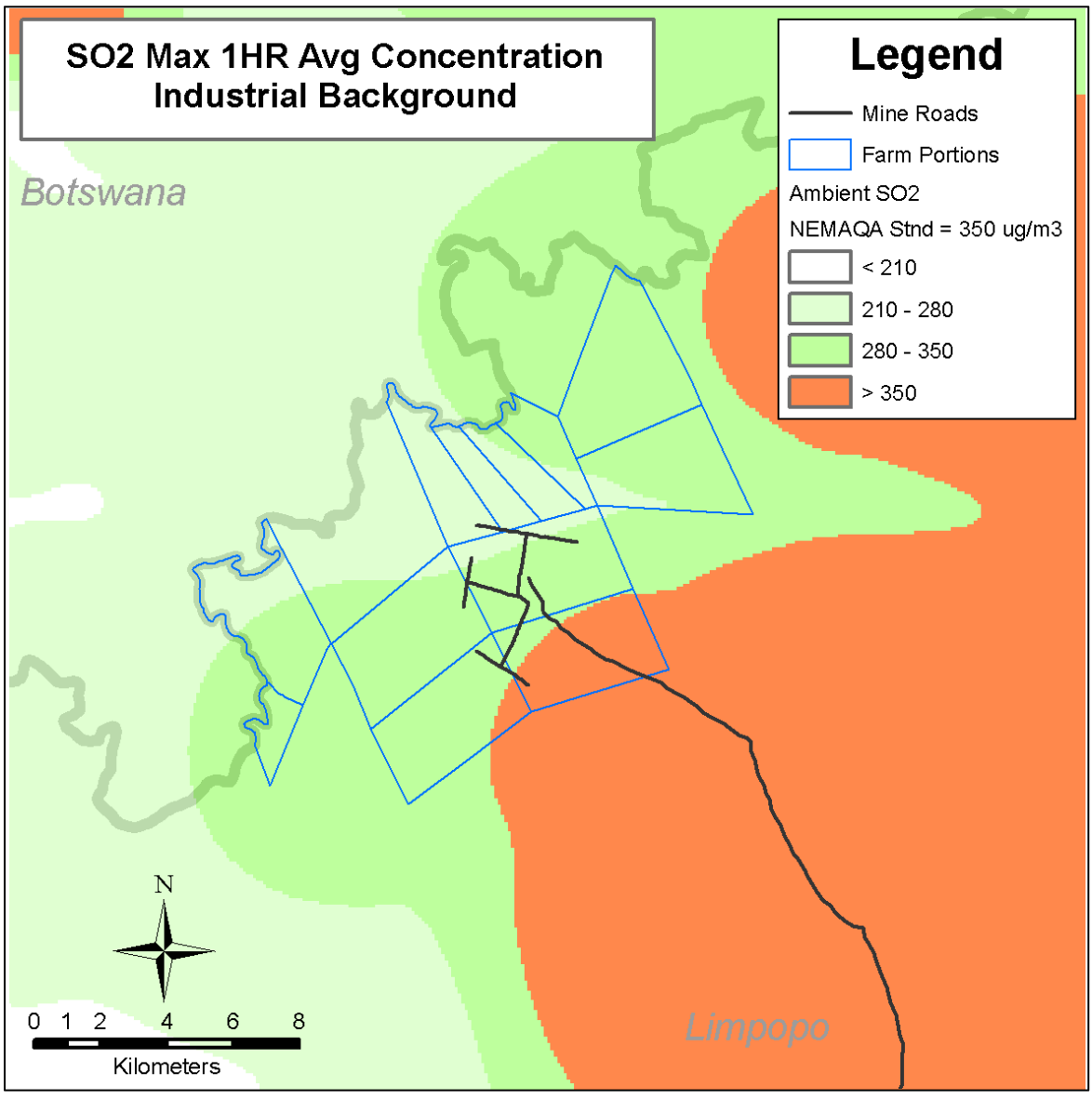


Figure 7-8: Maximum 1 hour average SO_2 ambient concentrations from background sources