

# CoAL of Africa

## GREATER SOUTPANSBERG PROJECT

### Chapudi Project Final Report

#### Macro and Micro-Economic Impact Analysis of the Coal of Africa Chapudi Project located near Makhado within the Vhembe District Municipality

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**09 December 2013**



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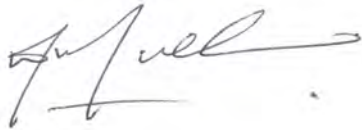
**\* Macro-economic Analysis \* Regional & Sectorial Analysis\* Cost-Benefit Analysis**

This document has been prepared by Mosaka Economic Consultants cc trading as Conningarth Economists.

Name of Project: Greater Soutpansberg – Chapudi Project.

Report Title: Macro and Micro-Economic Impact Analysis of the Coal of Africa Chapudi Project located near Makhado within the Vhembe District Municipality.

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## ACRONYMS

<b>Term/Abbreviation</b>	<b>-</b>	<b>Meaning</b>
AU	-	Animal Unit
BCR	-	Benefit Cost Ratio
CBA	-	Cost Benefit Analysis
CoAL	-	Coal of Africa Limited
DAFF	-	Department of Agriculture, Forestry and Fisheries
DMR	-	Department of Mineral Resources
DMS	-	Dense Medium Separation
DWA	-	Department of Water Affairs
EIA	-	Environmental Impact Assessment
EMP	-	Environmental Management Programme
FEL	-	Front End Loader
FOB	-	Free on Board
GAP	-	Good Agriculture Practice
GDP	-	Gross Domestic Product
GOS	-	Gross Operating Surplus
HCC	-	Hunters Valley Coking Coal
IRR	-	Internal Rate of Return
LOM	-	Life of Mine
MEIM	-	Macro-Economic Impact Model
MRA	-	Mining Right Application
MT	-	Million Tonnes
NPV	-	Net Present Value
RBCT	-	Richards Bay Coal Terminal
RLT	-	1Rapid Load-out Terminal
ROM	-	Run-of-Mine
SAM	-	Social Accounting Matrix
SSCC	-	Semi Soft Coking Coal
TFR	-	Transnet Freight Rail
WIM	-	Water Impact Model
WARMS	-	Water Use Authorisation and Registration Management System
WRC	-	Water Research Commission

## GLOSSARY OF TERMS

**Gross Margin** of an enterprise is the gross production value less directly allocatable variable cost. It is expressed on a per hectare or livestock unit basis and is a very useful tool for the financial planning of agricultural projects.

**Animal Unit (AU):** Is a technique to express different sizes of animals in similar equivalents. A live mass of 500 kg is normally accepted as one AU.

**Animal Unit (AU):** Is used to calculate the amount of pasture space and animal feed necessary for a group of livestock. An AU is normally defined as one mature cow weighing about 1,000 pounds (450kg) with or without her unweaned calf.

**Carrying Capacity:** Refers to the grazing potential of pastures or for natural grazing. It is expressed as number of hectares required per AU.

**Weaner:** Refers to a beef cattle calf that has recently been weaned. Calves are normally weaned at an age of seven to eight months.

**Enterprise Budgets:** A system introduced by Departments of Agriculture to compile gross margins for agricultural enterprises.

## EXECUTIVE SUMMARY

The primary objective of this macro-economic study is to determine the nature and magnitude of the economic and socio-economic impacts that will result from the proposed Greater Soutpansberg Chapudi Project.

The overall conclusion is that the project will be very beneficial to the provincial and national economies; however, some negative impacts can be experienced in the project area as far as the current economic activities are concerned.

The current economic activities in the area include a game farming industry which is very active with large investments made in acquiring and breeding trophy and rare animals and providing upmarket accommodation facilities to hunters and eco-tourists. The dominating land use activity in the area is game farming, representing approximately 87% of the total area. In the past beef farming was dominant but has since been replaced by game farming. Extensive irrigated vegetable production is present in the areas bordering the Sand River. The area has the advantage of mild winters; virtually a frost free production area with the fresh produce market being a major outlet for the fresh produce.

The study has been divided into the following sections which were investigated separately and eventually integrated in order to come to a conclusion and make a recommendation:

- The quantification of the Current Local Economic Activities in the project area and the possible impact of the mining activities in the short, medium and long term,
- The determination of the Economic Viability of the mining project from a governmental and societal viewpoint, this is done by using two economic tools, namely:
  - Economic Cost Benefit Analysis, incorporating possible negative impacts to the local economic activities, natural environment, social structures and rehabilitation costs, where identified by the other project studies.
  - Macro-economic Impacts of the Mining Project, estimating the projected impacts on the Gross Domestic Product, Employment, Payments to Households, Capital Formation, Payments to Fiscus and Impact on Balance of Payments.

### Current Local Economic Activities

The following Current Economic Activities have been identified as being present in the area:

- Live Stock Farming.
  - Commercial Cattle.
- Game Farming.
  - Live Sales.
  - Hunting, sub-divided into “Trophy” and “Biltong”.
    - Trophy hunting - including the services like professional hunter, skinner, tracker, etc.
    - Biltong hunting - including the services of trackers, skimmers, etc.
  - Hunting Accommodation.
- Eco-Tourism.
- Irrigation.

The approach followed was to first establish the current activities in the area which then formed the baseline used to draw up a risk profile<sup>1</sup> in order to calculate the projected impacts and lastly convert it to macro-economic parameters. However, as so often happens, the economic benefits accruing from the mining project could put a negative burden on the current local economic activities in the project area. For purposes of the study the area was divided into three sub-areas, namely; the project area east of the Sand River which includes the Wildebeesthoek Section and the Chapudi Section and the area west of the Sand River referred to as Chapudi West Section.

The following table presents a summary of the current land use in the project area.

Land Use	Wildebeesthoek		Chapudi		Chapudi West		Total	
	Percentage	Hectares	Percentage	Hectares	Percentage	Hectares	Percentage	Hectares
Irrigation	0.5%	51	1.4%	213	2.2%	274	1.4%	<b>537</b>
Beef Game	14.0%	1 566	12.1%	1 819	10.8%	1366	12.2%	<b>4 750</b>
Game	85.5%	9 568	86.5%	12 998	87.0%	11 008	86.4%	<b>33 574</b>
<b>Total</b>	<b>100.0%</b>	<b>11 185</b>	<b>100.0%</b>	<b>15 029</b>	<b>100.0%</b>	<b>12 648</b>	100.0%	<b>38 862</b>

The following table gives an indication of the magnitude of the current activities in the project area.

	Annual Income	Annual Income	Annual Income	Annual Income
	Wildebeesthoek	Chapudi	Chapudi West	Total
	Rand mil.	Rand mil.	Rand mil.	Rand mil.
Beef Farming	R 0.40	R 0.46	R 0.49	R 1.36
Game Farming – Animals (Turn Over)	R 2.35	R 3.33	R 3.19	R 8.87
Hunting	R 3.32	R 3.75	R 0.68	R 7.75
Eco-Tourism	R 10.19	R 6.72	R 3.10	R 20.02
Irrigation	R 10.51	R 47.35	R 64.22	R 122.07
<b>Grand Total</b>	<b>R 26.78</b>	<b>R 61.61</b>	<b>R 71.68</b>	<b>R 160.07</b>

The table shows that irrigation and game farming with the related activities such as accommodation are by far the largest income generators in the area representing 90% of the total annual estimated turnover of R160.07 million, expressed in 2013 prices.

In the following table the total economic activities for the three farming areas identified and analysed are expressed in terms of GDP and employment opportunities.

<sup>1</sup> The Risk Analyses of Wildebeesthoek, Chapudi and Chapudi West Section farms are available in Appendix D.

	Gross Domestic Product			Employment			Payments to Households		
	Direct R mil.	Indirect/ Induced R mil.	Total R mil.	Direct Number	Indirect/ Induced Number	Total Number	Total R mil.	High/ Medium R mil.	Low R mil.
Irrigation	64.29	65.33	129.62	737	335	1 073	47.61	38.23	9.38
Beef Farming	1.28	0.56	1.83	4	1	5	0.29	0.22	0.07
Game Farming	8.36	5.77	14.14	28	42	70	3.45	2.80	0.65
Hunting	4.51	4.41	8.92	50	18	68	4.19	2.83	1.35
Taxidermy, Game catching, etc.	3.45	3.47	6.92	19	13	32	2.19	1.62	0.56
Accommodation	9.09	10.60	19.68	60	43	103	10.27	6.94	3.33
<b>Total</b>	<b>90.98</b>	<b>90.14</b>	<b>181.12</b>	<b>898</b>	<b>452</b>	<b>1350</b>	<b>67.99</b>	<b>52.65</b>	<b>15.34</b>

The table shows that the activities support 898 full time direct employment opportunities with another 452 indirect and induced opportunities, in total 1 350. It generates a total of R181.12 million in GDP of which R90.98 million is direct, expressed in 2013 prices.

The total payments to households are R67.99 million of which R15.34 million is to low income households.

The following table presents the estimated incremental negative impact of the proposed mines in the study area, expressed in macro-economic parameters for the rail transport option; the coal will be loaded at the mining site then railed to the selected railway siding. In total the impact of all the areas identified are reflected in the table below.

	Gross Domestic Product			Employment			Payments to Households		
	Direct R mil.	Indirect/ Induced R mil.	Total R mil.	Direct Number	Indirect/ Induced Number	Total Number	Total R mil.	High/ Medium R mil.	Low R mil.
Irrigation	-32.14	-32.14	-64.28	-341	-184	-525	-23.95	-19.34	-4.61
Beef Farming	-0.34	-0.15	-0.49	-1	-1	-2	-0.08	-0.06	-0.02
Game Farming	-2.20	-1.52	-3.72	-7	-10	-17	-0.91	-0.74	-0.17
Hunting	-1.27	-1.24	-2.52	-16	-5	-21	-1.18	-0.80	-0.38
Taxidermy, Game catching, etc.	-1.25	-1.26	-2.51	-7	-4	-11	-0.79	-0.59	-0.20
Accommodation	-6.07	-7.08	-13.14	-40	-30	-70	-6.86	-4.64	-2.22
<b>Total</b>	<b>-43.27</b>	<b>-43.38</b>	<b>-86.66</b>	<b>-412</b>	<b>-234</b>	<b>-646</b>	<b>-33.76</b>	<b>-26.16</b>	<b>-7.61</b>

The table shows that as many as 412 direct employment opportunities may be lost in the project area and a total of 646 overall. The projected direct GDP loss is R43.27 million with a total of R86.66 million. The estimated reduction in payments to low income households is R7.61 million.

### Property Values

The estimated property values depend on a number of issues and are normally valued using a number of different fixed capital improvements. The economic values differ from R1 503 per hectare for a beef producing unit and from R2 344 for a basic game producing unit without any value added improvements to R12 204 per hectare for units catering for the luxury market.

It is accepted that some of the property owners will not only suffer losses as far as income is concerned, but also face the possibility that their property value could be devaluated, especially in cases where the mining company is not interested in acquiring the property. It must be kept in mind that the major contributing factor to a possible devaluation in property values is the negative experience of “sense of place” for a specific property, especially those catering for the upmarket trophy hunters and eco-tourists. The two main issues affecting the formation of these perceptions are noise and visual intrusions.

In the case of the irrigation units the possible threat of the water being contaminated can affect the property values, also where the mining company is not interested in buying the specific farm.

### Cost Benefit Analysis – Economic Viability

A detailed Economic Cost Benefit Analysis was performed for the proposed mining activity, and the coal rail transport option to the identified siding in current financial prices using a varying inflation for different elements and constant economic prices was used. The CBA analysis incorporated the negative impacts on current local activities as a cost item over the mining period, environmental and loss of biodiversity costs and identified social costs.

In the following table the differences between a private sector financial CBA and a public sector economic CBA is presented.

Attributes	Economic CBA	Financial CBA
Perspective	The broader community.	Project shareholders/capital providers.
Goal	The most effective application of scarce resources.	Maximization of net value.
Discount Rate	Social discount rate.	Market determined weighted cost of capital.
Unit of Valuation	Opportunity costs.	Market prices.
Scope	All aspects necessary for a rational, economic decision.	Limited to aspects that affect profits.
Benefits	Additional goods, services, income and/or cost saving.	Profit and financial return on capital employed.
Costs	Opportunity costs of goods and services foregone.	Financial payments and depreciation calculated according to generally accepted accounting principles.

The benefits associated with the project are the revenue resulting from the sale of the coking coal variety and Eskom quality coal.

Approximately 205.9 million tons of coking coal is expected to be produced over the LOM of the Wildebeesthoek Section with another approximately 205 million tons from the Chapudi Section and Chapudi West Section. Of this volume about 18% of the Wildebeesthoek Section and 28% of the two Chapudi Sections will be destined for Eskom. The 2011 price of HCC<sup>2</sup> coking coal was at an all-time high, the Australian coking coal varied from July 2010 to June 2011 from US\$ 225 to \$328 per ton FOB. Currently, September 2013, the price is varying around US\$ 171 per ton FOB for the export of the HCC variety. Determining the Free-on-Board (FOB.) price was therefore a bit of a puzzle and it is necessary to discuss some of the parameters used in the calculations:

<sup>2</sup> Hunters Valley Coking Coal – the so called best quality coking coal

**1) The 2011 situation**

- FOB HCC price expressed in US\$ - \$207 ton/coking coal, the average 2010 price,
- Exchange rate – R7 per 1US\$,
- Providing a FOR price of R1449 per ton.

**2) Current 2013 situation**

- Average 2013 FOB HCC price expressed in US\$ - \$171 per ton<sup>3</sup>,
- Exchange Rate –R9.50 per 1 US\$,
- Providing a FOB price of R1 624 per ton.

Although the price has dropped in US\$ terms by 8% expressed in terms of Rand, the price has actually increased by 12%, compensating for any inflated expenditure prices.

Coal had a separate coking coal market study done by Wood Mackenzie; the report forecasted the following price scenario for the next number of years based on the different coking quality coal. A summary of the forecasted prices for HCC and SHCC varieties is shown in the next table.

	2013	2014	2015	2020	2025	2030
HCC <sup>4</sup> (QLD)	171.25	176.25	184	194	229	235
SHCC <sup>5</sup> (Qld)	143.64	147.84	154.56	164.9	194.65	202.1

The table shows that they expect the price, over time, will increase in constant terms; we accepted these figures for the base scenario as they are in line with other predictions found in a cursory research of possible coal price expectations.

The second issue is the possible movement of the South African Rand exchange rate, we accepted for the base scenario an annual weakening of 1.67% against the US dollar as forecasted in the Manuel for Cost Benefit Analysis<sup>6</sup>. However, current predictions produce even a faster deterioration of the value of the Rand.

The Eskom destined coal is priced according to the average 2012 price of R283 per ton FOR with a 10% annual escalation for the first number of years as announced by Eskom and then a constant price.

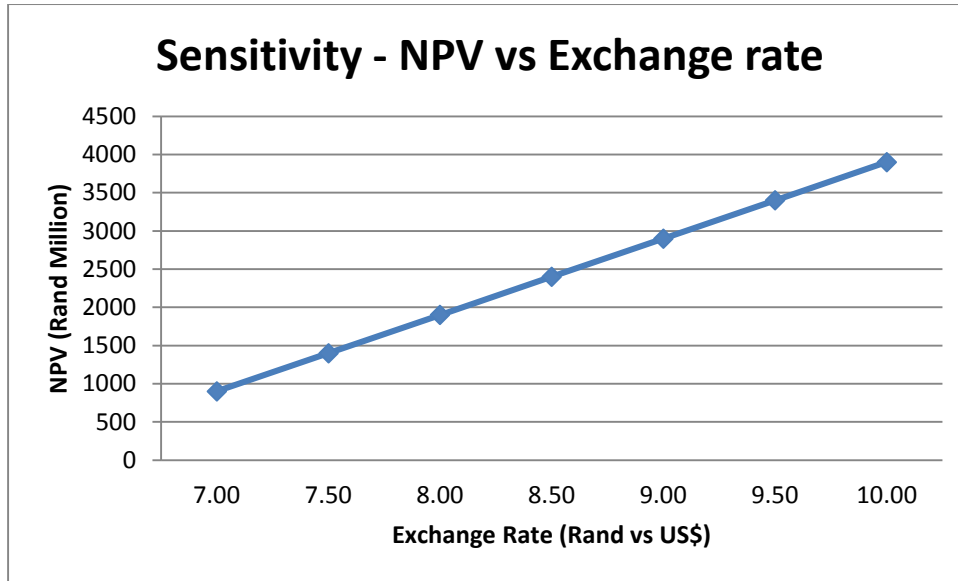
The following graph shows the impact of different exchange rates on the Net Present Value for the R1 477 per ton, the average 2011 price.

<sup>3</sup> Wood Mackenzie - Market Study for CoAL - 2012

<sup>4</sup> HCC – Hard Coking Coal.

<sup>5</sup> SHCC – Semi Hard Coking Coal.

<sup>6</sup> WRC Report No. TT 305/07 – A Manuel for Cost Benefit Analysis in South Africa with specific reference to Water Resource Development - August 2007.



The graph shows that a linear relationship exists between the exchange rate and economic viability of the project. Currently the exchange rate is very volatile with dramatic movements up and down, however, a consensus opinion is that the lower limit would be R9 to the US\$, although no guarantee exists that this would be the lower limit.

The following table presents the results of the financial and economic CBA models.

	<b>Financial CBA</b>	<b>Economic CBA</b>
Net Present Value (NPV) (Rand million)	<b>32 534.92</b>	<b>18 623.32</b>
Benefit Cost Ratio (BCR)	<b>5.30</b>	<b>4.53</b>
Internal Rate of Return (IRR)	<b>43.3%</b>	<b>37.6%</b>

The results show that the project is economically very viable when the inflation adapted financial prices have positive parameters for all three the price scenarios as well as the economic CBA in constant economic prices.

### Macro-Economic Impact Analysis

The macro-economic impact analysis also shows a positive picture for both the economic impacts on the Limpopo Province as well as for the South African economy. In the following table a summary of the Construction Phase annual impact results [R millions, 2012/2013 Prices] is presented.

In the following tables the total macro-economic impacts on the RSA and the Limpopo Province is presented.

Summary of the Construction Phase Results on the National Economy [R millions, 2010/2011 Prices]

	<b>Wildebeesthoek</b>	<b>Chapudi</b>	<b>Chapudi West</b>
Total GDP (Rand million)	1 568.6	1 069.7	883.34
Total Employment	6 343	4 325	3 572
Total Payments to Households (Rand millions)	1 061.4	723.8	597.7
Fiscal Impact	477.0	325.3	268.6



Summary of the Construction Phase Results on the Limpopo Province Economy [R millions, 2010/2011 Prices]

	<b>Wildebeesthoek</b>	<b>Chapudi</b>	<b>Chapudi West</b>
Total GDP (Rand million)	354	242	200
Total Employment	2 136	1 778	1 486
Total Payments to Households (Rand millions)	187.3	127.7	105.5
Fiscal Impact	78.8	53.9	44.4

The above table's shows that the construction phase will have a positive impact on the National as well as the Limpopo Provincial economy for the duration of the construction phase. It is interesting to observe that out of a total 6 343 employment opportunities created, 2 136 will be in the Limpopo Province during the construction period.

Summary of the Operational Phase results of the Chapudi Project showing the impact on the National and Limpopo Province economies [R millions, 2012/2013 Prices]. The Limpopo results are included in the National results.

	<b>National - RSA Economy</b>	<b>Provincial - Limpopo Economy</b>
<b>Impact on GDP (R millions)</b>	<b>25 329</b>	<b>14 362</b>
<b>Impact on Total Employment [numbers]:</b>	<b>42 665</b>	<b>14 472</b>
<b>Impact on Households (R millions):</b>	<b>17 710</b>	<b>7 503</b>
<i>Low Income Households (R millions)</i>	2 945	2 254
<i>Medium Income Households (R millions)</i>	7 276	1 473
<i>High Income Households (R millions)</i>	8 517	3 776
<b>Fiscal Impact (R million):</b>	<b>6 960</b>	<b>2 887</b>
<b>Balance of Payments (R million)</b>	<b>10 827</b>	

The table shows that the operational phase of the proposed Chapudi Project will have a very positive impact on the economy of the province and that as much as 14 472 employment opportunities can be created of which over 1 834 will be direct employment opportunities on the mine itself.

The mine will, at full production, pay various taxes amounting to R6 960 million annually and have a positive contribution to the "Balance of Payments" of R10 827 million per annum if expressed in 2013 prices and values.

## Conclusion

A comparison of the Local Economic Activities Baseline and estimated Negative Impact with the estimated impact of the operational phase of the proposed Chapudi Project (2013 prices).

<b>Baseline Local Economic Activities and Impact of Mining</b>							
<b>Annual Current Activities and Impact of the Mining Activities</b>							
		<i>Base Line</i>	<i>Impact</i>			<i>Base Line</i>	<i>Impact</i>
<i>Gross Domestic Product Rand million</i>	<i>Direct</i>	90.98	-43.27	<i>Employment</i>	<i>Direct</i>	898	-412
	<i>Indirect/Induced</i>	90.14	-43.28		<i>Indirect/Induced</i>	452	-234
	<i>Total</i>	181.12	-86.66		<i>Total</i>	1 350	-646
<b>Mining Operational Phase – Annual Impact Limpopo Province</b>							
<i>Gross Domestic Product Rand million</i>	<i>Direct</i>	10 517		<i>Employment</i>	<i>Direct</i>	1 834	
	<i>Indirect/Induced</i>	3 845			<i>Indirect/Induced</i>	12 638	
	<i>Total</i>	14 362			<i>Total</i>	14 472	

From the above table it appears that the current local economic activities in the defined project area contribute R181.12 million in total GDP and sustain 1 350 total employment opportunities of which 898 are direct. The mine activity will cost the local economic activities in the project area R 86.66 million in GDP and 646 employment opportunities, of which 412 will be direct.

The project will offer 1 834 direct employment opportunities compensating for the loss of 412 jobs in the project area. It is, however, in the rest of the province where the project will create many more jobs than the current activities namely 12 638 versus 452.

From the above and the rest of the analysis it appears that the proposed mining project will be an economic viable entity which will add value to the province. This will, however, take place at the expense of some of the current local economic activities, especially the game with ecology included, however, proper mitigation and even compensation must be part of the final solution. The investment the owner has made to a property can be negatively impacted if the hunting and accommodation facilities on the property are not fully utilised because of a down turn in visitors resulting from the mining activities.

The possible threat to the irrigators of underground and surface water being contaminated is of utmost importance and possible mitigation will have to be in place. In this respect the irrigators further to the north along the Sand River and outside of the project area should be included.

Probably the two most important benefits to the ***national*** economy are:

- The annual impact on the “Fiscus” with an annual tax contribution of R 6 960 million expressed in 2013 prices, which at present represents the salary package of roughly 21 400 teachers or 23 200 nursing staff, if the government were to apply it for that purpose.
- The second impact is the favourable annual impact on the “Balance of Payments “amounting to R10 827 million, if expressed in 2013 prices.

As stated, this will be a permanent impact and it will be necessary for the mining company to negotiate a proper mitigation programme.

## 1 Introduction and Background

The location of the proposed mine is within the Makhado Local Municipality area which falls under the jurisdiction of the Vhembe District Municipality comprising of four local municipalities covering 21 407 km<sup>2</sup> of the surface area of the province. The town Makhado is the main business centre in the area. The Makhado Region has an active tourism industry with a wide variety of hotels and lodges which sport panoramic views to the north and south of the Soutpansberg with a variety of meanders. The northern foot hills of the Soutpansberg are rich in game lodges offering game viewing and hunting. The Soutpansberg also attracts birdwatchers to the area which hosts a large variety of species.

Coal deposits have been preserved in four down-faulted basins in the Limpopo Province, in the areas known as the Waterberg, in the vicinity of Lephalale (Ellisras), the Soutpansberg (along the northern flank of the Soutpansberg Mountains), the Limpopo (along the southern bank of the Limpopo River, west of Musina) and the Springbok Flats coalfields.

The Chapudi Project forms part of the Greater Soutpansberg Project (GSP) situated to the north of the Soutpansberg in the Limpopo Province. Map 1 depicts the locality of the various GSP projects, from which it is evident that they are within close vicinity of each other, permitting possible rationalisation of infrastructure. Map 2 depicts the location of the Wildebeesthoek, Chapudi and Chapudi West Sections.

### 1.1 Project Location

The proposed Chapudi Project is situated approximately 20 km (direct) and 35 km (via road) north-west of the town Makhado in the Makhado Local Municipal area. Musina is situated approximately 65 km to the north – refer to Map 1 and Map 2. Musina and Makhado are connected by well-developed road infrastructure.

The N1 national road passes the mining right application (MRA) area (Wildebeesthoek and Chapudi Sections) in the east with the R523 running through the site from east to west. Both of these roads carry sufficient traffic to impact on the ambient sound levels a distance away from these roads. There is an undefined road just west of the Waterpoort Station that appears to carry heavy traffic. The Makhado-Musina railway line runs in a north-south direction through the proposed Chapudi Project area.

Socio-economic activities in the area are mixed between intensive irrigated agriculture, hunting and tourism. The intensive irrigated agricultural activities are focused along the Sand River catchment and neighbouring areas, using ground water. The land use in the Wildebeesthoek Section of the Chapudi Project is predominantly hunting, game farming and eco-tourism. The Chapudi Section has a combination of hunting/game farming and irrigated/dry land agriculture. The Chapudi West Section has portions of intensive agriculture, while the portions further to the south-west are utilised for conservation, hunting and eco-tourism.

The majority of the intensive agricultural area is utilised for predominantly vegetable production and is known as the winter pantry of South Africa (winters are mild, with light frost only occurring occasionally, virtually a frost free production area). Some of the properties are also focused on

mixed farming, with a mixture of livestock, game and irrigated agriculture. A number of pack houses for fresh commodities are operational in the region. The fresh produce markets remain a major outlet for fresh produce. Direct marketing is also a popular marketing outlet and producers deliver direct to chain stores such as Woolworths, Pick 'n Pay etc.

Hunting, game trading and eco-tourism is an established socio-economic driver in the area. There are a number of properties utilized for trophy (for local and foreign tourists) and biltong hunting with eco-tourism spin-off activities.

## 1.2 Community Description and Farming Area

The communities located within or in close proximity of the Chapudi Project are:

- Waterpoort Town: Waterpoort Town is located on the farms Dorpsrivier 696 MS and Bergwater 697 MS and consists of a general dealer, bottle store, filling station, post office, police station and Mondi packing material warehouse. Less than five houses are located within the town and are limited to workers in the above economic activities.
- So-ja Village: A 'Share Block Scheme' Village is partially located on the northern border of the farm Kliprivier 692 MS and the farm Koedoesveld 666 MS in close proximity to the old So-Ja mineral baths. There are 47 houses on this property with 11 permanent residents. The remaining houses are used over the weekends and during the holidays.
- Waterpoort Property Labour Tenant Village: The Labour Tenant Village is situated in two locations east of the D854 road on the farm Waterpoort 695 MS within the MRA area. Approximately 20 extended families reside in two locations on the property.
- Mamvuka Village: The Mamvuka Village is situated east of the N1 and outside the MRA area. The village is under the leadership of the Musekwa Traditional Leadership.

The area covered by the NOMR applications includes forty-two (42) farms.

## 1.3 Brief Project Description

The Chapudi Project has the potential to produce good quality hard coking coal (HCC<sup>7</sup> quality) and a domestic thermal coal product.

The current planning is that construction and mining will commence at the Wildebeesthoek Section first where the coking coal yields are the highest. It is expected that mining operations at the Chapudi Sections will only commence much later (in terms of current data towards 2033) by which time the Transnet infrastructure will have been enhanced to cope with the greater annual production of coal from the Project.

The Wildebeesthoek Section will be mined at 12.5 Mtpa, whilst the Chapudi and Chapudi West Sections combined will be mined at 12.5 Mtpa and the life of mine of the two latter sections (LOM) is expected to exceed 30 years. The total mining period is estimated at 60 plus years.

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<sup>7</sup> HCC – Hard Coking Coal

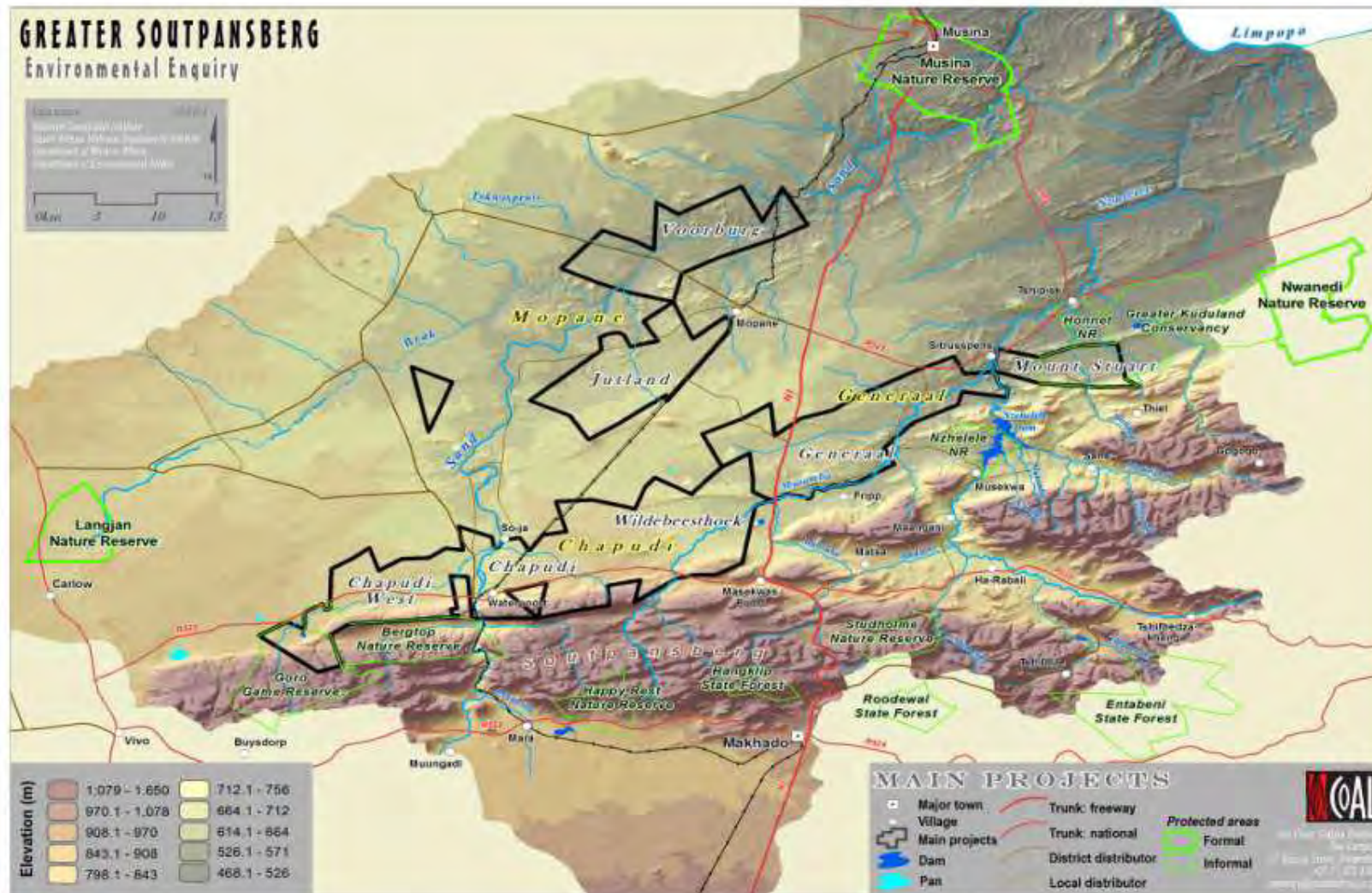
From the date of granting of the mining right (anticipated to be in 2015) further prospecting, feasibility studies and final design studies will be undertaken. Construction will only commence in 2018. The proposed project is scheduled over the next 10 years.

#### **1.4 Macro-Economic Study**

The primary objective of this socio-economic study is to determine the nature and magnitude of the economic and socio-economic impacts that will result from the proposed Chapudi mine. The study has been divided in the following sections which were investigated separately and eventually integrated to come to a conclusion and make a recommendation:

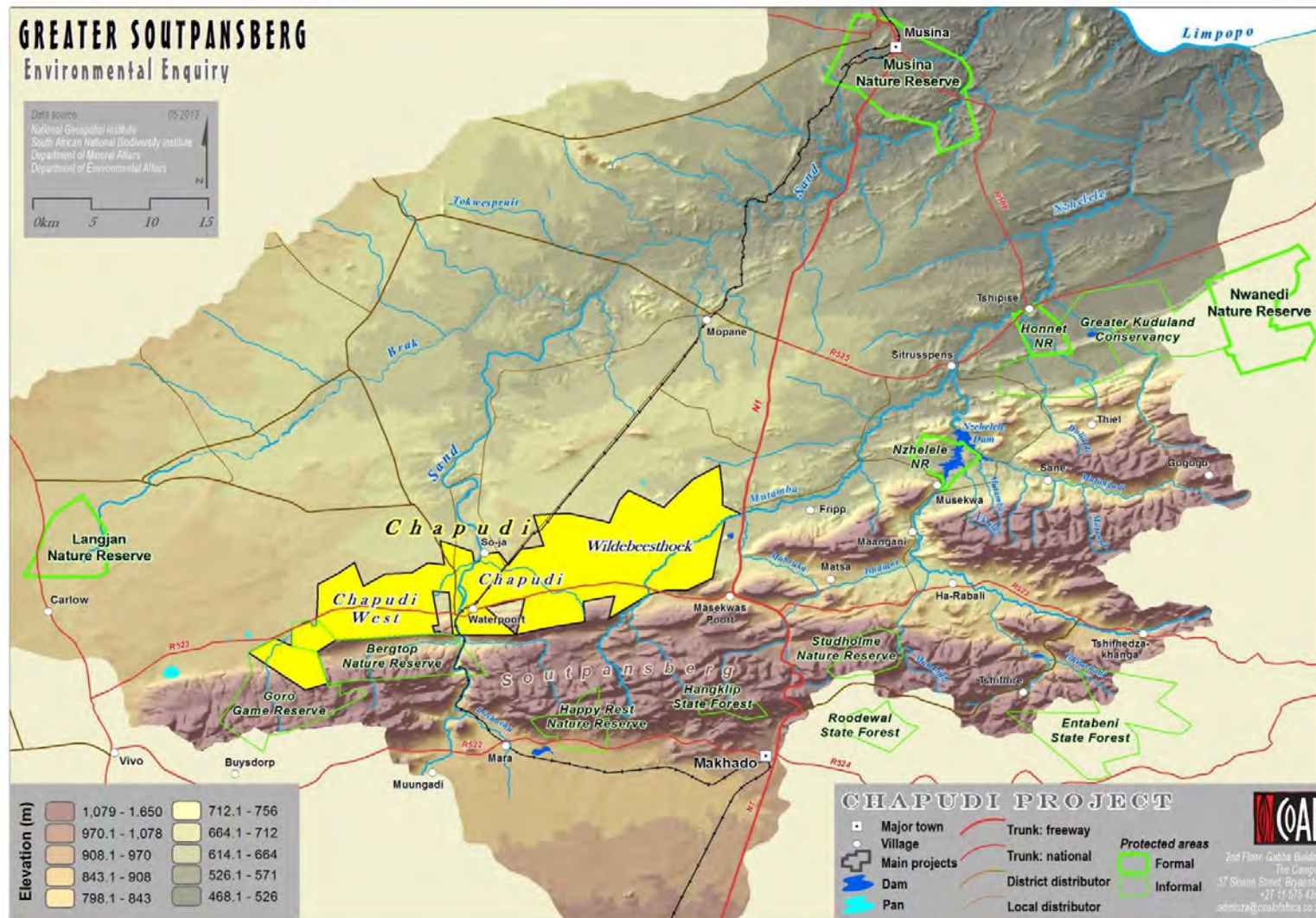
- The quantification of the current local economic activities in the project area and the possible impact of the mining activities, short, medium and long term,
- The possible impact on the game, cattle and irrigation activities in the area,
- The determination of the economic viability of the mining project from a governmental viewpoint, this is done by using two economic tools, namely:
  - Economic Cost Benefit Analysis, incorporating possible negative impacts to the local economic activities, natural environment, social structures and rehabilitation costs, as identified by the other project studies.
  - Macro-Economic Impacts of the Mining Project, estimating the projected impacts on Gross Domestic Product, Employment, Payments to Households, Capital Formation, Payments to Fiscus and the Impact on the Balance of Payments.

