Department of Water Affairs

Republic of South Africa
Directorate Option Analysis

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Draft 1: - Economic Impact Assessment of the Proposed Mokolo River Water Augmentation Project

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MCWAP – Economic Impact Assessment of the Proposed Mokolo River Water Augmentation Project

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ACRONYMS USED

AZ	-	Allocation Zone
BCR	-	Benefit Cost Rate
CBA	-	Cost Benefit Analyses
CTL	-	Coal to Liquid Fuel
DPLG	-	Department of Provincial and Local Government
DWA	-	Department of Water Affairs
EIA	-	Environmental Impact Assessment
EMP	-	Environmental Management Plan
Eskom	-	Electricity Supply Commission
EWR	-	Ecological Water Requirements
FGD	-	Flue Gas Desulphurisation
GDP	-	Gross Domestic Product
GDPR	-	Gross Domestic Product Regional
IB	-	Irrigation Board
IPP	-	Independent Power Producer
IRR	-	Internal Rate of Return
LLM	-	Lephalale Local Municipality
LSU	-	Large Stock Unit
MCWAP	-	Mokolo and Crocodile River (West) Water Augmentation Project
Mm^3	-	Million Cubic meters
M^3m/a	-	Million Cubic meters per annum
M^3	-	Cubic meters
MW	-	Mega Watt
NPV	-	Net Present Value
PGM	-	Platinum Group Metals
PSP	-	Professional Service Provider
SADC	-	Southern African Development Community
SAFRIM	-	SA Inter Industry Forecasting Model
SAM	-	Social Accounting Matrix
SNA	-	System of National Accounts
SU	-	Supply and Use
ToR	-	Terms of Reference
WDM	-	Water Demand Management
WIM	-	Water Impact Model

WMA	-	Water Management Area
WRYM	-	Water Resources Yield Model
WWTW	-	Wastewater Treatment Works

EXECUTIVE SUMMARY

Background

Currently the Government is engaged in an Environmental Impact Assessment (EIA) study concerning water augmentation to provide water for Lephalale in Limpopo Province. The EIA is done under the auspices of the project management consulting group, Nemai Consulting cc. The Mokolo and Crocodile River (West) Water Augmentation Project (MCWAP) for bulk water supply to coal mining and coal fired electricity generation at Steenbokpan in the Lephalale area results from the need for Eskom to increase the generation of electricity, and Sasol to increase coal-to-liquid fuel production. These new developments in turn require increased coal mining and bulk water supply to the area.

Conningarth Economists have been appointed by Nemai Consulting to do the economic component of the EIA. The study by Conningarth is to determine the specific local and regional economic and socio-economic impacts of the preferred augmentation option. The study is restricted to the Mokolo River and the main stem of the Crocodile River (West) downstream of the Hartebeespoort Dam, but includes the possible influence on the urban development around the dam and the expected impact of population growth trends in the catchment area on water inflows to the dam.

The Conningarth Economic Study is not based on the usual EIA study approach and framework. The study has two distinct approaches; one being the integrated part of the EIA as mentioned above. A further dimension of the study is the determination of the justification of the regional location and the macro-economic impact of the proposed new developments in the areas involved. Although construction of the Medupi Power Station has already commenced, forming part of the Eskom investment program, the rest of the program can be terminated if it is found that there is no justification for the development in this area. The water augmentation infrastructure is a critical cost element of the total development.

The specific EIA concerns the augmentation from the Mokolo Dam and the Crocodile River (West), which in effect not only entails the construction of a number of pipelines and weirs, but also the secondary impacts that this water infrastructure will have on the area such as impact on irrigation, game farming and tourism.

The economic impacts that could reasonably be expected from these developments, the several large capital investment projects in the mining, electricity generation and coal-to-liquid industries foreseen in and around Lephalale, will have a significant if not dramatic effect on Lephalale in the foreseeable future. Lephalale will probably become the next energy hub of Southern Africa. All these possibilities could change the composition of the region permanently from a rural bushveld area into a very large town.

Major Regional and Local Economic Impacts

The primary objective of this macro-economic study has been to measure the nature and magnitude of the economic and socio-economic impacts that will result from the total development project. The macro-economic impacts emanating from the project have proven to be quite significant. The following is a brief summary of the most important macro-economic aggregates that have been impacted upon by the total development project.

The essence of the above national, regional and local results for the year 2009 can be summarised as follows:

- The impact of the total development project on the GDP of South Africa will amount to a positive contribution of R80.2 billion in current prices and for Limpopo an amount of R41.0 billion in current prices.
- On an annual basis, the total development project could sustain 525 690 employment opportunities nationally and locally in the Lephalale area.
- The total positive impact on national household income amounts to R52.8 billion of which 16% is earmarked for the lower-income households. Similarly in the Limpopo region the impact on households amounts to R22.9 billion of which R6.8 billion is allocated to low-income households. The impact on the low income households come through the linkages that the total development project has with other sectors of the economy i.e. agriculture, textiles, clothing, etc. through the buying of materials and the payment of salaries in the system as a whole.

It is very important that the impact of the total development project on the South African economy be reviewed periodically because external conditions can change rapidly. For instance, global economic developments impacted negatively on the South African economy in 2009.

Mitigation Measures to Support the Lephalale Local Municipality

The Lephalale Local Municipality is mainly a mining and industrial town. Its economy is dominated by electricity generation which currently contributes approximately 67% to the GDP.

The demand for infrastructure, financial planning, governance capacity and institutionalisation of legally enabling processes are vast and deserves priority status in the impacted area should this proposed electricity and infrastructural development materialise. The Lephalale Local Municipality (LLM) will have to act as a facilitator and catalyst for the envisaged developments in its vicinity.

The total economy of Lephalale Local Municipality will probably quadruple and it is estimated that the current population will grow from 100 000 to over 400 000. It is important to understand that the need for service delivery (water, sanitation, electricity, etc.) by the municipality will have to grow accordingly.

The extent to which the large investment envisaged can take place with the local communities living in harmony and functioning in an appropriate and efficient way will, to a large extent depend on the effectiveness of the Lephalale Local Municipality. It is important that additional priority be given to the extension of the capacity of the municipality. This will be a function of the Department of Provincial and Local Government (DPLG), the Limpopo Province and Government Developmental Agencies such as the Development Bank of Southern Africa (DBSA).

As mitigation measure it is proposed that a task team under the guidance of DPLG and supported by the government structures involved, be appointed. The objective of the task team should be to assist, guide and provide the necessary funding to the LLM to ensure that the necessary municipal services be put in place to ensure that the new infrastructural development proceeds effectively and efficiently. It is important to note that in national interest, the power generation should be developed efficiently and timeously, to meet the electricity needs of the national economy.

Rationale for Water Augmentation in the Waterberg Region

Current Water Situation in the Waterberg Region

The Waterberg region is part of the Bushveld which can be classified as a hot and an arid region. Due to the irrigation that currently exist in the region, which stems from the climate conducive to agriculture production and its current mining development, based on the vast mineral deposits present, the current water availability and water use in the Waterberg region is relatively in balance. This argument also applies to the broader Bushveld region of which it forms part and from which an argument can be put forward as to where its future water allocations can be drawn from.

Water Demand for the Development

The major projects envisaged for the Waterberg region include the four additional power stations by Eskom, the petro chemical project of Sasol, the Exxaro coal mines which will feed Eskom and the investment in water development which will be financed mainly by DWA.

The economic impacts that could reasonably be expected due to the several large capital investment projects in the mining, electricity generation and coal-to-liquid industries foreseen in and around Lephalale, will have a significant if not dramatic effect on Lephalale in the foreseeable future. Lephalale will probably become the next energy hub of Southern Africa.

The demand for water will increase drastically by 2024 due to the above mentioned projects. The current use of water will increase nearly tenfold by 2031. As already indicated, the current supply of water from the Waterberg region as well as the surrounding bushveld area will not be able to accommodate this massive water demand.

The additional water supply infrastructure as proposed is therefore seen as an absolute necessity for this project. The proposed water infrastructure can be summarised as follows:

- The present Mokolo-Matimba water transfer will be doubled to 39.1 million m^3 from the Mokolo Dam as Phase 1 of the water augmentation scheme.
- The shortfall of 158 million m^3 will be augmented as Phase 2 from the Crocodile River (West) catchment.

Sectoral Impacts/Externalities due to the Water Development

The huge water demand, the limited availability of water in the area as well as the fact that available water is not in close proximity to the project development, requires that water be prioritised and be sourced from regions afar. The consequence of this is the secondary impacts that arise on current and future water users, inside and outside the Waterberg region. The impacts are on irrigation, game farming and livestock.

Irrigation

The irrigation cost impacts result from the possible reduced water supply to farms within the Mokolo River catchment affected by the implementation of the water transfer system. The construction phase will not impact on the water supply to the irrigation farmers downstream of the Mokolo Dam if, however, during the operational phase the augmentation out of the Crocodile River (West) is not in place, the farmers could lose water to the supply to Medupi. It could either be permanent or for a year or two.

As mitigation measures for the impact on irrigation the following is proposed:

- That a proper river management and control plan should be compiled and implemented by DWA, to ensure proper coordination and effective water usage. One of the outcomes must be the management of the available storage capacity for maximum efficiency.
- That the final decisions on mitigation of the impact on irrigation be made only after the completion of the Crocodile (West) Reconciliation Study, when the final results are available on the availability of water.
- The rightful irrigators' water entitlements should be timeously determined and communicated to the user farmers.

Game Farming, Associated Eco-Tourism and Cattle Farming

The impact of the water augmentations projects, both the construction and operational phases will have a low impact on game farming and related activities if properly managed. In the area directly affected by the development it is foreseen that although the breeding of game and game farming will continue, the farmers could temporally lose the additional income from eco-tourism during the construction phase only.

The impact of the water augmentations projects, both the construction and operational phases will have a very low impact on cattle farming, if properly managed.

The following general mitigation measures are proposed for game farming, associated eco-tourism and cattle farming:

- Coordination between game farmers and inspection and maintenance staff of the pipeline is essential. A part of the contract with the pipeline constructors is that, before construction commences, a consulting forum be established with representation of all the impacted stakeholders and that regular monthly meetings be held to oversee and address all issues of importance, throughout the construction period.
- The entire industrial sites properly and effectively fenced. The responsible developers and authorities are to ensure that this is complied with.

Business Tourism

Both the water augmentation and future developments will be beneficial for the business tourist activities, the impact will be high and permanent. As this is a private sector activity no mitigation measures are proposed.

Macro-Economic Impacts

The Macro-economic impacts (2009 – 2030) on the Lephalale area, including the Mokolo catchment economy, of all identified capital investment on the construction and operation of the augmentation pipelines and the weirs, irrigation, game farming, hunting and tourism are positive impacts in terms of GDP and employment opportunities

1 Introduction

1.1 Background

Currently the Government is engaged in an Environmental Impact Assessment (EIA) study concerning water augmentation to provide water to Lephalale in Limpopo Province. The EIA is done under the auspices of the project management consulting group, Nemai Consulting. The Mokolo and Crocodile River (West) Water Augmentation Project (MCWAP) investigating the bulk water supply to coal mining and coal fired electricity generation at Steenbokpan in the Lephalale area, results from the need for Eskom to increase the generation of electricity, and Sasol to increase coal-to-liquid fuel production. These new developments in turn require increased coal mining and bulk water supply to the area. These envisaged activities involve a number of planned and anticipated developments associated with the rich coal reserves in the Lephalale area of the Waterberg coal fields.

Conningarth Economists has been appointed by Nemai Consulting cc to do the economic component of the EIA. This part of the study by Conningarth is to determine the specific local economic and socio-economic impacts of the preferred augmentation option. The study is restricted to the Mokolo River and the main stem of the Crocodile River (West) downstream of the Hartebeespoort Dam.