Map 1: Map Showing the Locality of the GSP Project Area



Source: Courtesy of Coal of Africa Limited

Map 2: Location of Wildebeesthoek, Chapudi and Chapudi West Sections



Source: Courtesy of Coal of Africa Limited

## 1.5 Mining Schedule<sup>8</sup>

### 1.5.1 Wildebeesthoek Section

The schedule runs over a period of approximately 31 years at a ROM production rate of 12.5 Mtpa including the ramp down phase in the 31st year. The waste volumes to be mined are at approximately 130 Mtpa for the first 5 years, 112.5 Mtpa for years 6 to 18, 120 Mtpa for years 19 to 25 and then ramps down from year 26 to LOM.

### 1.5.2 Chapudi and Chapudi West Sections

Chapudi Section only starts mining operations in 2033 and the Chapudi West Section in 2041. The estimated ROM coal production is 12.5 Mtpa with 100 Mtpa of waste mining and combined product of 7 Mtpa. The expected LOM is 43 years with year 1 starting in 2033.

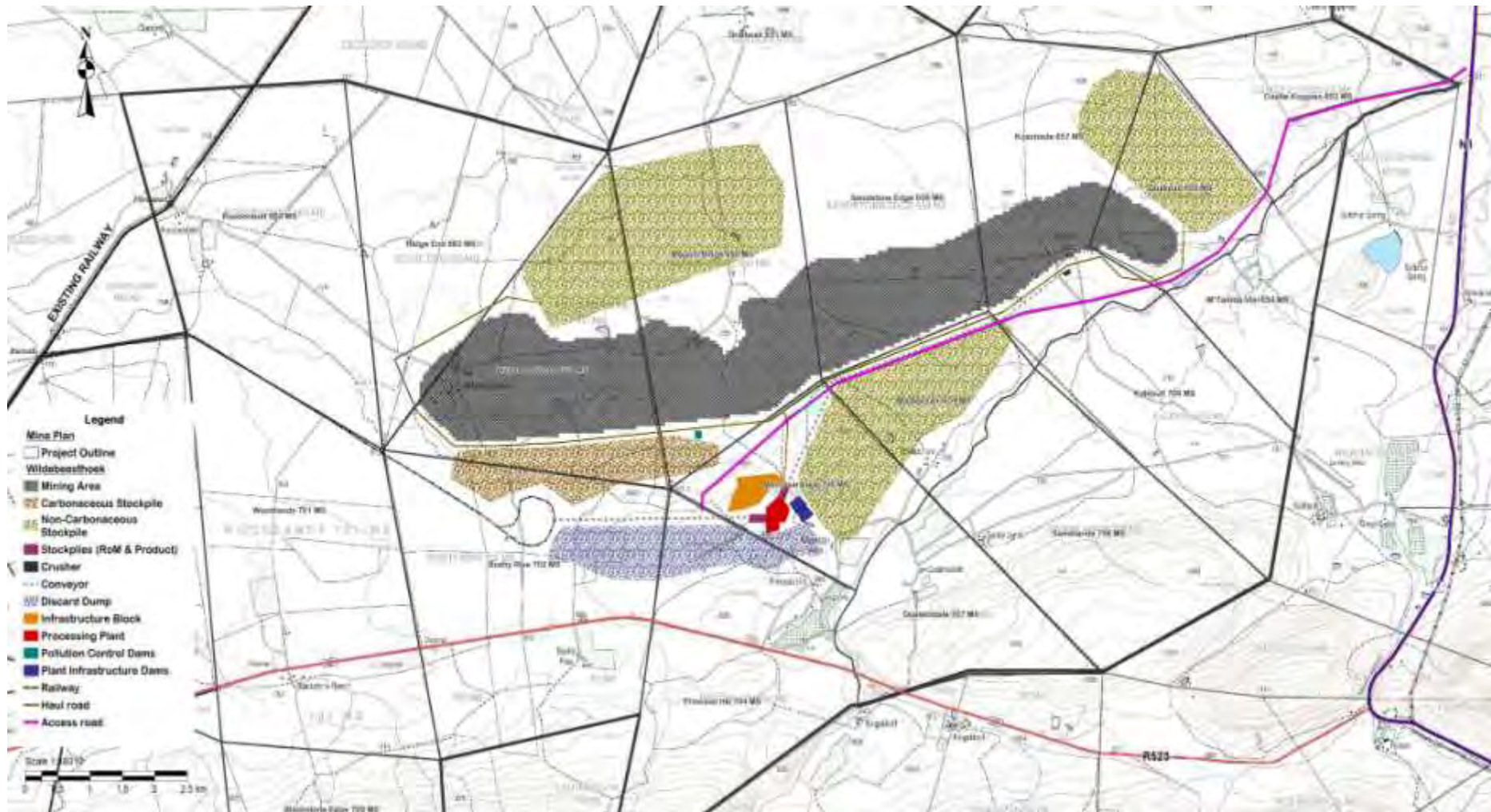
The mine and infrastructure layout plans for the Wildebeesthoek, Chapudi and Chapudi West Sections are shown in Maps 3, 4 and 5 respectively.

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<sup>8</sup> Source: Greater Soutpansberg - Chapudi Project – Scoping Report dated August 2013.

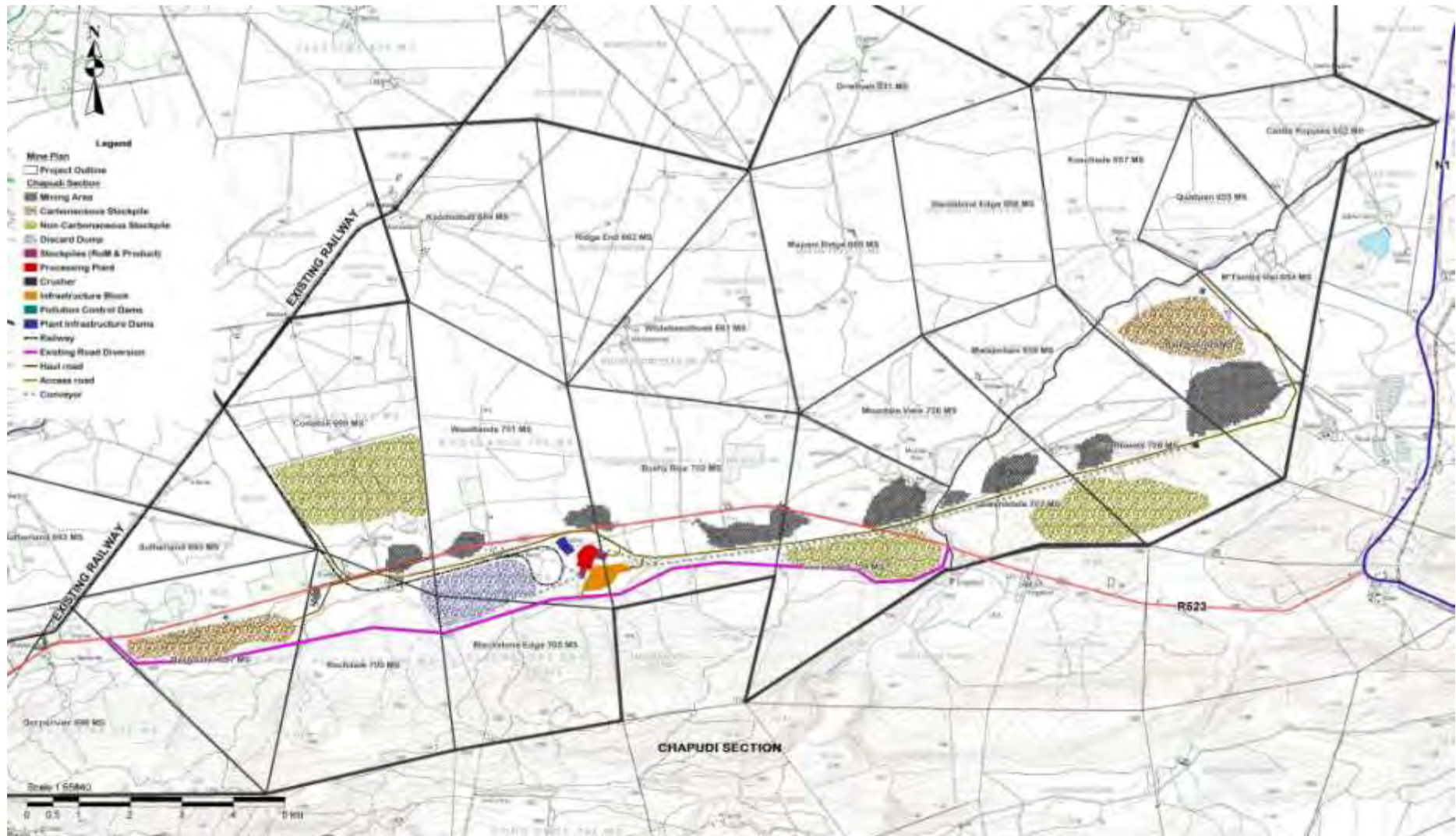


Map 3: Wildebeesthoek Section - Mine and Infrastructure Layout Plan



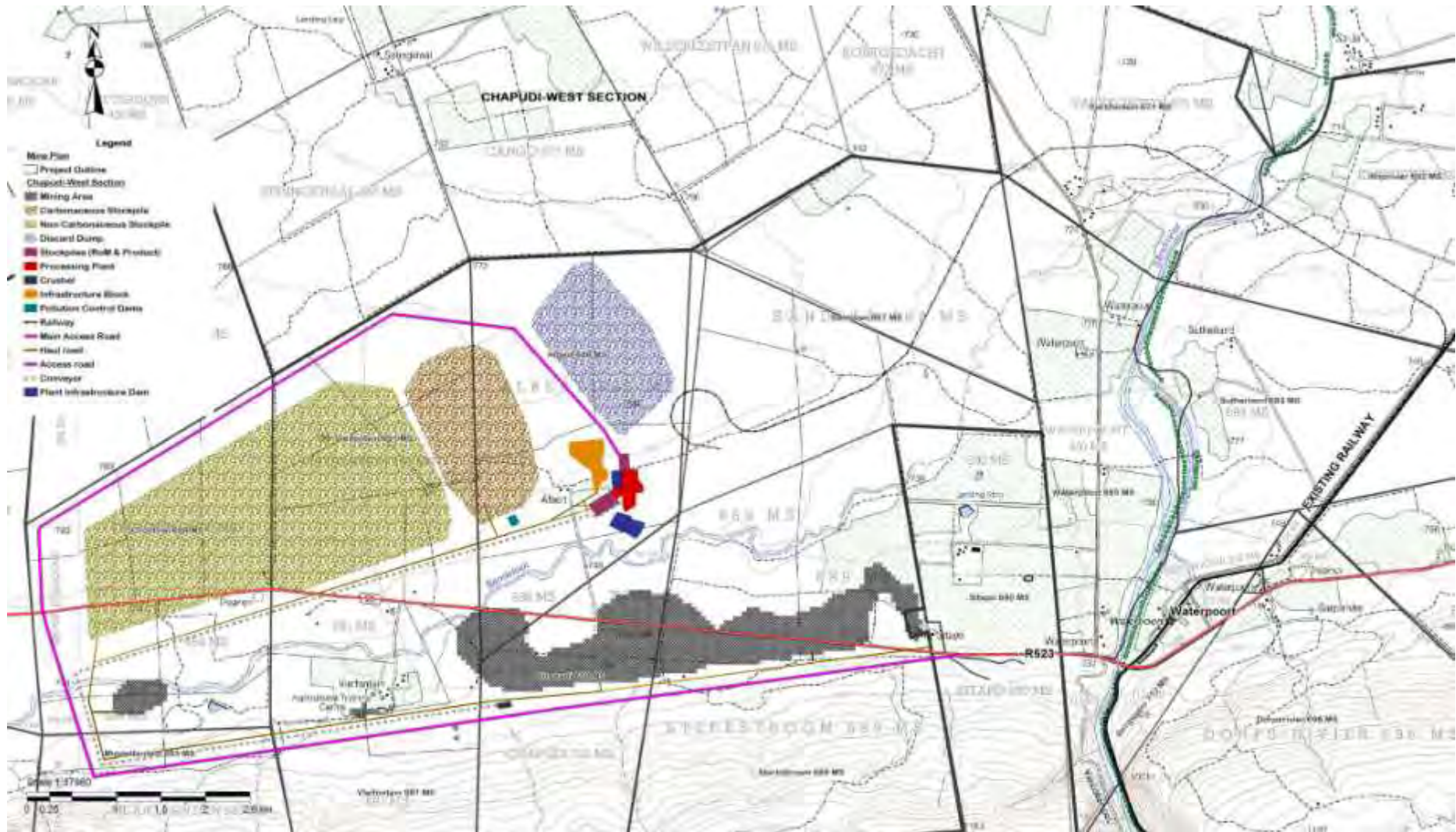
Source: Courtesy of Coal of Africa Limited.

Map 4: Chapudi Section - Mine and Infrastructure Layout Plan



Source: Courtesy of Coal of Africa Limited.

Map 5: Chapudi West Section - Mine and Infrastructure Layout Plan



Source: Courtesy of Coal of Africa Limited.

## 1.6 Coal Processing

Each of the Wildebeesthoek, Chapudi and Chapudi West Sections will each require a dedicated coal beneficiation plant, situated on the farms Mountain View 706 MS, Woodlands 701 MS and Albert 686 MS, respectively. The necessary conveyor systems will be put in place to transport the run of mine (ROM) from the open pits to the respective beneficiation plants.

The total run of mine (ROM) capacity for the Wildebeesthoek beneficiation plant is 12.5 Mtpa. Two mining areas will be exploited for Chapudi coals with the Chapudi Section supplying 8 Mtpa to a large beneficiation plant and the Chapudi West Section supplying 4.5 Mtpa to a smaller beneficiation plant.

The design of the coal beneficiation plant was selected on the basis of using concepts that ensure efficient and effective beneficiation of the Chapudi resource at the required quality within reasonable capital and operating costs. The technologies selected are well proven in the coal industry, that is, two-stage dense medium separation (DMS) for coarse coal (50 x 1mm) beneficiation using cyclone separators, up-flow classification for recovery of fine coal (1 x 0.3mm) using reflux classifiers and two-stage flotation using micro-bubble and conventional mechanical technologies for the recovery of ultra-fine coking coal (-0.3mm) product.

The coal beneficiation plant will produce two products namely a middling product with an ash content of 30% and a coking product with an ash content of 10%.

Coal discard will be dumped onto discard dumps until sufficient pit room is available, where after it will be disposed of into the open pit.

## 1.7 Mine Infrastructure

The mine infrastructure areas (MIA) comprise all the facilities, roads, services and systems required for the mine to operate optimally. The individual mining sections will be provided with workshops and other necessary infrastructure required for the mining operation. The centrally located infrastructure will comprise a coal beneficiation plant, personnel support structures, vehicle support structures, water management structures and management and monitoring systems. Buildings will include management offices, production offices, change house, medical and firefighting facility, shift changing facility, security and access control, training centre, control room and contractors accommodation camp.

The major infrastructure items were designed and positioned to accommodate mining layouts at both pits, access to stockpiles, location of the beneficiation plants, and environmental requirements (including the management of dirty and clean water and protection of water courses and rivers).

### 1.7.1 Wildebeesthoek Section

The Wildebeesthoek Section support infrastructure is located centrally between the east and the west extremities of the pit on the farm Mountain View 706 MS.

#### **1.7.1.1 Access Road**

Access to the Wildebeesthoek Section is by way of the N1 towards Musina, turning west onto a new proposed intersection with the N1 where the D745 intersects east towards the Nzhelele Dam.

The main entrance to the Wildebeesthoek Section is approximately 12 km along the new route following the Mutamba River in a westerly direction from the N1 intersection. It is envisaged that a more appropriate route may be from the R523; this will be investigated during the feasibility phase. This road will have a gravel wearing surface.

#### **1.7.1.2 Mining Roads**

Haul roads link the west, central and the east sides of the Wildebeesthoek pits, the stockpile areas and the infrastructure areas on the east and west sides of the mining pits respectively. Haul roads have been planned to be 30m wide with gravel surfaces to meet the requirements of the hauling fleet.

Service roads will be constructed gravel roads and provide ease of access to remote areas for light mining vehicles. These roads are separate from the haul roads in order to separate light mine traffic from the heavy traffic (haul trucks) as a site safety measure.

### **1.7.2 Chapudi and Chapudi West Sections**

The Chapudi and Chapudi West Sections will require dedicated infrastructure areas, which will be centrally located between the east and west extremities of the open pits on the farms Woodlands 701 MS and Albert 686 MS.

#### **1.7.2.1 Access Road**

Access to the Chapudi Section site is by way of the N1 towards Musina, turning west onto the R523. The main entrance to the Chapudi Section is approximately 15 km along this route and crosses the Mutamba River along the way. The access road to the mining site will have a gravel wearing surface.

From the farm Prince's Hill 704 MS towards the west the R523 needs to be re-routed. During the feasibility phase a significant road study will be commissioned to evaluate this. The new road will be a surfaced road to Provincial Standards. The mine entrance should be located on the relocated R523.

#### **1.7.2.2 Mining Roads**

Haul roads link the central and the east sides of the Chapudi pits, the stockpile areas and the infrastructure areas on the north and south sides of the mining pits respectively.

At Chapudi West the pits are also linked to the mine infrastructure and plant areas by means of haul roads. However, in this instance the infrastructure is located on the northern side of the pits due to a lack of space on the southern side.

Haul roads have been planned to be 30m wide with gravel surfaces to meet the requirements of the hauling fleet.

Service roads will be constructed gravel roads and provide ease of access to remote areas for light mining vehicles. These roads are separate from the haul roads in order to separate light mine traffic from the heavy traffic (haul trucks) as a site safety measure.

## **1.8 Storm Water Management**

Water is a scarce commodity and every effort has been made in the design of the water management systems to conserve and re-use as much water as possible. A water management strategy will be implemented on the Chapudi Project to address the following salient issues:

- Water uses and users, with a particular focus on consumption rates;
- Engineering design basis for the water reticulation and distribution systems required to provide water to all the infrastructure, mining and beneficiation operations;
- Effluent management, including sewage treatment and disposal;
- Engineering design basis for the clean water diversion system; and
- Engineering design basis for the dirty water collection and management systems, including flood protection.

Clean storm water run-off along the various small water courses will be diverted around the proposed infrastructure, the mining pits and dump areas. These storm water drains and deflection berms have been positioned along the southern boundaries of the proposed mining pits to collect and convey clean water into the closest natural river course. Dirty water such as storm water run-off from the various terraces and plant area is captured and conveyed along lined channels towards the various dirty water dams positioned around the site. All water polluted on site as well as run-off from the carbonaceous dumps as well as seepage under carbonaceous dumps is retained and recycled on site. A detail water management strategy will be developed and implemented for the Chapudi Project.

## **1.9 Bulk Power Supply**

The lengthy Eskom Tabor and Spencer 132 kV Distribution networks stretching 200 km from Polokwane to 50 km away from the Musina border-post result in low voltages and thermal constraints during transformation and line contingencies. The expected Tabor and Spencer 132 kV load growth is located 100 km north of Tabor and 70 km from Spencer - generally the area in which the Chapudi Project resides - therefore, the Transmission outreach constraint will cap load growth.

The Polokwane Customer Load Network (CLN), including the Tabor and Spencer power corridor, remains susceptible to voltage instability and is the weakest part of the Northern Grid network due to being operated beyond its reliability power transfer limit. Eskom Transmission Division plan to strengthen the Northern Grid in the areas north of the Soutpansberg with a new 400 kV power line between the Tabor Main Transmission Substation and the newly approved Bokmakirie (Nzhelele) Substation.

Eskom is accordingly establishing additional Distribution and Transmission assets to cater for load north of the Soutpansberg, including the Bokmakirie Distribution Station and the 4x250 MVA 400/132 kV Nzhelele Main Transmission Station (MTS). The proposed network solution meets the 10 year Distribution load requirements in the Tabor and Spencer network area and it is also

informed by the 20 year Transmission and Distribution load forecast in meeting the Transmission 20 year plan. The Chapudi Project requires an electrical supply capability of 60 MVA.

An Eskom connection can only be established once the Nzhelele/Bokmakirie 400/132 kV Main transmission Station has been commissioned - this is planned for 2017/8.

The Chapudi Project electrical supply will be taken from the 132 kV network and transformed to 11kV/550/400/230V. The exact supply configuration is yet to be determined and the least environmental impact solution will be followed. The project team has evaluated the possible supply options and has identified a direct supply from Nzhelele / Bokmakirie 400/132 kV Main transmission Station.

A 132/11 kV substation will be established at each of the mining operations. Power factor correction equipment will be installed at each of the 132/11kV substations to reduce the amount of reactive power required from Eskom and to improve the voltage regulation over the 11kV/550/400/230V distribution networks.

### 1.10 Bulk Water

The water requirement estimate for the Chapudi Project indicates that a maximum of 11 000 m<sup>3</sup>/day of water is required at the mining peak. The water supply to the mine will probably come from the following sources:

- Groundwater (boreholes and seepage into the mining pits;
- Storm water run-off impounded on site;
- An external water source piped to site;
- Sewage effluent release from Makhado; and
- Abstraction from the Sand River.

Storm water run-off on site is seasonal and, although it will be utilised, it is not a constant water supply and has therefore not been included in the water-supply chain.

The investigation into the most cost-effective source for water supply to the Chapudi Project has yet to be completed; however, for the Makhado Colliery Feasibility Study, a reconnaissance was done of all potential water sources to support the mine water requirements. Recently supply from the Nzhelele Dam has been formalised and CoAL has reached an agreement with the Nzhelele irrigation farmers to obtain 7.7% of their irrigation allocation for mining purposes. A further agreement with the farmers is that CoAL will invest significant effort into developing “new water” by investigating the possibilities to increase the yield from the Nzhelele River catchment. The yield of the dam can also be increased by either raising the dam or other methods of increasing the capacity of the dam. One such method that was considered was to de-silt the dam and all of these will be considered in more detail as part of the new water initiative.

The abstraction rights obtained by CoAL from the Nzhelele Dam is such that some spare water will be available from this system (even during the early stages of the mine) which can be utilised for the early stages of the Chapudi Project. It will thus be possible to, if conservative assumptions concerning both demand and availability of groundwater and rain water harvesting in the Makhado mine has been made, to distribute the excess water to the Chapudi Project.

## 1.11 Logistics

The primary domestic destination for coking coal is located at ArcelorMittal, Vanderbijlpark. The intent is to export an initial 1 Mtpa (million tonnes per annum) of coking coal, and transport 2.1 Mtpa to ArcelorMittal. Up to 3.6 Mtpa of middling will be railed to local destinations from the proposed Chapudi Project in the Limpopo Province. The volumes increase later when other mines come into production with export growing to 1.6 Mtpa of coking coal, 3.8 Mtpa coking coal to ArcelorMittal and 8 Mtpa of middling coal to local destinations. The primary domestic location for middling coal is Eskom's Tutuka, Majuba, Camden and Grootvlei Power Stations in Mpumalanga Province.

The Chapudi Project is close to the railway line running southwards from Beitbridge/Musina and is an important link to the main hub of the Transnet Freight Rail (TFR) network connecting at Pyramid South, near Pretoria. An important junction occurs at Groenbult, where a connecting line joins the Hoedspruit – Kaapmuiden – Komatipoort export channel avoiding the Pretoria complex.

From Pyramid South links are available to Richards Bay Coal Terminal (RBCT), Maputo or Durban. The export route through Mozambique to the Port of Maputo is in the process of being upgraded for the planned increase in volumes. Through agreements reached to expand the port facility as well as on-going negotiations with Transnet Freight Rail, the Port of Maputo is the export port of destination. These upgrades have been driven by the current tonnage being railed from the Vele Mine.

Private sidings with RLT facilities and railway links on the farms Bushy Rise 702 MS, Woodlands 701 MS and Sandpan 687 MS railway links has proven to be the preferred solution on the basis of repeated review and iterative evaluations of option, within this highly dynamic phase of project development. Factors influencing this conclusion include the low long term operational cost for coal transport from plant to port, lower environmental impact and the lessening of community impact (lower road traffic, congestion and pollution). A rail link provides a seamless transition from the loading siding to a direct link to TFR mainline network.

The rail links originates at the turn-outs at kilometre points 123.11 for Chapudi West, 125.11 for Chapudi and 127.11 for Wildebeesthoek on the Waterpoort – Huntleigh mainline section. The total rail lengths for the private sidings including their load out stations are 13.2 km for Chapudi West, 10.8 km for Chapudi and 10.7 km for Wildebeesthoek.

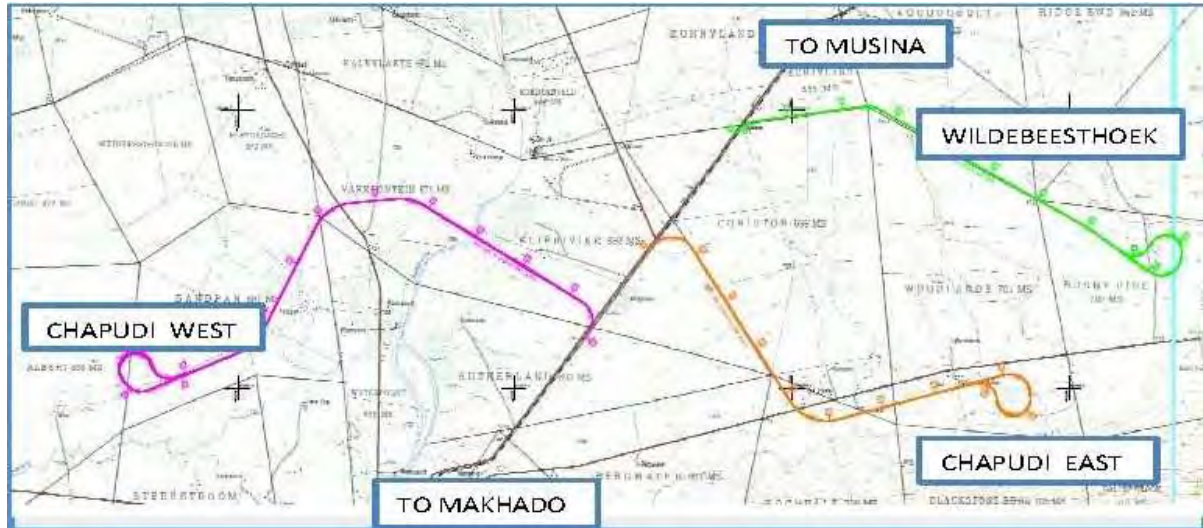
Three RLT's are planned on the balloon lines on the farms Bushy Rise 702 MS, Woodlands 701 MS and Sandpan 687 MS. The balloon layouts allow for continuous loading of rail wagons, without uncoupling the TFR locomotives. The balloons are designed to cater ultimately for 100 CCL wagon trains. The TFR train consist (locomotives and wagons) will enter the siding via the 1:12 turnout on the main line. The train pulls clear of the main line and stops at the permanent stop sign. Siding personnel will provide permission to enter the siding.

The train then pulls into the siding, travels to the RLT. The locomotive will pull the wagons at a constant speed underneath the rail load-out station while the wagons are loaded. Once all the wagons are loaded, the locomotive departs to the stop boards protecting the main line, where it will obtain permission from TFR's train control offices in Polokwane to depart.



In light of higher volumes the rail siding is designed to have 100 wagons waiting off the main line at the entrance of the RLT and once train in the RLT has completed loading the second train can be received in the RLT prior to the first loaded train departing.

### Map 6: Wildebeesthoek, Chapudi and Chapudi West Proposed Private Sidings



Source: Courtesy of Coal of Africa Limited.

### 1.12 Mine Residue Management

Mine residue stockpiles are required to accommodate mining overburden, partings and plant discards on the mine surface. Mine residue stockpiles are categorised as topsoil stockpiles, non-carbonaceous stockpiles and carbonaceous stockpiles.

#### 1.12.1 Carbonaceous and Non-Carbonaceous Stockpiles

Design philosophy is based on the requirement to minimise the volume and surface area required for stockpiling by starting in-pit backfilling as soon as possible during the mining operation as double handling of the material is costly. It is envisaged that the dumping of material on the surface will be required for a period of three years after which the material mined from the pit and discards from the plant will be returned to the pit minimising the fill material during the rehabilitation process.

#### 1.12.2 Topsoil Stockpiles

Topsoil will be stripped from the pit mining areas, roads and terrace areas and will be placed as close as possible to the point of stripping. The topsoil will be used as fill material, for the construction of berms and also be placed between the discards to act as isolating material. Topsoil will also be used as capping material during final rehabilitation of the stockpiles.

#### 1.12.3 Bulk Earthworks

Bulk earthworks are required for the construction of roads and terraces around the mining site. It has been assumed that all material required for the construction of the roads and terraces will be available on site. The exact extent of available material has still to be confirmed by geotechnical

investigations. Material will be taken from borrow pits but also be sourced from the mining pit such as concrete aggregates and rail ballast. This material will require crushing to reduce the aggregate size.

A layout of the mine residue stockpiles for the Wildebeesthoek, Chapudi and Chapudi West Sections is shown in Maps 3, 4 and 5 respectively.

### **1.13 Closure Planning and Rehabilitation**

A detail Mine Rehabilitation Plan has been developed for the Chapudi mining operation which, *inter alia*, includes the following:

- Materials Placement Plan to ensure a free draining landform;
- Topsoil Management Plan; and
- Reclamation (Re-vegetation) Plan.

The sustainable utilisation of natural resources within the mining area is also addressed.

## 2 Economic Approach and Methodology

In determining the economic impact of the proposed Chapudi mining operation, the economic impact on a wider scale, namely the Limpopo Province and the RSA, was considered together with the possible impact on the current economic activities in and surrounding the proposed mining area.

At present a certain land use pattern has developed in the project area, the area has changed from a predominantly beef producing (cattle farming) area in the past to game farming with the related activities. The agricultural areas are utilised for predominantly game ranching, cattle rearing and intensive irrigated vegetable production with some high value crops such as peppadew (for export), patty pans, baby marrows and baby carrots. Smaller enterprises such as the Mondi packing material warehouse in Waterpoort town and the manufacture and treatment of support poles for tomato farms are present in the area. Three small built-up areas, namely Waterpoort town, a 'Share Block Scheme' Village and a Labour Tenant Village are present in the MRA area.

Three economic evaluation methodologies have been applied to contribute to the final decision on the mining application.

- Possible impact on local economic activities. A macro-economic approach was used to determine the magnitude of the present economic activities and the possible impact of the planned mining activities.
- Economic Viability. A Cost Benefit Analysis (CBA) approach to determine medium to long term economic viability.
- A Social Accounting Matrix (SAM) approach to estimate the macro-economic impact on the National Economy and the Limpopo Provincial Economy.

### 2.1 Situational Analysis

All the economic sectors in the immediate vicinity of the proposed mining activities, as well as for the Limpopo Province as a whole, have been included in the analysis. Various stakeholders raised concerns regarding the sustainability of mining development in relation to agricultural and other economic sector activities in the proposed mining area. The long-term sustainable impact was measured in terms of mainly two alternative land use options:

- If the mine is not developed. Therefore, current activities continue, over the projected lifetime of a typical mine, without optimisation or expansion of the land; and,
- If the mine development goes ahead. The lifetime of the mine was applied in all calculations. Rehabilitated land, after mining, cannot necessarily be utilised for the same products and if utilised the same yields might not necessarily be attained.

The impact on the economy, before, during and after the mine's establishment, was calculated *versus* the non-mining alternative. Focus was primarily on the properties directly affected, but also to a decreasing degree on neighbouring properties, due to possible negative environmental impacts, such as air and ground water pollution, noise and visual impacts. The impact of the project on the agricultural sector was calculated, namely whether it may decrease products produced.

## 2.2 Assumptions and Projections

Due to the large number of properties not visited due to denial of access and other reasons, the necessary current land use calculations for these farming enterprises were based on assumptions made for the possible crops cultivated, or beef production according to the land carrying capacity and/or game reared for trophy or biltong hunting with or without accommodation facilities. The required information was, as far as possible, acquired by studying Google Earth images dated January 2009 and acquired data of neighbouring farms.

## 2.3 Objective and Methodology

The objective of the study is to determine the economic and socio-economic impacts of both the construction and operation of the coal mining processes, to be conducted by CoAL, on the micro and macro-economy and the economic viability of the mining development. The study reflects the total direct and indirect macro-economic impacts in quantified terms for the investment that will be generated through the inputs from all of the economic entities that are required to supply goods and services to the construction and operational segments of the project. In addition, quantification is made of the induced effects that the infrastructural investments will have on economic entities such as households, in terms of their income and expenditure activities. For analytical purposes, the total economic impact of the coal mining process can be disaggregated into the following components:

- The impact of the investment phase (construction of the mine) based on the particular capital investment in the Limpopo Province.
- The impact of the everyday operation of the mine.
- The transportation of coal from the mine to ArcelorMittal SA – Vanderbijl Park and/or Port of Maputo by rail.
- Medium to long term economic viability of the mining project.