The Conningarth Economic Study is not based on the standard EIA study approach and framework. The purpose of this study is to assess the economic impact of the proposed new developments on the proposed Lephalale location and the macro-economic impact on the areas involved. Although construction of the Medupi power station has already commenced, forming part of the Eskom investment program, the rest of the program can be terminated if it is found that there is no justification for the development in this area. The water augmentation infrastructure is a critical cost element in the justification of the total development.

The specific EIA concerns the augmentation from the Mokolo Dam and the Crocodile River (West), which in effect not only entails the construction of a number of pipelines and weirs, but also the secondary impacts that this water infrastructure will have on the area such as impact on irrigation, game farming and tourism.

The planned future power stations are to be built at Steenbokpan (West of Lephalale) in the Waterberg Coalfields, some 400kms north west of Johannesburg. Water drilling in the 1920s indicated the presence of a large amount of coal bearing strata in the area. This basin is a fault bounded basin with dimensions of approximately 90kms East-West by 40kms North-South orientation. The fault plays a distinct role in the preservation and depositional characteristics of the coal occurrences in the region.

In 1955 coal exploration was initially undertaken in a joint program by Iscor and Sasol, which led to the opening of Grootegeluk Mine in 1980. Further major development projects were initiated in the area, when Eskom built the Matimba Power Station and is currently constructing the Medupi power station and, Exxaro is currently expanding the Grootegeluk coal mine to supply coal to the Medupi power station.

The water augmentation for the total project takes place in two rivers. One part of the development is situated in the Mokolo River catchment, which is part of the Limpopo Water Management Area (WMA). The Mokolo Dam is the largest dam in the catchment. The dam supplies water to Eskom's Matimba Power Station and Exxaro's Grootegeluk Coal Mine, as well as to Lephalale Municipality and agricultural irrigation downstream of the dam.

The objective of the MCWAP is to make water available for the development of strategic industries and associated domestic growth expected in the area, without impacting on the legal entitlements of the existing users. It seems that in Phase 1 the additional yield of Mokolo Dam can be made available and from Phase 2 the return flows into the Crocodile River can be made available. The MCWAP project identifies a number of alternative options. The preferred option identifies Phase 1 of the water augmentation project to increase the capacity of the existing pipeline from Mokolo Dam to the Medupi Power Station and the expansion of the Grootegeluk coal mine. This would, however, not deliver sufficient water for the further expansion plans which, as a result, require the implementation of Phase 2, which will entail the transfer of water from the Crocodile River (West) catchment to the Mokolo River catchment, more specifically for the power generation, envisaged coal to liquid plants and coal mining activities at Steenbokpan. The proposed water augmentation project is therefore meant to secure water supply to these projects, which otherwise would not have been feasible.

The economic impacts that could reasonably be expected from these developments, the several large capital investment projects in the mining, electricity generation and coal-to-liquid industries foreseen in and around Lephalale, will have a significant if not dramatic effect on Lephalale in the foreseeable future. Lephalale will probably become the next energy hub of Southern Africa. All these possibilities could change the composition of the region permanently from a rural bushveld area into a very large town.

1.2 Elements of the Study

The purpose of this study, the *Economic Impact Assessment of the Proposed Mokolo and Crocodile (West) Water Augmentation Project*, is to provide a specialist assessment of the potential economic impacts of the proposed project for the Environmental Impact Assessment (EIA) process. This report is to be submitted to the Department of Environmental Affairs and is a requirement, under the existing laws before permission to proceed with the construction of the pipelines could be granted.

The EIA process is concerned with the construction of the pipelines and the possible impact of the construction and operation on the physical and bio-physical environment. The construction of the pipelines is divided into two phases, Phase 1 includes the doubling of the capacity of the present pipeline from the Mokolo Dam to the Matimba Power Station and Exxaro coal mines in order to supply Medupi, still under construction, and the accompanying coal mining. Phase 2 includes the construction of the pipelines from the Crocodile River (West) to the construction site in order to supply water for the further envisaged developments by both Eskom and Sasol. The total development is subject to the availability of sufficient water supplies.

To give clarity to the study's main objective; namely the economic component of the EIA and the economic evaluation of the investments by Water Affairs, the study cover the following:

- In the first place a broad description is given of the investments required. The macro-economic analysis is based on the water augmentation investment infrastructure to be

made by the Department of Water Affairs to supply the envisaged investments by Eskom, Sasol and Exxaro mines, with sufficient water for construction and operational purposes. Specifically the water augmentation plan, part of this EIA study, will form the basis for the calculation of the secondary impacts on the irrigation, game farming, property development, tourism, population and social sectors.

- A detail sectoral analysis was done to determine the impact on the proposed water augmentation which forms the foundation of the EIA and in the end supports the arguments leading to the mitigation proposals.
- For purposes of the economic analysis, emphasis was put on Eskom's investments into the construction of the new power stations at Lephalale in order to understand the magnitude of the proposed investments and future developments, in the light of the major water augmentation cost and its resultant impact. Matimba Power Station is operational and Medupi is in the process of being constructed and is therefore not addressed.

The Project Planning Team (PPT) developed a number of water demand scenarios, when the original Terms of Reference (ToR) was published the two most relevant scenarios were Scenarios 4 and 8. After the appointment of the economic consultants it was decided that a later version of Scenario 8 namely 9 should be used as a guideline for the development of the timeline for the proposed developments in the Lephalale area. Each scenario contains a number of projections based on the projected needs for the future users of coal. The following table gives an indication of the estimated developments, on which variations were applied to develop the different scenarios, in consultation with the different role players.

Table 1: Projected Developments used to Compile the Different Scenarios

Agent	Development	Detail
Eskom	Power Stations	Existing – Matimba Medupi under construction 4 other coal fired power stations
Independent Power Producers	Power Stations	2
Mining - Exxaro	Mining	Matimba and Medupi + a number of other projects
Mining - other	Mining	Supply to Eskom power stations
Sasol	Coal to Liquid Plant	Mafutha 1 + coal mining
Urban and other development		Population growth projections

Source: Project Planning Team

In Table 2 Scenario 9 is summarised by the economic team to provide an indication of the projected power generation developments, associated mining and domestic water demands. In the final instance the projected volumes to be transferred from the Crocodile River (West) are presented. According to the assumptions used to develop Scenario 9 water will only be transferred from 2012 onwards, a very small volume growing to 48.85Mm^3 in 2015, peaking at 157.80Mm^3in 2030.

The projections as presented in Scenario 9 were then used to calculate the possible impacts in the two catchments for this study.

Table 2: Summarised Scenario 9 Timeline

Agent	Project Information		2009 Mm^3	2015 Mm^3	2020 Mm^3	2025 Mm^3	2030 Mm^3
Matimba	Construction	In operation					
	Operational	In operation	3.6	3.6	3.6	3.6	3.6
Medupi	Construction	2009 - 2013	0.72				
	Operational	2014 >>>		6.00	13.10	14.00	14.00
Eskom Coal 3	Construction	2011 - 2017		4.18			
	Operational	2018>>>			15.00	15.00	15.00
Eskom Coal 4	Construction	2013 - 2019		0.50			
	Operational	2020>>			15.00	15.00	15.00
Eskom Coal 5	Construction	2017 - 2022			3.51		
	Operational	2023>>				15.00	15.00
Eskom Coal 6	Construction	2020 - 2024			0.72		
	Operational	2025>>				15.00	15.00
Sub-Total Eskom			***4.32***	***14.28***	***50.93***	***77.60***	***77.60***
Independent Power Producer 1	Construction	2010 - 2015		10.18			
	Operational	2015>>			12.00	12.00	12.00
Independent Power Producer 2	Construction	2010 - 2015		3.06			
	Operational	2016>>			3.6	3.6	3.6
Sub-Total Independent Producers			***-***	***13.24***	***15.60***	***15.60***	***15.60***
Coal Mining Power Generation	Eskom Coal 3	2011>>		4.00	5.00	5.00	5.00
	Eskom Coal 4	2012>>		2.80	5.00	5.00	5.00
	Eskom Coal 5	2016>>			2.30	5.00	5.00
	Eskom Coal 6	2018>>			2.80	5.00	5.00
Sub-Total Coal Mining Power Generations			***-***	***6.80***	***15.10***	***20.00***	***20.00***
Coal Mining Exxaro Projects	Matimba	In operation	2.64	3.42	3.60	3.60	3.60
	Medupi	2009>>	0.07	2.26	2.26	2.26	2.26
	Project A to K	2012 >>>>	0.31	5.11	10.06	10.38	12.75
Sub-Total Coal Mining Exxaro			***3.02***	***10.79***	***15.91***	***16.24***	***18.60***
Sasol	Construction	2011 - 2018		1.668			
	Operational	2015>>		18.88	37.00	37.00	37.00
	Mining			4.63	6.50	6.50	7.00
Sub-Total Sasol			***-***	***25.18***	***43.50***	***43.50***	***44.00***
Sub-Total Domestic, Light Industries, etc.			***5.58***	***14.53***	***20.37***	***21.18***	***21.40***
Total Scenario 9			**12.92**	**84.81**	**161.42**	**194.11**	**197.20**
Irrigation			10.40	10.40	10.40	10.40	10.40
Total Demand			***23.32***	***95.21***	***171.82***	***204.51***	***207.60***
Return Flows				7.26	10.19	10.59	10.70
Mokolo Dam			39.10	39.10	39.10	39.10	39.10
Volume to be Transferred			**-**	**48.85**	**122.53**	**154.82**	**157.80**

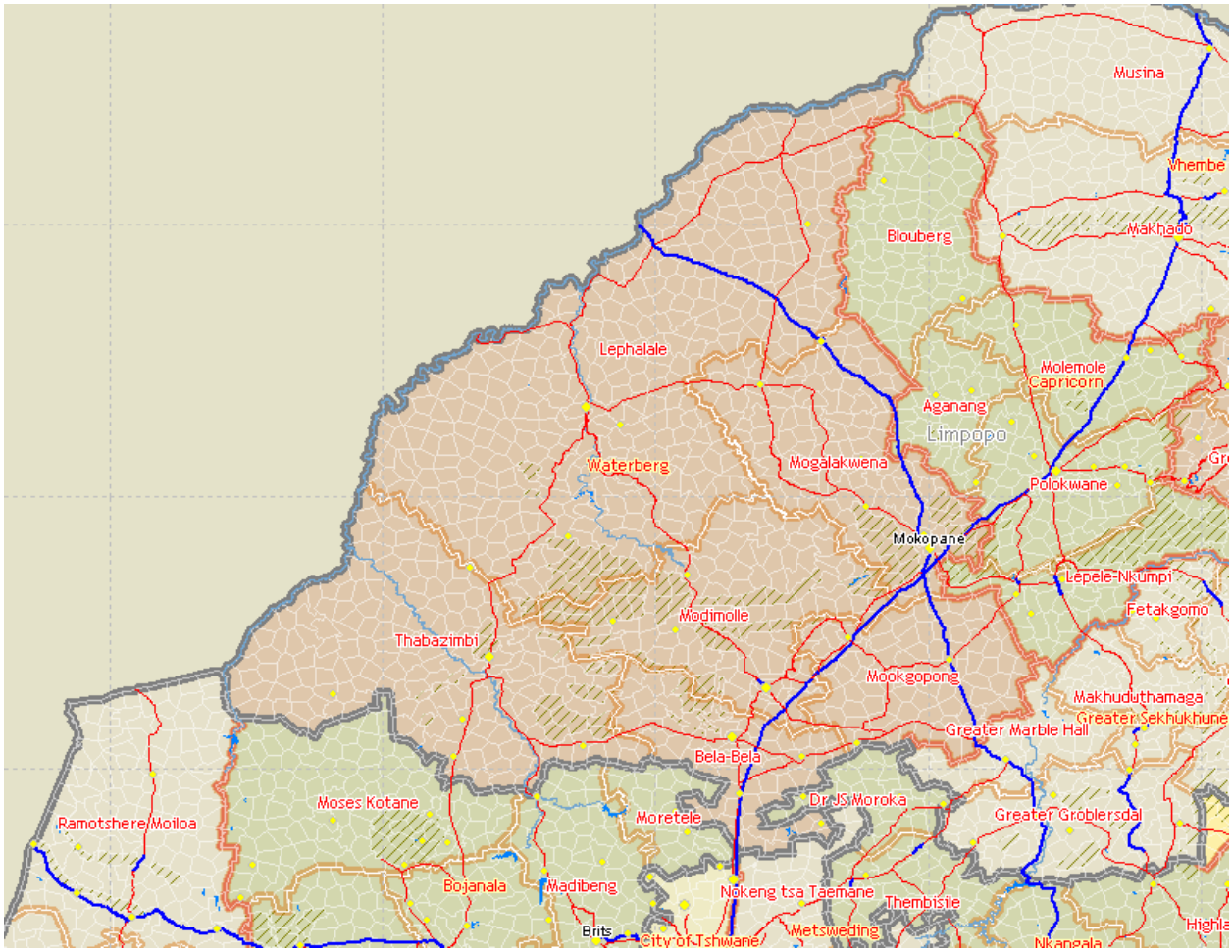
Source: Project Planning Team – Scenario 9

1.3 Defining the Study Area

1.3.1 Administrative Boundaries – Districts and Local Municipalities

A large part of the eastern portion of the Waterberg District Municipality is included in the study area and covers the local municipalities of Thabazimbi and Lephalale which includes Thabazimbi town, Lephalale town and the Seleka Tribal Trust area north of Lephalale, also the western corner of the Bojanala District Municipality namely Madibeng Local Municipality, is included in the study area covering Brits town, Bapong and Garankuwa. See map of the administrative regions below. As these selected municipalities and towns will be affected by the increased water demand on the Mokolo and Crocodile River (West) supply, the socio-economic profiling focused on these areas.

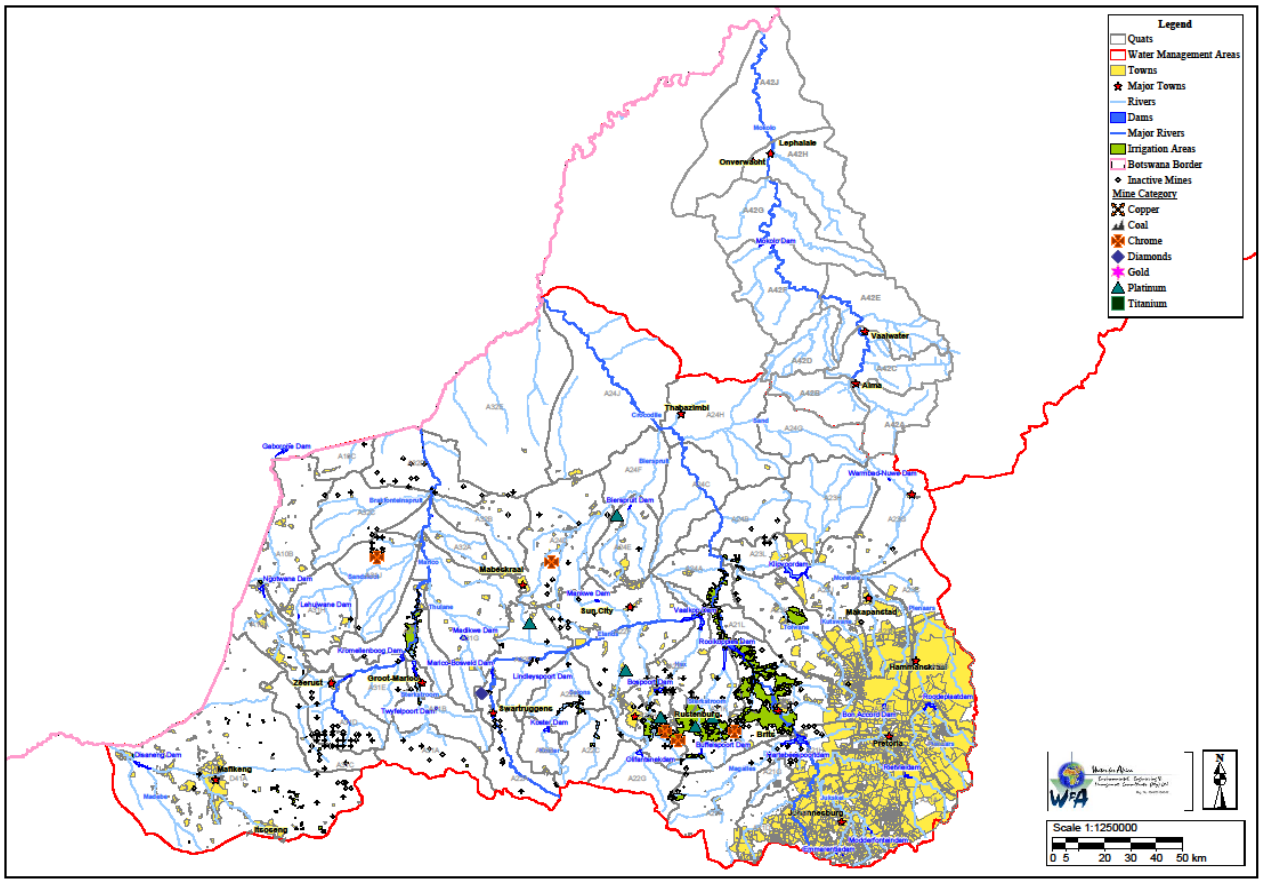
Map 1: District and Local Municipalities



1.3.2 Catchment Area – Mokolo and Crocodile River (West)s

The study area comprises the Crocodile River catchment from the Hartebeespoort Dam and the Elands River catchment in the South to the Lephalale/Steenbokpan area in the North and the Mokolo River catchment. In both cases the main focus of the study covers the economic activities dependant on the water from the rivers and dams i.e. the Hartebeespoort and Roodekopjes.

Map 2 Crocodile River and Mokolo Catchment



The drainage regions[1] as determined by the Water Research Commission have been applied and the applicable area is divided into two main catchment areas namely the Mokolo River and the Crocodile River.

The Mokolo River and Crocodile River (West) drainage regions comprise the following quaternary sub-catchments:

- AZ 1 Alma sub-area, which comprises the Alma area. (A42A to A42C).
- AZ 2 Vaalwater sub-area, which comprises the upper Mokolo River upstream from the Mokolo Dam excluding the Alma area. (A42D to A42F).
- AZ 3 Lephalale sub-area, which comprises the lower Mokolo River downstream from the Mokolo Dam to the confluence with the Limpopo River. (A42G to A42J).
- AZ 4 The Lehurutshe River sub-area on the international border with Botswana. (A10A to A10C).
- AZ 5 The Crocodile River sub-area, which corresponds to the catchment of the Crocodile River upstream of the confluence of the Elands River. (A21A to A21J).

[1] Surface Water Resources of South Africa 1990. Vol. 1. WRC Report No. 298/1.2/94 First Edition. Water Research Commission.

- AZ 6 The Elands River sub-area, which corresponds to the catchment of the Elands River. (A22A to A22J).
- AZ 7 The Apies/Pienaars Rivers sub-area, which comprises the catchment of the Moretele River down to its confluence with the Crocodile River. (A23A to A23L).
- AZ 8 The Lower Crocodile River sub-area, representing the remainder of the Crocodile River catchment. (A24A to A24J).
- AZ 9 The Marico River sub-area, which corresponds to the catchment of the Marico River catchment. (A31A to A31H and A32A to A32E).
- AZ 10 The Matlabas River sub-area, which corresponds to the catchment of the Matlabas River catchment. (A41A to A41E).

As the water from all these sub-catchments mentioned above are not impacted upon by the planned and also the anticipated consequential developments in the Lephalale area, only the sub-catchments with water supply affected by the developments have been included for the study. The sub-catchments impacted upon are as set out below.

1.3.2.1 Mokolo River Catchment

The Mokolo River catchment includes the following quaternary sub-catchments:

- AZ 1 Alma sub-area, which comprises the Alma area. (A42A to A42C).
- AZ 2 Vaalwater sub-area, which comprises the upper Mokolo River upstream from the Mokolo Dam excluding the Alma area. (A42D to A42F).
- AZ 3 Lephalale sub-area, which comprises the lower Mokolo River downstream from the Mokolo Dam to the confluence with the Limpopo River. (A42G to A42J).

1.3.2.2 Crocodile River (West) Catchment

In the Crocodile River (West) catchment only the following quaternary sub-catchments are affected:

- AZ 4 The Hartebeespoort Irrigation Board (IB) AZ, covering only the quaternary sub-catchments of A21J and A21K (downstream of the Hartebeespoort Dam and above the Roodekopjes Dam).
- AZ 5 The Crocodile West (IB) AZ, covering the quaternary sub-catchments of A21L, A24A to A24C and A21E to A 21F (Amandelbult).
- AZ 6 The Makoppa AZ, covering the quaternary sub-catchments of A21J.

1.4 Approach and Methodology to the Study

The approach to the study is in accordance with the Terms of Reference (ToR) for the project, namely; being part of the Environmental Impact Assessment studies (EIA) for the water augmentation process from respectively the Mokolo River and the Crocodile River (West).

The construction and operational phases of the water augmentation projects are the purpose of the EIA study, but the major part of the impact will only materialise once the water is delivered to the project area.

Issues emerging from the ToR are questions such as: Is the Lephalale area the most appropriate area for the development? In the Lephalale area the coal is available and the water and manpower has to be transported in and the electricity out. The question is whether it is not a better option to bring the coal to an area where the manpower is available; the water in close proximity and the demand for electricity high. This question is addressed, but it is also a question which overlaps and forms part of both the EIA and the Economic Assessment.

Answering the question regarding the suitability of the Lephalale area for the development is presented briefly in the EIA report.

Two econometric models have been used in calculating the macro-economic impact parameters of the project, whether positive or negative. In the case of development projects, construction and operation, a standard Social Accounting Matrix (SAM) model, based on the Limpopo provincial SAM was used.

For irrigation water projects a Water Impact Model (WIM) was used, which is for the project also an econometric model based on a SAM, but incorporating water and agricultural budgets to calculate the impacts.

1.5 Format of the Report

The structure of the document reflects the dualistic nature of the report and project and is as follows:

Chapter 1: – Introduction.

Chapter 2: – Situational Analyses and Description of Expected Investments in the Project Development Area.

Chapter 3: – Risk Analyses of the Potential Impacts on Categories of the Social-Economic Environment in the Study Area.

Chapter 4: – Cost Benefit Analyses and Macro-Economic Impacts.

Chapter 5: – Conclusion and Mitigation.

Appendix A: – Socio-Economic Profile.

2 Situational Analyses and Description of Expected Investments in the Project Development Area

2.1 Introduction

In this chapter the major investments that will drive the economic impact in the Lephalale area will be briefly explained. These major investments include the three additional power stations by Eskom (additional to the existing Matimba, and Medupi, currently under construction); the coal-to-liquid

project of Sasol (Mafutha 1); and the Exxaro coal mines, which will feed the power stations and the coal-to-liquid project.

The economic impacts that could reasonably be expected from these large capital investment projects in the mining, electricity generation and petro chemical industries, in and around Lephalale, will have a significant if not dramatic effect on Lephalale in the foreseeable future.