The results of the study focus on the contribution, negative or positive, that CoAL is expected to make towards the economy in terms of:

- Gross Domestic Product (GDP).
- Employment opportunities.
- Effective capital utilisation (investment).

In order to measure all of the economic implications associated with the construction and operational phases of the project, a partial general macro-economic equilibrium calculation was applied to determine the nature and magnitude of the macro-economic impacts of the project, based on two Social Accounting Matrices (SAMs) developed by Conningarth Economists, namely:

- The national SAM for the South African economy; and
- The regional SAM for the Limpopo Province.

A detailed description of these SAMs is provided in Appendix A and the magnitude of linkages in Appendix C.

## 2.4 Cost Benefit Analysis

A Cost-Benefit Analysis (CBA) forms part of the macro-economic impact analysis and focuses on the positive and negative economic impacts in order to put all direct and secondary impacts of the project into perspective for effective decision making purposes. .

The theoretical foundations of a CBA are: benefits are defined as increases in human wellbeing (utility) and costs are defined as reduction in human wellbeing. For a project or policy to qualify on cost-benefit grounds, its social benefits must exceed its social costs. "Society" is simply the sum of individuals. The geographical boundary for a CBA is usually the nation, but can be readily extended to wider limits. See Appendix B for more detail about the theoretical context of a CBA.

## 2.5 Macro-Economic Impact Analysis

According to the general economic equilibrium analysis, the impacts of the project's development can only be evaluated meaningfully if such impacts are assessed against the background of its total effect (direct and indirect) on certain economic objectives. The updated and benchmarked 2006 Limpopo Provincial SAM tables were used as a modelling input to quantify the relevant economic impacts. Thus, both the investment and operational activities of the project were analysed in terms of its impacts.

The macro-economic impact analysis can be regarded as an extension of the more narrowly defined financial cost-benefit analysis, at the macro level and not at the project level, demonstrating the efficiency of utilising scarce capital and other economic resources. The macro-economic analysis is therefore used in conjunction with the micro project CBA to provide an indication of the project's use of scarce resources relative to the main economic objectives contained in the economic development plan.

The macro-economic aggregates covered in the study are the following:

- Employment levels (jobs).
- Value added to the economy (or gross Limpopo Province product).
- Aggregate wages and salaries.
- Fiscal impacts.

Each of these measures reflects a particular dimension of improvement or impact in the economic well-being of the area's households.

There are different types of impacts that occur over time. In the initial construction phase, labour and materials will be used. After completion, on-going employment and other long-term impacts will result, as set out below.

- **Total Employment Levels**, reflecting the number of additional employment opportunities created by economic growth. This is the most popular measure of economic impact because it is easy to comprehend. However, employment opportunity counts do not necessarily reflect the quality/nature of the employment opportunities, nor salary levels. Therefore levels of employment, i.e. skilled/unskilled could also be assessed where necessary.

- **Value Added**, which is normally equivalent to Gross Domestic Product or Gross Regional Product, and a broader measure of the full income effect.
- **Aggregate Wages and Salaries** in the area increase as pay levels rise and/or additional employees are hired. Either or both of these conditions can occur as a result of growth in business revenues. As long as nearly all of those affected employees live in the study area, this is a reasonable measure of the personal income benefit impact of a project.

It is also important to note that economic impacts also lead to financial impacts, which are changes in government revenues and expenditures. Economic impacts on total business sales, wealth creation or personal income, can affect municipal and other government revenues by expanding or contracting the tax base. Impacts on employment and associated population levels can affect municipal and other government expenditures by changing demand for public services.

This on-going process of macro-economic impact analysis focuses on aspects stressing linkages between the project and the surrounding economy. Environmental externalities may affect other economic sectors and are, therefore, included in the techniques of macro-economic impact assessment. **This is necessary to assist in determining whether the project will enhance net societal welfare.**

This necessitates the analysis of impacts on different sectors or groups that make up society. At a broad level, investigating impacts on overall economic welfare requires considering the efficiency, equity and sustainability of the project. It is important that all three of these aspects are considered in order to provide adequate information to decision makers:

- The principle of **efficiency** raises the issue of whether the nature and form of the project would constitute the efficient use of resources.
- The **equity** principle requires the consideration of whether the project results in outcomes that can be considered fair/equitable in socio-economic terms. Investigating the distribution of impacts is required to clearly indicate who is impacted upon, in what way and for what period.
- **Sustainability** relates to the consideration of whether the project is likely to be financially viable over the medium to long term and whether it will be economically sustainable. Risks to the long-term success of the project, including factors such as changing interest and exchange rates, therefore, become important aspects for assessment.

### 3 Data and Data Sources

#### 3.1 CoAL of Africa

The data regarding the total tonnage, mining period and construction input prices was sourced from Coal of Africa Limited. Coal of Africa used a specific coking quality coal price for analysis purposes, Mosaka investigated the pricing system and took a position on future exchange rate movement and used a slightly different price structure in the analysis.

As per data received from CoAL a projected volume was sold to Eskom.

##### 3.1.1 Relevant Mining Data

The relevant construction and operational phase data used in the analysis was provided to Mosaka Economists by CoAL, the application of the data in the CBA and Macro-Economic Impact models is the responsibility of Mosaka.

###### 3.1.1.1 Construction Phase

The final data received regarding the cost and construction period for the construction phase of the Wildebeesthoek Section is reflected in Table 1.

**Table 1: Wildebeesthoek Section proposed Construction Schedule and Capital Values (constant 2013 prices)**

Year	1	2	3	4	5	6	7	8
	2015	2016	2017	2018	2019	2020	2021	2022
Upfront Capex	142	110	95					66
Capital Construction costs				1 077	2 678	1 690		

All figures are Rand million

The final data received regarding the cost and construction period for the construction phase of the Chapudi Section and Chapudi West Section are reflected in Table 2.

**Table 2: Chapudi and Chapudi West Sections Proposed Construction Schedule and Capital Values (constant 2013 prices)**

Year	18	19	20
	2023	2024	2025
Upfront Capex			
Capital Construction costs	1 403	3 507	2 106

###### 3.1.1.2 Production

The estimated build-up in the production of coal in the Wildebeesthoek mine over the expected life span of the mine is reflected in Table 3. It is projected that production will start in year seven, counting from the year the initial planning started.

**Table 3: Production Figures for the Life of the Wildebeesthoek Section**

Wildebeesthoek	YEAR:	1	2	3	4	5	6	7	8	9	10	11
		2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Eskom coal		-	-	-	-	-	-	963	906	1 302	1 345	1 335
Export coal		-	-	-	-	-	-	6 372	8 731	5 151	6 033	5 715
Other coal		-	-	-	-	-	-	-	-	-	-	-
<b>Turnover per annum</b>		-	-	-	-	-	-	<b>7 335</b>	<b>9 637</b>	<b>6 453</b>	<b>7 378</b>	<b>7 050</b>

Wildebeesthoek	YEAR:	12	13	14	15	16	17	18	19	20	21	22
		2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034
Eskom coal		1 009	1 390	1 494	1 480	1 267	1 290	961	1 524	1 470	1 211	1 088
Export coal		8 281	4 776	6 556	6 567	6 677	7 659	11 886	6 630	6 666	8 746	9 650
Other coal		-	-	-	-	-	-	-	-	-	-	-
<b>Turnover per annum</b>		<b>9 290</b>	<b>6 165</b>	<b>8 050</b>	<b>8 048</b>	<b>7 944</b>	<b>8 949</b>	<b>12 847</b>	<b>8 154</b>	<b>8 136</b>	<b>9 957</b>	<b>10 739</b>

Wildebeesthoek	YEAR:	23	24	25	26	27	28	29	30
		2035	2036	2037	2038	2039	2040	2041	2042
Eskom coal		1 050	1 557	1 552	1 379	1 073	1 549	1 216	865
Export coal		10 244	6 583	6 184	7 863	10 547	7 042	7 771	3 352
Other coal		-	-	-	-	-	-	-	-
<b>Turnover per annum</b>		<b>11 294</b>	<b>8 139</b>	<b>7 736</b>	<b>9 242</b>	<b>11 619</b>	<b>8 591</b>	<b>8 987</b>	<b>4 217</b>

**Table 4: Production Figures for the Life of the Chapudi and Chapudi West Sections**

Chapudi	YEAR:	22	23	24	25	26	27	28	29	30
		2034	2035	2036	2037	2038	2039	2040	2041	2042
Eskom coal		1 626	1 658	1 628	1 609	1 702	1 802	1 667	1 705	1 731
Export coal		5 794	5 528	5 885	6 418	6 378	5 845	6 148	6 032	6 190
Other coal		-	-	-	-	-	-	-	-	-
<b>Turnover per annum</b>		<b>7 420</b>	<b>7 186</b>	<b>7 513</b>	<b>8 027</b>	<b>8 080</b>	<b>7 647</b>	<b>7 815</b>	<b>7 736</b>	<b>7 921</b>

Table 4 indicates that production will only start in year 22 (2034), and although the table only shows nine years of production the estimated period is also 30 years.

### 3.2 Makhado Municipal Area Situational Analysis<sup>9</sup>

The proposed Chapudi Project is located within the Makhado Local Municipality (LM) in the Vhembe District. The Makhado local economy, with a value of production of close to R13 billion, is large in the context of the Limpopo Province. Government is the driver of this local economy, mostly because of the public sector needs of the very large population, which includes education, public health, safety and security, as well as local government services.

<sup>9</sup> Source: Greater Soutpansberg Chapudi Project Scoping Report dd August 2013.



The finance sector is significant, largely due to the assigned rent estimates of extensive tracts of land that command very high prices.

The third largest sector is trade and catering. Makhado town provides a service function for a large surrounding area that stretches beyond its borders. Attractive landscapes have also provided opportunities to create accommodation and catering product offerings.

Agriculture is stagnant at best, but with a tendency to shrink. Important commodities include fruit, timber and meat.

Mining has never been an important sector in the Makhado local economy, but this could change in the foreseeable future due to the interest that the Soutpansberg Coalfield is receiving with its attractive metallurgical properties.

The Makhado Integrated Development Plan (IDP) indicates that current infrastructure is inadequate to service a growing population. This was confirmed by municipal planning managers during a stakeholder consultation meeting with CoAL Ltd on 19 March 2013. Water sources in particular are insufficient and roads are generally in a bad condition. Properties in rural areas are difficult to access, particularly during times of high rainfall.

Historical evidence from other construction and mine development sites indicate that an influx of work seekers should be expected and that their numbers could significantly exceed the number of employment opportunities that may be available.

Socio-economic activities in the area are mixed between intensive irrigated agriculture, hunting and tourism.

### **3.2.1 Overview of the Area Included in Chapudi Project MRA**

Land use within the Chapudi Project area is varied and comprises irrigated commercial crops, cattle and game farming. Some game farms accommodate upmarket game lodges and host international visitors. Other commercial enterprises include a creosote operation which produces and supplies preserved wooden stake supports to the tomato farmers and a Mondi packing material warehouse. Settlements include Waterpoort town, So-ja Village (a 'Share Block Scheme' Village) and a Labour Tenant Village.

The intensive irrigated agricultural activities are focused along the Sand River catchment and neighbouring areas. Most of the irrigation water is extracted from the sand in the Sand River bed. The significance of the intensive agricultural area is that it is utilised for predominantly vegetable production and is known as the winter pantry (production area) of South Africa.

The land use in the Wildebeesthoek Section of the Chapudi Project is predominantly hunting, game farming and eco-tourism with some livestock. The Chapudi Section has a combination of livestock, hunting/game farming and irrigated/dry land agriculture. The Chapudi West Section has portions of intensive irrigation agriculture, the south-west portions are utilised for conservation, hunting and eco-tourism. Some of the properties are also focused on mixed farming, with a mixture of livestock, game and irrigated agriculture. A number of pack houses for fresh commodities are operational in the region. The fresh produce markets are a major outlet for fresh produce.

**Game ranches:** Where trophy hunting and providing accommodation is concentrated on. These ranches focus mainly on the foreign market and offer luxury services and accommodation to clients. Trophy hunting and lodging is the main source of income. Excess game is harvested by means of live capturing or other methods. All the game ranches are fenced in with electrified game proof fencing.

**Extensive game and beef production:** Extensive beef, in combination with game and even irrigation, is practiced by some land-owners. Excess game is also marketed through live capturing or biltong hunting. The income and operational cost is lower than that from trophy hunting. Most of the cattle and game ranches are fenced in with electrified game proof fencing.

**Irrigation:** Irrigation areas for the production of vegetables are mainly equipped with drip irrigation systems. Some Lucerne in the study area is produced under centre pivot irrigation systems. As stated a wide variety of crops is produced, it must be kept in mind that not the total irrigation area along the Sand River falls within the Chapudi project area as irrigation crop production is also present further north.

**Dry land farming:** Due to the low rainfall, no dry-land farming is exercised in the study area although the so-called “cleared lands” are considerably more than the actual irrigated area.

Hunting, game trading and eco-tourism are established socio-economic drivers in the area. There are a number of properties utilized for trophy (for local and foreign tourists) and biltong hunting with eco-tourism spin-off activities.

The area is known locally to be water scarce; therefore, livelihoods in the project area largely rely on water sources to be able to sustain their socio-economic activities. Surface and groundwater is captured in dams for utilization on the various properties. In collaboration with the surface and groundwater specialists the water resources utilized and the purpose have been determined to evaluate the secondary socio-economic dependencies on water use in the area.

Beef farming has over time been overtaken by game as the major land use activity and is presently less than 10%. Game farming supports the value added components of eco-tourism and also stimulates the hunting industry.

### 3.2.2 Approach

It must be noted that some of the large safari enterprises, such as the Brink Schlesinger Family Trust, BerthaTrust and Manupond 124 (Pty) Ltd. extend outside of the demarcated study area. These areas are operated as a unit with the result that it is not always possible to isolate requested information to indicate the situation within the study area only and, for example, labourers are employed for the total farming unit. In some instances game is not restricted to farm boundaries. Other information, such as crop production, is submitted for the study area only.

The proposed mining operation of the Chapudi Project is divided into three sections, namely; the Wildebeesthoek Section, the Chapudi Section and the Chapudi West Section. For purposes of the study the area has been divided into the same three sub-areas with the Sand River as the north-south dividing line, the area comprising of the farms to the east of the Sand River referred to as the Wildebeesthoek Section and the Chapudi Section and the farms to the west of the Sand River referred to as Chapudi West Section.

The main agricultural enterprises found in the study area and the adjacent areas are game ranching, extensive cattle production and irrigated crop production which includes a range of vegetable varieties with double crop production and fruit.

### ***3.2.2.1 Wildebeesthoek Section***

The Wildebeesthoek Section covers the general area east of the Sand River and north of the R523. The farms Pienaar 635MS, Castle Koppies 652MS (consolidated with Mutamba 668 MS), Qualipan 655MS, Koschade 657MS (was Mapani Kop 656MS), Driehoek 631MS, Sandstone Edge 658MS, Malapchani 659MS, Mapani Ridge 660MS, Mountain View 706MS, Wildebeesthoek 661MS, Ridge End 662MS and Bushy Rise 702MS are located wholly or partially within the Wildebeesthoek Section MRA area.

#### Farming Activities

The Wildebeesthoek Section of the study area boasts a variety of land uses including game ranching, cattle farming and to a lesser extent, irrigation farming. Game farms within this block offer activities such as trophy hunting, culling hunting and biltong hunting. Natural grazing within this area is used for game ranching and extensive beef production.

#### Residential – formal and informal

The Bertha Trust Lodge and farm dwelling are situated on the farm Malapchani 659 MS, a bush lodge facility is situated on Mountain View and lodges of Manupond 124 (Pty) Ltd. on the farms Koschade and Pienaar. These luxury lodges are situated on high ground which provides the visitors with a magnificent view over the study area and therefor also the proposed mining activities.

#### Hunting, Tourism and Related Activities

The main tourist attraction within the Wildebeesthoek Section of the study area is hunting (trophy/leisure). The farms within this area offer luxury bush lodge facilities for predominantly overseas trophy hunters and accompanying eco-tourists.

### ***3.2.2.2 Chapudi Section***

The Chapudi Section covers the general area east of the Sand River, south of the road R523 and immediately north of the Soutpansberg. The farms M'tamba Vlei 654MS, Kalkbult 709MS, Sandilands 708MS, Queensdale 707MS, Prince's Hill 704MS, Bushy Rise 702MS, Woodlands 701MS, Blackstone Edge 705MS, Coniston 699MS, Ons Plasie 775MS, Rochdale 700MS, Kliprivier 692MS, Sutherland 693MS, Dorpsrivier 696MS and Bergwater 712MS are located wholly or partially within the Chapudi Section MRA area. Of these farms Kalkbult, Sandilands and Queensdale are located to the east of the Mutamba River.

#### Farming activities

The Chapudi Section of the study area also boasts a variety of land uses. The majority of the land use on these farms consists of natural grazing. Animal breeding projects by Manupond 124 (Pty) Ltd. are operated on the properties Kalkbult and Sandilands for roan antelope, sable antelope, buffalo, nyala and lion. The other main activities which also occur on these two properties are trophy hunting, provision of luxury accommodation and eco-tourism. Natural grazing within this area is used for game ranching and extensive beef production where the grazing potential on the valley floor is better than on the mountain range and the areas further north of the study area.

The general farming activities include irrigation crop farming as well as cattle and game farming. In the west of the Chapudi Section towards the Sand River intensive irrigation crop farming is present. Crops such as peppadew (for export), patty pans, processed tomatoes, baby marrows, baby butternuts, sweet water melon, sweetcorn, guavas and citrus are cultivated on the farms Coniston, Kliprivier, Sutherland and Bergwater. The ZZ2-group is also active in this area with the production of tomatoes.

#### Residential – formal and informal

A guest camp is located on Dorpsrivier, the village Waterpoort is located on Dorpsrivier and Bergwater and consists of a general dealer, bottle store, filling station, post office, police station and Mondi packing material warehouse.

The 'Share Block Scheme' village is partially located on the northern border of Kliprivier and the farm Koedoesveld (which is located outside of the study area) in close proximity to the old So-Ja mineral baths. There are 47 houses on this property with 11 permanent residents. The remaining houses are used over the weekends and during the holidays.

#### Hunting, Tourism and Related Activities

The farms Kalkbult and Sandilands are part of the larger Manupond 124 operation which extends outside of the Chapudi Project study area. Manupond 124 (Pty) Ltd. focuses on trophy hunting and eco-tourism for high ranking foreign clients. The big five (black and white rhino, lion, leopard, elephant and buffalo) are present on this game ranch. Three luxury and four tented lodges, some of which are situated on the farms just outside the study area, are provided for these visitors.

In addition to the activities available on the farms within the project area, the Soutpansberg Conservancy borders the southern side of the area and is a major tourist attraction of the area. It is home to over 500 tree species which contribute to the uniqueness of this terrain. Historically, the Soutpansberg is also a key area to understanding the early relationships between Khoi, San and Bantu cultures which is evident from the numerous rock art sites which have been found in the caves and overhangs in the Soutpansberg.

#### ***3.2.2.3 Chapudi West Section***

The farms Varkfontein 671MS, Waterpoort 695MS, Sandpan 687MS, Sterkstroom 689MS, Albert 686MS, Chapudi 752MS, Vleifontein 691MS including Vierfontein, Brosdoorn 682MS, Grootvlei 684MS, Middelfontein 683MS, Enfield 512MS, Grootboomen 476MS, Vastval 477MS, Bluebell 480MS and Melrose 469MS are located wholly or partially within the Chapudi West Section MRA area.

#### Farming activities

The main farming activity taking place in the western region of the study area is irrigation crop farming. A portion of Varkfontein is irrigated with a drip irrigation system for the production of baby marrows, sweetcorn, peppadew, green beans and tomatoes. Irrigation also occurs at the Vierfontein Agricultural training Centre and portions of the farm Waterpoort. Other large irrigated operations, includes the ZZ2-group, also other minor farms are present in this region where the production of tomatoes and other vegetables occur. Cattle and game farming activities are also present.

### Residential – formal and informal

Settlements are restricted to farm houses and farm buildings. No lodges are found on these properties.

### Hunting, Tourism and Related Activities

Game farming with possibly informal game hunting is present in the area. The Bergtop Nature Reserve, a tourist attraction in the area, borders the southern portion of the area.

#### **3.2.2.4 Water**

Water within the Chapudi Project area is scarce due to the dry climate. Water scarcity impacts greatly on agriculture and therefore the type of land use. On farms where cultivation of crops occurs, farmers rely on the abstraction of groundwater and therefore, a number of boreholes are found throughout the study area. A dominant form of land use within the area is game farming where farmers also rely on groundwater for their animals. Farms situated in close proximity to the Sand River utilise this surface water supply for irrigation of their crops. Greater evidence of cultivated land is therefore present around the Sand River than on other portions of the study area.

#### **3.2.2.5 Impact on Tourism**

Limpopo in general has a thriving tourism industry comprising 54 provincial reserves and several luxury private game reserves. Some farms within the study area are used for trophy hunting and are routinely visited by overseas tourists. The development of the mine could impact negatively on the aesthetic value of the land and may discourage any further game farming activities or expansion of existing activities within the study area. In this respect the larger picture of the impact mining will have in the area north of the Soutpansberg must also be considered.

In addition to the potential loss in game farming activities impacting on tourism, the Soutpansberg Conservancy, to the immediate south of the study area, is a designated tourist attraction within the area. This conservancy is rich in cultural heritage as well as plant and animal life. The development of a mine in close proximity to this conservancy would also impact on the aesthetic value of this area and could potentially deter tourists.

#### **3.2.2.6 Impact on Employment**

The unemployment rate in the Limpopo Makhado Local Municipality is high (36.7%)<sup>10</sup>, while in Ward 21 (the study area is within this ward) of the Makhado Local Municipality it is less (7.2%)<sup>11</sup> and many of the people in the study area rely on their employment as farm workers in this agriculturally rich area. These farm workers come from mixed backgrounds but most of them originate from Venda and Zimbabwe. Farms like the ZZ2 operations and the game farms employ a large percentage of the farm workers within the study area and the regions beyond the study area. A potential loss of these farms would result in employment losses for the farm workers.

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<sup>10</sup> Source: Greater Outpansberg Chapudi Project Scoping Report – August 2013.

<sup>11</sup> Source: Greater Outpansberg Chapudi Project Scoping Report – August 2013.

### **3.2.2.7 Impact on Agricultural Production**

Agricultural activities such as the cultivation of vegetables, cattle farming and tourism (trophy hunting and eco-tourism) make a large contribution to the GDP of the Makhado Local Municipality. Z22 tomato farms are situated within the study area as it provides a favourable environment for tomato growth. The Z22 operation in Limpopo (with substantial land in Ward 21) is the largest tomato producer in the country, providing 40% of South Africa's tomatoes. Mining in this area could result in the potential cut back on production of some of these farms or could have an impact on the agricultural production of tomatoes (including other crops) within the province.

Several marketing strategies for vegetables produced in the region are applied. A number of pack houses for fresh commodities are operational in the region. The fresh produce markets remain a major outlet for fresh produce. Direct marketing is also a popular marketing outlet. Producers deliver direct to chain stores such as Woolworths, Pick 'n Pay, etc.

It must also be kept in mind that most of the irrigated areas are equipped with drip irrigation systems and dust on plants is therefore not washed off. Land-owners are particularly concerned that dust particles will potentially be generated from mining activities and that the presence of dust associated with strong winds can cause severe damage to crops.

A number of processing plants are situated in the region. Some of the farmers, in particular smaller farmers, produce tomatoes to these plants.

In the case of the mining operations impacting negatively on the vegetable and tomato production these pack houses and processing plants may suffer to the extent of closing down.

The grazing potential on the valley floor may vary but it is in the vicinity of 14 to 16 ha per AU. Grazing potential on the mountain range is not so good and is approximately 40 ha per AU. Official government norms for grazing capacity are more conservative. Extensive cattle production is practiced, and mainly weaners are sold to feedlots.

Several marketing strategies are exercised with respect to game ranching, such as hunting, which includes trophy hunting, biltong hunting and bow hunting. Excess game is captured alive and translocated or sold at auctions.

Eco-tourism is also practiced in the area where visitors enjoy wildlife and nature.

#### **Water**

Water in the Chapudi Project area is scarce and in heavy demand for farming, specifically for irrigation. Water availability is a critical factor in terms of agricultural development.

The area is drained by two seasonal rivers, the Sand River in the west and the smaller Mutamba River in the east, both of which flow northward towards the Limpopo River.

The main water sources for farming activities are the Sand River and groundwater. The depth of boreholes may vary from 40 to 300 m and the yield may vary from low to 70,000 litres per hour. The quality of ground water close to the mountain is good. The ground water in the basalt regions is of a poorer quality and the chlorine, magnesium and sodium contents of this water tend to deteriorate over time.

The implication of the mine development on groundwater sources in both quality and quantity is used in the possible estimation of the impact on future crop production and is based on the separate water study for the project.

For analytical purposes, as mentioned, the farming activities in the project area were divided into the three sub-areas referred to as the Wildebeesthoek Section, Chapudi Section and the Chapudi West Section. The activities were grouped as follows:

- Wildebeesthoek land use: The following farming practices were included in this group:
  - Cattle and game or only game ; and/or
  - Luxury lodges.
- Chapudi land use: The following farming practices were included in this group:
  - Cultivation of irrigation crops as the main source of income; and/or
  - Cattle and game or only game ; and/or
  - Game lodges.
- Chapudi West land use: The following farming practices were included in this group:
  - Cultivation of irrigation crops as the main source of income; and/or
  - Cattle and game or only game ; and/or
  - Luxury lodges and other accommodation.

**Table 5: Estimated Present Land Use in the Project Area<sup>12</sup>**

Land Use	Wildebeesthoek		Chapudi		Chapudi West		Total	
	Percentage	Hectares	Percentage	Hectares	Percentage	Hectares	Percentage	Hectares
Irrigation	0.5%	51	1.4%	213	2.2%	274	1.4%	<b>537</b>
Beef	14.0%	1 566	12.1%	1 819	10.8%	1366	12.2%	<b>4 750</b>
Game	85.5%	9 568	86.5%	12 998	87.0%	11 008	86.4%	<b>33 574</b>
<b>Total</b>	<b>100.0%</b>	<b>11 185</b>	<b>100.0%</b>	<b>15 029</b>	<b>100.0%</b>	<b>12 648</b>	100.0%	<b>38 862</b>

The dominating land use activity in all three of the areas is game farming representing approximately 86% of the total area. In the past beef farming was dominant but has since been replaced by game farming.

### 3.2.2.8 Land Use Assumptions

Due to the fact that access to the majority of the farms in the area was denied, information was obtained from staff members of Naledi Development Restructured who had been working in the area and assumptions had to be made regarding further missing information by studying Google Earth images and known data of neighbouring farms.

#### 3.2.2.8.1 Cattle and Game Numbers and Species per Farming Unit

As both the cattle and game numbers, together with the game species for every farm in the study area could not be determined due to the fact that contact could not be made with all the involved landowners or the fact that the landowner was reluctant to divulge the information, therefore cattle

<sup>12</sup> Source: Conningarth Research

and game numbers together with the species present were projected in accordance with the neighbouring farms of which the data and also the land size was available.

The accepted grazing norm for the area together with the “Animal Unit” (AU) namely 14ha to 16 ha /AU was used to estimate cattle and game numbers, which were then converted to animal numbers.

#### 3.2.2.8.2 Allocation of Game Sold to Trophy Hunters and Biltong Hunters or Caught for Auction

The assumption was made that all game farms are fully stocked to carrying capacity. In order to determine the percentage of game sold to trophy hunters and biltong hunters or caught to be sold at auctions or to direct buyers, some of the landowners were requested to give an estimate for their specific businesses and the average of these allocations was applied to the area. The allocation used in the analysis is<sup>13</sup>:

- Male animals 22% trophy hunting, 54% biltong hunting and 24% live game sales;
- Female animals 14% trophy hunting, 61% biltong hunting and 25% live game sales.

The percentages differ per animal group; the numbers reflected above are the average of all the game off-take.

#### 3.2.2.9 Site Visits

Representatives of Mosaka Economic Consultants cc did not physically visit the farms within the NOMR area, but submitted a questionnaire to Naledi Development Restructured (Pty) Ltd to be completed by their representatives who visited the farms involved and obtain the required information as per the questionnaire.

Although a farming unit may be classified as being mainly a cattle farm, all the cattle farms also stock some game and allow hunting by means of concessions made to professional hunters. Some farms, classified as game farms also have small herds of cattle.

The following sub-divisions of commercial farming enterprises in the study area were applied:

- Cattle farming.
- Game farming.
  - Live game sales.
  - Trophy hunting.
  - Biltong hunting.
- Hunting supporting services.
  - Professional hunter.
  - Skinner and tracker.
  - Transport.
  - Taxidermist
  - Game Catching
  - Other.
- Accommodation.
  - Hunting.

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<sup>13</sup> Source: Conningarth Estimation



- Irrigation.
- Other.

### 3.2.2.10 Cattle Farming

As mentioned, cattle (beef) farming has over the time been overtaken by game as the major land use activity. Other than the inconvenience and disruption of prospecting (access to and the presence on premises for drilling), traffic and road surface deterioration, the proposed mining activity will have little negative impact on the industry; a positive point may be the expected labour population increase and resulting higher demand for beef. The monetary value of the present beef farming has been calculated using a macro-economic approach based on a carrying capacity (grazing norm) of 14 hectares per AU with an average annual growth of 130kg per AU per annum as basis. Average 2013 beef prices were used and the results are presented in the following table.

**Table 6: Beef Farming in the Project Area<sup>14</sup> (2012/2013 prices)**

	Wilbeesthoek	Chapudi East	Chapudi West	Total
<b>Number of AU (Commercial)</b>	109	138	86	333
<b>Number of Animals (Commercial)</b>	169	205	149	523
<b>Annual Turnover (Commercial) (R.mil.)</b>	R0.40	R0.46	R0.40	R1.27

The table indicates that the annual turnover of the commercial beef in the Chapudi Project group of farms is about R1.27 million.

### 3.2.2.11 Game Farming

The game farming industry is very active in the area with large investments being made in acquiring and breeding trophy and rare animals and providing accommodation facilities.

In the study area there are farms which cater for all the needs of the industry and there are game farms that only stock the game and do not cater for the other supplementary needs of the industry such as professional hunters, trackers, skimmers, accommodation, etc. This has resulted in safari organisers negotiating with such landowners to reserve certain game species to be hunted. This is referred to as concession hunting. The landowner has no responsibility to the hunters and also has no amenities to support the hunters.

A game farm as an independent enterprise can present a “one stop” hunting venture by providing the hunting supporting services, the game and the accommodation for both the hunters and non-hunters. Such an enterprise may also have acquired hunting concessions from game farms in the area for specific game species not stocked or available on the farm where the supporting services and accommodation infrastructure is located. Also, a game farm (or cattle farm) may have no supporting services or accommodation infrastructure available and only sell game by allowing hunting concessions. In some cases no hunting takes place on the farm as the game is caught and sold at auctions or to private individuals.

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<sup>14</sup> Source: Conningarth Research.

For purposes of this study the breeding of game and the eventual marketing of the animals are divided in to three groups:

- Sale of live animals at either game auctions or through private transactions (the supporting service of game catching is included);
- Trophy hunting, predominantly foreign tourists, and
- Biltong hunting, predominantly South African groups.

Game hunting includes both rifle and bow hunting.

As the numbers per sale activity varies from game specie to specie the price also differs for the different outlet activities. It was therefore necessary to use a number of assumptions, which not necessarily applies to all the farms or game producers. We also accept that this approach is open to criticism, but with the available data collected this approach gives acceptable results.

The grazing norm applied is 14 ha/AU. The different AU to game number conversion rates are presented in the following table.

**Table 7: Estimated Game Representation Used in the Project Area plus the Sex Ratio and Annual Growth Rate**

Specie	Conversion Rate <sup>15</sup>	Animal Representation <sup>16</sup>	Number of Females per Male <sup>17</sup>	Annual Growth Rate <sup>18</sup>
	Number/AU	Percentage	Numbers	Percentage
<b>Blesbuck</b>	4.50	2.73%	10	30%
<b>Bushbuck</b>	7.50	0.71%	6	20%
<b>Blou Wildebeest</b>	2.40	11.03%	10	25%
<b>Buffalo</b>	1.00	1.20%	15	20%
<b>Eland</b>	1.00	5.92%	15	20%
<b>Gemsbok</b>	2.20	9.11%	10	25%
<b>Giraffe</b>	0.70	1.75%	13	15%
<b>Impala</b>	7.00	39.38%	10	35%
<b>Kudu</b>	2.20	16.56%	7	20%
<b>Nyala</b>	3.30	1.31%	10	20%
<b>Hartebeest (Red)</b>	2.00	2.19%	10	20%
<b>Sable Antelope (Swartwitpens)</b>	1.67	1.15%	12	20%
<b>Roan Antelope (Bastergemsbok)</b>	1.56	0.95%	10	20%
<b>Tsessebe (Basterhartbees)</b>	2.63	0.57%	10	20%
<b>Reedbuck, Klipspringer, Duiker, Steenbuck</b>	7.70	2.08%	4	20%
<b>Warthog</b>	5.00	1.86%	10	20%
<b>Waterbuck</b>	2.40	0.63%	10	20%
<b>Zebra</b>	1.60	0.87%	6	25%
<b>Average</b>	3.29	100.00%		

The presence of rhinoceros and other big five animals, except buffalos, have been ignored. The selection of specific animal species and percentage representation is the interpretation of Mosaka based on the survey results.

Applying the above to the number of Animal Units (AUs) and then converting it to animal numbers the following numbers are available for trading or hunting purposes.

**Table 8: Estimated Number of AU and Game Available for Sale or Hunting purposes**

		Chapudi East	Chapudi West	Total
<b>Number of AU</b>	683	928	786	2 397
<b>Number of Animals</b>	2 927	3 977	3 352	10 256
<b>Annual Growth</b>	817	1 102	919	2 838

A decision was then made on the numbers of animals sold live, the number hunted as trophy animals and the number hunted for biltong. It was firstly decided that some of the species are too expensive for the “biltong” market and was allocated to the live sales and trophy hunting section, the animals treated this way are:

<sup>15</sup> Department of Agriculture.

<sup>16</sup> Mosaka Research and Interpretation.

<sup>17</sup> The SA Financial Sector Forum – HB Falkena: Profit and Honour in Game Ranching (2003).

<sup>18</sup> Ditto.

- Buffalo;
- Giraffe; and
- Sable Antelope.

Of the male animals of the above group, 45% were mostly allocated to trophy hunting, 27% were allocated to live sales and 28% to biltong hunting; in the case of the females 34% to trophy, 30% were allocated to live sales and 36% to biltong hunting.

For the rest of the animals an analysis was performed in terms of the number of animals per specie that was sold and feedback on the preferences of biltong hunters and information received from professional hunters on the preferences of trophy hunters.

The prices of trophy game were sourced from Greater Kudu Land Safaris - Rifle Hunters Price List 2012 (Trophy), the pricelist presents the prices in US\$ which was converted by Mosaka to Rand using an exchange rate of ZAR9.50 = 1US\$, eliminating decimals.

**Table 9: Different Outlet Prices for Game as Used in the Calculations (2013 prices)**

	Male Off take - Average Prices			Female Off take - Average Prices		
	Game Sales	Trophy	Biltong	Game	Trophy	Biltong
Blesbuck	1 615	2 800	2 900	1 064	2 800	2 500
Bushbuck	2 557	6 300	-	-	6 300	-
Blou Wildebeest	2 231	6 300	3 216	3 460	6 300	2 538
Buffalo	400 000	85 000	-	400 000	85 000	-
Eland	5 673	11 200	9 300	6 000	6 000	6 000
Gemsbok	4 834	7 000	4 250	4 834	6 000	3 150
Giraffe	13 750	14 700	7 000	13 750	14 700	8 000
Impala	761	2 275	1 122	1 300	700	720
Kudu	2 397	9 800	4 000	3 000	2 100	2 700
Nyala	6 100	13 650	1 122	6 100	13 650	720
Hartebeest (Red)	4 000	9 100	-	4 000	9 100	-
Sable Antelope (Swartwitpens)	135 000	52 500	-	147 500	52 500	-
Roan Antelope	120 000	70 000	-	100 000	70 000	-
Tsessebe (Basterhartbees)	12 000	19 600	-	12 000	19 600	-
Reedbuck, Klipspringer, Duiker,	1 020	6 860	4 500	1 020	6 860	4 500
Warthog	1 000	2 800	900	1 000	2 800	900
Waterbuck	4 132	11 900	6 000	4 334	11 900	4 000
Zebra	5 000	11 900	6 000	15 000	11 900	6 000

Using the above approach the estimated game farming annual turnover is presented in the following table.

**Table 10: Annual Turnover (2013 prices)**

	<b>Wildebeesthoek</b>	<b>Chapudi</b>	<b>Chapudi West</b>	<b>Total</b>
<b>Annual Turnover (R.mil.)</b>	R2.35	R3.20	R3.05	R8.60

### **3.2.2.12 Hunting, Accommodation and Eco-tourism**

With the game farming industry rapidly increasing in the area, large investments have been made to establish new luxury accommodation or upgrading existing accommodation for the trophy hunting fraternity, simultaneously accommodating the eco-tourism segment.

The two types of hunters hunting in the area are divided into the so-called trophy hunters and biltong hunters.

The trophy hunters are mostly foreigners who are looking for specific game species for which they are prepared to pay a very high price. They are mostly not interested in the meat of the hunted animals. They, however, support a number of supplementary activities grouped together and referred to as “Supporting Services”.

Supporting services (usually included in the daily rates and package purchased) comprise the transport from the airport of arrival to the hunting camp and for the duration of the hunting expeditions, the services of a professional hunter, trackers and skinners, use of facilities such as cold room and salt, the field preparation of trophies, capping of trophies, laundry, accommodation and all refreshments.

Taxidermy, shipping of trophies and dipping and packing of trophies is for the account of the hunter and is not included in the daily rates and package quoted, although assistance is offered to deliver the trophy to the taxidermist.

#### **3.2.2.12.1 Accommodation**

- Trophy hunter accommodation

The hunting camps and lodges used for trophy hunters and non-hunters (observers) accompanying the hunters and tourists range from very comfortable to luxurious with all modern amenities always available.

- Biltong hunter accommodation

The biltong hunters decide, according to their budget, what accommodation is preferred. The average biltong hunter requires only basic accommodation with limited personal amenities such as sleeping quarters (single or shared), shower and facilities to prepare meals/coffee/tea (braai) all self-catering.

The number of available beds and tariffs was sourced from Naledi Development Restructured and the internet, and an estimation of the bed occupation was made. The trophy hunter group presented a special problem because included in their daily tariffs are not only the accommodation fee, but also the services of a professional hunter, skinners, trackers and vehicles. It is an all-

inclusive package which also includes the transfer from the OR Tambo airport and only excludes the price of the animal and the taxidermy services.

The following number of beds could be traced per area:

- Wildebeesthoek – 89;
- Chapudi – 65; and
- Chapudi West – 30.

A 35% bed occupation was used to calculate the number of bed nights per annum.

After analysing the data obtained the accommodation turnover in the area was estimated and is presented in the following table.

**Table 11: Annual Accommodation Turn Over in the Project Area (2011 prices)**

Categories	Eco-tourism	Hunters	Total
	<i>Rand mil.</i>	<i>Rand mil.</i>	<i>Rand mil.</i>
<b>Wildebeesthoek</b>	2.90	7.29	10.19
<b>Chapudi</b>	2.41	4.31	6.73
<b>Chapudi West</b>	1.11	1.99	3.10
<b>Total</b>	<b>6.42</b>	<b>13.60</b>	<b>20.02</b>

The total accommodation turnover in the project area is R20.02 million.

#### 3.2.2.12.2 Hunting Supporting Services

The professional hunter operates independently and is contracted by the hunting organiser for a specific safari. The professional hunter often resides in the Gauteng area and meets the hunting party at the airport on arrival. From arrival he/she will accompany the hunting party to the game farm with either his/her own transport or transport supplied by the hunting organiser or hired helicopter.

The trackers and skimmers are the responsibility of the hunting organiser and are separately hired by the organiser for the specific safari. They do the field preparation of trophies and the capping of trophies. It could also be that the tracker(s) and skimmers are in the full employment of the hunting organiser.

All transport and amenities on the game farm is the responsibility of the hunting organiser. Transport to visit local sights, souvenir hunting and entertainment is also supplied at additional cost.

The facilities such as cold room and salt, the field preparation of trophies, capping of trophies is provided by the hunting organiser. The arrangement and responsibility for taxidermy, the shipping of the trophies and the dipping and packing of trophies is the hunter's, although advice is given and assistance is offered to deliver the trophy to the taxidermist.

A hunting trophy is an item prepared from the carcass of a game animal killed by a hunter and kept as a souvenir of the successful hunting expedition. Often the heads or entire bodies are processed by a taxidermist, although sometimes other body parts such as teeth, tusks or horns are used as the trophies.

The cost of hunting services was calculated separately from the money spent on taxidermist services. The taxidermy fees were obtained from the internet and the number of animals treated determined from discussions with individuals in the industry. In the following table the support services and taxidermist costs are presented.

**Table 12: Annual Value of Support Services and Taxidermy Costs (2011 prices)**

	<b>Support Services Rand mil.</b>	<b>Taxidermy Rand mil.</b>	<b>Total Rand mil.</b>
<b>Wildebeesthoek</b>	1.50	1.82	3.32
<b>Chapudi</b>	0.94	2.81	3.75
<b>Chapudi West</b>	0.43	0.25	0.68
<b>Total</b>	<b>2.97</b>	<b>4.88</b>	<b>7.75</b>

The table shows that the value of the support services is R2.97 per annum and the taxidermy costs are around R4.88 million per annum for the project area.

### **3.2.2.13 Irrigation**

As no detailed data about the exact crop varieties produced was available, it was necessary that some assumptions be made to be used for the analysis:

- In the case of tomato production it was accepted that the cultivation practice is one crop period followed by three crop free periods, in the case of a 100 hectares tomatoes the implication is that if only the 100 hectares is cultivated per annum, 25 hectares is in production at a time. The direct employment is based on the number used for 25 hectares while the direct and indirect reflects the 100 hectares. In the case of GDP it reflects the value of 100 hectares.
- It appears as if the more accepted practice for the other crops is three crops in a two year period, although some farmers claim two crops per annum. A 67% double cropping factor for the other vegetable crops was used.
- As the area is also producing some high value, the so-called “baby” vegetables, which were included in the mix, the exact hectare areas were not available.

In the next table a breakdown of the physical hectares and crop hectares used in the calculation is presented based on the available information and the formulated assumptions.

**Table 13: Estimated Irrigation Areas and the Crops produced**

	Wildebeesthoek		Chapudi		Chapudi West		Total	
	Physical Area	Crop Area	Physical Area	Crop Area	Physical Area	Crop Area	Physical Area	Crop Area
	hectares	hectares	hectares	hectares	hectares	hectares	hectares	hectares
Winter vegetables	28	47	78	131	93	156	199	334
Summer vegetables	8	13	19	32	16	27	43	72
Tomatoes	7	7	74	74	110	110	191	191
Citrus	2	2	15	15	11	11	28	28
Potatoes	3	4	11	18	19	32	33	54
Baby carrots	1	3	6	11	11	18	18	32
Patty Pans	2	3	9	14	14	23	25	40
<b>Total</b>	<b>51</b>	<b>79</b>	<b>212</b>	<b>295</b>	<b>274</b>	<b>377</b>	<b>537</b>	<b>751</b>

The total physical irrigated hectares are estimated at 537 with 51 in the Wildebeesthoek Section, 212 in the Chapudi Section and 274 in the Chapudi West Section farming areas. The estimated annual crop hectares are 79 in the Wildebeesthoek Section, 295 in the Chapudi Section and 377 in the Chapudi West Section totalling 751 hectares for the project farming area.

Enterprise budgets compiled for the Land Bank and Development Bank during 2012 were updated to 2013 values and applied to arrive at the total irrigation value per category. The structure of the Baby Carrots and Patty Pan budgets are sourced from: *An economic overview of the baby vegetable industry in South Africa by Nomfundo Nadine Monaren. It was submitted in partial fulfilment of the requirements for the degree M.Com in Agricultural Economics in the Faculty of Economic and Management Sciences, University of Pretoria, February 2013.*



**Table 14: Enterprise Budgets (2013 Values)**

<i>Current Situation (per hectare)</i>	Tomatoes	Brassicas (Winter)	Cucurbits (Summer)	Citrus	Potatoes	Baby Carrots	Patty Pans
<b>Gross Income</b>	<b>R 262 500</b>	<b>R 128 000</b>	<b>R 56 100</b>	<b>R 122 439</b>	<b>R129 960</b>	<b>R 285 000</b>	<b>R 144 000</b>
<b>Variable Costs</b>	<b>R 183 331</b>	<b>R 56 017</b>	<b>R 32 040</b>	<b>R 79 147</b>	<b>R 91 696</b>	<b>R 146 839</b>	<b>R 69 750</b>
-Marketing Costs	R 32 813	R 7 047	R 7 013	R 805	R 16 125	R 39 900	R 20 160
-Pre Harvest Cost	R 0			R 0			
-Irrigation labour	R 0						
- Other pre-harvest costs	R 74 965	R 37 545	R 12 726	R 29 301	R 49 691	R 44 010	R 27 352
-Harvest Cost	R 75 553	R 11 425	R 12 302	R 49 040	R 25 880	R 62 929	R 22 238
<b>Interest on Working Capital</b>	<b>R 2 375</b>	<b>R 1 690</b>	<b>R 704</b>	<b>R 3 304</b>	<b>R 2 315</b>	<b>R 1 980</b>	<b>R 1 231</b>
<b>Gross Margin</b>	<b>R 76 794</b>	<b>R 70 293</b>	<b>R 23 356</b>	<b>R 39 988</b>	<b>R 35 949</b>	<b>R 136 181</b>	<b>R 73 019</b>
<b>Fixed Costs</b>	<b>R 4 199</b>	<b>R 3 594</b>	<b>R 2 910</b>	<b>R 7 412</b>	<b>R 3 639</b>	<b>R 3 594</b>	<b>R 3 519</b>
-Depreciation	R 0						
- Irrigation equipment							
- Other	R 2 106.8	R 2 041	R 1 758	R 2 660.60	R 2 660.60	R 2 041	R 2 041
-Labour	R 354.00	R 184	R 115	R 736.00	R 736.00	R 184	R 184
-Insurance	R 321.98	R 311	R 269	R 572.40	R 572.40	R 311	R 311
-Repairs & Maintenance	R 604.20	R 596	R 511	R 1 287.90	R 1 287.90	R 596	R 596
-Administration Costs	R 508.80	R 184	R 85	R 975.20	R 975.20	R 184	R 184
-Fuel & Electricity	R 247.80	R 223	R 117	R 743.40	R 743.40	R 223	R 223
-Sundry	R 55.12	R 55	R 55	R 436.72	R 436.72	R 55	R 55
<b>Net Farm Income</b>	<b>R 72 596</b>	<b>R 66 700</b>	<b>R 20 446</b>	<b>R 32 575</b>	<b>R 32 312</b>	<b>R 132 587</b>	<b>R 69 425</b>

In the following table the estimated value of the irrigation activities per area is presented.

**Table 15: Estimated Value of the Irrigation Activities (2013 prices)**

<b>Farm Category</b>	<b>Value Rand million</b>
Wildebeesthoek	10.51
Chapudi	47.35
Chapudi West	64.22
<b>Total</b>	<b>122.07</b>

The table shows that the annual estimated value of the irrigation activities in the total Chapudi Project area is around R122.07 million.

### **3.2.2.14 Summary: Current Activities**

In the next table the total estimated annual value of the current activities in the project area is presented.

**Table 16: Annual Turn Over of the Activities in the Project Area (2013 prices)**

	<b>Annual Income</b>	<b>Annual Income</b>	<b>Annual Income</b>	<b>Annual Income</b>
	<b>Wildebeesthoek</b>	<b>Chapudi</b>	<b>Chapudi West</b>	<b>Total</b>
	<b>Rand mil.</b>	<b>Rand mil.</b>	<b>Rand mil.</b>	<b>Rand mil.</b>
<b>Beef Farming</b>	0.40	0.46	0.49	1.36
<b>Game Farming - Animals(Turn Over)</b>	<b>2.35</b>	<b>3.33</b>	<b>0.00</b>	<b>8.87</b>
- <i>Game Sales</i>	0.27	0.33	-	0.60
- <i>Trophy Hunting</i>	1.19	1.79	1.48	4.47
- <i>Biltong Hunting</i>	0.89	1.21	1.70	3.80
<b>Hunting</b>				
- Professional Hunting Services (including game catching)	1.50	0.94	0.43	2.88
- <i>Taxidermy</i>	1.82	2.81	0.25	4.87
- <i>Accommodation</i>	7.29	4.32	1.99	13.60
<b>Total</b>	<b>10.61</b>	<b>8.06</b>	<b>0.00</b>	<b>21.35</b>
<b>Eco-Tourism</b>	2.90	2.41	1.11	6.42
<b>Irrigation</b>	10.51	47.35	64.22	122.07
<b>Grand Total</b>	<b>26.78</b>	<b>61.61</b>	<b>65.82</b>	<b>160.07</b>

The annual total value of the current activities are estimated at R160.07 million, with irrigation contributing around R122.07 million, 76.2%, with accommodation the second largest contributor at R20.02 million.

It is, however, also important to realise that the game farming and related activities, hunting, taxidermy, game catching and accommodation contributes in total R30.22million.

## 4 Current Activities – Macro-Economic Parameters

In this section the baseline activities are converted to macro-economic parameters, in a later section a risk profile is established for all three the identified areas, the risk is then converted to macro-economic parameters and presented as such.

### 4.1 Approach

A Macro-Economic Impact Model (MEIM) is used, based on the Limpopo Social Accounting Matrix (SAM) which has been converted to an econometric model to be used in the project area. The MEIM was adapted to accommodate each of the identified project areas and was then populated with the baseline data.

The magnitude of the current activities in the project area has been calculated according to the methods as explained. In the following sections the current economic activities are expressed in terms of the following macro-economic parameters:

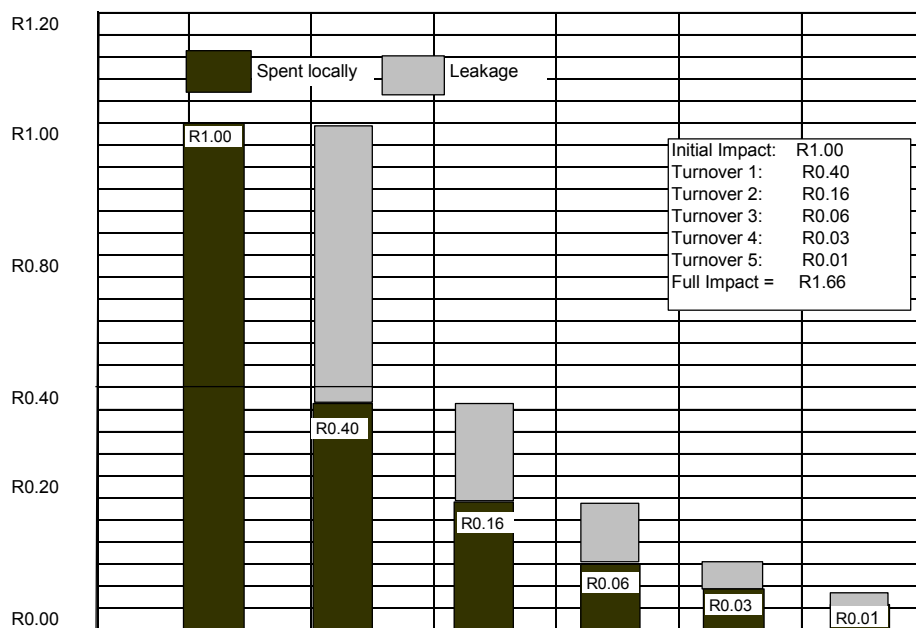
- Gross Domestic Product (GDP) – Direct and Indirect/Induced Impacts;
- Employment – Direct and Indirect/Induced Impacts;
- Payments to Households – Low Income and Medium/High Income.

The possible impacts of the proposed coal mine on the current economic activities was estimated and converted to the macro-economic parameters to show the impacts.

The Limpopo Social Accounting Matrix (SAM) was used to synthesise appropriate multipliers to be used in the Macro-Economic Impact Model (MEIM) to calculate the macro-economic impact of the different activities.

All economic models incorporate a number of “multipliers” which form the nucleus of the modelling system. The nature and extent of the impact of a change in a specific economic quantity, e.g. exports, on that of another economic quantity or quantities, e.g. production output or employment, is determined by a “multiplier”. A multiplier summarises the total impact that can be expected from a change in a given economic activity. For illustrative purposes the figure below shows the multiplier concept used in assessing the change in economic activity.

**Graph 1: Multipliers and Turnover**



In this example, R1 is received into the local economy of the area from sales beyond the local borders. Of this, 40 cents is spent for goods and services within the region. The economic sectors and individuals who receive the 40 cents spend 16 cents within the local area. Of the 16 cents, only six cents is spent locally, and so on. The total amount of money received by local firms and residents as a result of the initial R1 in added exported earnings is R1.66. Therefore, the multiplier is R1.66.

The change in economic activity resulting from the change in one factor of production, such as water resources, is measured by different multipliers. Four multipliers are commonly used to assess the impacts of an initial increase in production resulting from an increase in sales, usually called final demand in multiplier analysis. The four multipliers are: (1) output, (2) employment; (3) income; and (4) value added.

Sectorial multipliers are calculated using information contained in the applicable Provincial Social Accounting Matrix (SAM) and the National SAM as well as data obtained from the South African Reserve Bank and Statistics South Africa. These inverse matrices capture all the direct and indirect relationships among the inputs and outputs of the various entities included in the applicable provincial SAM.

Direct GDP, labour and capital multipliers for each sector are calculated using the following formula:

$$\text{GDP multiplier} = \frac{\text{Value Added}}{\text{Production}}$$

$$\text{Labour multiplier} = \frac{\text{Employment}}{\text{Production}}$$

$$\text{Capital multiplier} = \frac{\text{Capital stock}}{\text{Production}}$$

These multipliers were incorporated into the MEIM and used to calculate the macro-economic impacts. By using a SAM for the applicable region, the above multipliers can be calculated. The multipliers that were used in this study to determine the economic impacts are as follows:

- Economic growth, i.e. the impact on GDP.
- Employment creation, i.e. the impact on labour requirements.
- Income distribution, i.e. the impact on low income, poor households and total households.

A breakdown of the different effects of the agricultural sector multipliers used in this study is as follows:

- Direct Impacts: the effects occurring directly in the agriculture sector:
- Indirect Impacts: those effects occurring in the different economic sectors that link backwards to agriculture due to the supply of intermediate inputs, e.g., fertilisers, seeds, hunting professional services, transport, etc.
- Induced Impacts: the chain reaction triggered by the salaries and profits (less retained earnings) that are ploughed back into the economy in the form of private consumption expenditure.
- Total Impacts: Represents the direct, indirect and induced summed effect.

## 4.2 Risk Assessment

Risk is a combination of the probability, or frequency of occurrence of a hazard and the magnitude of the consequence of the occurrence (Nel 2002). Risk estimation (RE) is concerned with the outcome, or consequences of an intention, taking account of the probability of occurrence and can be expressed as  $P$  (probability)  $\times$   $S$  (severity) = RE. Risk evaluation is concerned with determining significance of the estimated risks and also includes the element of risk perception. Risk assessment combines risk estimation and risk evaluation (Nel 2002).

The risk assessment methodology that will be used during the EIA Phase to estimate the risk and determine the impact significance is tabled below.

In developing a possible impact scenario for the construction and operation on the local economic activities, it was necessary to differentiate the activities and to again estimate it within the three identified sub-areas as the possible impacts differ for the three areas.

A risk profile was developed for each of the areas making provision for a weight allocated to a specific intrusion caused by the mining activity. A percentage impact is then allocated to each economic activity, which is then multiplied with the weight; the answer is converted to percentage impact. The percentage impact is then applied to the estimated annual turnover to arrive at the negative impact to be caused by the mining activity.

Mathematically the process can be explained as follows:

[Mining weights]  $\times$  [Estimated Percentage Impact] = [Impact] ► converted to monetary values.

The weights allocated to the different identified infringements in respect of the Category 1 farmers areas are shown in the table below. For each of the other two categories a separate model was developed.

**Table 17: Risk Factors Considered**

Infringement	Activity	Sub -Activity
Noise	<b>Beef and other Livestock Farming</b>	Commercial
		Community
	<b>Game Farming</b>	Game (breeding)
		Live Sales
		Trophy Hunting
		Biltong Hunting
	<b>Tourism &amp; Accommodation</b>	Eco - tourists
		Hunters
	<b>Irrigation</b>	Citrus
		Other Crops
<b>Community</b>	Life Style	
	<b>Environment (birds &amp; plants)</b>	
	<b>Sub-total</b>	7
Dust	<b>Beef and other Livestock Farming</b>	Commercial
		Community
	<b>Game Farming</b>	Game (breeding)
		Live Sales
		Trophy Hunting
		Biltong Hunting
	<b>Tourism &amp; Accommodation</b>	Eco - tourists
		Hunters
	<b>Irrigation</b>	Citrus
		Other Crops
<b>Community</b>	Life Style	
	<b>Environment (birds &amp; plants)</b>	
	<b>Sub-total</b>	14.00
Blasting	<b>Beef and other Livestock Farming</b>	Commercial
		Community
	<b>Game Farming</b>	Game (breeding)
		Live Sales
		Trophy Hunting
		Biltong Hunting
	<b>Tourism &amp; Accommodation</b>	Eco - tourists
		Hunters
	<b>Irrigation</b>	Citrus
		Other Crops
<b>Community</b>	Life Style	
	<b>Environment (birds &amp; plants)</b>	
	<b>Sub-total</b>	7.00
Social, Crime and other impacts	<b>Beef and other Livestock Farming</b>	Commercial
		Community
	<b>Game Farming</b>	Game (breeding)
		Live Sales
		Trophy Hunting
		Biltong Hunting
	<b>Tourism &amp; Accommodation</b>	Eco - tourists
Hunters		

	<b>Irrigation</b>	Citrus
		Other Crops
	<b>Community</b>	Life Style
	<b>Environment (birds &amp; plants)</b>	
	<b>Sub-total</b>	12.00
<b>Destroying the sense of place -Visual</b>	<b>Beef and other Livestock Farming</b>	Commercial
		Community
	<b>Game Farming</b>	Game (breeding)
		Live Sales
		Trophy Hunting
		Biltong Hunting
	<b>Tourism &amp; Accommodation</b>	Eco - tourists
		Hunters
	<b>Irrigation</b>	Citrus
		Other Crops
<b>Community</b>	Life Style	
<b>Environment (birds &amp; plants)</b>		
	<b>Sub-total</b>	10.00
<b>Underground water - contamination and water levels</b>	<b>Beef and other Livestock Farming</b>	Commercial
		Community
	<b>Game Farming</b>	Game (breeding)
		Live Sales
		Trophy Hunting
		Biltong Hunting
	<b>Tourism &amp; Accommodation</b>	Eco - tourists
		Hunters
	<b>Irrigation</b>	Citrus
		Other Crops
<b>Community</b>	Life Style	
<b>Environment</b>		
	<b>Sub-total</b>	33.00
<b>Surface water - contamination and run-off</b>	<b>Beef and other Livestock Farming</b>	Commercial
		Community
	<b>Game Farming</b>	Game (breeding)
		Live Sales
		Trophy Hunting
		Biltong Hunting
	<b>Tourism &amp; Accommodation</b>	Eco - tourists
		Hunters
	<b>Irrigation</b>	Citrus
		Other Crops
<b>Community</b>	Life Style	
<b>Environment</b>		
	<b>Sub-total</b>	17.00
	<b>Total</b>	<b>100</b>

### 4.3 Baseline Parameters and Risk Induced Parameters

The macro-economic parameters used are the Gross Domestic Product (GDP) and employment opportunity which is calculated for each of the different identified activities. It is expressed as Direct, Indirect/Induced and Total. Employment opportunities are used as many of the hunting activities are only practised for 9 to 10 months of the year, this approach has as a result the fact that the number of people involved is more than the number of opportunities.

The results are presented for the three identified group of farms namely Wildebeesthoek, Chapudi and Chapudi West.

A separate risk analysis is performed for each of the three areas. In evaluating the results it is necessary to keep in mind that although a mathematical model is used to estimate the possible negative risk, it is still a subjective issue in the allocation of the different weights and the possible impacts.

#### 4.3.1 Wildebeesthoek Section

The following table presents the activities expressed in macro-economic parameters.

**Table 18: Current Situation in the Wildebeesthoek Section Expressed as Macro-Economic Parameters (2013 prices)**

	Gross Domestic Product			Employment			Payments to Households		
	Direct R mil.	Indirect/ Induced R mil.	Total R mil.	Direct Number	Indirect/ Induced Number	Total Number	Total R mil.	High/ Medium R mil.	Low R mil.
Irrigation	6.28	5.20	11.48	91	25	116	3.91	3.15	0.76
Beef Farming	0.38	0.21	0.59	1	1	2	0.11	0.09	0.03
Game Farming	4.69	3.09	7.78	8	24	32	1.78	1.28	0.50
Hunting	0.85	0.83	1.67	31	3	34	0.78	0.53	0.25
Taxidermy, Game catching, etc.	1.00	1.01	2.01	5	3	8	0.64	0.47	0.16
Accommodation	4.63	5.39	10.02	31	22	53	5.23	3.53	1.69
<b>Total</b>	<b>17.82</b>	<b>15.74</b>	<b>33.56</b>	<b>167</b>	<b>78</b>	<b>245</b>	<b>12.46</b>	<b>9.06</b>	<b>3.39</b>

The table above reflects that all the activities support 167 direct and 78 indirect and induced employment opportunities. Irrigation provides the majority of the direct employment, namely 91.

As far as direct GDP is concerned irrigation creates R 6.28 million per annum.

In the following table the identified risks are presented as a percentage.

**Table 19: Percentage Change Expressed as Macro-Economic Parameters (2013 prices)**

	Gross Domestic Product			Employment			Payments to Households		
	Direct R mil.	Indirect/ Induced R mil.	Total R mil.	Direct Number	Indirect/ Induced Number	Total Number	Total R mil.	High/ Medium R mil.	Low R mil.
Irrigation	-62.9%	-62.9%	-62.9%	-60.1%	-63.7%	-60.9%	-62.9%	-62.9%	-62.9%
Beef Farming	-26.8%	-26.8%	-26.8%	-23.4%	-100.0%	-56.6%	-26.8%	-26.8%	-26.8%
Game Farming	-26.3%	-26.3%	-26.3%	-26.3%	-25.0%	-25.3%	-26.3%	-26.3%	-26.3%
Hunting	-36.5%	-36.5%	-36.5%	-36.5%	0.0%	-33.2%	-36.5%	-36.5%	-36.5%
Taxidermy, Game catching, etc.	-36.5%	-36.5%	-36.5%	-36.5%	0.0%	-23.6%	-36.5%	-36.5%	-36.5%
Accommodation	-66.8%	-66.8%	-66.8%	-66.8%	-68.2%	-67.4%	-66.8%	-66.8%	-66.8%
<b>Total</b>	<b>-50.8%</b>	<b>-53.5%</b>	<b>-52.0%</b>	<b>-54.5%</b>	<b>-48.8%</b>	<b>-52.7%</b>	<b>-55.9%</b>	<b>-56.0%</b>	<b>-55.9%</b>



The percentage reduction in employment opportunities as shown in the table above will come to 54.5% direct and 48.8% indirect and induced employment opportunities. The total percentage change in direct employment will be 52.7%.

As far as direct GDP is concerned percentage reduction for irrigation will be 62.9% per annum.

The following table presents the macro-economic parameters after the estimated risk factors were applied.

**Table 20: New Situation in the Wildebeesthoek Section Expressed as Macro-Economic Parameters (2013 prices)**

	Gross Domestic Product			Employment			Payments to Households		
	Direct R mil.	Indirect/ Induced R mil.	Total R mil.	Direct Number	Indirect/ Induced Number	Total Number	Total R mil.	High/ Medium R mil.	Low R mil.
Irrigation	2.33	1.93	4.26	36	9	45	1.45	1.17	0.28
Beef Farming	0.28	0.16	0.43	1	0	1	0.08	0.06	0.02
Game Farming	3.45	2.28	5.73	6	18	24	1.31	0.95	0.37
Hunting	0.54	0.52	1.06	19	3	22	0.50	0.34	0.16
Taxidermy, Game catching, etc.	0.64	0.64	1.28	3	3	6	0.40	0.30	0.10
Accommodation	1.54	1.79	3.33	10	7	17	1.74	1.17	0.56
<b>Total</b>	<b>8.77</b>	<b>7.32</b>	<b>16.10</b>	<b>76</b>	<b>40</b>	<b>116</b>	<b>5.49</b>	<b>3.99</b>	<b>1.50</b>

According to the table above the activities after the possible impact of the mining activities have been accounted for, will support 76 direct and 40 indirect and induced employment opportunities. The total employment will be 116.

As far as direct GDP is concerned, irrigation will create R 2.33 million per annum.

In the following table the projected negative impact of the proposed mining activity are presented

**Table 21: Change Expressed as Macro-Economic Parameters in the Wildebeesthoek Section (2013 prices)**

	Gross Domestic Product			Employment			Payments to Households		
	Direct R mil.	Indirect/ Induced R mil.	Total R mil.	Direct Number	Indirect/ Induced Number	Total Number	Total R mil.	High/ Medium R mil.	Low R mil.
Irrigation	-3.95	-3.27	-7.22	-55	-16	-71	-2.46	-1.98	-0.48
Beef Farming	-0.10	-0.06	-0.16	0	-1	-1	-0.03	-0.02	-0.01
Game Farming	-1.23	-0.81	-2.05	-2	-6	-8	-0.47	-0.34	-0.13
Hunting	-0.31	-0.30	-0.61	-11	0	-11	-0.29	-0.19	-0.09
Taxidermy, Game catching, etc.	-0.37	-0.37	-0.74	-2	0	-2	-0.23	-0.17	-0.06
Accommodation	-3.09	-3.60	-6.69	-20	-15	-35	-3.49	-2.36	-1.13
<b>Total</b>	<b>-9.05</b>	<b>-8.41</b>	<b>-17.46</b>	<b>-91</b>	<b>-38</b>	<b>-129</b>	<b>-6.97</b>	<b>-5.07</b>	<b>-1.90</b>

The reduction in employment opportunities as shown in the table above will be 91 direct and 38 indirect and induced employment opportunities. The total reduction in employment will be 129.

As far as direct GDP is concerned, irrigation will reduce by R 3.95 million per annum.

#### 4.3.2 Chapudi Section

The following table presents the activities expressed in macro-economic parameters.

**Table 22: Current Situation in the Chapudi Section Expressed as Macro-Economic Parameters (2013 prices)**

	Gross Domestic Product			Employment			Payments to Households		
	Direct R mil.	Indirect/ Induced R mil.	Total R mil.	Direct Number	Indirect/ Induced Number	Total Number	Total R mil.	High/ Medium R mil.	Low R mil.
Irrigation	25.17	25.88	51.05	299	120	419	18.79	15.07	3.72
Beef Farming	0.50	0.20	0.71	2	-	2	0.10	0.08	0.03
Game Farming	1.23	1.78	3.01	11	14	25	1.17	1.14	0.03
Hunting	1.87	1.83	3.70	10	7	17	1.74	1.18	0.56
Taxidermy, Game catching, etc.	2.07	2.08	4.15	11	8	19	1.31	0.98	0.34
Accommodation	3.05	3.56	6.61	20	15	35	3.45	2.33	1.12
<b>Total</b>	<b>33.90</b>	<b>35.34</b>	<b>69.24</b>	<b>353</b>	<b>164</b>	<b>517</b>	<b>26.56</b>	<b>20.78</b>	<b>5.79</b>

The table above reflects that all the activities support 353 direct and 164 indirect and induced employment opportunities. Irrigation provides the majority of the direct employment, namely 299.

As far as direct GDP is concerned irrigation creates R25.17 million per annum.

In the following table the identified risks are presented as a percentage.

**Table 23: Percentage Change Expressed as Macro-Economic Parameters (2013 prices)**

	Gross Domestic Product			Employment			Payments to Households		
	Direct R mil.	Indirect/ Induced R mil.	Total R mil.	Direct Number	Indirect/ Induced Number	Total Number	Total R mil.	High/ Medium R mil.	Low R mil.
Irrigation	-53.2%	-53.2%	-53.2%	-53.2%	-53.5%	-53.3%	-55.9%	-56.6%	-53.2%
Beef Farming	-26.8%	-26.8%	-26.8%	-26.8%	0.0%	-26.8%	-26.8%	-26.8%	-26.8%
Game Farming	-26.3%	-26.3%	-26.3%	-26.3%	-28.6%	-27.6%	-26.3%	-26.3%	-26.8%
Hunting	-26.3%	-26.3%	-26.3%	-30.0%	-28.6%	-27.2%	-26.3%	-26.3%	-26.3%
Taxidermy, Game catching, etc.	-36.5%	-36.5%	-36.5%	-36.5%	-37.5%	-36.4%	-36.5%	-36.5%	-36.5%
Accommodation	-66.8%	-66.8%	-66.8%	-66.8%	-73.3%	-69.6%	-66.8%	-66.8%	-66.8%
<b>Total</b>	<b>-50.5%</b>	<b>-50.7%</b>	<b>-50.6%</b>	<b>-51.9%</b>	<b>-51.7%</b>	<b>-51.6%</b>	<b>-53.0%</b>	<b>-53.3%</b>	<b>-52.0%</b>

The percentage reduction in employment opportunities as shown in the table above will come to 51.9% direct and 51.7% indirect and induced employment opportunities. The total percentage change in employment will be 51.6%.