2.2 Socio-Economic Profiling

2.2.1 Power Generation (Matimba and Medupi)

The existing Matimba Power Station is designed to generate 4 000 MW and is the largest direct dry-cooled power station in the world. Coal is supplied to Matimba by means of a conveyer belt system from the Grootegeluk mine. Eskom has already started constructing another new power station, namely Medupi. This power station is slightly bigger than Matimba and produces 4 800 MW. For purposes of reducing air pollution, Medupi will later be equipped with the new Flue Gas Desulpherisation technology (the planning is to do this with Phase 2 being operational), whereas Matimba uses older technology. Important to note is that the Medupi Power Station's new technology carbon cleaning process uses much more water than the process used by Matimba.

2.2.2 Mining

Exxaro's Grootegeluk Colliery is currently the only commercial coal mining operation in the Waterberg Basin.

At present annual production of Grootegeluk coal mine is 15.3 Mt/a. It is the largest open cast coal mine of its kind in the world. The mine is now being expanded to supply the new Medupi Power Station with coal.

2.3 Envisaged Projects

2.3.1 Power Generation

Additional to Matimba and Medupi three new Eskom power stations CF3, CF4 and CF5 are planned for the future as well as a further two by independent power producers envisaged by the private sector. According to available information these power stations will be slightly bigger than Medupi, but will use the same technology as Medupi. Therefore, the required coal and water supply, as well as capital cost, income generation, employment and other related elements for economic impact assessment, will be a multiple of Medupi's, taking into account that it is slightly larger.

2.3.2 Coal-to-Liquid Fuel Plants

The Lephalale area was selected by Sasol to access the vast coal reserves in the Waterberg coal fields for its Maphuta coal to liquid fuel projects. According to information obtained (Internet publications) the construction of two new Sasol coal-to-liquid fuel plants, Mafutha 1 and 2, are envisaged in the project area. It is estimated that the first of these plants will commence operations around 2014. It is assumed that Mafutha 1 will on average be similar in size to the present Secunda, Sasol 3 plant. The total investment could be of the order of R129 billion (in August 2009 prices). For

purposes of this study it is assumed that only Mafutha 1 will be established in the foreseeable future.

2.3.3 Mining

Without the Matimba and other power stations to consume the high-ash coal, the Grootegeluk coal mine and envisaged other possible mines will not be economically viable. The low grade Waterberg coal with its high ash content and low yields is a significant stumbling block to further development from coal, other than power generation and coal-to-liquid fuel plants.

The assumptions made in regard to Eskom's coal fired power stations (Matimba, Medupi and CF3, CF4 and CF5); Sasol's Coal-to-Liquid Plant, Mafutha 1; and the coal mining development to supply these projects, are given in the table below.

Table 3: Assumptions Regarding the Power Stations, Coal-To-Liquid Plant and Coal Mines (2009 prices, Rand million if not indicated otherwise)

Envisaged New Projects	Capital Investment Rand Mil.	Total Production/Turnover Rand mil.	Direct Employment Numbers
Power Stations			
Matimba (Eskom)	101 133	9 855	700
Medupi (Eskom)	121 360	11 826	750
CF3; CF4; CF5 (Eskom)	118 360	11 826	750
Sub Total	**340 853**	**33 507**	**2 200**
Coal-to-Liquid Plant			
Mafutha 1 (Sasol)	129 000	16 715	4 600
Sub Total	**129 000**	**16 715**	**4 600**
Coal Mines			
Grootegeluk (Exxaro)	In Operation	4 514	1 800
Grootegeluk Expansion (Exxaro)	3 374	4 986	2 160
CF3; CF4; CF5 (Eskom)	16 503	4 986	2 160
Mafutha 1 (Sasol)	19 530	5 900	2 556
Sub Total	**39 407**	**20 386**	**8 676**
Grand Total	**509 260**	**70 608**	**15 476**

Source: Previous work done by Conningarth Economists and internet publications

2.3.4 Water Development

The water development projects and the investment needed to accommodate the projected water requirements envisaged for the further development of power generation, mining, coal to liquid fuel production and the urban requirements has been analysed. The nature and magnitude of the water development projects are based on the needs as discussed in paragraph 2.4. It should be kept in mind that this report is an economic report concerned with the value of water and not a water resource report. Volumes of water mentioned are only to indicate what volumes were used in the further calculations or to serve as back ground information.

The water development project will take place in two river systems, namely, the Mokolo development and the Crocodile River (West) development.

2.3.4.1 Mokolo Development

The Mokolo (Mogol) River catchment is part of the Limpopo Water Management Area (WMA). The Mokolo River originates close to Modimolle (Nylstroom) and then drains to the north into the Limpopo River. The Mokolo Dam (formerly known as the Hans Strijdom Dam) is the largest dam in the catchment. The dam was constructed in the late 1970s and completed in June 1980, to supply water to Matimba Power Station, Grootegeluk Mine, and Lephalale (Ellisras) Municipality and to stabilise the irrigation downstream of the dam. Based on the water infrastructure, the current water availability and water use is in the balance with no spare capacity existing for future allocations for the anticipated surge in economic development in the area.

To optimise the usage of the Mokolo Dam, it is envisaged to double the current capacity by constructing a second pipeline, which supplies water to the Matimba Power Station, domestic and industrial users.

2.3.4.2 Crocodile River (West) Development

There are surplus effluent return flows in the Crocodile River (West)/Marico WMA that can be transferred to the Mokolo Catchment in the Limpopo WMA to augment the water supply in support of possible new strategic developments in this area.

To augment the current water supplies in the Lephalale area will include, *inter alia*, the construction of a pipeline along various possible routes, from a point downstream of the confluence of the Moretele and the Crocodile River, to a terminal point still to be finalised. From the terminal point the water needs to be distributed to the users. For this study, these options include the distribution to the current identified users such as the Medupi and existing Matimba Power Stations and Grootegeluk Mine, as well as possible further developments such as petro-chemical plant and power stations (the exact locations are still unknown), etc. which need to be investigated.

2.3.4.2.1 Proposed Pipeline Development in Both the Mokolo and Crocodile River (West)

The construction of the pipelines is divided into two phases, Phase 1 includes the doubling of the capacity of the present pipeline from the Mokolo Dam to the Matimba Power Station and Exxaro coal mines in order to supply Medupi, still under construction, and the accompanying coal mining. Phase 2 includes the construction of the pipelines from the Crocodile River (West) to the construction site in order to supply water for the further envisaged developments by both Eskom and Sasol.

In the following table the physical data of the Phase 1 and 2 on the proposed water transfer systems are listed.

Table 4: Information on Water Transfer Systems

Activity	Mokolo Transfer	Crocodile West Transfer
Maximum Volume water transferred	39.1Mm^3/a	157.3Mm^3/a
Length of pipeline	55km	135km
Construction cost (2009 Prices)	R1.64 billion	R8.81 billion
Direct Employment	2 372	13 549
Construction period	2 years	4 Years

Source: Project Planning Team – escalated

The expected time for delivery of Phase 1 is during 2013, in time to supply Medupi when it starts producing power. The commencement date for Phase 2 will depend on the finalisation and announcement by Eskom of its envisaged construction plan for further coal fired power stations.

2.3.4.2.2 Assumptions Regarding Water Provision

The investment details for the Mokolo Water Development and the Crocodile West Water Development is shown in the following table.

Table 5: Investment Details for the Mokolo and Crocodile West Water Development (2009 prices, Rand million)

A. Capital Investment	Mokolo Pipeline R.mil.	Crocodile Weir R.mil.	Crocodile Pipeline R.mil.	Pump Stations R.Mil.	Reservoirs R.mil.
1. Total Investment: Water	1 639.43	457	7 270	193	59
2. Capital Investment Asset Structure					
Asset Types	**Mokolo Pipeline**	**Crocodile Weir**	**Crocodile Pipeline**	**Pump Stations**	**Reservoirs**
Bulk water (dams and weirs)	0	137	0	0	0
Reservoirs	0	0	0	0	59
Pump stations (water and sewer)	0	91	0	193	0
Bulk pipelines (water and sewer)	1 148	228	5 089	0	0
Treatment works (water and sewer)	164	0	727	0	0
Reticulation (water and sewer)	328	0	1454	0	0

Source: Aurecon - escalated

2.3.5 Projected Economic and Population Growth

2.3.5.1 Introduction

The impacted area and specifically the two catchments stretch over a number of district municipalities and local municipalities. The socio-economic profile of each of the municipalities is detailed in Appendix A.

2.3.5.2 District and Local Municipalities

2.3.5.2.1 Waterberg District Municipality

The Waterberg District Municipality, in which the Mokolo River catchment falls, consists of four local municipalities namely Lephalale, Modimolle, Mookopong and Thabazimbi. The 2010 population of the Waterberg District Municipality is 644 642 with an anticipated growth natural of 0.54% if no development should take place. The annual household income of the majority of the people is between R9 601 and R19 200 per annum which comprises 16% of the population whereas 37 250, which is 22%, have no income.

The employment status reflects that 38% (140 374) are employed, 17% (62 622) are unemployed and 45% (165 480) are not economically active.

The majority of the people employed in industry are employed in agriculturally related work.

2.3.5.2.2 Lephalale Local Municipality

The 2010 population of the Lephalale Local Municipality is 100 787 with an anticipated growth of 0.53%, if the development does not take place. The annual household income of the majority of the people is between R4 801 – R 9 600 per annum which comprises 25% of the population whereas 5 081, which is 18%, have no income.

The employment status reflects that 49% (28 673) are employed, 9% (5 273) are unemployed and 42% (25 039) are not economically active.

The majority of the people employed in industry are employed in agriculturally related work.

2.3.5.2.3 Thabazimbi Local Municipality

The 2010 population of the Thabazimbi Local Municipality is 67 455 with an anticipated growth of 0.60%. The annual household income of the majority of the people is between R19 201 – R 38 400 per annum which comprises 23% of the population whereas 3 529, which is 14%, have no income.

The employment status reflects that 57% (26 248) are employed, 15% (7 046) are unemployed and 27% (12 617) are not economically active.

The majority of the people employed in industry are employed in mining and quarrying related work.

2.3.5.3 Targeted Geographic Areas

In the area a number of specifically targeted areas which is highlighted because of the possible dramatic impact that the proposed developments may have on the areas.

2.3.5.3.1 Seleka Tribal Areas

The Seleka Tribal Area is part of the Lephalale Local Municipality area of jurisdiction. The 2010 population of the Seleka Tribal Areas is 28 217 with an anticipated growth of 0.53%. The annual household income of the majority of the people is between R4 801 – R 9 600 per annum which comprises 27% of the population whereas 1 791, which is 24%, have no income.

The employment status reflects that 48% (7 531) are employed, 9% (1 396) are unemployed and 43% (6 697) are not economically active.

The majority of the people employed in industry are employed in agriculturally related work.

2.3.5.3.2 Lephalale Town

This is the urban area of the Lephalale Local Municipality or the old "Ellisras" town and Onverwacht and Marapong. The 2010 population of the urban area is around 19 280 with an anticipated growth of 0.53% if the anticipated development projects do not materialise. It must be emphasised that different sources mention different figures and is the above figure a compromise. The annual household income of the majority of the people is between R38 401 – R 76 800 per annum which comprises 24% of the population and 8%, who have no income.

The employment status reflects that 71% are employed, 5% are unemployed and 24% are not economically active.

The majority of the people employed in industry are employed in the electric, gas and water sector.

2.3.5.3.3 Thabazimbi Town

The 2010 population of Thabazimbi Town is 21 822 with an anticipated growth of 0.60%. The annual household income of the majority of the people is between R4 801 – R 9 600 per annum which comprises 23% of the population and 466 which is 7%, have no income.

The employment status reflects that 62% (8 835) are employed, 7% (1 033) are unemployed and 30% (4 321) are not economically active.

The majority of the people employed in industry are employed in agriculturally related work.

2.3.5.3.4 Brits Town, Bapong and Garankuwa

The 2010 population of Brits Town, Bapong and Garankuwa is 64 163 with an anticipated growth of 0.59%. The annual household income of the majority of the people is between R4 801 – R 38 400 per annum which comprises 54% of the population and 3 216 which is 21%, have no income.