As far as direct GDP is concerned percentage reduction for irrigation will be 53.2% per annum.

The following table presents the macro-economic parameters after the estimated risk factors were applied.

**Table 24: New Situation in the Chapudi Section Expressed as Macro-Economic Parameters (2013 prices)**

	Gross Domestic Product			Employment			Payments to Households		
	Direct R mil.	Indirect/ Induced R mil.	Total R mil.	Direct Number	Indirect/ Induced Number	Total Number	Total R mil.	High/ Medium R mil.	Low R mil.
Irrigation	11.78	12.11	23.89	140	56	196	8.29	6.55	1.74
Beef Farming	0.37	0.15	0.52	1	0	1	0.08	0.06	0.02
Game Farming	0.91	1.31	2.22	8	10	18	0.86	0.84	0.02
Hunting	1.38	1.35	2.73	7	5	12	1.28	0.87	0.41
Taxidermy, Game catching, etc.	1.31	1.32	2.64	7	5	12	0.83	0.62	0.22
Accommodation	1.01	1.18	2.20	7	4	11	1.15	0.77	0.37
<b>Total</b>	<b>16.76</b>	<b>17.43</b>	<b>34.19</b>	<b>170</b>	<b>80</b>	<b>250</b>	<b>12.49</b>	<b>9.71</b>	<b>2.78</b>

According to the table above the activities after the possible impact of the mining activities have been accounted for, will support 170 direct and 80 indirect and induced employment opportunities. The total employment will be 250.

As far as direct GDP is concerned, irrigation will create R11.78 million per annum.

In the following table the projected negative impact of the proposed mining activity are presented.

**Table 25: Change Expressed as Macro-Economic Parameters (2013 prices)**

	Gross Domestic Product			Employment			Payments to Households		
	Direct R mil.	Indirect/ Induced R mil.	Total R mil.	Direct Number	Indirect/ Induced Number	Total Number	Total R mil.	High/ Medium R mil.	Low R mil.
Irrigation	-13.39	-13.77	-27.16	-159	-64	-224	-10.50	-8.52	-1.98
Beef Farming	-0.13	-0.05	-0.19	0	0	0	-0.03	-0.02	-0.01
Game Farming	-0.32	-0.47	-0.79	-3	-4	-7	-0.31	-0.30	-0.01
Hunting	-0.49	-0.48	-0.97	-3	-2	-5	-0.46	-0.31	-0.15
Taxidermy, Game catching, etc.	-0.76	-0.76	-1.52	-4	-3	-7	-0.48	-0.36	-0.12
Accommodation	-2.04	-2.38	-4.42	-13	-11	-24	-2.30	-1.56	-0.75
<b>Total</b>	<b>-17.14</b>	<b>-17.91</b>	<b>-35.05</b>	<b>-183</b>	<b>-85</b>	<b>-267</b>	<b>-14.08</b>	<b>-11.07</b>	<b>-3.01</b>

The reduction in employment opportunities as shown in the table above will be 183 direct and 85 indirect and induced employment opportunities. The total reduction in employment will be 267.

As far as direct GDP is concerned, irrigation will reduce by R13.39 million per annum.

#### 4.3.3 Chapudi West Section

The following table presents the activities expressed in macro-economic parameters.

**Table 26: Current Situation Expressed in the Chapudi West Section as Macro-Economic Parameters (2013 prices)**

	Gross Domestic Product			Employment			Payments to Households		
	Direct R mil.	Indirect/ Induced R mil.	Total R mil.	Direct Number	Indirect/ Induced Number	Total Number	Total R mil.	High/ Medium R mil.	Low R mil.
Irrigation	32.84	34.25	67.09	347	190	537	24.90	20.01	4.90
Beef Farming	0.39	0.14	0.53	1	-	1	0.07	0.05	0.02
Game Farming	2.45	0.90	3.35	9	4	13	0.50	0.37	0.13
Hunting	1.79	1.75	3.54	10	8	18	1.66	1.13	0.54
Taxidermy, Game catching, etc.	0.38	0.38	0.75	2	1	3	0.24	0.18	0.06
Accommodation	1.41	1.64	3.05	9	6	15	1.59	1.08	0.52
<b>Total</b>	<b>39.26</b>	<b>39.07</b>	<b>78.33</b>	<b>378</b>	<b>209</b>	<b>587</b>	<b>28.97</b>	<b>22.81</b>	<b>6.16</b>

The table above reflects that all the activities support 378 direct and 209 indirect and induced employment opportunities. Irrigation again provides the bulk of the employment with 347 direct jobs.

As far as direct GDP is concerned irrigation creates R32.84 million.

In the following table the identified risks are presented as a percentage.

**Table 27: Percentage Change Expressed as Macro-Economic Parameters (2013 prices)**

	Gross Domestic Product			Employment			Payments to Households		
	Direct R mil.	Indirect/ Induced R mil.	Total R mil.	Direct Number	Indirect/ Induced Number	Total Number	Total R mil.	High/ Medium R mil.	Low R mil.
Irrigation	-45.1%	-44.1%	-44.6%	-36.6%	-54.7%	-43.0%	-44.1%	-44.1%	-43.9%
Beef Farming	-26.8%	-26.8%	-26.8%	-12.1%	0.0%	-12.1%	-26.8%	-26.8%	-26.8%
Game Farming	-26.3%	-26.3%	-26.3%	-26.3%	0.0%	-18.3%	-26.3%	-26.3%	-26.3%
Hunting	-26.3%	-26.3%	-26.3%	-26.3%	-37.5%	-31.4%	-26.3%	-26.3%	-26.3%
Taxidermy, Game catching, etc.	-33.9%	-33.9%	-33.9%	-33.9%	-50.0%	-41.8%	-33.9%	-33.9%	-33.9%
Accommodation	-66.8%	-66.8%	-66.8%	-66.8%	-66.7%	-66.7%	-66.8%	-66.8%	-66.8%
<b>Total</b>	<b>-43.5%</b>	<b>-43.7%</b>	<b>-43.6%</b>	<b>-36.7%</b>	<b>-53.3%</b>	<b>-42.6%</b>	<b>-43.9%</b>	<b>-43.9%</b>	<b>-43.8%</b>

The percentage reduction in the employment opportunities as shown in the table above will be 36.7% direct and 53.3% indirect and induced employment opportunities.

As far as direct GDP is concerned the percentage reduction for accommodation and tourism will come to 66.8% million followed by professional services with 33.9% per annum.

The following table presents the macro-economic parameters after the estimated risk factors were applied.

**Table 28: New Situation in the Chapudi West Section Expressed as Macro-Economic Parameters (2013 prices)**

	Gross Domestic Product			Employment			Payments to Households		
	Direct R mil.	Indirect/ Induced R mil.	Total R mil.	Direct Number	Indirect/ Induced Number	Total Number	Total R mil.	High/ Medium R mil.	Low R mil.
Irrigation	18.04	19.15	37.19	220	86	306	13.92	11.17	2.75
Beef Farming	0.29	0.10	0.39	1	-	1	0.05	0.04	0.01
Game Farming	1.80	0.66	2.47	7	4	11	0.37	0.27	0.10
Hunting	1.32	1.29	2.61	7	5	12	1.23	0.83	0.40
Taxidermy, Game catching, etc.	0.25	0.25	0.50	1	1	2	0.16	0.12	0.04
Accommodation	0.47	0.55	1.01	3	2	5	0.53	0.36	0.17
<b>Total</b>	<b>22.17</b>	<b>22.01</b>	<b>44.17</b>	<b>240</b>	<b>98</b>	<b>338</b>	<b>16.26</b>	<b>12.79</b>	<b>3.46</b>

According to the table above the activities will support 240 direct and 98 indirect and induced employment opportunities. Irrigation provides the majority of the direct employment, namely 220.

In the following table the projected negative impact of the proposed mining activity are presented.

**Table 29: Change Expressed as Macro-Economic Parameters (2013 prices)**

	Gross Domestic Product			Employment			Payments to Households		
	Direct R mil.	Indirect/ Induced R mil.	Total R mil.	Direct Number	Indirect/ Induced Number	Total Number	Total R mil.	High/ Medium R mil.	Low R mil.
Irrigation	-14.80	-15.10	-29.90	-127	-104	-231	-10.98	-8.83	-2.15
Beef Farming	-0.10	-0.04	-0.14	0	0	0	-0.02	-0.01	-0.00
Game Farming	-0.64	-0.24	-0.88	-2	0	-2	-0.13	-0.10	-0.03
Hunting	-0.47	-0.46	-0.93	-3	-3	-6	-0.44	-0.30	-0.14
Taxidermy, Game catching, etc.	-0.13	-0.13	-0.26	-1	-1	-2	-0.08	-0.06	-0.02
Accommodation	-0.94	-1.10	-2.04	-6	-4	-10	-1.06	-0.72	-0.34
<b>Total</b>	<b>-17.09</b>	<b>-17.06</b>	<b>-34.15</b>	<b>-139</b>	<b>-112</b>	<b>-251</b>	<b>-12.72</b>	<b>-10.02</b>	<b>-2.70</b>

The reduction in employment opportunities as shown in the table above will be 139 direct and 112 indirect and induced employment opportunities. Direct employment for irrigation will be reduced by 127.

As far as direct GDP is concerned the irrigation direct reduction will be R14.80million, with the total irrigation GDP reduction estimated at R29.90 million.

#### 4.3.4 Total Impact – Chapudi Project

**Table 30: Current Situation Expressed as Macro-Economic Parameters (2013 prices)**

	Gross Domestic Product			Employment			Payments to Households		
	Direct R mil.	Indirect/ Induced R mil.	Total R mil.	Direct Number	Indirect/ Induced Number	Total Number	Total R mil.	High/ Medium R mil.	Low R mil.
Irrigation	64.29	65.33	129.62	737	335	1 073	47.61	38.23	9.38
Beef Farming	1.28	0.56	1.83	4	1	5	0.29	0.22	0.07
Game Farming	8.36	5.77	14.14	28	42	70	3.45	2.80	0.65
Hunting	4.51	4.41	8.92	50	18	68	4.19	2.83	1.35
Taxidermy, Game catching, etc.	3.45	3.47	6.92	19	13	32	2.19	1.62	0.56
Accommodation	9.09	10.60	19.68	60	43	103	10.27	6.94	3.33
<b>Total</b>	<b>90.98</b>	<b>90.14</b>	<b>181.12</b>	<b>898</b>	<b>452</b>	<b>1 350</b>	<b>67.99</b>	<b>52.65</b>	<b>15.34</b>

The table above reflects that the total impact of all the current activities support 898 direct and 452 indirect and induced employment opportunities, with a total dependency of 1 350. Irrigation provides the majority of the direct employment, namely 737 with a total of 1 073 jobs.

As far as direct GDP is concerned irrigation creates a total of R129.62 million per annum, with a direct figure of R64.29 million.

The total payments to households are R67.99 million of which R15.34 million is destined for low income households.

In the following table the identified risks are presented as a percentage.

**Table 31: Percentage Change Expressed as Macro-Economic Parameters (2013 prices)**

	Gross Domestic Product			Employment			Payments to Households		
	Direct R mil.	Indirect/ Induced R mil.	Total R mil.	Direct Number	Indirect/ Induced Number	Total Number	Total R mil.	High/ Medium R mil.	Low R mil.
Irrigation	-50.0%	-49.2%	-49.6%	-46.2%	-55.0%	-49.0%	-50.3%	-50.6%	-49.1%
Beef Farming	-26.8%	-26.8%	-26.8%	-21.4%	-100.0%	-37.3%	-26.8%	-26.8%	-26.8%
Game Farming	-26.3%	-26.3%	-26.3%	-26.3%	-23.8%	-24.8%	-26.3%	-26.3%	-26.3%
Hunting	-28.2%	-28.2%	-28.2%	-32.5%	-27.8%	-31.3%	-28.2%	-28.2%	-28.2%
Taxidermy, Game catching, etc.	-36.2%	-36.2%	-36.2%	-36.2%	-30.8%	-34.0%	-36.2%	-36.2%	-36.2%
Accommodation	-66.8%	-66.8%	-66.8%	-66.8%	-69.8%	-68.0%	-66.8%	-66.8%	-66.8%
<b>Total</b>	<b>-47.6%</b>	<b>-48.1%</b>	<b>-47.8%</b>	<b>-45.9%</b>	<b>-51.8%</b>	<b>-47.9%</b>	<b>-49.7%</b>	<b>-49.7%</b>	<b>-49.6%</b>

The percentage change in the reduced employment opportunities as shown in the table above is estimated to be around 45.9% direct and 51.8% indirect and induced employment opportunities. Direct employment for irrigation will come down by 46.2% and accommodation and tourism by 66.8% direct employment opportunities.

As far as direct GDP is concerned the percentage reduction for irrigation will come to 50% and accommodation with 66.8% per annum.

The following table presents the macro-economic parameters after the estimated risk factors were applied.

**Table 32: New Situation Expressed as Macro-Economic Parameters (2013 prices)**

	Gross Domestic Product			Employment			Payments to Households		
	Direct R mil.	Indirect/ Induced R mil.	Total R mil.	Direct Number	Indirect/ Induced Number	Total Number	Total R mil.	High/ Medium R mil.	Low R mil.
Irrigation	32.15	33.19	65.34	397	151	548	23.66	18.89	4.77
Beef Farming	0.93	0.41	1.34	3	-	3	0.21	0.16	0.05
Game Farming	6.17	4.25	10.42	21	32	53	2.55	2.06	0.48
Hunting	3.24	3.17	6.40	34	13	47	3.00	2.04	0.97
Taxidermy, Game catching, etc.	2.20	2.22	4.42	12	9	21	1.40	1.04	0.36
Accommodation	3.02	3.52	6.54	20	13	33	3.41	2.31	1.10
<b>Total</b>	<b>47.70</b>	<b>46.76</b>	<b>94.46</b>	<b>486</b>	<b>218</b>	<b>704</b>	<b>34.23</b>	<b>26.49</b>	<b>7.74</b>

According to the table above the activities will support 486 direct and 218 indirect and induced employment opportunities. Irrigation will provide 397 direct employment opportunities.

As far as direct GDP is concerned, irrigation will create R32.15 million.

In the following table the projected negative impact of the proposed mining activity is presented.

**Table 33: Change Expressed as Macro-Economic Parameters (2013 prices)**

	Gross Domestic Product			Employment			Payments to Households		
	Direct R mil.	Indirect/ Induced R mil.	Total R mil.	Direct Number	Indirect/ Induced Number	Total Number	Total R mil.	High/ Medium R mil.	Low R mil.
<i>Irrigation</i>	-32.14	-32.14	-64.28	-341	-184	-525	-23.95	-19.34	-4.61
<i>Beef Farming</i>	-0.34	-0.15	-0.49	-1	-1	-2	-0.08	-0.06	-0.02
<i>Game Farming</i>	-2.20	-1.52	-3.72	-7	-10	-17	-0.91	-0.74	-0.17
<i>Hunting</i>	-1.27	-1.24	-2.52	-16	-5	-21	-1.18	-0.80	-0.38
<i>Taxidermy, Game catching, etc.</i>	-1.25	-1.26	-2.51	-7	-4	-11	-0.79	-0.59	-0.20
<i>Accommodation</i>	-6.07	-7.08	-13.14	-40	-30	-70	-6.86	-4.64	-2.22
<b>Total</b>	<b>-43.27</b>	<b>-43.38</b>	<b>-86.66</b>	<b>-412</b>	<b>-234</b>	<b>-646</b>	<b>-33.76</b>	<b>-26.16</b>	<b>-7.61</b>

The change in employment opportunities as shown in the table above will be -412 direct and -234 indirect and induced employment opportunities. Direct employment for irrigation will be reduced by 341 direct opportunities, with the accommodation and tourism reduced by 40 direct employment opportunities.

As far as direct GDP is concerned the irrigation change will be -R32.14 million followed by accommodation and tourism with -R6.07 million per annum.

#### 4.3.5 Projected Income Loss

**Table 34: Estimated Annual Income Loss (2013 prices)**

	<i>Wildebeesthoek Farms Rand Million</i>	<i>Chapudi Farms Rand million</i>	<i>Chapudi West Farms Rand million</i>	<i>Total Rand million</i>
Beef and Livestock Farming	R -0.11	R -0.12	R -0.13	R -0.36
Game Farming and Hunting	R -0.62	R -0.88	R -0.84	R -2.33
Professional and Taxidermist	R -1.21	R -1.37	R -0.23	R -2.81
Accommodation (Tourists and	R -6.81	R -4.49	R -2.07	R -13.37
Irrigation	R -6.61	R -25.19	R -34.16	R -65.96
Environmental Impact	R -0.88	R -5.46	R -0.99	R -7.33
<b>Total</b>	<b>R -16.23</b>	<b>R -37.51</b>	<b>R -38.43</b>	<b>R -92.17</b>

The Chapudi West Section farms stand to lose the most with a R38.43 million reduction, followed by the Chapudi Section farms with a reduction of R37.51 million and Wildebeesthoek Section farms with R16.23 per annum expressed in 2013 prices.



## 5 Cost Benefit Analysis: Justification of the Greater Soutpansberg Project – Chapudi

### 5.1 Objective of the Cost Benefit Analysis

The principles underlying the Standard Cost Benefit Analysis (CBA) are applied to evaluate the financial and economic viability of the Chapudi Project, taking into consideration all negative and positive costs (impacts) of the mining activities.

The CBA approach provides a logical framework by means of which development projects can be objectively evaluated and, as such, serves as an aid in the decision-making process. (A more detailed explanation of the CBA can be found in Appendix B).

### 5.2 Cost Benefit Analysis Methodology

A CBA comprises two distinct portions, a financial CBA component and an economic CBA component. The financial CBA component is based on market and nominal prices, whilst the economic CBA component is based on shadow/economic and constant prices. The use of shadow/economic prices is necessary in order to reflect more realistic values of scarce economic resources. Market prices often do not give a true representation of the scarcity values of resources, owing to interference in market price setting such as government tax regulation and artificial adjustments to, for example, fossil fuels prices, electricity tariffs and minimum wage levels.

Within the CBA framework, various impacts have been calculated for each year of the project period.

The impacts for each year of the project are discounted to present values, using an appropriate discount rate. The financial CBA is conducted in current prices (with the assumption that the SA inflation rate over the longer period will be less than 6%) and a real yield on capital of 5% giving a discount rate of 11% per annum, reflecting the cost of capital. The economic CBA is done in constant prices and discounted by a social discount rate of 8% per annum.

The CBA methodology has been chosen to indicate whether the project in question is feasible or not. Within the framework, the estimated cost of the project is compared by means of a ratio (Benefit Cost Ratio) to the estimated benefits of the project. In order for a project to be considered financially and economically viable, this ratio must have a value greater than 1 in order to indicate that benefits outweigh costs.

Additional viability indicators provided are Net Present Value (NPV) and Internal Rate of Return (IRR). A more detailed discussion on the interpretation of each indicator is included in the results section of each of the two CBA components.

### 5.3 General Overview

The CBA clearly distinguishes between cost and benefit aspects of the project.

Costs: Within the CBA framework, the costs related to the project can be separated into three distinct components:

- capital expenditure;
- operational expenditure; and

- external cost impacts (externalities).

This breakdown mirrors the more widely-defined macro-economic impact, a discussion of which follows in Appendix A.

Capital expenditure is made up of:

- Investment in the mine infrastructure itself (the largest capital expenditure component);
- Expenditure on the construction of transport infrastructure;
- Expenditure on the development of structures to supply water to the mine.

Operational expenditure includes:

- Railway maintenance cost and operational costs,
- Water Supply - Maintenance and Operation costs,
- Processing costs, and
- Coal Transport and port costs.

The benefits of the project are in the form of revenue generated from the sale of the extracted coal to domestic markets, in lieu of imported coking quality coal or revenue from exporting of the coal.

## 5.4 Assumptions Underlying the CBA

### 5.4.1 Costs Relating to the Project

The assumptions that were used in relation to the costs for both the financial and economic CBA are briefly discussed below.

#### 5.4.1.1 Capital Expenditure:

The Chapudi Project consists of three separate mines that are separately phased and developed in the same area nearly 15 years apart. All capital expenditure is assumed to occur over a three year construction periods with a three year early planning period namely 2015, 2016 and 2017. The Wildebeesthoek Section construction period is estimated to be from 2018 to 2020. The Wildebeesthoek Section life of mine (LOM) period runs from 2019 to at least 2048, 31 years, during which period the coal resources at the project location should be exhausted.

The Chapudi Project construction is planned to start in 2032 to 2034. Chapudi Project is divided into two phases; the Wildebeesthoek Section, then the Chapudi and Chapudi West Sections thus the Wildebeesthoek Section will be developed first followed by the Chapudi and Chapudi West Sections. As mentioned the farms have been divided into three sub-areas, namely the farms on the east of the Sand River referred to as the Wildebeesthoek Sector and the Chapudi Sector and the farms to the west referred to as the Chapudi West Sector. The construction period of the Chapudi and Chapudi West Sections will take place simultaneously.

The estimated Capital expenditure as provided by CoAL is provided in the table below:

**Table 35: Projected Capital Expenditure for the proposed Wildebeesthoek, Chapudi and Chapudi West Sections (2013 constant prices)**

	Chapudi			Chapudi West			Wildebeesthoek		
	Financial Costs	Shadow Price Factor	Economic Costs	Financial Costs	Shadow Price Factor	Economic Costs	Financial Costs	Shadow Price Factor	Economic Costs
<b>Upfront Cape</b>	R Millions		R Millions	R Millions		R Millions	R Millions		R Millions
	R214.00	0.9866	R211.14	R357.00	0.9866	R352.23	R -	0.9866	R -
<b>Capital Construction costs</b>	R3 842.60		R3 735.59	R3 171.42	0.9659	R3 081.09	R5 350.96	0.9659	R5 199.50
Exploration	R53.95	0.9896	R53.39	R -	0.9896	R -	R74.34	0.9896	R73.57
Bulk Services	R248.21	0.9323	R231.41	R164.03	0.9323	R152.93	R300.79	0.9323	R280.42
Mine Infrastructure	R606.65	0.9855	R597.86	R707.39	0.9855	R697.15	R930.34	0.9855	R916.87
Surface Mining East Pit	R688.48	0.9323	R641.86	R637.51	0.9323	R594.35	R650.72	0.9323	R606.66
Surface Mining Central Pit	R -	0.9323	R -	R -	0.9323	R -	R145.84	0.9323	R135.96
Surface Mining West Pit	R -	0.9323	R -	R -	0.9323	R -	R252.95	0.9323	R235.82
ROM Handling	R406.34	0.9837	R399.71	R426.51	0.9837	R419.55	R592.60	0.9837	R582.93
Plant	R1 175.65	0.9857	R1 158.87	R641.00	0.9857	R631.85	R1 516.26	0.9857	R1 494.62
Product Handling	R357.07	0.9837	R351.24	R378.96	0.9837	R372.78	R352.79	0.9837	R347.03
Overheads	R306.25	0.9837	R301.26	R216.00	0.9837	R212.48	R534.33	0.9837	R525.61

From the above it appears that expressed in 2013 prices the estimated capital for the Wildebeesthoek Section is estimated at R5 350.96 million with no upfront capital spending. In the case of the two Chapudi Sections the estimated capital is R7 014.02 million with R571 capital upfront.

In the following table the construction schedule and associated amounts for the Wildebeesthoek section are presented.

**Table 36: Wildebeesthoek Section Proposed Construction Schedule and Capital Costs (constant 2013 prices)**

Year	2018	2019	2020	Total
Construction schedule	20%	50%	30%	100%
Capital Construction costs	R1 070.19	R675.48	R1 605.29	R5 350.96

*Note: All figures are Rand million*

The above table show that there no is planned upfront Capex and that construction costs will be incurred over a period of three years.

In the following table the construction schedule and associated amounts for the Chapudi sections is presented.

**Table 37: Chapudi and Chapudi West Sections Proposed Construction Schedule and Capital Costs (constant 2013 prices)**

	<u>2015</u>	<u>2016</u>	<u>2017</u>	<u>2018</u>	<u>2019</u>	<u>2020</u>	<u>2021</u>	<u>2022</u>	<u>2023</u>	<u>2024</u>
<b>Construction Schedule</b>	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
<b>Upfront Capex - Chapudi</b>	-		R -	R -	R -	R85.00	R -	R66.00	R -	R -
<b>Upfront Capex - Chapudi West</b>	R142.00	R110.0	R95.0	R7.0	R3.0	R -	R -	R -	R -	R -
<b>Capital Construction costs - Chapudi</b>	R -	R -	R -	R -	R -	R -	R -	R -	R -	R -
<b>Capital Construction costs - Chapudi West</b>	R -	R -	R -	R -	R -	R -	R -	R -	R -	R -

<u>Year</u>	<u>2032</u>	<u>2033</u>	<u>2034</u>	<u>Total</u>
<b>Construction Schedule</b>	20%	50%	30%	<b>R214.00</b>
<b>Upfront Capex - Chapudi</b>	R -	R -	R2.00	<b>R357.00</b>
<b>Upfront Capex - Chapudi West</b>	R -	R -	R -	<b>R -</b>
<b>Capital Construction costs - Chapudi</b>	R768.5	R1 921.3	R1 152.78	<b>R3 842.58</b>
<b>Capital Construction costs - Chapudi West</b>	R634.2	R1 585.7	R951.43	<b>R3 171.33</b>

The above table shows that it is planned that the upfront Capex will be spent over a period of four years for the Chapudi Sections.

#### 5.4.1.1.1 Operational Expenditure

In the following table the projected mining costs used in the model is presented as received from mining consultants.

**Table 38: Wildebeesthoek Section Estimated Operational Mining Cost (2013 constant prices)**

Item	Cost per year Rand	Rate Rand/ton
Parting Mining		26.33
Coal Mining		25.27
Diesel		6.12
Exploration & Drilling	3 000 000.00	
Head Office	3 000 000.00	
Mining Contractor	8 400 000.00	
Other Fixed	5 100 000.00	
Owners Team	9 000 000.00	
Processing		40.00
Rehabilitation		0.235
Siding		5.40
Soft Overburden including waste mining		0
Survey	1 680 000.00	
Topsoil Stripping		0
Waste Mining		21.78
Port		45.16
Rail Export		151.20

**Table 39: Chapudi and Chapudi West Sections Estimated Operational Mining Cost (2013 constant prices)**

Item	Cost per year Rand	Rate Rand/ton
Parting Mining		27.63
Coal Mining		25.05
Diesel		6.20
Exploration & Drilling	3 000 000.00	
Head Office	3 000 000.00	
Mining Contractor	8 400 000.00	
Other Fixed	5 100 000.00	
Owners Team	9 000 000.00	
Processing		40.00
Rehabilitation		0.235
Siding		5.40
Soft Overburden including waste mining		0
Survey	1 680 000.00	
Topsoil Stripping		0
Waste Mining		21.73
Port		61.34
Rail Export		205.35

As the cost is expressed as a value per ROM ton, if converted to product tons the amount is R185.46.

The following transport costs were used in the calculations as presented in the tables above:

- Loading Cost – R5.40 per saleable ton for both Chapudi and Wildebeesthoek
- Rail transport from Siding to Maputo – R205.35 per ton for the Chapudi Section and R151.20 per ton for Wildebeesthoek Section.
- Port Costs – R45.16 per ton for the Chapudi Section and R61.34 per ton for the Wildebeesthoek Section.

The estimated maintenance costs expressed as a percentage used in the CBA model is presented in the following table.

**Table 40: Projected Maintenance Costs (2013 prices)**

	Chapudi R million	Chapudi West R million	Wildebeest- hoek R million	Classifica- tion	Mainte- nance %	Chapudi R million	Chapudi West R million	Wildebeest- hoek R million
Exploration	53.9	-	74.3	Civil	0.5%	0.27	-	0.37
Bulk Services	248.2	164.0	300.8	Civil	0.5%	1.24	0.82	1.50
Mine Infrastructure	606.6	707.4	930.3	Mechanical	5.0%	30.33	35.37	46.52
Surface Mining East Pit	688.5	637.5	650.7	Civil	0.5%	3.44	3.19	3.25
Surface Mining Central Pit	-	-	145.8	Civil	0.5%	-	-	0.73
Surface Mining West Pit	-	-	252.9	Civil	0.5%	-	-	1.26
ROM Handling	406.3	426.5		Mechanical	1.0%	4.06	4.27	5.93
Plant	1 175.7	641.0	1 516.3	Engineering	5.0%	58.78	32.05	75.81
Product Handling	357.1	379.0	352.8	Mechanical	1.0%	3.57	3.79	3.53
Overheads	306.3	216.0	534.3		0.0%	-	-	-
Discard Dump	-	-	-		0.0%	-	-	-
<b>Total</b>	<b>3 843</b>	<b>3 171</b>	<b>5 351</b>			<b>102</b>	<b>79</b>	<b>139</b>

At full production the amount of R102.69 million is allocated as maintenance per annum for the Chapudi mine, R79.49 million for the Chapudi West mine and R138.91 million for maintenance of the Wildebeesthoek mine.

#### 5.4.1.2 Externalities

A number of externalities have been identified which have been costed and were included in the model. The following have been included:

- Current Local Economic Activities. These costs have been estimated in a separate section and are included in the appropriate model. The costs to the farming livestock, game and irrigation practices are discussed in detail in a previous section and the estimated annual loss in turnover by the three categories of farms were investigated and added, and an amount of R84.37 million per annum was added to the CBA as a cost to the system.
- Rehabilitation and Environmental Costs. The amount of R0.235 per ton was used as the rehabilitation costs. A value of R25.54 million was estimated and included as the

environmental cost item. It must be emphasised that this amount can change as the rest of the project reports become available.

- Mine Closure: A statutory amount of R1 847 million was used over time in constant prices.

#### 5.4.2 Social Costs

As no social cost has yet been provided, the item is not included in the analysis.

#### 5.4.3 Benefits Relating to the Project

The benefits associated with the project are the revenue resulting from the sale of the coal to Eskom and the coal exported. Two issues are important in this instance, namely the quantity of coal produced and the tons as provided by the mining report has been used for the base calculation.

Two price structures are present in this case, namely; the Eskom price and the export price. The Eskom price is determined during a negotiation process and is at present calculated using the Giga Joules output per ton at R10.51 per Giga Joule. The coal price is estimated at R283/ton for both Chapudi and Chapudi West and Wildebeesthoek. It is obvious that these prices will depend on the quality of the coal supplied and is at present based on the provided giga joules output of the coal.

As far as the export price is concerned two factors play a role, namely; international demand which again is influenced by the health of the world wide economy and the relative strength of the Rand versus the US\$. International prices are quoted in US dollars and the exchange rate has a direct influence on the Rand price. For the base price \$171 per ton was used and an exchange rate of R9.50 to the US\$ was used. Sensitivity analyses were run on a number of price scenarios and are reported on separately.

### 5.5 Results

#### 5.5.1 Financial Cost Benefit Analysis

The table below reflects the summarised results of the Financial CBA. As previously discussed, the analysis has been done in nominal terms at a 6% SA inflation rate, and using a financial discount rate of 11% per annum. The long-term discount rate of 11% is in line with a real interest rate of 5%. However, it was necessary to change certain item inflation rates because of certain externalities applicable to specific items.

The following detailed rates were used.

**Table 41: Inflation Rates used in the Financial CBA Model**

Cost Item	Inflation Rate <sup>19</sup>
Capital	6%
Mining Costs - Including Labour and Electricity	8.5%
Maintenance Costs	6%
Transport Costs	7.5%
Disbenefits	6%

<sup>19</sup>Source: Conningarth Projections

As construction capital is utilised over a number of years the constant prices had to be adapted, using the Reserve Bank upper limit.

Mining costs includes labour and electricity and it was necessary to make provision for a higher rate, the same applies to the transport costs.

The results for the total mining project are presented in the table below.

**Table 42: Results of the Financial CBA (Current prices)**

	CBA Results		
	NPV	IRR	BCR
<b>Financial CBA Results</b>	Rand Million	%	number
<b>Indicators</b>	32 534.92	43.3%	5.30

Results are interpreted as follows:

- The Net Present Value (NPV) of an investment compares the present value of the benefits from an investment with the present value of all costs. In order for a project to be considered viable, a positive NPV is required as this indicates that the overall benefits outweigh the overall costs of the project over time. The NPV above shows that the net benefit accrued is positive with an amount of R 32 534.92million.
- The Benefit Cost Ratio (BCR) is a ratio of the present value of benefits relative to the present value of costs. A project should only be considered viable if the BCR is greater than 1. The BCR of 5.30 implies that for each Rand invested in the project there is an expected return of between R1 and R5.30.
- The Internal Rate of Return (IRR) is the discount rate at which present values of both benefits and costs are equal. Projects should have an IRR greater than the discount rate to be considered viable. In this case the IRR is 43.3% which is four times above the discount rate.
- The NPV, BCR and IRR all confirm the financial viability of the project.

### 5.5.2 Economic Cost Benefit Analysis

The economic CBA is conducted in terms of the economic values of costs and benefits. For this purpose, the shadow prices are used in order to reflect the real cost of using scarce economic resources in the production processes, as discussed in the Methodology. Constant 2012 prices are used and a Social Discount Rate of 8% is applied.