The employment status reflects that 43% (10 358) are employed, 57% (13 815) are unemployed and 0% are not economically active.

The majority of the people employed in industry are employed in manufacturing related work.

2.3.5.4 Summary

The statistics reflect a picture of general poverty with the majority of the households having a low annual income in the rural areas with a large proportion unemployed and perhaps even

unemployable because of a lack of skills. The Seleka Tribal Trust area will benefit from future developments in the area, specifically during the construction periods when opportunities for unskilled and low skilled people will exist.

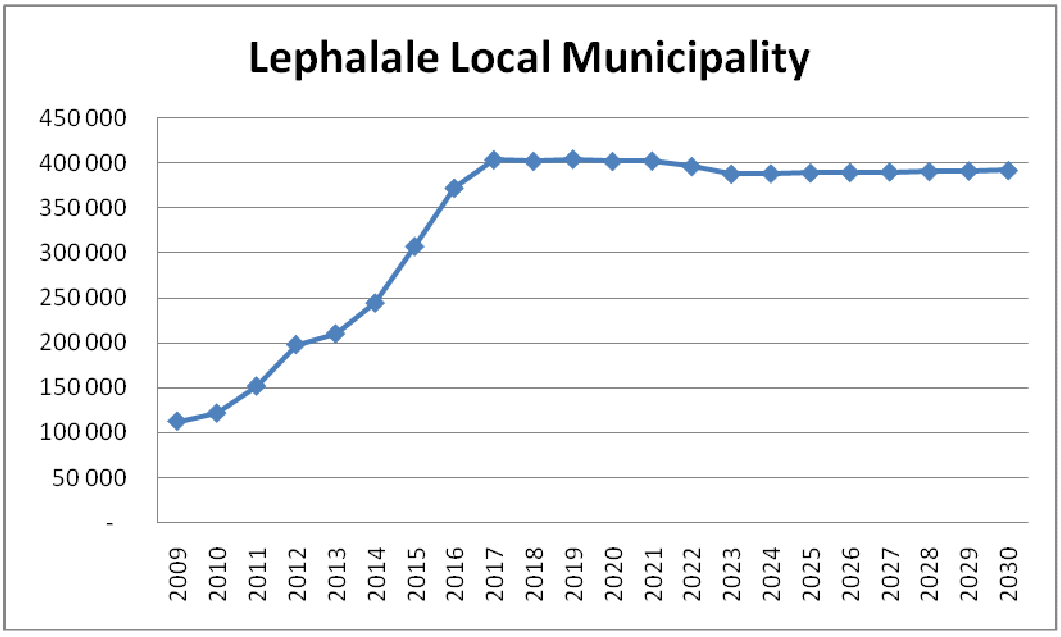
2.3.5.5 Projected Population Growth for Lephalale Local Municipality

Most of the direct and indirect economic development will have a spin off affect in Lephalale town, but for purposes of the population growth projections it was decided to do it for the total Lephalale Local Municipality, believing that it will give a better overall picture of the impact of the proposed development. A number of assumptions are driving the projections, namely:

- To avoid double counting specific project associated temporary construction workers will eventually leave the area,
- Operational workers will stay permanently in the area,
- Specific labour/turnover and labour/capital multipliers obtained from the National SAM are used to estimate indirect and induced impacts.

The graph below indicates the expected resultant population growth if the anticipated development materialises as projected.

Graph 1: Projected Population Growth for the Lephalale Municipality



Source: Conningarth Economists' calculations based on information from Statistics SA

From the above graph it is evident that a huge population growth is expected for the Lephalale district. Currently the population is in the order of 110 000, including present construction workers, and will increase fourfold to just under 400 000 in a space of 20 years. This would put huge demands on the delivering of services by the municipality and as already stated this should be red flagged as a priority attention by the relevant government organisations involved.

A study performed by Aurecon for the local authority arrives at very similar figure, but having it split in urban and rural components:

- Urban – 317 625
- Rural – 98 254
- Total – 415 879

This figure differs from that of the task team by about 18 000, which is less than a 4% difference which statistically acceptable and makes it possible to use the figure of 400 000 as base figure for future planning. Taking into consideration that the growth in population numbers will depend on the timing of the development projects, the actual growth in population numbers will also depend on the actual economic growth of the country.

2.4 Water Development Needs

2.4.1 Introduction

In this section the water development projects and the investment needed to accommodate the projected water requirements envisaged for the further development of power generation, mining, coal to liquid fuel production and the urban requirements is analysed. The nature and magnitude of the water development projects are based on the needs as reflected in this chapter.

The water development project will take place in two river systems, namely, the Mokolo development and the Crocodile-West development.

2.4.2 Mokolo River Water Situation

The Mokolo (Mogol) River catchment is part of the Limpopo Water Management Area (WMA). The Mokolo River originates close to Modimolle (Nylstroom) and then drains to the north into the Limpopo River. The Mokolo Dam (formerly known as the Hans Strijdom Dam) is the largest dam in the catchment. The dam was constructed in the late 1970s and completed in June 1980, to supply water to Matimba Power Station, Grootegeluk Mine, and Lephalale (Ellisras) Municipality and for irrigation downstream of the dam. Based on the water infrastructure, the current water availability and water use is in the balance with no spare capacity in the existing Exxaro pipeline for future allocations for the anticipated surge in economic development in the area.

To optimise the usage of the Mokolo Dam, it is envisaged to double the current capacity by constructing a second pipeline, which supplies water to the Matimba Power Station, domestic and industrial users.

In the following paragraphs the future projected water requirements for agriculture, industry and the urban requirements together with the future supply situation in the Mokolo River is analysed and reported on.

2.4.2.1 Irrigation Agriculture

Sometimes terminology can be very misleading and it is therefore necessary to clarify terms before using them in the rest of the section. In terms of irrigation agriculture the term “Existing Lawful Water Use” (ELU) is defined in Section 32 of the National Water Act (NWA), 1998. The publication: - *The Mokolo River Catchment: Validation of the Existing Lawful Use of Water – DWAF -2007* indicates the existing water uses in the Mokolo River Catchment. The report also proposes that the existing

water uses must be verified (the section 35 process in the NWA) as soon as practically possible. The existing water use might differ from the ELU, because of either over abstraction or non availability of water. In the next table the existing water use is presented.

Table 6: Existing Water Use

Allocation Zone	Water Use Mm^3	Area Hectares
Alma	30.107	4 829
Vaalwater	20.955	4 008
Lephalale	24.350	3 480
Total	75.414	12 318

Source: The Mokolo River Catchment: Validation of the Existing Lawful Use of Water – DWAF -2007

According to the validation report the possible unlawful water use for the total catchment is about 8.6 Mm^3 more than the possible ELU. The total of 75.4Mm^3 includes 24.3Mm^3 to the Lephalale economic zone which is the area of jurisdiction of the Mokolo Irrigation Board, who again claim that their allocation was determined in 1987 at 16Mm^3 and not the scheduled water use mentioned in the Validation Report. The DWA position on this is that the 16Mm^3 is part of the dam operating rule when the dam level is above 50% on the 1st of April of each year. This water supply is at a higher risk. The official allocation is considered as the 10.4 Mm^3/a as indicated in the White Paper. This matter will be dealt with by DWA in due course. Irrespective of the implementation of the MCWAP project the actual irrigated areas considered that may be impacted on is thus 1 500 ha.

However, the Mokolo Irrigation Board claims that because of the total control and the condition of the river system, irrigation farmers very seldom receive their full allocation. According to the Mokolo Irrigation Board, 3 700 hectares (3 468.44ha scheduled according to the report) are listed but on average only ±1 500 hectares are regularly cultivated.

2.4.2.2 Mining

According to records the total water allocation to Grootegeluk[2] is 9.9Mm^3, with the actual use by the mine around[3] 4Mm^3/annum. The balance is for water supplied by Exxaro to domestic users for what is now the municipality.

2.4.2.3 Power Generation

Matimba Power Station is at present still the largest dry cooling power station in the world. In terms of water use the average consumption per kWh send out is 2.006 litres for the wet cooling stations compared to the 0.120 litre for Matimba. According to data supplied by Eskom the average water use for Matimba expressed in terms of kWh send out; vary between 0.102 litres to 0.157 litres with an average of 0.120 litres for the 2006-2007 year. The total average annual use is 3.59Mm^3/annum compared to the allocation of 7.3Mm^3/annum.

[2] Report No. P WMA 01/000/00/0304 – Internal Strategic Perspective: Limpopo WMA.

[3] Exxaro Personal Communication.

2.4.2.4 Urban Use

The current water use by the municipality is divided into the individual users and other, which then includes the commercial and a number of small business ventures. The total urban population (2005) is estimated at about 17 500 people with a total water use of 2.353Mm^3/annum. No sizeable other industries operate in the municipal areas and the total water use is less than 3Mm^3/annum.

The long term yield of the Mokolo Dam with 99.5% assurance of supply has been established at 39.1Mm^3/annum by Aurecon. It therefore appears that both the current use and original allocation volumes are within the long term supply of the dam.

The present project analysis and specifically in Scenario 9, the technical team use the yield of 39.1Mm^3/a, and use the White Paper irrigation allocation of 10.4Mm^3/a, in line with the 1 500 hectares irrigated. The 39.1Mm^3/a at 99,5 % assurance is then used as yardstick in balancing the demand for the new Medupi Power Station, the accompanying increase in coal mining and the growing urban demand.

It must be kept in mind that the 39.1Mm^3/annum was determined with the present Environmental Water Requirement (EWR) estimates and that at present a detailed study is on going to determine the EWR level.

2.4.3 Crocodile River (West) Water Situation

The Crocodile River (West) water situation will be discussed in the Phase 2 version of this report under the headings as listed below.

- Current and Future Water Requirements.
- Irrigation Agriculture.
- Municipal Water Use.
- Mining and Non-Urban Industries.
- Water Resources of the Crocodile River (West) Catchment.
- Impacts Due to Phase 2: Transfer from Crocodile River (West).

3 Risk Analyses of the Potential Impacts on Categories of the Socio-Economic Environment in the Study Area

3.1 Risk Assessment

Major developments planned for the Lephalale area over the next few years will significantly increase the water demands in the area over the next 20 years. Due to the limited availability of water in the Lephalale area, the Department of Water Affairs commissioned a feasibility study of the Mokolo Crocodile River (West) Water Augmentation Project (MCWAP) to establish how future demands could be met. Two phases for the proposed infrastructure for transferring water from the Mokolo Dam and the Crocodile River are planned.

- Phase 1: A pipeline parallel to the existing Exxaro pipeline, to augment supply from the Mokolo Dam.
- Phase 2: Transfer scheme from the Crocodile West at Vlieëpoort near Thabazimbi to the Lephalale area.
- De-Bottlenecking - De-bottlenecking of the existing pipeline that stretches from Mokolo Dam to Lephalale, which belongs to Exxaro in order to improve the hydraulic gradient at Rietspruitnek, where the existing pipeline passes over a high point.

A scoping exercise has been undertaken for Phase 1 and 2, with the EIA to be commissioned in 2010. A Basic Assessment was undertaken for the De-Bottlenecking phase.

As part of the Environmental Impact Assessment study, an Economic module was commissioned to undertake a cost benefit analysis of the MCWAP development. The environmental impacts will be analysed as part of this module.

A summary of the environmental impacts were sourced from the Scoping reports for Phase 1 and 2 and the Basic Assessment Report for the De-bottlenecking. A quantification of the impacts, in terms of probability, magnitude and significance are envisaged to take place as part of the EIA process which will be commissioned in 2010 and is therefore not addressed in this summary. Where and when and by whom?

This summary as depicted in the table below provides an outline of the category of impact and the associated expected economic effects.