**Table 43: Results of the Economic CBA (Economic prices)**

	CBA Results		
	NPV	IRR	BCR
<b>Economic CBA Results</b>	Rand Million	%	number
<b>Indicators</b>	R18 623.32	37.6%	4.53

The results show the following features:



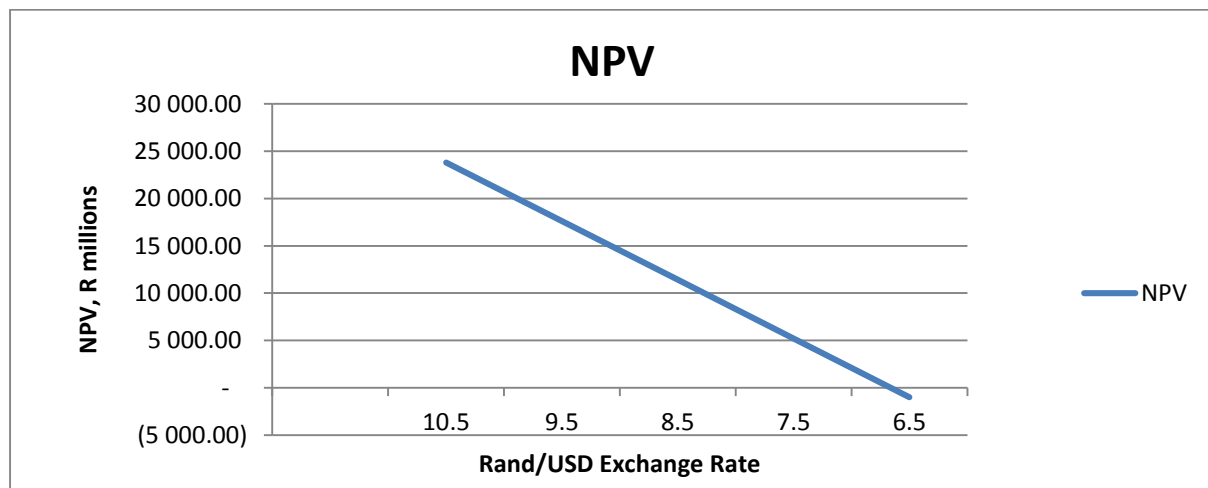
- When considering the economic CBA, results similar to those in the Financial CBA are depicted. The discount rate used for the economic CBA is 8% per annum and figures are not adjusted for inflationary effects. The NPV of R18 623 million is a very positive net gain.
- The BCR of 4.53 shows that returns of R4.53 are expected for each Rand invested in the project.
- The IRR of 37.6% is over four times the social discount rate of 8%.
- The NPV, BCR and IRR all confirm economic viability of the mining project.

### 5.5.3 Sensitivity Analysis

A sensitivity analysis was performed on a number of price options, specifically the export price as expressed in US\$ terms and the possible movements in the exchange rate.

The following options were considered namely a 10% drop in US\$ prices and a remarkable strengthening of the Rand against the dollar. In the following graph the NPV of a \$171 per ton international price with a strengthening Rand is presented.

**Graph 2: The Net Present Value for an International Coal Price at different Exchange Rates**



The graph indicates that with a \$171 per ton international price and an exchange rate above R6.5 to the US\$ the NPV still remains positive. It must be kept in mind that less than two years ago the international price was around \$207 per ton and the exchange rate R7 to the US\$, giving a rand price of nearly R1 450 per ton. The current \$171 per ton at R6.5 to the US\$ gives a rand price of R1 113 per ton and with the prevailing exchange rate of around R9.50 plus to the US\$, the price per ton expressed in RSA Rand is R1 624.

Approximately 205.9 million tons of coking coal is expected to be produced over the LOM of the Wildebeesthoek mine with another approximate 205 million tons from the Chapudi and Chapudi East mine. Of this volume about 18% of the Wildebeesthoek mine will be destined to Eskom and 28% of the Chapudi mines. The 2011 price of HCC<sup>20</sup> coking coal was at an all-time high, the Australian coking coal varied from July 2010 to June 2011 from US\$ 225 to \$328 per ton FOB. Currently, September 2013 the price is varying around US\$ 171 per ton FOB. Determining the Free-

<sup>20</sup> Hunters Valley Coking Coal – the so called best quality coking coal

on-Board (FOB) price was therefore a bit of a puzzle and it is necessary to discuss some of the parameters used in the calculations:

**1) The 2011 situation**

- FOB HCC price expressed in US\$ - \$207 ton/coking coal, the average 2010 price,
- Exchange rate – R7 per 1US\$,
- Providing a FOR price of R1449 per ton.

**2) Current 2013 situation**

- Average 2013 FOB price expressed in US\$ - \$171 per ton<sup>21</sup>,
- Exchange Rate –R9.50 per 1 US\$,
- Providing a FOB price of R1624 per ton.

Although the HCC price has dropped in US\$ terms by 8%, expressed in terms of Rand the price has actually increased by 12%.

Coal had a separate coking coal market study done by Wood Mackenzie; the report forecasted the following price scenario for the next number of years based on the different coking quality coal. In the next table is a summary of the forecasted prices for HCC and the next grade SHCC coking coal.

**Table 44: Projected HCC Prices used in the Analysis (US\$/ton)**

	2013	2014	2015	2020	2025	2030
HCC <sup>22</sup> (Qld)	171.25	176.25	184.00	194.00	229.00	235.00
SHCC <sup>23</sup> (Qld)	143.64	147.84	154.56	164.90	194.65	202.10

The table shows that they expect the price over time will increase in constant terms; we accepted these figures for the base scenario as they are in line with other predictions found in a cursory research of possible coal price expectations.

The second issue is the possible movement of the South African Rand exchange rate, we accepted for the base scenario an annual weakening of 1.67% against the US dollar as forecasted in the Manuel for Cost Benefit Analysis<sup>24</sup>. However, current predictions produce even a faster deterioration of the value of the Rand.

The Eskom destined coal is priced according to the average 2012 price of R349 per ton FOR with a 10% annual escalation for the first number of years as announced by Eskom and then a constant price.

All international price projections indicate a strengthening of the international price over time. We are therefore of the opinion that the economic viability of the project is strong and the project is feasible.

<sup>21</sup> Wood Mackenzie - Market Study for CoAL - 2012

<sup>22</sup> HCC – Hard Coking Coal

<sup>23</sup> SHCC – Semi Hard Coking Coal

<sup>24</sup> WRC Report No. TT 305/07 – A Manuel for Cost Benefit Analysis in South Africa with specific reference to Water Resource Development - August 2007.

#### 5.5.4 CBA Conclusion

For the purpose of this report, a CBA was applied in order to consider the viability of the Chapudi Project.

In conducting the CBA, the various stakeholders, who will be either positively or negatively impacted by the project, have been identified. The various impacts have been calculated for each year over the period that was used to evaluate the project, and then discounted to present values, using appropriate discount rates. The financial CBA has been done in nominal prices and discounted by a rate reflecting the cost of capital of 11%. The economic CBA has been done in constant prices and discounted by a social discount rate of 8%.

It thus appears that overall the project is economically viable using a CBA approach and the results indicate a very economically viable project.

## 6 Macro-Economic Impact Analysis: National, Regional and Local Impacts of the Proposed Greater Soutpansberg Project - Chapudi

### 6.1 Objective

The objective of this section is to present the macro and socio-economic impacts that emanate from both the construction and operational phases of the capital investment project under consideration. The Cost Benefit Analysis (CBA) preceded the macro-economic impact analysis and the information requirements for the CBA will serve as a major data source needed to initiate the macro-economic modelling system that quantifies the impacts.

The macro-economic impact analysis was conducted at a national, regional/provincial and local level. However, the main focus of the analysis is the Limpopo Province and the Makhado and Musina Local Municipality areas, in particular. The impact analysis is based on the contribution that the project is expected to make towards the national, provincial and local economies in terms of the following macro-economic aggregates:

- Gross Domestic Product (Economic Growth);
- Employment Creation:
  - Skilled Labourers;
  - Semi-Skilled Labourers; and
  - Unskilled Labourers.
- Capital Utilisation (Investment);
- Household Income (Poverty Alleviation in terms of Low Income Households);
- Fiscal Impacts; and
- Balance of Payments.

The macro-economic impact analysis was so structured to reflect the average annual production output over the project period of 30 years. Furthermore these macro-economic impacts also reflect the ultimate or total outcome, i.e. through the direct, indirect and induced linkages of the construction and operational parts of the project in question.

### 6.2 Methodology

#### 6.2.1 Overview of the Macro-Economic Impact Analysis

As indicated previously in the report, the main purpose of this chapter of the study is to estimate the impact of the proposed Chapudi Project on the South African economy as well as to give an indication of the impact it will have on the provincial economy of Limpopo and the local economy of Musina and Makhado Local Municipalities. *It is important to note that the National and Provincial macro-economic impact results are shown in a separate format for the construction and operational phases.* For purposes of the impact analysis Conningarth Economists has compiled and updated the Social Accounting Matrixes (SAMs) for the South African and Limpopo economies which formed the basis of the impact model – viz – a general equilibrium model. This model will quantify the direct, indirect and induced impacts over time.

The compilation of the updated South African and Limpopo SAMs was part of a major initiative by the Development Bank of Southern Africa (DBSA), Department of Provincial and Local Government (DPLG), Statistics South Africa (StatsSA) and the South African Reserve Bank (SARB) to compile nine comparable provincial SAMs that have all been updated to 2006 prices and have been benchmarked with the new South African SAM of 2006. The Limpopo SAM was finalized in October 2009, and was overseen by an expert group of people from the Limpopo Province, chaired by the Limpopo Economic Development Department.

The benchmarking exercise was necessary to ensure that all control totals add up to the National Account figures as reflected in the SARB Quarterly Bulletin – June 2008 and the relevant figures reflected in the StatsSA publications, especially P0144 that reflects the 2006 Supply and Use Matrix.

The provincial SAMs compiled by Conningarth Economists were converted into user-friendly macro-economic impact models which can be used by each province to calculate the economic impact of “interventions” by way of programmes and projects on the economy of the relevant province.

The model makes use of Excel spread sheets and is driven by a set of “Macros” which are used to eliminate the need to repeat the steps in a simple task over and over. For a specific project or say a policy intervention, the model provides the size of the macro-economic impacts, the values of which are then also used to calculate key economic performance or efficiency indicators at national, provincial and local government level. Such key macro-economic performance indicators can be produced for both the construction and operational phases of a specific project.

It is also important to highlight the fact that the macro-economic impact model is robust enough to cater for varying degrees of input data qualities and availability. For instance, if the impacts are required at local government level, the model lends itself well to adjusting relevant provincial coefficients to realistically portray the situation at lower levels.

### **6.2.2 The Social Accounting Matrix**

In layman’s terms a Social Accounting Matrix (SAM) also represents a mathematical matrix depicting the linkages that exist in financial terms between all the major role players in the economy, i.e. business sectors, households and government. It is very similar to the input/output table in the sense that it also reflects the inter-sectorial linkages that are present in an economy. The development of the SAM also provides a logical framework within the context of the National Accounts in which the activities of especially households are accentuated and distinguished prominently. The households are indeed the basic economic unit where significant decisions are taken affecting economic variables, such as consumption expenditure and personal saving. By combining households into homogenic groups in the SAM, makes it possible to study how the economic welfare of these groups is affected by changes in the economy.

To summarise, the SAM serves a dual purpose. Firstly, it is a reflection of the magnitude of financial linkages that exist between the major stakeholders in an economy, and secondly, it becomes a powerful econometric tool that can be used to conduct various economic analyses such as calculating the impact of investment projects on the economy. A more detailed technical description of the SAM and its analytical attributes are provided in Appendix A.

By applying the general tenets of the general equilibrium economic model to the SAM structure, the so-called direct, indirect and induced effects emanating from the various levels of value adding at all levels i.e. primary (including mining), manufacturing, commercial services etc. are quantified.

The direct impact that occurs, for example, in the mining industry, is measured through changes in production/turnover, payment of remuneration to employees and profit generation. The indirect impacts refer to impacts on industries that provide raw material inputs to the mining industry and other backward linkages. The induced effect or income effect refers to a further round of economic activity that takes place in the economy because of additional consumer spending as a result of the additional salaries and wages that occur throughout the economy. The impact analysis will be based on the standard economic aggregates.

### **6.3 Data Sources and Assumptions**

Modelling the macro-economic impact of the construction and operational phases of the Chapudi Project requires certain detailed information regarding these two phases of the project. However, complicating the issue are the three sections of the project namely the Wildebeesthoek and Chapudi and Chapudi West Sections, which will be developed a number of years apart. The construction data used in the analysis is the capital cost for an average year during the construction period before the relevant the mine producing, interpreting the results means that for the three mines three sets of construction data are used. Also, because of the long period between the construction of the Wildebeesthoek Section and the two Chapudi Sections a possibility exists that a change in the mining company's plans can take place; therefore the results are published separately.

The same applies to the operational phase as the Wildebeesthoek mine is in production a number of years before the Chapudi mines start with production. The results presented are for an average Wildebeesthoek Section production year as well as for a Chapudi Section and Chapudi West Section production year and then for a combined production year for the total project.

When evaluating the construction and operational phases the model requires information on the new mine such as costs of buildings, machinery and equipment, etc. This type of data as well as the planned outputs of the mine, etc. are discussed in detail in the appropriate section. There are, however, also externalities linked to the operation of the mine, such as the negative impact on agriculture and positive impacts on government spending. The possible magnitude of these externalities is discussed in detail in the previous chapters.

## **6.4 Macro-Economic Impact Results on the South African Economy**

### **6.4.1 Summary of Results**

The macro-economic impact assessments contained in this study covers the totals of the construction phase over the construction phase period of two four year periods and the average annual operational phase totals for the Wildebeesthoek Section years of production and then the Wildebeesthoek Section and the Chapudi Section and Chapudi Section production combined. The entire results are reflected in a construction phase and/or in an operational phase, respectively. The results that follow reflect the impact arising from the main components involved with the construction and operation of the coal mine, transportation and water supply.

### 6.4.1.1 National Economy - Construction Results

In the three tables below the impact on the National Economy is presented for the construction period of the three mines.

The table below presents the macro-economic results per annum during the construction phase of the Wildebeesthoek Mine.

**Table 45 The Annualised Macro-economic Average Impact of the Construction Phase of the Wildebeesthoek Mine on the South African Economy (2013 prices)**

	<b>Construction Impact: National</b>			
	<b>2.Mining</b>			
	<b>Direct impact</b>	<b>Indirect impact</b>	<b>Induced impact</b>	<b>Total impact</b>
<b>Impact on Gross Domestic Product (GDP)</b>	R 443	R 483	R 642	<b>R1 568.64</b>
<b>Impact on capital formation</b>	R 644	R 796	R 1 196	<b>R 2 636.10</b>
<b>Impact on employment [person years]</b>	3 303	1 289	1 750	<b>6 343</b>
<i>Skilled impact on employment [person years]</i>	614	301	423	<b>1 339</b>
<i>Semi-skilled impact on employment [person years]</i>	1 530	545	726	<b>2 801</b>
<i>Unskilled impact on employment [person years]</i>	1 159	443	600	<b>2 203</b>
<b>Impact on Households</b>				<b>R1 061.4</b>
<i>Low Income Households</i>				<b>R165.6</b>
<i>Medium Income Households</i>				<b>R204.7</b>
<i>High Income Households</i>				<b>R691.1</b>
<b>Fiscal Impact</b>				<b>R477.0</b>
<i>National Government</i>				R438.33
<i>Provincial Government</i>				R5.38
<i>Local Government</i>				R33.26

All monetary numbers represent millions.

The table below presents the macro-economic results per annum during the construction phase of the Chapudi Mine.

**Table 46 : The Annualised Macro-economic Average Impact of the Construction Phase of the Chapudi Mine on the South African Economy (2013 prices)**

	<b>Construction Impact: National</b>			
	<b>2.Mining</b>			
	<b>Direct impact</b>	<b>Indirect impact</b>	<b>Induced impact</b>	<b>Total impact</b>
<b>Impact on Gross Domestic Product (GDP)</b>	302	329	438	<b>1 069.70</b>
<b>Impact on capital formation</b>	439	543	816	<b>1 797.63</b>
<b>Impact on employment [person years]</b>	2 253	879	1 193	<b>4 325</b>
<i>Skilled impact on employment [person years]</i>	419	205	289	<b>913</b>
<i>Semi-skilled impact on employment [person years]</i>	1 043	372	495	<b>1 910</b>
<i>Unskilled impact on employment [person years]</i>	791	302	409	<b>1 502</b>
<b>Impact on Households</b>				<b>723.8</b>
<i>Low Income Households</i>				<b>113.0</b>
<i>Medium Income Households</i>				<b>139.6</b>
<i>High Income Households</i>				<b>471.3</b>
<b>Fiscal Impact</b>				<b>325.3</b>
<i>National Government</i>				298.91
<i>Provincial Government</i>				3.67
<i>Local Government</i>				22.68

All monetary numbers represent millions.

The table below presents the macro-economic results per annum during the construction phase of the Chapudi West Mine.

**Table 47: The Annualised Macro-economic Average Impact of the Construction Phase of the Chapudi West Mine on the South African Economy (2013 prices)**

	<b>Construction Impact: National</b>			
	<b>2.Mining</b>			
	<b>Direct impact</b>	<b>Indirect impact</b>	<b>Induced impact</b>	<b>Total impact</b>
<b>Impact on Gross Domestic Product (GDP)</b>	250	272	R 362	<b>883.34</b>
<b>Impact on capital formation</b>	363	448	R 674	<b>1 484.45</b>
<b>Impact on employment [person years]</b>	1 860	726	985	<b>3 572</b>
<i>Skilled impact on employment [person years]</i>	346	170	238	<b>754</b>
<i>Semi-skilled impact on employment [person years]</i>	861	307	409	<b>1 577</b>
<i>Unskilled impact on employment [person years]</i>	653	250	338	<b>1 241</b>
<b>Impact on Households</b>				<b>597.7</b>
<i>Low Income Households</i>				<b>93.3</b>
<i>Medium Income Households</i>				<b>115.3</b>
<i>High Income Households</i>				<b>389.2</b>
<b>Fiscal Impact</b>				<b>268.6</b>
<i>National Government</i>				246.83
<i>Provincial Government</i>				3.03
<i>Local Government</i>				18.73
<b>All monetary numbers represent millions.</b>				

The following table presents an average annualised result showing the comparison of the construction of the three mines of the Chapudi Project on the National Economy.

**Table 48: Comparison of the Construction Results of the different Sections of the Chapudi Project in the National Economy (2013 prices)**

	<b>Wildebeesthoek</b>	<b>Chapudi</b>	<b>Chapudi West</b>
Total GDP (Rand million)	1 568.6	1 069.7	883.34
Total Employment	6 343	4 325	3 572
Total Payments to Households (Rand millions)	1 061.4	723.8	597.7
Fiscal Impact	477.0	325.3	268.6

The table above indicates that all three mines will have a very positive impact on the national economy, although it will be for a very short period during the construction period.

#### **6.4.1.2 Provincial Results – Construction Phase**

The following three tables present the annualised results of the construction phase per mine.

The table below presents the macro-economic results per annum during the construction phase of the Wildebeesthoek Mine.



**Table 49: The Annualised Macro-economic Average Impact of the Construction Phase of the Wildebeesthoek Mine on the Limpopo Provincial Economy (2013 prices)**

	<b>Construction Impact: Provincial</b>			
	<b>2.Mining</b>			
	<b>Direct impact</b>	<b>Indirect impact</b>	<b>Induced impact</b>	<b>Total impact</b>
<b>Impact on Gross Domestic Product (GDP)</b>	242	52	60	<b>354</b>
<b>Impact on capital formation</b>	388	131	165	<b>684</b>
<b>Impact on employment [person years]</b>	2 136	155	316	<b>2 607</b>
<i>Skilled impact on employment [person years]</i>	340	33	51	<b>425</b>
<i>Semi-skilled impact on employment [person years]</i>	947	68	131	<b>1 146</b>
<i>Unskilled impact on employment [person years]</i>	849	54	134	<b>1 036</b>
<b>Impact on Households</b>				<b>187.37</b>
<i>Low Income Households</i>				<b>59.92</b>
<i>Medium Income Households</i>				<b>30.89</b>
<i>High Income Households</i>				<b>96.56</b>
<b>Fiscal Impact</b>				<b>78.88</b>
<i>National Government</i>				75.45
<i>Provincial Government</i>				0.83
<i>Local Government</i>				2.59

*Note: All Rand values reflected are expressed in Rand Millions*

The table below presents the macro-economic results per annum during the construction phase of the Chapudi Mine.

**Table 50: The Annualised Macro-economic Average Impact of the Construction Phase of the Chapudi Mine on the Limpopo Provincial Economy (2013 prices)**

	<b>Construction Impact: Provincial</b>			
	<b>2.Mining</b>			
	<b>Direct impact</b>	<b>Indirect impact</b>	<b>Induced impact</b>	<b>Total impact</b>
<b>Impact on Gross Domestic Product</b>	165	36	41	<b>242</b>
<b>Impact on capital formation</b>	264	89	113	<b>466</b>
<b>Impact on employment [person years]</b>	1 457	106	216	<b>1 778</b>
<i>Skilled impact on employment [person]</i>	232	23	35	<b>290</b>
<i>Semi-skilled impact on employment</i>	646	47	90	<b>782</b>
<i>Unskilled impact on employment</i>	579	37	91	<b>707</b>
<b>Impact on Households</b>				<b>127.77</b>
<i>Low Income Households</i>				<b>40.86</b>
<i>Medium Income Households</i>				<b>21.06</b>
<i>High Income Households</i>				<b>65.85</b>
<b>Fiscal Impact</b>				<b>53.79</b>
<i>National Government</i>				51.45
<i>Provincial Government</i>				0.57
<i>Local Government</i>				R 1.77

All monetary numbers represent millions.

The table below presents the macro-economic results per annum during the construction phase of the Chapudi West Mine.

**Table 51: The Annualised Macro-economic Average Impact of the Construction Phase of the Chapudi West Mine on the Limpopo Provincial Economy (2013 prices)**

	<b>Construction Impact: Provincial</b>			
	<b>2.Mining</b>			
	<b>Direct impact</b>	<b>Indirect impact</b>	<b>Induced impact</b>	<b>Total impact</b>
<b>Impact on Gross Domestic Product (GDP)</b>	136	29	34	<b>200</b>
<b>Impact on capital formation</b>	218	73	93	<b>385</b>
<b>Impact on employment [person years]</b>	1 203	87	178	<b>1 468</b>
<i>Skilled impact on employment [person years]</i>	192	19	29	<b>239</b>
<i>Semi-skilled impact on employment [person years]</i>	533	38	74	<b>645</b>
<i>Unskilled impact on employment [person years]</i>	478	30	75	<b>584</b>
<b>Impact on Households</b>				<b>105.51</b>
<i>Low Income Households</i>				<b>33.75</b>
<i>Medium Income Households</i>				<b>17.39</b>
<i>High Income Households</i>				<b>54.38</b>
<b>Fiscal Impact</b>				<b>44.42</b>
<i>National Government</i>				42.49
<i>Provincial Government</i>				0.47
<i>Local Government</i>				1.46

*Note: All Rand values reflected are expressed in Rand Millions*

The following table presents an average annualised result comparison of the construction of the three mines of the Chapudi Project on the Limpopo Provincial Economy.

**Table 52: Comparison of the Construction Results of the Three Mines of the Chapudi Project in the Limpopo Provincial Economy (2013 prices)**

	<b>Wildebeesthoek</b>	<b>Chapudi</b>	<b>Chapudi West</b>
Total GDP (Rand million)	354	242	200
Total Employment	2 136	1 778	1 486
Total Payments to Households (Rand millions)	187.3	127.7	105.5
Fiscal Impact	78.8	53.9	44.4

The table above indicates that all three mines will have a very positive impact on the Provincial economy, although it will be for a very short period during the construction phase.

#### **6.4.1.3 National Economy – Operational Results**

In the following tables the macro-economic results of an average production year for each of the three mines of the Chapudi project are presented.

**Table 53: The Annualised Macro-economic Impact of the Operational Phase of the Wildebeesthoek Mine on the South African Economy (2013 prices)**

	<b>Operational Impact: <i>National</i></b>			
	<b>2.Mining</b>			
	<b>Direct impact</b>	<b>Indirect impact</b>	<b>Induced impact</b>	<b>Total impact</b>
<b>Impact on Gross Domestic Product (GDP)</b>	5 083	1 958	5 201	<b>12 241</b>
<b>Impact on capital formation</b>	1 877	4 576	9 667	<b>16 120</b>
<b>Total impact on employment [job opportunities]</b>	917	5 361	14 372	<b>20 650</b>
<i>Skilled impact on employment [job opportunities]</i>	147	1 195	3 442	<b>4 784</b>
<i>Semi-skilled impact on employment [job opportunities]</i>	605	2 214	5 971	<b>8 791</b>
<i>Unskilled impact on employment [job opportunities]</i>	165	1 951	4 959	<b>7 075</b>
<b>Impact on Households</b>				<b>8 559</b>
<i>Low Income Households</i>				<b>1 423.7</b>
<i>Medium Income Households</i>				<b>3 517</b>
<i>High Income Households</i>				<b>4 116</b>
<b>Fiscal Impact</b>				<b>3 364</b>
<i>National Government</i>				3 107
<i>Provincial Government</i>				36
<i>Local Government</i>				221
<b>Impact on the Balance of Payments</b>				<b>5 233</b>

*Note: All Rand values reflected are expressed in Rand Millions*

The table shows that the Wildebeesthoek Mine will have a very positive impact on the national economy, not only will the direct GDP contribution be more the R5 billion per annum, it will also support over 20 000 employment opportunities in the total economy. The total payments to the Fiscus at current rates are estimated at R3.3 billion per annum. The positive impact on the balance of payments is estimated at R5.2 billion per annum.

**Table 54: The Annualised Macro-economic Impact of the Operational Phase of the Chapudi Mine on the South African Economy (2013 prices)**

	<b>Operational Impact: <i>National</i></b>			
	<b>2.Mining</b>			
	<b>Direct impact</b>	<b>Indirect impact</b>	<b>Induced impact</b>	<b>Total impact</b>
<b>Impact on Gross Domestic Product (GDP)</b>	2 043	787	2 091	<b>4 921</b>
<b>Impact on capital formation</b>	1 057	1 839	3 886	<b>6 783</b>
<b>Total impact on employment [job opportunities]</b>	385	2 155	5 778	<b>8 318</b>
<i>Skilled impact on employment [job opportunities]</i>	62	481	1 384	<b>1 926</b>
<i>Semi-skilled impact on employment [job opportunities]</i>	254	890	2 400	<b>3 545</b>
<i>Unskilled impact on employment [job opportunities]</i>	69	784	1 993	<b>2 847</b>
<b>Impact on Households</b>				<b>3 441</b>
<i>Low Income Households</i>				<b>572.3</b>
<i>Medium Income Households</i>				<b>1 414</b>
<i>High Income Households</i>				<b>1 655</b>
<b>Fiscal Impact</b>				<b>1 352</b>
<i>National Government</i>				1 249
<i>Provincial Government</i>				15
<i>Local Government</i>				89
<b>Impact on the Balance of Payments</b>				<b>2 104</b>

*Note: All Rand values reflected are expressed in Rand Millions*

The table show that the Chapudi Mine will have a very positive impact on the national economy, not only will the direct GDP contribution be over R2 billion per annum, it will also supports over 8 000 employment opportunities in the total economy. The total payments to the Fiscus at current rates are estimated at R1.3 billion per annum. The positive impact on the balance of payments is estimated at R2.1 billion per annum.

**Table 55: The Annualised Macro-economic Impact of the Operational Phase of the Chapudi West Mine on the South African Economy (2013 prices)**

	<b>Operational Impact: <i>National</i></b>			
	<b>2.Mining</b>			
	<b>Direct impact</b>	<b>Indirect impact</b>	<b>Induced impact</b>	<b>Total impact</b>
<b>Impact on Gross Domestic Product (GDP)</b>	2 822	1 087	2 887	<b>6 796</b>
<b>Impact on capital formation</b>	1 057	2 540	5 367	<b>8 964</b>
<b>Total impact on employment [job opportunities]</b>	532	2 976	7 979	<b>11 487</b>
<b>Skilled impact on employment [job opportunities]</b>	85	664	1 911	<b>2 660</b>
<b>Semi-skilled impact on employment [job opportunities]</b>	351	1 229	3 315	<b>4 895</b>
<b>Unskilled impact on employment [job opportunities]</b>	96	1 083	2 753	<b>3 932</b>
<b>Impact on Households</b>				<b>4 752</b>
<i>Low Income Households</i>				<b>790.3</b>
<i>Medium Income Households</i>				<b>1 952</b>
<i>High Income Households</i>				<b>2 285</b>
<b>Fiscal Impact</b>				<b>1 867</b>
<i>National Government</i>				1 725
<i>Provincial Government</i>				20
<i>Local Government</i>				123
<b>Impact on the Balance of Payments</b>				<b>2 905</b>

*Note: All Rand values reflected are expressed in Rand Millions*

The table show that the Chapudi West section will have a very positive impact on the national economy, not only will the direct GDP contribution be over R2.8 billion per annum, it will also supports over 11 000 employment opportunities in the total economy. The total payments to the Fiscus at current rates are estimated at R1.8 billion per annum. The positive impact on the balance of payments is estimated at R2.9 billion per annum.

Currently the proposed planning is that the Wildebeesthoek Mine will be in production for a number of years before Chapudi and Chapudi West Mines will be developed. The total estimated period of production is 60 years for the total project; the current plans make provision for a period when all three sections will be in production simultaneously. The following table presents the results for the period when all three mines will be in production at the same time.

**Table 56: The Annualised Macro-economic Impact of the Operational Phase of the Wildebeesthoek, Chapudi and Chapudi West Mines on the South African Economy when they are in Production Simultaneously (2013 prices)**

<b>Operational Impact: <i>National</i></b>				
<b>2.Mining</b>				
	<b>Direct impact</b>	<b>Indirect impact</b>	<b>Induced impact</b>	<b>Total impact</b>
<b>Impact on Gross Domestic Product (GDP)</b>	10 517	4 052	10 761	<b>25 329</b>
<b>Impact on capital formation</b>	1 057	9 468	20 003	<b>30 528</b>
<b>Total impact on employment [job opportunities]</b>	1 834	11 093	29 738	<b>42 665</b>
<i>Skilled impact on employment [job opportunities]</i>	293	2 473	7 123	<b>9 890</b>
<i>Semi-skilled impact on employment [job opportunities]</i>	1 210	4 582	12 355	<b>18 147</b>
<i>Unskilled impact on employment [job opportunities]</i>	330	4 038	10 260	<b>14 628</b>
<b>Impact on Households</b>				<b>17 710</b>
<i>Low Income Households</i>				<b>2 945.8</b>
<i>Medium Income Households</i>				<b>7 276</b>
<i>High Income Households</i>				<b>8 517</b>
<b>Fiscal Impact</b>				<b>6 960</b>
<i>National Government</i>				6 428
<i>Provincial Government</i>				75
<i>Local Government</i>				457
<b>Impact on the Balance of Payments</b>				<b>10 827</b>

*Note: All Rand values reflected are expressed in Rand Millions*

The table shows that the total Chapudi Project will have a very positive impact on the national economy, not only will the direct GDP contribution be over R10 billion per annum, it will also support over 42 000 employment opportunities in the total economy. The total payments to the Fiscus at current rates are estimated at R6.9 billion per annum. The positive impact on the balance of payments is estimated at R10.8 billion per annum.

#### **6.4.1.4 Provincial Results – Operational Phase**

In the following three tables the results of the annualised operational phase of the three mines of the Chapudi Project on the Limpopo Provincial Economy are presented.

**Table 57: The Annualised Macro-economic Impact of the Operational Phase of the Wildebeesthoek Mine on the Limpopo Provincial Economy (2013 prices)**

	<b>Operational Impact: Provincial</b>			
	<b>2.Mining</b>			
	<b>Direct impact</b>	<b>Indirect impact</b>	<b>Induced impact</b>	<b>Total impact</b>
<b>Impact on Gross Domestic Product (GDP)</b>	5 418	905	1 076	<b>7 399</b>
<b>Impact on capital formation</b>	1 057	3 010	2 953	<b>7 020</b>
<b>Total impact on employment [job opportunities]</b>	917	2 360	4 152	<b>7 428</b>
<i>Skilled impact on employment [job opportunities]</i>	147	451	802	<b>1 400</b>
<i>Semi-skilled impact on employment [job opportunities]</i>	605	982	1 706	<b>3 293</b>
<i>Unskilled impact on employment [job opportunities]</i>	165	926	1 644	<b>2 735</b>
<b>Impact on Households</b>				<b>3 865</b>
<i>Low Income Households</i>				<b>1 162</b>
<i>Medium Income Households</i>				<b>759</b>
<i>High Income Households</i>				<b>1 945</b>
<b>Fiscal Impact</b>				<b>1 488</b>
<i>National Government</i>				1 425
<i>Provincial Government</i>				18
<i>Local Government</i>				45

*Note: All Rand values reflected are expressed in Rand Millions*

The contribution to direct GDP is estimated R5.4 billion with a total contribution of R7.4 billion. The number of direct jobs is estimated at 917 with the indirect and induced added it will be around 7 428. The payments to households are estimated at R3.8 billion with the payment to low income households at R1.1 billion.

**Table 58: The Annualised Macro-economic Impact of the Operational Phase of the Chapudi Mine on the Limpopo Provincial Economy (2013 prices)**

	<b>Operational Impact: Provincial</b>			
	<b>2.Mining</b>			
	<b>Direct impact</b>	<b>Indirect impact</b>	<b>Induced impact</b>	<b>Total impact</b>
<b>Impact on Gross Domestic Product (GDP)</b>	2 043	341	406	<b>2 790</b>
<b>Impact on capital formation</b>	1 057	1 135	1 114	<b>3 306</b>
<b>Total impact on employment [job]</b>	385	890	1 566	<b>2 841</b>
<i>Skilled impact on employment [job]</i>	62	170	302	<b>534</b>
<i>Semi-skilled impact on employment [job]</i>	254	370	643	<b>1 268</b>
<i>Unskilled impact on employment [job]</i>	69	349	620	<b>1 038</b>
<b>Impact on Households</b>				<b>1 458</b>
<i>Low Income Households</i>				<b>438</b>
<i>Medium Income Households</i>				<b>286</b>
<i>High Income Households</i>				<b>733</b>
<b>Fiscal Impact</b>				<b>561</b>
<i>National Government</i>				537
<i>Provincial Government</i>				7
<i>Local Government</i>				17

*Note: All Rand values reflected are expressed in Rand Millions*

The contribution to direct GDP is estimated R2.04 billion with a total contribution of R2.79 billion. The number of direct jobs is estimated at 385 with the indirect and induced added will be around 2 841. The payments to households are estimated at R1.46 billion with the payment to low income households at R438 million.

**Table 59: The Annualised Macro-economic Impact of the Operational Phase of the Chapudi West Mine on the Limpopo Provincial Economy (2013 prices)**

	<b>Operational Impact: Provincial</b>			
	<b>2.Mining</b>			
	<b>Direct impact</b>	<b>Indirect impact</b>	<b>Induced impact</b>	<b>Total impact</b>
<b>Impact on Gross Domestic Product (GDP)</b>	2 822	471	560	<b>3 853</b>
<b>Impact on capital formation</b>	1 057	1 568	1 538	<b>4 162</b>
<b>Total impact on employment [job opportunities]</b>	532	1 229	2 162	<b>3 923</b>
<i>Skilled impact on employment [job opportunities]</i>	85	235	418	<b>738</b>
<i>Semi-skilled impact on employment [job opportunities]</i>	351	511	888	<b>1 751</b>
<i>Unskilled impact on employment [job opportunities]</i>	96	482	856	<b>1 434</b>
<b>Impact on Households</b>				<b>2 013</b>
<i>Low Income Households</i>				<b>605</b>
<i>Medium Income Households</i>				<b>395</b>
<i>High Income Households</i>				<b>1 013</b>
<b>Fiscal Impact</b>				<b>775</b>
<i>National Government</i>				742
<i>Provincial Government</i>				9
<i>Local Government</i>				23

*Note: All Rand values reflected are expressed in Rand Millions*

The contribution to direct GDP is estimated R2.8 billion with a total contribution of R3.8 billion. The number of direct jobs is estimated at 532 with the indirect and induced added will be around 3 923. The payments to households are estimated at R2.01 billion with the payment to low income households at R605 million.

Currently the proposed planning is that the Wildebeesthoek Mine will be in production for a number of years before the Chapudi and Chapudi West Mines will be developed. The total estimated period of production for the total project is 60 years; the current plans make provision for a period in which all three mines will be in production simultaneously. The following table presents the results for that period.

**Table 60: The Annualised Macro-economic Impact of the Operational Phase of the Wildebeesthoek, Chapudi and Chapudi West Mines on the Limpopo Provincial Economy when they are in Production Simultaneously (2013 prices)**

	<b>Operational Impact: Provincial</b>			
	<b>2.Mining</b>			
	<b>Direct impact</b>	<b>Indirect impact</b>	<b>Induced impact</b>	<b>Total impact</b>
<b>Impact around 1ct on Gross Domestic Product (GDP)</b>	10 517	1 757	2 088	<b>14 362</b>
<b>Impact on capital formation</b>	1 057	5 843	5 732	<b>12 632</b>
<b>Total impact on employment [job opportunities]</b>	1 834	4 580	8 058	<b>14 472</b>
<i>Skilled impact on employment [job opportunities]</i>	293	876	1 557	<b>2 726</b>
<i>Semi-skilled impact on employment [job opportunities]</i>	1 210	1 906	3 311	<b>6 428</b>
<i>Unskilled impact on employment [job opportunities]</i>	330	1 798	3 190	<b>5 318</b>
<b>Impact on Households</b>				<b>7 503</b>
<i>Low Income Households</i>				<b>2 254</b>
<i>Medium Income Households</i>				<b>1 473</b>
<i>High Income Households</i>				<b>3 775</b>
<b>Fiscal Impact</b>				<b>2 887</b>
<i>National Government</i>				R 2 766
<i>Provincial Government</i>				R 34
<i>Local Government</i>				R 87

*Note: All Rand values reflected are expressed in Rand Millions*

The table show that the annual direct contribution to the Provincial Economy will be about R10.5 billion with total contribution of R14.36 billion. It will employ 1 834 people directly and with the indirect and induced number added be around 14 472. The payments to households will be around R7.5 billion annually with 2.25 billion to low income households.

#### **6.4.2 Economic Efficiency Criteria**

The macro-economic impacts discussed above provide an indication of the contribution that the coal mine will make to economic and socio-economic goals and objectives. However, it is also necessary to further interpret these impacts in order to determine whether or not the project represents an effective use of scarce economic resources. Since capital is a scarce resource in South Africa, the effectiveness criteria used in this study measure the use of capital in terms of GDP and job creation, relative to averages for South Africa.

In order to do these comparisons, two key multipliers/ratios have been calculated i.e. the GDP/Capital ratio, and the Labour/Capital ratio. Using these two ratios, it is possible to establish whether the capital employed in these projects and the contribution towards economic growth and employment creation could in fact be regarded as effective and efficient. If continuous economic growth in the long-term is considered to be more important than job creation in the short-term, then the GDP/Capital ratio's performance is the more important of the two. However, if employment creation is given priority, particularly in the short term, then the Labour/Capital ratio is the more important one to use in evaluating the project's efficiency.

The efficiency/effectiveness criteria measured for the project is provided in the table below. This table also reflects the averages for the South African economy and for the mining sector.



**Table 61: Economic Effectiveness Criteria of the Chapudi Project Compared to the South African Economy**

	<b>GDP/Capital</b>	<b>Labour/Capital</b>	<b>Low Income/Total Income</b>
Project Efficiency Criteria	0.75	1.28	16.6%
Mining and quarrying	0.45	2.18	18.7%
<b>Total National Economy</b>	<b>0.45</b>	<b>2.94</b>	<b>16.2%</b>

A comparison of the coal mines GDP/Capital ratio with the average for the total South African economy indicates that for every R1 million of capital invested in the coal mine, it generates an overall GDP ratio of 0.75 compared to the average for the national economy of 0.45. This suggests that the coal mine utilises capital more effectively than other sectors in the national economy.

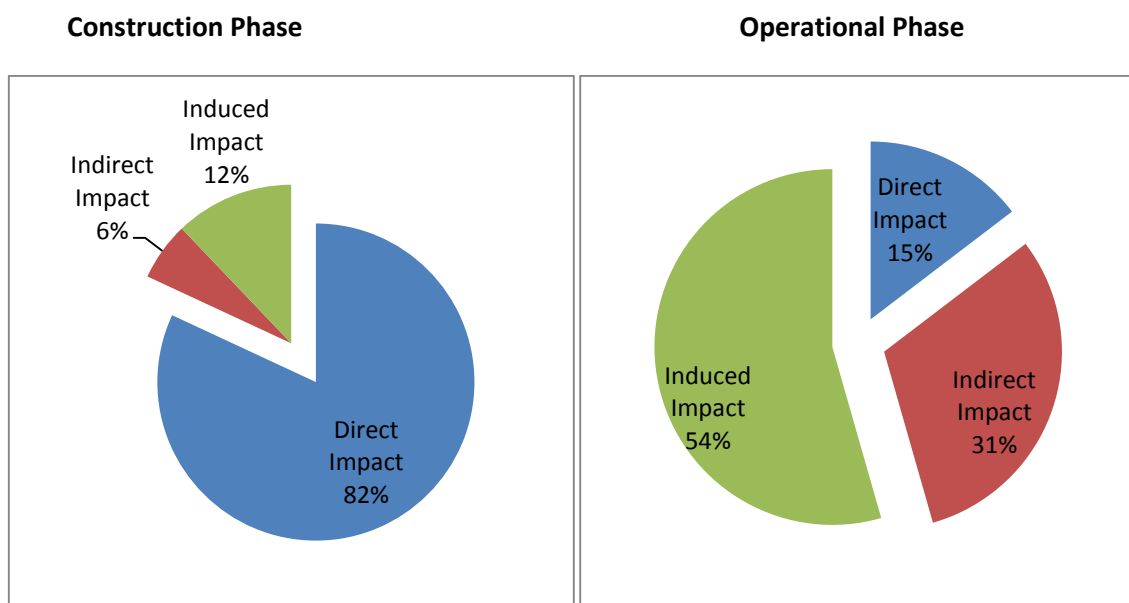
When a similar comparison of the Labour/Capital ratio is made, the coal mine will generate fewer employment opportunities i.e. 1.28 jobs created for every R1 million invested in this project, in comparison with the national average of 2.94 jobs created, but in comparison with the mining sector average of 2.18 jobs created, the project is also falling short..

In terms of the income portion that is distributed to the low income households during the operational phase it is above the national average of 16.2% at 16.6%.

**6.4.2.1 The direct, indirect and induced relationship**

The following figures present the relationship of the project for the direct, indirect and induced impacts in the Limpopo Province.

**Graph 3: Macro-economic Impact in Terms of the Employment on the Construction and Operational Phases for the Province of Limpopo**

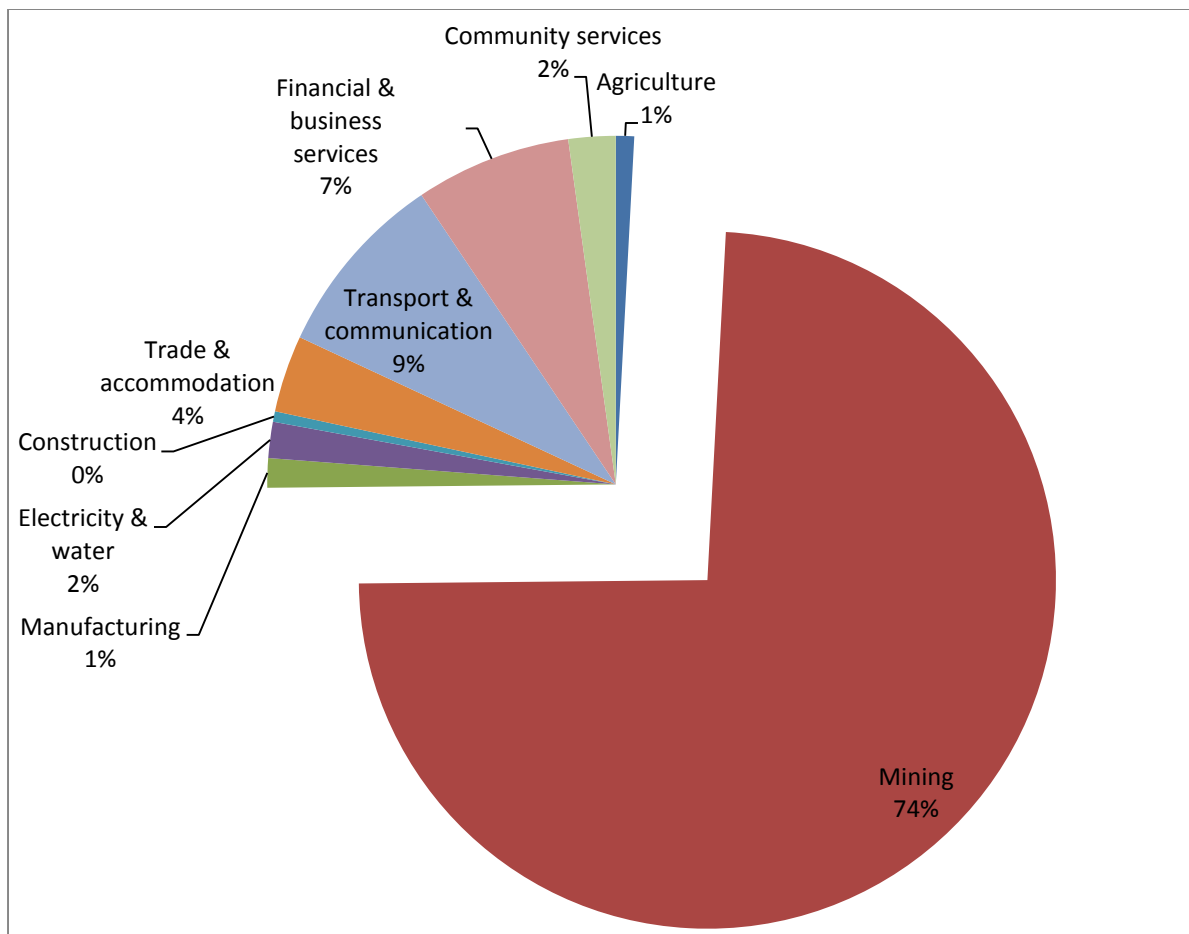


The construction graph indicates that 82% of the employment created will be on site compared to the 15% in the case of the operational phase, which is an indication that a considerable leakage will take place.

### 6.4.2.2 Sectorial Impact

It is important to note that the total impact of the project concerned in Limpopo takes place across a wider spectrum of sectors than those in which the investments initially take place. In the graph below the GDP is divided according to the nine (9) main sectors of the Limpopo Provincial economy. From this it can be seen that the total effect is more profound in the mining sector which is quite understandable because the capital development project *per se* is classified to fall in the mining sector.

**Graph 4: Sectorial GDP Impact on the Limpopo Province (percentages)**



## 7 Conclusion

A comparison of the Local Economic Activities Baseline and estimated Negative Impact with the estimated impact of the operational phase of the proposed Chapudi Project (2013 prices).

**Table 62: Comparison of the Current Local Economic Activities for the Proposed Chapudi Project (2013 prices)**

<b>Baseline Local Economic Activities and Impact of Mining</b>							
<b>Annual Current Activities and Impact of the Mining Activities</b>							
		<i>Base Line</i>	<i>Impact</i>			<i>Base Line</i>	<i>Impact</i>
<i>Gross Domestic Product Rand million</i>	<i>Direct</i>	90.98	-43.27	<i>Employment</i>	<i>Direct</i>	898	-412
	<i>Indirect/Induced</i>	90.14	-43.28		<i>Indirect/Induced</i>	452	-234
	<i>Total</i>	181.12	-86.66		<i>Total</i>	1 350	-646
<b>Mining Operational Phase – Annual Impact Limpopo Province</b>							
<i>Gross Domestic Product Rand million</i>	<i>Direct</i>	10 517		<i>Employment</i>	<i>Direct</i>	1 834	
	<i>Indirect/Induced</i>	3 845			<i>Indirect/Induced</i>	12 638	
	<i>Total</i>	14 362			<i>Total</i>	14 472	

From the above table it appears that the current local economic activities in the defined project area contribute R181.12 million in total GDP and sustain 1 350 total employment opportunities of which 898 are direct. The mining activity in the project area will cost the local economic activities R 86.66 million in GDP and 646 employment opportunities, of which 412 will be direct.

The project will offer 1 834 direct employment opportunities compensating for the loss of 412 jobs in the project area. It is, however, in the rest of the province where the project will create many more jobs than the current activities namely 12 638 versus 452.

From the above and the rest of the analysis it appears that the proposed mining project will be an economic viable entity which will add value to the region. This will, however, take place at the expense of some of the current local economic activities, especially the game with ecology included. Proper mitigation and even compensation must be part of the final solution. The investment the owner has made to a property can be negatively impacted if the hunting and accommodation facilities on the property are not fully utilised because of a down turn in visitors resulting from the mining activities.

The possible threat of underground and surface water contamination to the irrigators is of utmost importance and possible mitigation will have to be in place. In this respect the irrigators further to the north and outside of the project area should be included.

Probably the two most important benefits to the *national* economy are:

- The annual impact on the “Fiscus” with an annual tax contribution of R 6 960 million expressed in 2013 prices, which at present represents the salary package of roughly 21 400 teachers or 23 200 nursing staff, if the government were to apply it for that purpose.
- The second impact is the favourable annual impact on the “Balance of Payments” amounting to R10 827 million, if expressed in 2013 prices.

As stated, this will be a permanent impact and it will be necessary for the mining company to negotiate a proper mitigation programme.

## 8 Sources

The following sources were consulted:

1. CoAL of Africa Limited Greater Soutpansberg Chapudi Project Scoping Report June 2013.
2. GSP - Chapudi Project – Groundwater Flow Impact Assessment Report – November 2013 and Operations Bulk Water Supply – Makhado, Musina and Vondo Raw Water Abstraction. WSM Leshika Consulting (Pty) Ltd.
3. Van Der Merwe P. and Saayman, M.; Managing Game Farms from a Tourism Perspective – Published by the Institute for Tourism and Leisure Studies, North West University (2004).
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5. Game and Cattle farming in the Soutpansberg – Verbal and electronic communication with farmers in the study area.
6. Taxidermy – Waterberg Taxidermy see <http://www.waterbergtaxidermy.co.za> Price List.
7. Wild en Jag dated July 2013 – “An Economic Outlook: The Wildlife Industry”, by Bernard Groenewald and Richard York.
8. Wood Mackenzie -2012 – CoAL of Africa – Coking Coal Market Study

## 9 APPENDIX A: THE SOCIAL ACCOUNTING MATRIX (SAM)

A Social Accounting Matrix (SAM) is a comprehensive, economy-wide database, which contains information on the flow of resources that take place between the different economic agents that exist within an economy (i.e. business enterprises, households, government, etc.) during a given period of time – usually one calendar year.

When economic agents in an economy are involved in transactions, financial resources change hands. The SAM provides a complete database of all transactions that take place between these agents in a given period, thereby presenting a “snapshot” of the structure of the economy for that time period. As a system for organising information, a SAM presents a powerful tool in terms of which the economy can be described in a complete and consistent way:

Complete in the sense that it provides a comprehensive accounting of all economic transactions for the entity being represented (i.e. country, region/province, city, etc.), and Consistent in that all incomes and expenditures are matched.

Consequently, a SAM can provide a unifying structure within which the statistical authorities can compile and present the national accounts.

Like the traditional Input-Output Table, the SAM reflects the inter-sectorial linkages in terms of sales and purchases of goods and services, as well as the remuneration of production factors that forms the essence of any economy’s functioning. What is also of importance is that a SAM reflects the economic related activities of households in some detail. Households are responsible for decisions that have a direct and indirect effect on important economic variables such as private consumption expenditures and savings. These economic aggregates are important drivers of the economic growth processes and ultimately the creation of employment opportunities and wealth. Private consumption expenditure, for example, comprises approximately 60 percent of total gross final domestic spending in the economy. By combining households into meaningful categories, such as a range of income levels, the impact on these households’ welfare of a changing economic environment is made possible by the SAM.

It is clear from the above that because of the intrinsic characteristics of the SAM, once compiled, it renders itself as a useful tool for analytical purposes. Especially, based on the mathematical traits of the matrix notations that describe its structure, a SAM can be transformed into a powerful econometric tool/model. For example, the model can be used to quantify the probable impact on the economy of a new infrastructural project such as a new power station – both the construction phase and the operational phase will be modelled.

Thus apart from serving as an extension to a country’s National Accounts, the SAM in its model form opens up many opportunities for the economic analyst to conduct rigorous policy and other impact analyses for the purpose of ensuring optimal benefit to the stakeholders concerned.

### **Application(s) of the SAM**

The development of the SAM is very significant as it provides a framework within the context of the International System of National Accounts (SNA) in which the activities of all economic agents are accentuated and prominently distinguished. By combining these agents into meaningful groups, the

SAM makes it possible to clearly distinguish between groups, to research the effects of interaction between groups, and to measure the economic welfare of each group. There are two key reasons for compiling a SAM:

Firstly, a SAM provides a framework for organising information about the economic and social structure of a particular geographical entity (i.e. a country, region or province) for a particular time period (usually one calendar year), and

Secondly, to provide a database that can be used by any one of a number of different macro-economic modelling tools for evaluating the impact of different economic decisions and/or economic development programmes.

Because the SAM is a comprehensive, disaggregated, consistent, and complete data system of economic entities that captures the interdependence that exists within a socio-economic system, it can be used as a conceptual framework for exploring the impact of exogenous changes in such variables as exports, certain categories of government expenditure, and investment on the entire interdependent socio-economic system. The SAM, because of its finer disaggregation of private household expenditure into relatively homogenous socio-economic categories that are recognisable for policy purposes, has been used to explore issues related to income distribution.

The SAM's main contribution in the field of economic policy planning and impact analysis is divided into two categories:

#### **As a Primary Source of Economic Information**

As a detailed and integrated national and regional accounting framework consistent with officially published socio-economic data, a SAM instantly projects a picture of the nature of a country or region's economy. It lends itself to both descriptive and structural analysis.

#### **As a Planning Tool**

Due to its mathematical/statistical underpinnings it can be transformed into a macro-econometric model that can be used to:

- Conduct economic forecasting exercises/scenario building.
- Conduct economic impact analysis both for policy adjustments at a national and provincial level and for large project evaluation.
- Conduct self-sufficiency analysis i.e. gap analysis to determine, with the help of the inter industry and commodity flows contained in the provincial SAM, where possible investment opportunities exist, and
- Calculate the inflationary impacts on provincial level of price changes instigated at national level (i.e. administered prices, VAT, etc.).

To summarise, the SAM mechanism provides a universally acceptable framework within which the economic impact of development projects and policy adjustments can be reviewed and assessed at both national and provincial/regional levels. It serves as an extension to the official National Accounts of a country's economy and, therefore, provides a wealth of additional information, especially when disaggregated to more detailed levels.

## 10 APPENDIX B: COST BENEFIT ANALYSIS

### Introduction

The CBA method provides a logical framework for evaluating development programmes, and can serve as an aid in decision-making processes. The following is a brief overview of the theory underlying the CBA method.

The theoretical foundations of CBA are: benefits are defined as increases in human wellbeing (utility) and costs are defined as reduction in human wellbeing. For a project of policy to qualify on cost-benefit grounds, its social benefits must exceed its social costs. "Society" is simply the sum of individuals. The geographical boundary for a CBA is usually the nation, but can be readily extended to wider limits.

### Basic Aggregation Rules

There are two basic aggregation rules. Firstly, aggregating benefits across different social groups or nations involves summing willingness to pay for benefits, its willingness to accept compensation for losses (WTP and WTA, respectively), regardless of the circumstances of the beneficiaries or losers. A second aggregation rule requires that higher weights be given to benefits and costs accruing to disadvantages or low income groups. One rationale for the second rule is that marginal utilities or income will vary, being higher for the low income group.

The notions of WTP and WTA are firmly grounded in the theory of welfare economics and correspond to the notions of compensation and equivalent variations. WTP and WTA should not, according to past theory, diverge very much. In practice they appear to diverge, often substantially, and with  $WTA > WTP$ . Hence, the choice of WTP or WTA may be of importance when conducting a CBA.

### Discounting

Aggregating over time involves discounting. Expressing future benefits and costs in present value is known as discounting. Inflation can result in future benefits and costs appearing to be higher than is really the case. Inflation should be netted out to secure constant price estimates.

Costs and benefits that are immediately incurred are judged differently by the community from costs and benefits that materialize over a period of time. Usually a community would prefer receiving a benefit today rather than reaping the benefits in the future, while deferred costs are more attractive than immediate payment. Therefore, the money value of costs and benefits over time cannot simply be added together, and the time preference of the community has to be taken into account through the use of a weighting process. This is done by calculating the net present value by discounting future cash-flows at a rate that reflects the value of a benefit or cost over time, known as the social discount rate. In other words, at what real interest rate will the community be prepared to forego immediate benefits in exchange for longer term benefits?

Suppose  $b_0, b_1, b_2, \dots, b_n$



are the project benefits in years 0, 1, 2, ..., n and  $c_0, c_1, c_2, \dots, c_n$  are the costs in years 0, 1, 2, ..., n, respectively, and  $i$  is the social discount rate, then the present value of the benefits is given by

$$b_0 \div [(1+i)]^0 + b_1 \div [(1+i)]^1 + \dots + b_n \div [(1+i)]^n$$

And the present value of the costs are given by

$$c_0 \div [(1+i)]^0 + c_1 \div [(1+i)]^1 + \dots + c_n \div [(1+i)]^n$$

These present values are then used to calculate various assessment criteria, while assisting in the evaluation of each development sphere. These criteria are:

- Net Present Value (NPV).
- Internal Rate of Return (IRR).
- Benefit Cost Ratio (BCR).

#### *Net Present Value (NPV)*

The difference between the benefits and costs (the net benefits) in the specific year is discounted to the present by using the social discount rate. The discounted sum of all these net benefits over the economic project life is defined as the NPV. In terms of terminology set out above:

$$NPV = \sum_{j=0}^n b_j \div [(1+i)]^j - \sum_{j=0}^n c_j \div [(1+i)]^j$$

The criteria for the acceptance of a project are that the NPV must be positive; in other words, funds will be voted for a project only if the analysis produces a positive net present value. Where a choice has to be made between mutually exclusive projects, the project with the highest present value will be chosen since it maximizes the net benefits to the community.

#### *Internal Rate of Return (IRR)*

The IRR is the discount rate at which the present value of costs and benefits are equal. It is therefore the value of the discount rate,  $r$ , which satisfies the following criteria:

$$\sum_{j=0}^n b_j \div [(1+r)]^j - \sum_{j=0}^n c_j \div [(1+r)]^j = 0$$

Only projects with an IRR higher than the social discount rate, which forms a limit, will be considered for funding. The IRR must be handled carefully, because there are situations in which mathematical solution of the above equation is not unique. This happens when the stream of net benefits over the assessment period changes its sign (positive or negative) more than once.

#### *Benefit Cost Ratio (BCR)*

The discounted BCR is the ratio of the present value of the benefits to the present value of the costs, i.e.

$$BCR = \left\{ \sum_{j=0}^n b_j \div (1+r)^j \right\} \div \left\{ \sum_{j=0}^n c_j \div (1+r)^j \right\}$$

A project will be considered for funding if the BCR is greater than 1.

## Appropriate Discount Rate

When considering an appropriate discount rate, note must be taken of the various points of departure in the economic literature as well as of the rates applied in other countries and by international development institutions.

The points of departure described in the literature can be broadly divided into three schools of thought, namely those who argue that the discount rate should be equal to the marginal return on capital (opportunity cost of capital), those whose arguments rests on long-term real interest rate (cost of funding to the State), and those who advocate a social time preference rate.

The first two schools take an economic view, whilst the third school adopts a multiple-goal approach which includes social aims. There is no consensus which method should be used to determine the social discount rate that would apply for a specific country. Therefore, a relative pragmatic approach takes the following factors into account:

- The discount rate should not be influenced by business cycle conditions and policy, since the preferences that find expression in this rate are aimed at the extension of the long-term welfare structure.
- A low discount rate generally favours projects with a higher capital cost and low future current costs, while the opposite applies to high discount rates. Since labour costs are part of current expenditure, a high discount rate favours the employment of labour in the future. If the real social discount rate is lower than the real implicit discount rate in the private sector, then investment by the public sector will be encouraged at the expense of investment by the private sector. The larger the gap between the two discount rates, the stronger the effect.

## Financial Discount Rate

In the case of public projects, where CBA is being performed for financial purposes, calculations are done at either current price, where inflation is taken into consideration or at constant/real prices, where inflation is excluded.

In terms of the financial analysis, the discount rate used is equal to the market rate, or weighted marginal cost of capital, plus uncertainty and a risk premium. It should be noted that if the calculation is being done in constant/real prices, the discount rate used should be in real terms. For instance, if the discount rate in current prices is 10% and the prospects for inflation over the project appraisal is 5%, then the real discount rate is approximately 5%. It can be calculated as follows:

$$((1.10 \div 1.05) - 1) \times 100 = 4.76\%$$

Therefore the real discount rate is not exactly 5% but 4.76%.

Due to the fact that projections are made over a long period into the future, and the fact that the future inflation rate is dependent on various economic factors (e.g. worldwide shocks such as oil price, etc.), it is generally difficult to estimate long-term price movements. In this study, the Consultants have used a real discount rate of 5%, and an inflation rate of 6%. Using the methodology described above, this yields a nominal discount rate of 11%.

## **Economic Discount Rate**

Although the calculation of the social time preference rate (STPR) is very difficult to determine, this has not stopped some analysts attempting empirical estimates. According to Kirkpatrick and Weiss (1996) “such estimates are normally in the 1 percent to 5 percent range, since per capita consumption growth will rarely exceed 3 percent annually, and the conventional estimates of the elasticity of the marginal utility of consumption are typically between 1.0 and 1.5.” Walshe and Dafferen calculated that the STPR is slightly in excess of the potential growth rate of an economy.

The study uses an economic discount rate of 8%, which is standard to most studies of this nature.

## **Market *versus* Shadow Prices**

As indicated above, the CBA can be conducted in financial (market) as well as economic (shadow) prices. Market prices are those perceived prices at which products and services are traded in the market place, irrespective of the level of interference in the market, e.g. the market wage rate of labour, the price of 2kg of maize meal, the price of 1 kilowatt-hour of electricity, etc. In theory, market prices are mainly manifestations of consumers’ willingness to pay.

Shadow prices (economic prices) are regarded as the opportunity costs of products and services when the market price, for whatever reasons, does not reflect these costs in full. Examples are the shadow wages of labour, where minimum wages are fixed at levels higher than market prices; shadow price for fuel, where taxes and subsidies are excluded; and shadow exchange rates are pegged and/or some kind of exchange control is still in place. The shadow price is therefore nominal (market) price, adjusted for the effect of interventions or other factors that are causing the market not to perform its natural role.

In practice, shadow prices should only be use when the market price of products and services do not reflect their scarcity value or economic contributions. In cases where market prices give an indication of the scarcity of products and services, market prices are used not only for financial analysis, but also for economic analysis.

## **Financial and Economic Cost Benefit Analysis**

The private and public sectors evaluate projects very differently. The private sector is mostly interested in the profitability of a project and the return on capital that will be achieved. In doing so, the private sector makes use of market prices (i.e. the prices that would be paid in the open market for inputs, labour, etc.) when determining the value of direct project-related costs and financial benefits. Furthermore, a financial CBA evaluated the project using market-determined interest and return rates that reflect the cost of private funds, uncertainties and risk.

In contrast, evaluating a public sector project involves determining a broader range of costs and benefits that will affect the community. Furthermore, when calculating the value of costs and benefits, economic analysis re-evaluates the project by making use of prices that reflect the relative economic scarcity/value of inputs and outputs. As such, in the public sector it is necessary to evaluate and weigh the wider benefits emanating from a project against the capital expenditure and costs associated with a project, using discount and return rates that reflect the time preferences of the community, known as the social discount rate.

The table below summarises the main differences between a financial and economic CBA.

**Table 63: Comparison of Financial and Economic Costs Benefit Analysis**

<b>Attributes</b>	<b>Economic CBA</b>	<b>Financial CBA</b>
Perspective	The broader community	Project shareholders/capital providers
Goal	The most effective application of scarce resources	Maximization of net value
Discount Rate	Social discount rate	Market determined weighted cost of capital
Unit of Valuation	Opportunity costs	Market prices
Scope	All aspects necessary for a rational, economic decision	Limited to aspects that affect profits
Benefits	Additional goods, services, income and/or cost saving	Profit and financial return on capital employed
Costs	Opportunity costs of goods and services foregone	Financial payments and depreciation calculated according to generally accepted accounting principles

## **11 APPENDIX C: MAGNITUDE OF LINKAGES AND DEFINITION OF MACRO-ECONOMIC AGGREGATES**

Formally, economists distinguish between direct, indirect and induced economic effects. Indirect and induced effects are sometimes collectively called secondary effects. The total economic impact is the sum of direct, indirect and induced effects within a region. Any of these impacts may be measured in terms of gross output or sales, income, employment or value added.

### **Direct Impacts**

The direct impacts refer to the effect of the activities that take place in the mining and electricity industries. It refers to the income and expenditure that is associated with the everyday operation of each of the components of the relevant industry. For instance if the mining component is taken as an example the direct impacts refer to the total production/turnover of the mine; the intermediate goods bought by the mine; the salaries and wages paid by the mine; the profits generated by the mine.

### **Indirect Impacts**

The indirect impacts refer to economic activities that arise in the sectors that provide inputs to the mining and electricity industries' components and other backward linked industries. For example, if the electricity sector uses steel, the indirect impacts refer to the activity (paying of salaries and wages; and profit generation) that occurs in the steel sector as well as the sectors that provide materials to the steel sector.

### **Induced Impacts**

Induced impacts refer, inter alia, to the economic impacts that result from the payment of salaries and wages to people who are (directly) employed at the various consecutive stages of beneficiation of the mining and electricity industries. In addition the induced impact also includes the salaries and wages paid by businesses operating in the sectors indirectly linked to these industries through the supply of inputs. These additional salaries and wages lead to an increased demand for various consumable goods that need to be supplied by other sectors of the economy that then have to raise their productions in tandem with the demand for their products and services.

These induced impacts can then be expressed in terms of their contributions to GDP, employment creation and investment or other useful macro-economic variables.

Added together, the direct, indirect and induced impacts provide the total impact that these industries will have on the South African and Limpopo economies.

### **Definitions of Macro-Economic Aggregates**

Impact analysis will be based on a number of standard economic parameters and the results will be presented under the following headings:

- Impact on Gross Domestic Product (GDP).
- Impact on Capital Utilisation.
- Impact on Employment Creation.

- Skilled labourers.
- Semi-skilled labourers.
- Unskilled labourers.
- Impact on Households Income (Income distribution).
- Impact on Balance of Payments, as a result of Imports and Exports.

The following is a brief overview of the definition of each of these economic parameters.

### ***Impact on Gross Domestic Product (GDP)***

The impact on GDP reflects the magnitude of the values added to the coal mining industry from activities within the industry. Value added is made up of three elements, namely:

- Remuneration of employees,
- Gross operating surplus (which includes profit and depreciation), and
- Net indirect taxes.

### ***Impact on Capital Utilisation***

For an economy to operate at a specific level of activity, investment in capital assets (i.e. buildings, machinery, equipment, etc.) is needed. Capital, together with labour and entrepreneurship, are the basic factors needed for production in an economy.

The effectiveness and efficiency with which these factors are combined influence the overall level of productivity/profitability processes, bearing in mind that productivity is affected by an array of factors of which appropriate technology and skill level of the labour force are two important elements.

### ***Impact on Employment Creation***

Labour is a key element of the production process. The study will determine the number of new employment opportunities that will be created by investment in the coal mining industry. These employment opportunities will be broken down into those created directly by a particular project and those indirectly created and induced throughout the broader economy. Furthermore, a distinction will be made between skilled, semi-skilled and unskilled labourers.

### ***Impact on Household Income***

One of the elements of the additional value added (i.e. GDP) which will result from the proposed expansion is remuneration of employees, which, in turn, affects households income.

The SAM measures the magnitude of changes that will occur to both household income and spending/savings pattern. As such, the study will highlight the impact of the coal mining industry on the low income households as this can be used as an indicator of the extent to which the coal mining industry contributed to poverty alleviation throughout the economy.

### ***Impact on the Current Account of the Balance of Payments***

The coal mining industry will have direct, indirect and induced impacts on the exports and imports of goods and services that will take place across all of the various economic sectors that are affected by the coal mining industry. Imports consist of direct and indirect material imports, as well as goods consumed by households that are imported as a result of the induced impact.

### **Input Data Required Conducting the Macro-Economic Impact Analysis**

Modelling the macro-economic impact of the construction and operational phases of the total development project requires detailed information regarding these two phases of the project. The relevant “building blocks: containing the required data and information are given and discussed below.

#### ***Construction Phase***

The information required to model the macro-economic impact of the construction phase of a project relate to the nature and costs of the capital assets that are actually created. The following standard breakdown of the asset types is used:

- Civil engineering costs:
  - Earth works (site clearance, foundations, etc.).
  - Structures (bridges, dams and other structures built mainly from concrete).
  - Roads (freeways, other arterials and streets).
- Building and construction costs:
  - Residential buildings (houses, etc.).
  - Non-residential buildings (factories, offices, shopping centres, etc.).
- Machinery and other equipment costs:
  - Mechanical equipment.
  - Electrical and electronic equipment.
  - Research, design, architecture and development costs.
  - Furniture.
  - Rubber products.
  - Structural metal products.
  - Other fabricated metal products.
  - Manufacturing of transport equipment.
  - Other manufacturing and recycling.
- Water related construction costs:
  - Bulk water (dams).
  - Reservoirs.
  - Pump stations (water and sewerage).
  - Bulk pipelines (water and sewerage).
  - Treatment works (water and sewerage).
  - Reticulation (water and sewerage).
  - Storm water.
  - Parks and recreation.