A preliminary desktop attempt was made at quantifying the impacts. Aspects considered were:

- Probability - the possibility of the impact to occur.
- Impact - this considered the magnitude of the impact, should it occur.
- Extent - this considered to what degree the impact will be felt, e.g. does it have local or regional effects?

A short-coming of this assessment was that the effects of mitigation were not considered, particularly when assessing the magnitude and extent of the impacts.

The most important environmental aspects which have a major financial and economic impact have been analysed and a monetary value put on in the sectoral analysis. Examples of these are the loss of Agriculture production and Game Farming. These impacts are also part of the Cost Benefit Analysis and the Macro-economic impact analysis.

3.1.1 Outline Impact Category and Associated Expected Economic Effects

Table 7: Impacts Due to Phase 1: Augmentation from Mokolo Dam

Impact	Description of Impact	Quantification of Impacts during Construction	Quantification of Impacts during Operation
Loss of agricultural production	Loss of agricultural land due to servitudes and acquisition of land for infrastructure	Probability: High Impact: Medium Extent: Medium significance Mitigation: Not much	Probability: Medium Impact: Low-medium Extent: Medium significance Mitigation: Yes
Loss of income in eco-tourism sector (hunting and game farming)	Loss of income to smaller, narrower game farmers Loss of income from hunting, game viewing Increased cost on game farmers to protect animals and artificial feeding of animals Effects of blasting on condition of animals and effects on eco-tourism Disturbance and risk of harm to game animals. Disturbance to breeding patterns Temporary movement of game	Probability: High Impact: Low/medium Extent: Medium Mitigation: Not much	Probability: Low Impact: Low Extent: medium

	fences Risk of poaching Loss of animals due to improper access control Loss of habitat		
Loss of income along the Mokolo River due to change in operating rules (changes in assurance of supply)	Possible loss of crops under irrigated agriculture – Below Mokolo Dam Curtailments - loss of productivity	Probability: Low Impact: Low Extent: low significance	Probability: Medium Impact: Medium Extent: Downstream of Mokolo Dam. Low significance
Change in demographics This can be considered as a positive impact from a socio-economic perspective and negative from an environmental perspective	Influx of employment seekers (positive impacts of employment creation during construction and operation phase) Negative impacts on safety and security and health issues such as STDs Impact on existing infrastructure such as housing, water and sanitation services Increasing footprints of linear developments such as road and rail Effects on regional and local	Probability: Very High Impact: Very High Extent: Very significant	Probability: Very High Impact: Very High Extent: Very significant

	networks		
Change in traffic patterns	Movement of heavy vehicles transporting spoils to dumping sites, fill material from burrow pits, excessive use of dirt, local or maintenance roads Influx of employment seekers Degradation of roads infrastructure	Probability: High Impact: High Extent: Medium significance	Probability: High Impact: High Extent: Medium significance

Source: Tlou Consulting (Pty) Ltd

3.2 Socio-Economic Risk

3.2.1 Introduction

In the sections above the sectors which could possibly suffer financial losses due to the construction and operation of the water augmentation infrastructure and other envisaged projects, have been identified. The following sectors which have been identified will be analysed:

- Farming.
  - Irrigation.
  - Dry-land Cultivation.
  - Livestock.
  - Game.
- Tourism.
  - Business.
  - Eco-tourism.
  - Hunting.
- Hunting.
  - Trophy.
  - Biltong.
- Mining.

If the projected development materialise the population and specifically the urban population of Lephalale will grow substantially and is it therefore necessary that this sector also be analysed.

The agricultural sector is, for purposes of this analysis, sub-divided into four sections, namely: irrigation agriculture, dry land crop cultivation, livestock and game. Game farming is subdivided into a number of activities for analytical purposes, namely: Accommodation facilities called eco-tourism, game breeding and hunting. In the case of hunting it is divided in trophy and biltong hunting because of the large difference in game prices. Tourism to the area is problematic in that most of the activity is based on the nature conservation and game activities, however in the towns of Lephalale and Thabazimbi a considerable business tourist activity occurs, which is reported on separately.

In the next number of paragraphs the four activities are analysed and presented.

3.2.2 Project Area

The project area is for the analysis purposes presented in the two catchments namely: Mokolo River Catchment and Crocodile River (West) Catchment. In both cases the main focus of the study covers the economic activities dependant on the water from the rivers and dams i.e. the Mokolo, Hartebeespoort, Roodekopjes and Klipvoor dams. In this report only the Mokolo River Catchment is addressed.

3.2.3 Mokolo Catchment

The Mokolo River catchment is divided into three allocation zones (AZ), namely Alma and Vaalwater above the Mokolo Dam and the area below the dam referred to as Lephalale allocation zone, as already defined.

3.2.3.1 Irrigation

3.2.3.1.1 Introduction

The expansion of the irrigation agriculture sector is limited due to the availability of water and under the present conditions horizontal expansion is restricted. Future growth will have to be in terms of using better irrigation technology to improve water use efficiency and the production of high value crops and improved irrigation management approaches such as irrigation scheduling and crop mix. It must also be stated that a very small number of hectares are still irrigated by using flood irrigation and that a process of upgrading technology is ongoing.

3.2.3.1.2 Current Economic Parameters

In the Mokolo catchment, the Alma and Vaalwater AZ's irrigation water is extracted from a large number of farm dams, while in the area below the dam water is irrigated with water released from the dam and then pumped by individual farmers.

The irrigation agriculture consists of various sectors utilising different irrigation systems. The crops have been aggregated into six crop groups for the purpose of the economic evaluation. These are as follows:

- Maize and Wheat (Mainly Centre Pivot systems).
- Citrus incl. other Fruit and Tobacco (Mainly Drip systems).
- Vegetables (Mainly Micro Spray and Micro Sprinklers.

These crops are grown in all three economic zones as indicated in Table 8 below. As indicated in the table, the major crop grown in the upper economic zone of the Alma irrigation Forum area is maize. It is important to note that this is seed maize which is exported to other parts of the country. The other main crop is wheat. In the middle economic zone of Vaalwater tobacco is the major crop. The lower economic zone does not have a dominant crop(s) as in the other economic zones.

These crops contribute to the Mokolo Catchment economically, social from employment generation and which can be expressed in gross income or turnover and household income which are driven by number of hectares of the different crops and the crop water requirements. The hectares below show the allocated hectares for the Alma and Vaalwater economic zones. The hectares for the Lephalale economic zones show the current hectares being irrigated downstream of the dam with the water abstracted from the river and the sand aquifer. Water is released from the Mokolo Dam to augment the water annually available to the farmers.

Table 8: Estimate Irrigation Crop Distribution in the Mokolo River Catchment[4]

Irrigation Agriculture	Alma Allocation Zone	Vaalwater Allocation Zone	Mokolo Allocation Zone	Total Catchment
Sector	Hectares	Hectares	Hectares	Hectares
Citrus (incl. Vine)	114	61	-	175
Groundnuts	295	50	-	345
Maize	1 087	742	1 110	2 939
Other Fruits	173	-	502	675
Pastures	241	136	344	720
Tobacco	501	1 263	529	2 293
Vegetables	542	60	819	1 422
Wheat	1 059	759	396	2 215
Total	**4 012**	**3 071**	**3 700**	**10 783**

Maize and wheat are the predominant crops in the Alma AZ with citrus and fruit the least cultivated. In the Vaalwater AZ tobacco is the most cultivated crop and groundnuts, vegetables and citrus (incl. vine) the least with no fruit cultivation at all. The predominant crop in the Mokolo AZ is maize and vegetables followed by tobacco and other fruit. No citrus (incl. vine) and groundnuts are cultivated in the area and only limited wheat and pastures.

In the total catchment maize, tobacco and wheat are the most popular crops, with citrus (incl. vine), groundnuts, fruit and pastures being the less popular.

In the next table an indication of the gross income per crop is presented, 2008 prices.

Table 9: Total Estimated Gross Income in the Mokolo Catchment from Irrigation (2008 prices)

Irrigation Agriculture	Alma Allocation Zone	Vaalwater Allocation Zone	Mokolo Allocation Zone	Total Catchment
Sector	R Million	R Million	R Million	R Million
Citrus (incl. Vine)	9.73	4.7	-	14.43
Groundnuts	5.19	1.15	-	6.34
Maize	19.02	14.52	6.02	39.56
Other Fruits	11.25	-	10.76	22.01
Pastures	5.12	3.43	2.4	10.95
Tobacco	43.59	94	10.89	148.48
Vegetables	35.42	3.95	14.8	54.17
Wheat	20.02	16.05	2.32	38.39
Total	**149.35**	**137.80**	**47.19**	**334.34**

Source: Conningarth calculations based on information gathered

[4] Source: Mokolo and Crocodile (West) Water Augmentation Project (MCWAP) Feasibility Study: Technical Module – Project No. WP9528 Department of Water Affairs and Forestry. Report Number: P RSA A000/00/8809. November 2008 – Draft 1

In the Alma AZ tobacco reflects by far the best earning followed by vegetables and then wheat, maize and fruit with groundnuts and pastures earning the least income. The Vaalwater AZ has tobacco as the best income generator by far, with wheat and maize substantially less and no fruit. In the Mokolo AZ vegetables are the best income crops closely followed by tobacco and other fruit, while maize, pastures and wheat are the lesser good income crops and no citrus and groundnuts are cultivated.

In the total catchment tobacco is by far the best income crop followed by vegetables, maize and wheat. Groundnuts and pastures are the least favourable income crops.

In the next table the direct labour per allocation zone is presented.

Table 10: Direct Irrigation Employment Opportunities in the Mokolo Catchment

Mokolo River Catchment	Alma Allocation Zone	Vaalwater Allocation Zone	Mokolo Allocation Zone	Total Catchment
Sectors	Numbers	Numbers	Numbers	Numbers
Citrus (incl. Vine)	96	61	-	157
Groundnuts	123	50	-	173
Maize	29	742	30	801
Other Fruits	145	-	421	566
Pastures	1	136	1	138
Tobacco	1 092	1 263	1 152	3 507
Vegetables	450	55	204	709
Wheat	29	759	11	798
Total	**2 247**	**3 778**	**1 819**	**7 884**

Source: Conningarth calculations based on information gathered

In the Alma AZ tobacco has by far the highest employment figures followed by fruit, groundnuts and citrus (incl. vine), although substantially less. Wheat and maize have the lowest employment figures with pastures being very low. Employment figures in the Vaalwater AZ for tobacco is also by far the highest, followed by wheat maize and vegetables. Pastures, citrus (incl. vine), and groundnuts are substantially lower with no employment for other fruits. Likewise tobacco has the highest employment figures in the Mokolo AZ.

For the total catchment area tobacco has by far the highest employment figures followed by maize, wheat and other fruit with groundnuts, citrus (incl. vine), pastures and vegetables having the lowest employment figures.

3.2.3.1.3 Scenario Impacts

The two AZs in the Mokolo River above the dam will not be affected by the envisaged development; however, the AZ below the dam may be affected, by the possibility that for a period their water may be leased from them. The present view point is that under normal circumstances the Mokolo dam will be able to supply the Medupi Power Station and accompanying mining with sufficient water until the FDG technology is to be implemented. However a certain risk exist in that during a prolonged drought period and if the Crocodile augmentation is not in place that extra water will have to be sourced from irrigation. At present the allocation from the dam is as follows:-

- Strategic and Domestic = 9.9 Mm^3/a
- Grootegeluk Mine = 7.3 Mm^3/a
- Irrigation = 10.4 Mm^3/a

The current applicable operational rules for the Mokolo Dam state that, as long as the water level of the dam is above 50% on the 1st of April, 16 Mm^3 will be released. If, however, on the 1st of April the dam water level is below 50% only 5Mm^3 is to be released. However, due to the current under utilisation of the yield of the dam and existing allocations, the "Assurance of Supply" that irrigators experienced is high and it was very seldom, if ever, that the dam water level was below 50% on the 1st of April.