### ***Operational Phase***

In order to quantify the macro-economic impact of the operational component of a project, the following information is required by the model:

- Production/turnover, divided between:
- Sales/turnover destined for domestic consumption; and
- Export sales.

Production/Operation Costs, Broken Down Into:

- Intermediate input costs, i.e. all materials and services necessary for the production process broken down by industries from which inputs are sources (classified according to the Standard Industrial Classification (SIC) code system),
- Remuneration of staff, broken down by skill levels (i.e. skilled, semi-skilled and unskilled workers), and
- Gross operating surplus (i.e. remuneration of capital).

The table below gives an example of the exogenous vector for Water – Water Supply. These figures are used as the inputs for the operational phase of the model, but are only used as an example to give the reader more clarity on the input requirements for such a model.



## 12 APPENDIX D: RISK PROFILE

### 12.1 Risk Profile – Wildebeest Farms

Infringement	Weight
Noise	5.00
Dust	12.00
Blasting	5.00
Social, Crime and Other	5.00
Sense of Place - Visual	11.00
Ground Water	57.00
Surface Water	5.00
	<b>100.00</b>

Activity	Sub -Activity	Extend	Duration	Magnitude	Probability
<b>Beef and other Livestock Farming</b>	Commercial	1	2	2	1
	Community				-
<b>Game Farming</b>	Game (breeding)	1	2	2	1
	Live Sales	1	1	2	1
	Trophy Hunting	3	3	7	3
	Biltong Hunting	1	1	5	2
<b>Tourism &amp; Accommodation</b>	Eco - tourists	2	4	7	3
	Hunters	2	4	7	2
<b>Irrigation</b>	Citrus	1	1	1	1
	Other Crops	1	1	1	1
<b>Community</b>	Life Style	0	0	0	-
<b>Environment (birds &amp; plants)</b>		2	4	2	3
<b>Sub-total</b>	5				
<b>Beef and other Livestock Farming</b>	Commercial	1	5	4	2
	Community				-
<b>Game Farming</b>	Game (breeding)	3	5	4	2
	Live Sales	3	5	4	1
	Trophy Hunting	3	5	9	2
	Biltong Hunting	3	5	8	2
<b>Tourism &amp; Accommodation</b>	Eco - tourists	3	5	8	3
	Hunters	4	5	8	5
<b>Irrigation</b>	Citrus	4	5	8	4
	Other Crops	4	5	8	4
<b>Community</b>	Life Style				
<b>Environment (birds &amp; plants)</b>		3	5	6	4
<b>Sub-total</b>	12.00				

<b>Beef and other Livestock Farming</b>	<i>Commercial</i>	1	2	4	1
	<i>Community</i>				-
<b>Game Farming</b>	<i>Game (breeding)</i>	1	2	4	1
	<i>Live Sales</i>	1	1	2	1
	<i>Trophy Hunting</i>	2	3	8	2
	<i>Biltong Hunting</i>	2	3	6	1
<b>Tourism &amp; Accommodation</b>	<i>Eco - tourists</i>	1	3	8	4
	<i>Hunters</i>	1	3	7	3
<b>Irrigation</b>	<i>Citrus</i>	1	1	1	1
	<i>Other Crops</i>	1	1	1	1
<b>Community</b>	<i>Life Style</i>				
<b>Environment (birds &amp; plants)</b>		1	2	2	4
<b>Sub-total</b>	5.00				
<b>Beef and other Livestock Farming</b>	<i>Commercial</i>	2	5	6	2
	<i>Community</i>				-
<b>Game Farming</b>	<i>Game (breeding)</i>	2	5	6	2
	<i>Live Sales</i>	1	1	2	2
	<i>Trophy Hunting</i>	3	5	8	2
	<i>Biltong Hunting</i>	3	5	8	2
<b>Tourism &amp; Accommodation</b>	<i>Eco - tourists</i>	3	5	8	5
	<i>Hunters</i>	3	5	8	3
<b>Irrigation</b>	<i>Citrus</i>	1	1	1	1
	<i>Other Crops</i>	2	4	3	5
<b>Community</b>	<i>Life Style</i>				-
<b>Environment (birds &amp; plants)</b>		1	1	4	3
<b>Sub-total</b>	5.00				
<b>Beef and other Livestock Farming</b>	<i>Commercial</i>	1	1	2	1
	<i>Community</i>				-
<b>Game Farming</b>	<i>Game (breeding)</i>	1	1	2	1
	<i>Live Sales</i>	1	1	2	1
	<i>Trophy Hunting</i>	5	5	10	3
	<i>Biltong Hunting</i>	5	4	8	2
<b>Tourism &amp; Accommodation</b>	<i>Eco - tourists</i>	5	4	10	5
	<i>Hunters</i>	5	4	10	3
<b>Irrigation</b>	<i>Citrus</i>	1	1	1	1
	<i>Other Crops</i>	1	1	1	1
<b>Community</b>	<i>Life Style</i>				
<b>Environment (birds &amp; plants)</b>		3	5	10	5
<b>Sub-total</b>	11.00				
<b>Beef and other Livestock Farming</b>	<i>Commercial</i>	3	5	4	3
	<i>Community</i>				-
<b>Game Farming</b>	<i>Game (breeding)</i>	3	5	4	3
	<i>Live Sales</i>	3	5	4	1
	<i>Trophy Hunting</i>	4	5	8	2

	<i>Biltong Hunting</i>	4	5	8	2
<b>Tourism &amp; Accommodation</b>	<i>Eco - tourists</i>	3	5	8	5
	<i>Hunters</i>	3	5	8	4
<b>Irrigation</b>	<i>Citrus</i>	4	5	8	5
	<i>Other Crops</i>	4	5	8	5
<b>Community</b>	<i>Life Style</i>				
<b>Environment</b>		5	5	10	5
<b>Sub-total</b>	57.00				
<b>Beef and other Livestock Farming</b>	<i>Commercial</i>	1	5	4	3
	<i>Community</i>				0
<b>Game Farming</b>	<i>Game (breeding)</i>	1	5	6	3
	<i>Live Sales</i>	1	5	2	1
	<i>Trophy Hunting</i>	4	5	7	2
	<i>Biltong Hunting</i>	4	5	5	2
<b>Tourism &amp; Accommodation</b>	<i>Eco - tourists</i>	3	5	7	4
	<i>Hunters</i>	3	5	6	3
<b>Irrigation</b>	<i>Citrus</i>	4	5	8	4
	<i>Other Crops</i>	4	5	8	4
<b>Community</b>	<i>Life Style</i>				-
<b>Environment</b>		5	5	8	5

## 12.2 Risk Profile – Chapudi Farms

	Infringement	Weight
<b>Mining and Transport Operations</b>	<i>Noise</i>	5.00
	<i>Dust</i>	12.00
	<i>Blasting</i>	5.00
<b>Community, etc.</b>	<i>Social, Crime and Other</i>	5.00
	<i>Sense of Place - Visual</i>	11.00
<b>Water</b>	<i>Ground Water</i>	57.00
	<i>Surface Water</i>	5.00
		<b>100.00</b>

Infringement	Activity	Sub -Activity	Extend	Duration	Magnitude	Probability
<b>Noise</b>	<b>Beef and other Livestock Farming</b>	<i>Commercial</i>	1	2	2	1
		<i>Community</i>				-
	<b>Game Farming</b>	<i>Game (breeding)</i>	1	2	2	1
		<i>Live Sales</i>	1	1	2	1
		<i>Trophy Hunting</i>	3	3	7	3
		<i>Biltong Hunting</i>	1	1	5	2
	<b>Tourism &amp; Accommodation</b>	<i>Eco - tourists</i>	2	4	7	3
		<i>Hunters</i>	2	4	7	2
	<b>Irrigation</b>	<i>Citrus</i>	1	1	1	1
		<i>Other Crops</i>	1	1	1	1
	<b>Community</b>	<i>Life Style</i>	0	0	0	-
	<b>Environment (birds &amp; plants)</b>		2	4	2	3

	<b>Sub-total</b>		5				
<b>Dust</b>	<b>Beef and other Livestock Farming</b>	<i>Commercial</i>	1	5	4	2	
		<i>Community</i>				-	
	<b>Game Farming</b>	<i>Game (breeding)</i>	3	5	4	2	
		<i>Live Sales</i>	3	5	4	1	
		<i>Trophy Hunting</i>	3	5	9	2	
		<i>Biltong Hunting</i>	3	5	8	2	
	<b>Tourism &amp; Accommodation</b>	<i>Eco - tourists</i>	3	5	8	3	
		<i>Hunters</i>	4	5	8	5	
	<b>Irrigation</b>	<i>Citrus</i>	4	5	8	4	
		<i>Other Crops</i>	4	5	8	4	
	<b>Community</b>	<i>Life Style</i>					
<b>Environment (birds &amp; plants)</b>		3	5	6	4		
	<b>Sub-total</b>		12.00				
<b>Blasting</b>	<b>Beef and other Livestock Farming</b>	<i>Commercial</i>	1	2	4	1	
		<i>Community</i>				-	
	<b>Game Farming</b>	<i>Game (breeding)</i>	1	2	4	1	
		<i>Live Sales</i>	1	1	2	1	
		<i>Trophy Hunting</i>	2	3	8	2	
		<i>Biltong Hunting</i>	2	3	6	1	
	<b>Tourism &amp; Accommodation</b>	<i>Eco - tourists</i>	1	3	8	4	
		<i>Hunters</i>	1	3	7	3	
	<b>Irrigation</b>	<i>Citrus</i>	1	1	1	1	
		<i>Other Crops</i>	1	1	1	1	
	<b>Community</b>	<i>Life Style</i>					
<b>Environment (birds &amp; plants)</b>		1	2	2	4		
	<b>Sub-total</b>		5.00				
<b>Social, Crime and other impacts</b>	<b>Beef and other Livestock Farming</b>	<i>Commercial</i>	2	5	6	2	
		<i>Community</i>				-	
	<b>Game Farming</b>	<i>Game (breeding)</i>	2	5	6	2	
		<i>Live Sales</i>	1	1	2	2	
		<i>Trophy Hunting</i>	3	5	8	2	
		<i>Biltong Hunting</i>	3	5	8	2	
	<b>Tourism &amp; Accommodation</b>	<i>Eco - tourists</i>	3	5	8	5	
		<i>Hunters</i>	3	5	8	3	
	<b>Irrigation</b>	<i>Citrus</i>	1	1	1	1	
		<i>Other Crops</i>	2	4	3	5	
	<b>Community</b>	<i>Life Style</i>				-	
<b>Environment (birds &amp; plants)</b>		1	1	4	3		
	<b>Sub-total</b>		5.00				
<b>Destroying the sense of place - Visual</b>	<b>Beef and other Livestock Farming</b>	<i>Commercial</i>	1	1	2	1	
		<i>Community</i>				-	
	<b>Game Farming</b>	<i>Game (breeding)</i>	1	1	2	1	
		<i>Live Sales</i>	1	1	2	1	
		<i>Trophy Hunting</i>	5	5	10	3	
		<i>Biltong Hunting</i>	5	4	8	2	
	<b>Tourism &amp; Accommodation</b>	<i>Eco - tourists</i>	5	4	10	5	
		<i>Hunters</i>	5	4	10	3	
	<b>Irrigation</b>	<i>Citrus</i>	1	1	1	1	
		<i>Other Crops</i>	1	1	1	1	
	<b>Community</b>	<i>Life Style</i>					
<b>Environment (birds &amp; plants)</b>		3	5	10	5		
	<b>Sub-total</b>		11.00				
<b>Underground</b>	<b>Beef and other Livestock</b>	<i>Commercial</i>	3	5	4	3	

water - contamination and water levels	<b>Farming</b>	<i>Community</i>					-
	<b>Game Farming</b>	<i>Game (breeding)</i>	3	5	4	3	
		<i>Live Sales</i>	3	5	4	1	
		<i>Trophy Hunting</i>	4	5	8	2	
		<i>Biltong Hunting</i>	4	5	8	2	
	<b>Tourism &amp; Accommodation</b>	<i>Eco - tourists</i>	3	5	8	5	
		<i>Hunters</i>	3	5	8	4	
	<b>Irrigation</b>	<i>Citrus</i>	4	5	8	5	
		<i>Other Crops</i>	4	5	8	5	
	<b>Community</b>	<i>Life Style</i>					
	<b>Environment</b>		5	5	10	5	
<b>Sub-total</b>		57.00					
Surface water - contamination and run-off	<b>Beef and other Livestock Farming</b>	<i>Commercial</i>	1	5	4	3	
		<i>Community</i>				0	
	<b>Game Farming</b>	<i>Game (breeding)</i>	1	5	6	3	
		<i>Live Sales</i>	1	5	2	1	
		<i>Trophy Hunting</i>	4	5	7	2	
		<i>Biltong Hunting</i>	4	5	5	2	
	<b>Tourism &amp; Accommodation</b>	<i>Eco - tourists</i>	3	5	7	4	
		<i>Hunters</i>	3	5	6	3	
	<b>Irrigation</b>	<i>Citrus</i>	4	5	8	4	
		<i>Other Crops</i>	4	5	8	4	
	<b>Community</b>	<i>Life Style</i>					-
	<b>Environment</b>		5	5	8	5	
	<b>Sub-total</b>		5.00				

### 12.3 Risk Profile – Chapudi West Farms

	Infringement	Weight
Mining and Transport Operations	Noise	5.00
	Dust	12.00
	Blasting	5.00
Community,etc.	Social, Crime and	5.00
	Sense of Place - Visual	11.00
Water	Ground Water	57.00
	Surface Water	5.00
		<b>100.00</b>

Infringement	Activity	Sub -Activity	Exten	Duratio	Magnitud	Probabilit
Noise	<b>Beef and other Livestock Farming</b>	Commercial	1	2	2	1
		Community				-
	<b>Game Farming</b>	Game	1	2	2	1
		Live Sales	1	1	2	1
		Trophy Hunting	3	3	7	3
		Biltong Hunting	1	1	5	2
	<b>Tourism &amp; Accommodation</b>	Eco - tourists	2	4	7	3
		Hunters	2	4	7	2
	<b>Irrigation</b>	Citrus	1	1	1	1
		Other Crops	1	1	1	1
	<b>Community</b>	Life Style	0	0	0	-
	<b>Environment (birds &amp; )</b>		2	4	2	3
		<b>Sub-total</b>	5			
Dust	<b>Beef and other Livestock Farming</b>	Commercial	1	5	4	2
		Community				-
	<b>Game Farming</b>	Game	3	5	4	2
		Live Sales	3	5	4	1
		Trophy Hunting	3	5	9	2
		Biltong Hunting	3	5	8	2
	<b>Tourism &amp; Accommodation</b>	Eco - tourists	3	5	8	3
		Hunters	4	5	8	5
	<b>Irrigation</b>	Citrus	4	5	8	4
		Other Crops	4	5	8	4
	<b>Community</b>	Life Style				
	<b>Environment (birds &amp; )</b>		3	5	6	4
		<b>Sub-total</b>	12.00			
Blasting	<b>Beef and other Livestock Farming</b>	Commercial	1	2	4	1
		Community				-
	<b>Game Farming</b>	Game	1	2	4	1
		Live Sales	1	1	2	1
		Trophy Hunting	2	3	8	2
		Biltong Hunting	2	3	6	1
	<b>Tourism &amp; Accommodation</b>	Eco - tourists	1	3	8	4
		Hunters	1	3	7	3
	<b>Irrigation</b>	Citrus	1	1	1	1
		Other Crops	1	1	1	1
	<b>Community</b>	Life Style				
	<b>Environment (birds &amp; )</b>		1	2	2	4
		<b>Sub-total</b>	5.00			
Social, Crime and other impacts	<b>Beef and other Livestock Farming</b>	Commercial	2	5	6	2
		Community				-

	<b>Game Farming</b>	Game	2	5	6	2
		Live Sales	1	1	2	2
		Trophy Hunting	3	5	8	2
		Biltong Hunting	3	5	8	2
	<b>Tourism &amp; Accommodation</b>	Eco - tourists	3	5	8	5
		Hunters	3	5	8	3
	<b>Irrigation</b>	Citrus	2	4	4	5
		Other Crops	2	4	3	5
	<b>Community</b>	Life Style				-
	<b>Environment (birds &amp; )</b>		1	1	4	3
	<b>Sub-total</b>	5.00				
<b>Destroying the sense of place - Visual</b>	<b>Beef and other Livestock Farming</b>	Commercial	1	1	2	1
		Community				-
	<b>Game Farming</b>	Game	1	1	2	1
		Live Sales	1	1	2	1
		Trophy Hunting	5	5	10	3
		Biltong Hunting	5	4	8	2
	<b>Tourism &amp; Accommodation</b>	Eco - tourists	5	4	10	5
		Hunters	5	4	10	3
	<b>Irrigation</b>	Citrus	1	1	1	1
		Other Crops	1	1	1	1
<b>Community</b>	Life Style					
<b>Environment (birds &amp; )</b>		3	5	10	5	
	<b>Sub-total</b>	11.00				
<b>Underground water - contamination and water levels</b>	<b>Beef and other Livestock Farming</b>	Commercial	3	5	4	3
		Community				-
	<b>Game Farming</b>	Game	3	5	4	3
		Live Sales	3	5	4	1
		Trophy Hunting	4	5	8	2
		Biltong Hunting	4	5	8	2
	<b>Tourism &amp; Accommodation</b>	Eco - tourists	3	5	8	5
		Hunters	3	5	8	4
	<b>Irrigation</b>	Citrus	4	5	8	4
		Other Crops	4	5	8	4
<b>Community</b>	Life Style					
<b>Environment</b>		5	5	10	5	
	<b>Sub-total</b>	57.00				
<b>Surface water - contamination and run-off</b>	<b>Beef and other Livestock Farming</b>	Commercial	1	5	4	3
		Community				0
	<b>Game Farming</b>	Game	1	5	6	3
		Live Sales	1	5	2	1
		Trophy Hunting	4	5	7	2
		Biltong Hunting	4	5	5	2
	<b>Tourism &amp; Accommodation</b>	Eco - tourists	3	5	7	4
		Hunters	3	5	6	3
	<b>Irrigation</b>	Citrus	4	5	8	4
		Other Crops	4	5	8	4
<b>Community</b>	Life Style				-	
<b>Environment</b>		5	5	8	5	
	<b>Sub-total</b>	5.00				

## 13 APPENDIX E: CURRICULUM VITAE OF PROPOSED PROFESSIONAL STAFF

### MR WILLIAM MULLINS

#### PERSONAL DETAILS:

Date of Birth: 26 April 1949  
Nationality: South African  
Current Position: Economist - Agriculture Specialist

#### ACADEMIC QUALIFICATIONS:

1968: UED – University of Free State.  
1967 BSc – University of Free State.

#### OTHER TRAINING:

Excel, MS Word and Powerpoint.

#### LANGUAGE SKILLS:

<i>Language</i>	<i>Reading</i>	<i>Speaking</i>	<i>Writing</i>
English	Excellent	Excellent	Excellent
Afrikaans	Excellent	Excellent	Excellent

#### PROFESSIONAL CAREER:

William Mullins is originally trained as a mathematician and statistician and after a short spell in industry, became a teacher. In 1976, William took over the family farm in Southern KwaZulu Natal, where he farmed until joining by Mosaka Economic Consultants cc in 2000. During his time in farming William Mullins served a period as chairman of the Natal Agricultural Union and was a member of the Regional Development Committee of Region C (RDAC) and the National Regional Development Advisory Committee (NRDAC). He also served as a board member of the KwaZulu Development Corporation and its successor, the Ithala Development Corporation from 1993 to 2001. William was also a member of the KwaZulu Training Trust (KTT) and a board member of the Natal Parks Board.

In the early years of by Mosaka Economic Consultants cc, William worked on projects on a part-time basis and then, in 2000, he joined the organisation as the resident statistician. William's leadership qualities and ability to work with people makes him a natural choice as a project team leader. His extensive experience in the agricultural field means that he is involved in most projects in this field, as well as impact studies on rivers. William has also worked in specialist fields like the SKA Telescope study and impact studies for Eskom.

Some of William Mullins's most recent projects include:



- Macro-economic Impact Analysis and Cost Benefit Analysis of the Sekoko Coal Waterberg Project, 2011 [Sekoko Resources (Pty) Ltd.]
- Macro-economic Impact Analysis and Cost Benefit Analysis of the Proposed Vele Colliery near Musina, Limpopo 2010 [Naledi Development (Pty) Ltd.]
- Port Economic Decision Making Framework [eThekweni Municipality, 2007-2008].
- Environmental impact assessment for the proposed Gamma-Grass Ridge 765kV Transmission Power Lines (x2). [ESKOM Transmission, 2008].
- Integrated comprehensive study of the water resources of the Maputo River Basin [Plancenter Ltd, 2008].
- Comprehensive Determination of the Reserve for the Inkomati WMA [Water for Africa, 2007].
- CBA Analysis of Further Water Augmentation in the Komati and Extension and Updating of the Current Database of the Komati WMA [KNPSF/BIGEN, 2008].
- Feasibility Study of the Potential for Sustainable Water Resources Development in the Molopo-Nossob Watercourse [Iliso Consulting Pty Ltd, 2008].
- Impact study SKA/Meerkat [Imani Development (South Africa) Pty Ltd, 2008].
- Development of a Draft Water Allocation Plan to guide compulsory licensing in the Mhlatuze Catchment. [Iliso Consulting Pty Ltd, 2008].
- Environmental Impact Assessment and Environmental Management Programme for a Proposed Nuclear Power Station [Imani Development (South Africa) Pty Ltd, 2007].
- Socio-economic and ecological implications of water restrictions in the Letaba catchment [DWAF, 2009].

**PROJECT EXPERIENCE OUTSIDE SOUTH AFRICA:**

<b>Country</b>	<b>Date from - Date to</b>
Swaziland	1996, 2001, 2006-2007
Mozambique	2004-2006, 2008
Namibia	2002, 2004, 2008
Botswana	2008
South Africa	1996-2009

## TEFELO MAJORO

### PERSONAL DETAILS:

Date of Birth: 3 June 1981  
Nationality: Lesotho  
Current position: Economist at Mosaka Economic Consultants cc

### ACADEMIC QUALIFICATIONS:

1999-2003: B. Com (Accounting); National University of Lesotho, Lesotho  
2006-2009: MBA (Finance); Wuhan University of Technology, China  
Current studies: ACCA (CA)

### LANGUAGE SKILLS:

Sesotho      Read    Speak    Write  
English      Read    Speak    Write

### OTHER TRAINING:

MS Excel, MS Word and MS Powerpoint.

### PROFESSIONAL CAREER:

September 2010 – Present: Economist at by Mosaka Economic Consultants cc

January 2010 – July 2010: Qinfo Solutions: Business analyst.

April 2004 – July 2006: Educator at Lesotho High School.

Duties:

Responsible for various tasks ranging from consulting with clients to developing macro-economic models, macro-economic analyses, cost-benefit analyses and report writing and editing.

Extract on projects worked on at Mosaka Economic Consultants cc:

- Cost Benefit Analysis of either Developing Support Precinct 6 Land Commercially or Declaring it a Conservation Reserve (Dube Trade Port)
- Costs Benefit Analysis and Macro-economic Impact of the Richards Bay Industrial Development Zone (RBIDZ)
- Financial and Economic Costs Benefits Analysis of the 2010 FIFA Soccer World Cup in eThekweni (Golder Associates)

- Cost Benefit Analysis and Macro-economic Impact Analysis of the South African Sugar Industry (South African Sugar Association)
- Macro-economic Impact Analysis and Cost Benefit Analysis of the Sekoko Mine (Sekoko Resources (Pty) Ltd.)
- Financial and Economic Cost Benefit Analysis for implementing a 10 000 hectare sugar cane plantation in Mozambique (Burger and Du Plessis)
- Cost Benefit Analysis for Water Monitoring Programme (Department of Water Affairs)

## **JEAUNÉS VILJOEN**

### **PERSONAL DETAILS:**

Date of Birth: 6 May 1983  
Nationality: South African  
Current position: Senior Economist at Mosaka Economic Consultants cc

### **ACADEMIC QUALIFICATIONS:**

2002-2006: BSc in Economic Science and Mathematics - University of the Witwatersrand  
2006-2006: BEconSci (Honours) in Economic Science University of the Witwatersrand

### **LANGUAGE SKILLS:**

Afrikaans      Read    Speak    Write  
English        Read    Speak    Write

### **OTHER TRAINING:**

MS Excel, MS Word, MS Power Point, Inforum Modelling, G7 and Eviews.

### **PROFESSIONAL CAREER:**

2007 – Present: Mosaka Economists

Duties:

Economic analyses, economic policy as well as project evaluation, Input-Output Tables as well as Social Accounting Matrixes. Cost Benefit Analyses, Macro-economic Analyses and Econometric modelling.

Extract on projects worked on at Mosaka Economic Consultants cc:

- Economic Impacts Assessment of Roads and Adjacent Economic Activities (Namibia Road and Educational Infrastructure -2007).
- Feasibility Studies and Preparation of Tender Documents for Future Investments for the Athi Water Services Board (Nairobi Water and Sewerage Institutional Restructuring).
- Econometric Model to predict the effect that various water resource management scenarios would have on South Africa's Economic Development: K5/1570 (Water Research Commission).
- Town Proclamation of Koingnaas and Kleinzee: Programme Management Support. Conducting of an Econometric Sector analysis Study to determine the impact of all mining and proclamation activities on the local municipalities and economy - 2007 (Africon Engineering International (Pty) Ltd).

- Environment and Tourism in the Limpopo Province. A Desktop study on the Macroeconomic Impact Assessment of Industrial Clusters in the Limpopo Province. An Interim Study for the purposes of the Limpopo EXCO (The Department of Economic Development).
- Provincial Social Accounting Matrix for the Gauteng Province Training, November 2007 (Gauteng Province).
- Provincial Social Accounting Matrix for the KwaZulu-Natal Province Training, February 2008 (KwaZulu-Natal).
- Beira Feasibility Study: Storm water Drainage System Rehabilitation and Extension in Central and Northern Parts in the Beira Area (BKS).
- Development Impact of Projects Financed by DBSA (2006/2007) (DBSA).
- Updating of Provincial SAMs for 2006 (DBSA).
- Development and building of the Provincial Social Accounting Matrix for the KwaZulu-Natal Province for 2006 (DBSA).
- Development and building of the Provincial Social Accounting Matrix for the Western Cape Province for 2006 (DBSA).
- Stimulation of Economic Growth for Klerksdorp Airport. Cost Benefit Analysis and Macroeconomic Impact Assessment of Klerksdorp Airport on surrounding area (City of Matlosana).
- The Macro-economic Impacts of the Water Allocation Reform Process in Nkomazi Region and Middle Crocodile and the Cost Benefit Analysis of the Water Augmentation Option (Komati/Ngwenya Private Sector Forum of Mpumalanga).
- Transnet Freight Demand Model Update (2008) (University of Stellenbosch).
- Environmental Impact Assessment and Environmental Management Programme for a Proposed Nuclear Power Station (Imani Development (South Africa) (Pty) Ltd).
- Macro-economic Assessment of the Envisaged Developments in the Vicinity of Lephalale and their impact on the Lephalale Local Municipality DBSA).
- Proposed Integrated and Continual Project Information Management System for the DBSA (DBSA).
- Comprehensive Design of the South African Renewable Energy Sectoral Business Case - 2009 (Department of Minerals and Energy (DME)).
- Nature and Magnitude of Benchmarking the Provincial SAMs against the National SAM. Development and building of Provincial Benchmarking model (DBSA).
- Development and building of the National Social Accounting Matrix for South Africa for 2006 (DBSA).
- Development and Updating of all nine provincial Social Accounting Matrices of South Africa for 2006 (DBSA).
- Development and Update of the eThekweni Metropolitan Social Accounting Matrix for 2006 (DBSA).
- Development Impact of Projects Financed by DBSA (2008/2009) (DBSA).
- Impact of the Wine Industry on the Western Cape and the Rest of South Africa for 2009 (DBSA).
- Projection of Fuel Imports and the Impact on the South African Economy from 2005-2020 (2010) (PetroSA).

- Macro-economic Impact Assessment of Eskom's Capital Investment Programme and Subsequent Economic Impacts on the South African Economy of Costs Incurred through Different Funding Options (2010) (DBSA).
- Development and Implementation of a Model to be used for Economic Impact Assessment of Specific SAISC projects (2010) (Southern African Institute of Steel Construction (SAISC)).
- Determine the Economic Footprint of Kumba in the Northern Cape and the Rest of South Africa (2011) (Kumba Iron Ore).
- Development and Implementation of Models to be used for Economic Impact Assessment of Regulatory Decisions taken by NERSA (2010/2011/2012) (National Energy Regulator of South Africa (NERSA)).
- Acquisition of Computerized SAM based User-Friendly Macro-Economic Impact Model, including Refocused Training as well as Mentoring, Coaching, Conceptualization and Evaluation of Projects initiated by the Department of Finance (2011) (Mpumalanga Provincial Government - Department of Finance).
- Valuation of the Farm: Gedeelte 1, Volspruit 326 KR Limpopo Province of Mr Flippie de Klerk according to the Discounted Future Net Income Method (2011) (Frans Fourie Professional Accountants).
- Analyzing the Economic Impact of the Financial Sector in General and that of Standard Bank in particular, on the South African Economy through a Financial SAM (2011) (Standard Bank).
- Data Compilation and Pilot Applications of the Nile Basin Decision Support System (2012) (Aurecon).
- Analyzing and Optimizing the Metal Industry as well as the Economic Impact of Implementing measures to reduce on-going job losses and plant closures in the Foundry and Scrap Metal Industries (2012/2013) (Employment Promotion Plan Phase III).
- Review and Update of Annual Report and Provincial Project Impact Models based on the Social Accounting Matrices (SAMs) (2012) (DBSA).
- Review and Update of Annual Report Models based on the Social Accounting Matrices (SAMs) for SADC (2012) (DBSA).
- Analyse the Landbank in terms of Agriculture Commodities (2012) (DBSA/Landbank).
- Economic Footprint of Kumba Iron Ore in Limpopo, the Northern Cape and South Africa in total Update of the 2011 Study and Impact of Future Projects (2012) (Kumba Iron Ore).
- South Africa's Greenhouse Gas Mitigation Potential Analysis (2012/2013) (CAMCO).
- Training in G7 and Inforum Modelling.

#### Publications

- Mullins, D., Viljoen, J. & Leeuwner, H. (2011). Forecast and Analysis of South Africa's Electricity Sector. 19th INFORUM World Conference, Hazyview, South Africa. ISBN 978-0-620-53149-8.
- Mullins, D., Viljoen, J. & Mosaka, D. (2012). Analysis of South Africa's Petroleum Sector. 20th INFORUM World Conference, Florence, Italy.

## DANIEL SMITH HAMMAN

### PERSONAL DETAILS:

Date of Birth: 08 August 1938  
Nationality: South African  
Current position: Research and Data Collection

### ACADEMIC QUALIFICATIONS:

Date 1961 B.Mil (US)

### LANGUAGE SKILLS:

English	Read	Speak	Write
Afrikaans	Read	Speak	Write
French	Read	Speak	

### OTHER SKILLS:

MS Excel, MS Word and MS Power Point.

### PROFESSIONAL CAREER:

1999-present: Mosaka Economic Consultants cc – Information research, data collection and assisting in various tasks surrounding report writing etc.

1997-2009: Merhast (Pty) Ltd. Co-Director - Facilitating the utilisation of the vast pool of knowledge and expertise available in the large number of prematurely retired Defence Force members.

1993-1998: Inter-State Defence and Security Committee (ISDSC) as Reserve Officer - Coordinator of the Inter-State Defence and Security Committee (ISDSC) of the Southern African Development Community (SADC) and was responsible for the inter-state co-operation programme, committee agendas, monitoring the execution of ministerial committee decisions and the arrangement of the various levels of committee meetings (secretariat, accommodation, logistics, transport, meeting venue, etc.) on ministerial and defence chiefs level.

1958-1993: South African Defence Force – Served in several posts, retired in 1993 as Deputy Chief of the Army.

Extract on projects worked on at Mosaka Economic Consultants cc::

- Macro-economic Impact Analysis and Cost Benefit Analysis of the Sekoko Coal Waterberg Project, 2011 [Sekoko Resources (Pty) Ltd.]
- Macro-economic Impact Analysis and Cost Benefit Analysis of the Proposed Vele Colliery near Musina, Limpopo 2010 [Naledi Development (Pty) Ltd.]

- Eskom Makopane Integration Project – Economic Impact Assessment – Savannah Environmental (Pty) Ltd.
- Proposed construction of the Invubu Theta Transmission Power line – Macro Economic Impact Assessment – Bembani Sustainability Training.
- Proposed Eskom Venus – Sigma Transmission Line – Macro Economic Impact Assessment – Eskom Holdings Ltd.
- Mokolo and Crocodile River (West) Water Augmentation Project – Regional and Local Economic Impact Assessment of the Proposed Water Augmentation – Naledi Development Restructured.
- Intermediate Reserve Determination Study for the Surface and Groundwater Resources in the Mokolo Catchment, Limpopo Province – Socio Economic Present State Evaluation – Dept of Water Affairs.
- Millennium Development Goals needs assessment and costing exercise in Botswana – UNDP.
- Costing of the Lesotho Poverty Reduction Strategy Paper (PRSP) – UNDP.
- A Needs Assessment for Achieving the Millennium Development Goals (MDG) in Lesotho – World Bank.



## **PHINDILE NKOSI**

### **PERSONAL DETAILS:**

Date of Birth: 23 March 1987  
Nationality: South African  
Current position: Economist at Mosaka Economic Consultants cc

### **ACADEMIC QUALIFICATIONS:**

2009-2010: BCom. Honors in Trade and Development; University of Johannesburg, South Africa  
2007-2009: Bachelor of Economics & Econometrics; University of Johannesburg, South Africa

### **LANGUAGE SKILLS:**

Zulu            Read    Speak    Write  
English        Read    Speak    Write

### **OTHER TRAINING:**

MS Excel, MS Word and MS Power Point

### **PROFESSIONAL CAREER:**

January 2011 – Present: Economist at by Mosaka Economic Consultants cc  
January 2010 – November 2010: Tutoring Economics at University of Johannesburg.

Duties:

Ms Nkosi is responsible for various tasks ranging from developing macroeconomic models, report writing and editing.

Extract on projects worked on at by Mosaka Economic Consultants cc:

- Development and Implementation of a Model to be used for Economic Impact Assessment of Regulatory Decisions taken by NERSA (NERSA)
- Growth and Intelligence Network 2012. The Sub-Saharan Africa Logistics Flow Project (Growth and Intelligence Network)
- Review and Update of Annual Report Models based on the Social Accounting Matrices (SAM's) for SADC (Development Bank of Southern Africa)