Although the 10.4 Mm^3/a is allocated for irrigation purposes, the farmers claim that with the present areas cultivated, only between 5 and 6 Mm^3/a of the 16 Mm^3 released annually is used by the irrigators.

According to the Water Requirements: Pre-Feasibility Stage Report[5] the 1:200 year (99.5%) yield of the Mokolo Dam is 39.1 Mm^3/a of which 10.4 Mm^3/a is for irrigation purposes and 28.7 Mm^3/a available for use by domestic and industrial users at mixed assurances. However, the possibility exists that for a period during the construction of the augmentation pipelines from the Crocodile River (West), the availability of the irrigation allocation can be in doubt. The economic impact is analysed and the results from the Water Impact Model (WIM) presented in the following table if the possibility arises.

Table 11: Macro Economic Impact Parameters of Irrigation water in the Lephalale AZ. (2008 prices)

Gross Domestic Product	Employment Opportunities	Household Income
Direct	Direct	Low
R. mil.	Numbers	R. mil.
70.18	1 819	31.51

Source: Conningarth calculations based on information gathered

When interpreting the above results it is important to keep in mind that agriculture and in this irrigation very often employ large numbers of rural women and men with a low skill development. Especially in the case of rural women it is often the only source of income.

In this specific case the direct numbers would be from the area, so if the water supply is leased or bought 1 819 employment opportunities could be lost in the area, with a household income of R31,51 million, an annual income per person of around R20 000.00 per person.

Compared to the huge employment impact of the power stations, the number of opportunities lost is small, but it is in a very rural area and some attention should be paid to soften the impact, should the situation arise.

[5] Source: P RSA A000/00/8809 Water Requirements: Pre-Feasibility Stage

3.2.3.2 Dry-land Cultivation

Although some dry-land crop cultivation take place in the two catchments they will not be affected at all by the developments and were therefore ignored in the analysis.

3.2.3.3 Livestock

3.2.3.3.1 Introduction

The livestock numbers in the catchments was calculated using a dual pronged approach. The hectares of the quaternary catchment comprising each allocation zone was added, a grazing norm per Large Stock Unit (LSU) was allocated and the potential number of LSU's per allocation zone was calculated. Contact was then established with local sources in the respective areas to determine the percentage area utilised by livestock and game and the estimated number of livestock LSU was then calculated. The number of LSU was converted to cattle numbers by multiplying it with a factor of 1.18.

The Department of Agriculture's livestock census is available on a magisterial district level, these numbers are available up to 2005, and were used to compare our estimated numbers with. It must be kept in mind that the catchments are smaller than a magisterial district and these numbers can only act as a guide to trends. In the catchment area there are historical trends of switching from cattle and other livestock to game farming.

The hectares per allocation zone were calculated, then using accepted grazing norms per "Large Stock Unit" (LSU) and the number of potential LSU per allocation zone was estimated. The grazing norms were obtained from the Department of Agriculture. Then an estimation of the ratio of cattle and game LSU numbers were obtained by phoning a number of farmers.

In the table below the respective estimated cattle numbers and LSU per allocation zone is presented.

Table 12: Livestock Numbers in the Mokolo Catchment (2009)

Category	Alma AZ	Vaalwater AZ	Lephalale AZ	Total Catchment
	Numbers	Numbers	Numbers	Numbers
Livestock	21 094	14 859	11 988	47 941
Large Stock Units	17 930	12 630	10 190	40 750

Source: ISP - P WMA 03/000/00/0404 Version 1 - February 2004

In the Mokolo River area livestock numbers and specifically cattle numbers have declined considerably in the past number of years, gradually making way for game farming. At present the ratio between cattle and game on the commercial farms appears to be around 30% cattle and 70% game for the area. In some of the mountainous areas it is as low as 10%, while in other areas it is still around 50%, especially in the Vaalwater area.

3.2.3.3.2 Current Economic Parameters

In the following table the current macro-economic parameters for livestock in the area is presented.

Table 13: Macro-Economic Parameters for Livestock Farming in the Lephalale District

Annual Turnover	Annual Surplus	Gross Domestic Product	Employment Opportunities	Household Income
		Direct	Direct	Low
R. mil.	R. mil.	R. mil.	Numbers	R. mil.
R 56.75	R 14.15	R 60.32	408	R 4.70

Source: Conningarth Economists' calculations based on information gathered

The sector creates 408 direct employment opportunities and pays R4.70 million annually to Low-Income Households in the Lephalale area.

The sector produces a surplus value of around R14.15 million per annum.

3.2.3.3.3 Scenario Impacts

The future of cattle in the area is largely dependent on the future of the game farming and related activities in the area. The construction of the new Mokolo pipeline will not impact as such on the livestock industry in the area. The water pipeline crossing over both the livestock and game farms will only be affected temporarily during the construction phase of the pipeline. As the pipeline will run underground and not be fenced, it will have no effect on either the livestock or game farms during the operational phase. Access to the pipeline for inspection and maintenance will, however, impinge on the farming activities, especially hunting but not livestock.

But it is rather the consequences of the construction of the power stations, power lines and related mining activities and their influence on the future of game farming, eco-tourism and hunting that will impact cattle farming. If the impact is high on game and related activities cattle farming can stabilise at present levels as further development might not be feasible. The projected growth in the area could even stimulate the demand for meat and an optimistic possible scenario is that a switch back to cattle can take place.

The possible influence of the electromagnetic fields in the vicinity of the electricity lines has already been addressed in a separate study as part of a scoping report. The report comes to the conclusion that the electromagnetic fields will not impact negatively on the animals.

Two possible scenarios can thus be formulated:

- Scenario 1 – Cattle farming stabilise and do not decrease further.
- Scenario 2 – Cattle farming recover some lost ground and by 2030 have grown by 5% from present levels.

The economic impacts for Scenario 1 are the current parameters.

For Scenario 2 very little growth will take place and the following changes in parameters are projected:

- Employment Creation – 21 extra direct opportunities.
- Low-Income Households – R0.42 million extra if expressed in 2009 prices.

3.2.3.4 Game Farming, Nature Conservation and Other Economic Activities

3.2.3.4.1 Introduction

Under the livestock section the approach and methodology to calculate the number of game LSU has been discussed. In converting the number of game LSU to estimated game numbers the following approach was used[6]. The most common game species on the farms in the catchments were identified and together with the official conversion rates, an acceptable rate for the two catchments was calculated. The result was then used to convert the game LSU to game numbers using a 3.23 game/LSU ratio.

In the following table the game species used and the LSU conversion factors are shown.

Table 14: LSU Conversion Rate

Specie	Conversion Rate
	Number/LSU
Blou Wildebeest	2.40
Eland	1.00
Gemsbok	2.20
Giraffe	0.70
Impala	7.00
Kudu	2.20
Nyala	3.30
Southern Reedbuck	7.70
Warthog	5.00
Waterbuck	2.40
Zebra	1.60

Source: The National Department of Agriculture, Directorate Veterinary Services, Dec 2004 – Livestock Figures

3.2.3.4.2 Current Economic Parameters

The following table present an estimation of the game numbers in the Mokolo Catchment.

Table 15: Game Numbers in the Mokolo Catchment

Category	Alma AZ	Vaalwater AZ	Lephalale AZ	Total Catchment
	Numbers	Numbers	Numbers	Numbers
Game Numbers	86 798	95 108	98 658	280 563
Live Stock Units	26 895	29 470	30 570	86 935

Source: Conningarth Economists' calculations based on information gathered

The table shows that the actual game numbers are more than three times higher than that of the "Large Stock Units", based on the same grazing norms. It must be kept in mind that the figures

[6] The National Department of Agriculture, Directorate Veterinary Services, Dec 2004 – Livestock Figures

represent the estimation of the specific catchment and not of the magisterial districts or district municipalities.

Income from game farming is from the following sources:

- Hunting
- Game Sales
- Eco-Tourism activities

The eco-tourism activity is included with the tourist sector together with the accommodation part of the hunting section. In this section is included only an estimation of the live game sold and the game hunted, trophy and biltong.

The annual number of game available is calculated by using the Large Stock Units per area as a basis of fertility based on the cattle reproduction rate acceptable for the area. The number of game LSU is then converted back to game numbers, the estimated number of game hunted is subtracted and the difference is the number available for selling. This could either take place through an auction sale or private sale.

The average game prices for 2009 was obtained from the Vleissentraal auctioneers and the hunting prices were obtained from professional hunting groups advertising on the internet. It must be emphasised that data about the industry in general is very scarce and for the specific area even more so with the result that it is very difficult to verify the numbers. With this as background the following table give an indication of the size of the game industry in the Mokolo catchment.

Table 16: Estimated Annual Game Trading and Hunting Turnover in the Mokolo Catchment (2009 prices)

Activity	Annual Turnover
	Rand Million
Game Sales	R 33.58
Hunting	R 41.10
Total	**R 74.68**

Source: Conningarth Economists' calculations based on information gathered

The above figures exclude any income from accommodation and eco-tourism facilities, which is included in the tourism activity section. In the next table the macro-economic indicators related to the game activity is presented.

Table 17: Estimated Macro-Economic Parameters for the Game Activities in the Mokolo Catchment (2009 prices)

Annual Surplus	Gross Domestic Product	Employment Opportunities	Household Income
	Direct	Direct	Low
R. mil.	R. mil.	Numbers	R. mil.
R 23.88	R 62.50	870	R 6.25

Source: Conningarth Economists' calculations based on information gathered

According to the calculations the game sales and hunting, excluding the accommodation and eco-tourism, creates 870 direct employment opportunities and pay annually R6.25 million to Low-income Households.

3.2.3.4.3 Scenario Impacts

Future Scenarios

The upgrading and increase in capacity of the existing pipeline and pump stations from Mokolo dam will to our opinion not have a permanent negative impact on the game and hunting activities. The water pipeline crossing over both the livestock and game farms will only be affected temporarily during the construction phase of the pipeline. As the pipeline will run underground and not be fenced, it will have no effect on either the livestock or game farms during the operational phase. Access to the pipeline for inspection and maintenance will, however, impinge on the farming activities, especially hunting but not livestock.

It is however the accompanying expansion of the power generation by the construction of a number of power stations, power lines and mining activity that can impact negatively on the game and hunting activities. Game farming and sales as such would probably not be affected as dramatically as the eco-tourism activities and hunting, specifically trophy hunting where over 90% of the hunters is from overseas. It will also be depending on the property's exposure to the developments and the intrusion on the nature experience as well as the placing of the outgoing power lines.

In determining the impact a matrix was developed which were populated using the Delphi technique, asking a couple of knowledgeable people their opinion on the size of the impact, then using an average to determine the overall impact. An example of the matrix which was developed for this purpose is presented below. The matrix is not populated as it is merely an illustration of the method which was applied.

Table 18: Matrix Used to Estimate the Impact of the Development on the Game Farming and Related Activities

	Homestead and Accommodation Facilities	Pre-sale game handling facility	Restrictions on game catching	Impact on eco-conservation	Does distance play a role? If yes, please complete
	Impact Percentage	**Impact Percentage**	**Impact Percentage**	**Impact Percentage**	**Impact Percentage**
Game Farming – breeding					
Game Farming and related activities: ** Eco-tourists-holiday ** Eco –tourists-trophy hunter companions ** Trophy Hunting ** Biltong Hunting ** Sale of excess animals					

A second matrix is then developed allocating weights to the different activities and by applying these percentages an impact is calculated which is then applied to every segment to estimate the possible negative impact of the secondary development projects.

The impact on the accommodation facilities was included here to attain a full picture of the possible impact.

In the next table a summary of the negative impacts is presented.

Table 19: Estimated Negative Impacts on the Different Game Related Activities

Activity	Negative Percentage
Game Breeding and Game Sales	-4%
Eco-tourism activities	-40%
Trophy Hunting	-64%
Biltong Hunting	-9%

Source: Conningarth Economists' calculations based on information gathered

It must be emphasised that the above percentages arrived at is not based on primary research but the informed opinions of a couple of people using the Delphi technique. We are satisfied that the answers arrived at are acceptable.

In the next table is the turnovers presented before and after the application of the impact percentages.

Table 20: Estimated Negative Impacts on Annual Turnover (2009 prices)

Activity	Annual Turnover	Scenario Turnover	Estimated Annual Impact
	Rand Million.	Rand Million.	Rand Million.
Game Sales	R 33.58	R 32.24	R -1.34
Hunting – Trophy	R 24.10	R 8.68	R -15.43
Hunting - Biltong	R 17.00	R 15.46	R -1.54
Total	**R 74.68**	**R 56.38**	**R -18.30**

Source: Conningarth Economists' calculations based on information gathered

Using the above discussed approach it appears that the total impact could be as high as R18.30 million, 24.5%, on the total sector. Obviously this figure will not apply to all farmers, as some farms will not be affected at all, and others will be affected at a much higher figure. In the next table the macro-economic parameters of the impact are presented.

Table 21: Negative Impacts of the Developments in the Mokolo Catchment on the Game and Hunting Activities

Annual Surplus	Gross Domestic Product	Employment Opportunities	Household Income
	Direct	Direct	Low
R. mil.	R. mil.	Numbers	R. mil.
R -5.97	R -17.10	-218	R -1.56

Source: Conningarth Economists' calculations based on information gathered

From the table it appears that 218 direct employment opportunities could be lost and a R1.56 million annual payment to Low-income Households in the catchment. What is not included in the evaluation is the impact on further growth, which would probably only take place in the unaffected areas of the catchment.

3.2.3.5 Tourism

3.2.3.5.1 Introduction

Background

The Mokolo River catchment area offers a variety of recreational opportunities covering hunting, eco-tourism, game viewing, sport tourism, hiking, picnicking, bird watching (with some excellent bird hides) and cultural tourism experiences.

The tourism industry in the Mokolo River catchment is relatively new and is currently in a rapid growth phase. The rapid growth is resulting in significant land use changes in and around the catchment area. Traditionally the land uses in the area were agricultural (cattle) and mining (coal). Mr. Johan Erasmus[7] of the Lephalale Municipality indicated that 14 years ago, there was in the region of 120 000 head of cattle in the Lephalale Municipality area. This number has shrunk

[7] Environmental Impact Report for the proposed establishment of a new coal-fired power station in the Lephalale area, Limpopo Province, 2006.

drastically to 20 000 in 2006. This is likely to indicate a change from an agricultural-based land use to an eco-tourism and hunting-based land use[8].

The tourists to the catchment area have been grouped into the following groups:

- Business
- Leisure
- Hunting, both trophy and biltong
- Eco-tourism
- Passing through

Trophy hunters, leisure and eco-tourists make use of lodges, chalets and other "bush" accommodation, while hotels, motels and guest houses are frequented by business tourists. Lodges and chalets have the highest number of beds but relatively low occupancy and the length of stays are of shorter duration. The hotels, motels and guest houses have higher occupancy and stays of longer duration. Lodges and other "bush" accommodation are mainly occupied by hunters during the winter (the hunting season period from June to August does not apply to trophy hunters in which case special hunting licences are obtained). Eco-tourists (which include game viewing/drives, bird watching, hiking, fishing, 4x4 tracks, mountain biking, guided walks, boating/ canoeing, horseback, clay pigeon shooting, art studio) visiting for the outdoor and wildlife experience, visit throughout the year. Peak season is from March to October and during school holidays, long weekends and public holidays. Low season is from November to February. The biltong hunters, who are restricted to the hunting season (June to August) generally, stay in accommodation provided for by the farmer and such accommodation was not researched. Business tourists visit throughout the year and their visits to the area are primarily related to the existing power station (Matimba), the Medupi which is under construction and mines (Grootegeluk) for work related purposes. With the planned and anticipated developments in the Lephalale area the demand for business related accommodation will certainly increase.

Eco-tourism or photographic safaris (as opposed to hunting) is a relatively new industry in the area. While hunting lodges also offer eco-tourism opportunities, these activities are separated. To best utilise accommodation and other related facilities, safari and game farms generally cater for both eco-tourism and trophy hunters. These two activities are separated and the two groups are either accommodated very much apart or at different periods. Trophy hunters are the bigger spenders and are provided for first. Hunting appears to be the a primary income source for hunting lodges and other "bush accommodation" and they survive the summer period, when non-trophy hunting is not allowed, with eco-tourism. The hunting industry is very much the backbone of leisure tourism and the local entrepreneurs involved expect the sector to grow substantially over the years to come, especially the trophy hunting segment of the industry. The biltong hunters are difficult to track as they generally stay with the landowners in accommodation provided, bush camp or farmhouse, on a self catering basis. The accommodation is usually included in die hunting package. They also do the

[8] Environmental Impact Report for the proposed establishment of a new coal-fired power station in the Lephalale area, Limpopo Province, 2006.

slaughtering and meat preparation themselves. The people catering for this segment are very positive about the future, but it appears as if the number of hunters is not increasing.

Passing through tourism is considered to be small and was therefore not considered in this study.

3.2.3.5.2 Current Economic Parameters

Research undertaken by Dr. Hendrik Nel and Mr. Johan Erasmus (Lephalale Tourism, 2004) showed that more than 73% of all visitors to the area are leisure tourists (this includes hunting and eco-tourism). Business tourism makes up over 20% of the visitors and over 6% are holiday makers passing through the area. Furthermore it is noted that although foreign tourists only make up 31% of the tourists to the area, they contribute over 46% to the tourism income. Limpopo visitors and Lephalale residents both contribute less than 2% of the tourism income, with visitors from the rest of South Africa contributing 52% of the tourism economy, but making up 67% of the total visitors[9].

For purposes of this study the calendar year for the leisure group was divided into three periods each with its own occupancy rate, namely:

- Peak Tourist – January to March 45%.
- School holidays, weekends and public holidays - 70%.
- Rest of the year – 18%.

The number of beds was determined by using as base document the Medupi EIA scoping report, contacting the Lephalale local authority and performing an internet search. The beds available in the Lephalale urban area was allocated to business tourists, namely 590; the rest of the beds in the affected area which is located in the rural area, came to 2 535, bringing the total number of beds to 3 125. This figure must be treated with circumspection as all possible measures was taken when collecting the data to only include facilities within the Mokolo catchment, however no basic research was done to back up the figure. The total rural beds were allocated to the eco-tourism for the 90 days classified as the peak tourist period. Based on the traceable advertising of hunting farms and hunters the number of beds allocated to hunters was determined to be 736, with a 10 week, 70 day active period. During that time the beds available for eco-tourism were reduced to 1 799 beds. For the rest of the year the beds were again allotted to the full contingent of 2 535.

In the table below the number of bed nights per category sold are presented.

[9] Environmental Impact Report for the proposed establishment of a new coal-fired power station in the Lephalale area, Limpopo Province, 2006

Table 22: Estimated Bed Nights Sold in the Mokolo Catchment

	Business	Leisure - Eco-tourism			Hunters
	Business Tourists	Peak Tourist (January - March)	School Holidays, Weekends and Public Holidays	Rest of Year	Hunting Tourists
Occupancy	75%	45%	70%	18%	80%
Day	365	90	129	76	70
Number of Beds	590	2 535	1 799	2 535	736
Length of visit (days)	5.25	3.85	5.6	5.6	7
Number of tourists	30 764	26 667	29 009	6 193	5 888
Number of Bed nights Sold	161 513	102 668	162 450	34 679	41 216

Source: Conningarth Economists' calculations based on information gathered

The following daily tariffs were applied:

- R500 per day per person plus R50 per day on other spending for leisure and eco-tourists,
- R3 750 per day per trophy hunter, all inclusive,
- R400 per day per biltong hunter, all inclusive.

The estimated turnover per sector was determined, excluding hunting which is handled separately.

Table 23: Estimated Tourist Annual Turnover in the Mokolo Catchment (2090 prices)

Business	Eco-tourism			Hunters	Total
	Peak Periods	School Holidays	Rest of Year		
R million	R million	R million	R million	R million	R million
R 88.83	R 56.47	R 89.35	R 19.07	R 37.20	R 290.92

Source: Conningarth Economists' calculations based on information gathered

Total tourism spending in the Mokolo catchment amounts to R290.92 million per annum including the accommodation for hunting and accompanying tourists of which eco-tourism contributes R164.69 million and business tourists R88.83 million. It must be kept in mind that these figures are probably an under estimation, as no detailed research was undertaken although use was made of accepted econometric methods and models.

The above turnover figures were fed into the MEIM model and in the next table the macro-economic parameters are presented.

Table 24: Macro-Economic Indicators for the Tourist Activity in the Mokolo Catchment

Gross Domestic Product	Employment Opportunities	Household Income
Direct	Direct	Low
R. mil.	Numbers	R. mil.
R 163.58	3 398	R 48.96

Source: Conningarth Economists' calculations based on information gathered

From the above table it appears that the tourist facilities create 3 398 direct employment opportunities, and pay R48.96 million annually to Low-income Households. From the two above

table it is appears that game farming, hunting and the related activities on the farms have become big business.

3.2.3.5.3 Scenario Impacts

The construction of the augmentation infrastructure will have a small impact during the construction period and operational period on the tourist industry. The water pipeline crossing over both the livestock and game farms will only be affected temporarily during the construction phase of the pipeline. As the pipeline will run underground and not be fenced, it will have no effect on either the livestock or game farms during the operational phase. Access to the pipeline for inspection and maintenance will, however, impinge on the farming activities, especially hunting but not livestock.

It is however the development that will take place once the water is available that will have a dramatic impact on the farm related nature activities.

In the section about the impact of the developments on Game farming the approach to tourism has been explained and the table is repeated below.

Table 25: Estimated Negative Impacts on the Different Game Related Activities

Activity	Negative Percentage
Game Breeding and Game Sales	-4%
Eco-tourism activities	-40%
Trophy Hunting	-64%
Biltong Hunting	-9%

Source: Conningarth Economists' calculations based on information gathered

It was estimated that the farm related tourist activities can be affected by as much as a decline of 40%; this will be partially offset by an increase in business tourists, if the anticipated investments do take place. The present business tourist benchmark has been determined with Medupi already under construction; we therefore added a 15% future growth to the business sector.

Table 26: Estimated Macro-Economic Impact

Gross Domestic Product	Employment Opportunities	Household Income
Direct	Direct	Low
R. mil.	Numbers	R. mil.
R -38.67	-803	R -11.57

Source: Conningarth Economists' calculations based on information gathered

From the above table it appears that the potential exists that the immediate impact could be that the industry loses 803 employment opportunities and the annual payment to Low-income Households can be reduced to R11.57 million.

3.2.3.6 Mining and Industry

3.2.3.6.1 Current Economic Parameters

The main mining activities are centred in the Lephalale/Waterberg area where extensive and rich coal reserves are available. This is also the area where several planned and anticipated

consequential developments are to be realised. These mines produce thermal and semi-soft coking coal.

In the following table the present situation in as far coal production is concerned is presented.

Table 27: Current Coal Production in the Mokolo Catchment[10]

Type	Production (Million ton)	Value (R/ton)	Total Value (R million)	Total Water Use (Mm^3)	Total Employment Numbers
Power Station	15.3	75	1147.5		
Domestic - Metal and other Industries	1.5	240	360		
Mittal SA	2.7	262	707.4		
Export	1.1	312.5	343.8		
Total	20.6		R 2 559	9.9	2 100

3.2.3.6.2 Scenario

The coal activity will grow dramatically over the next number of years if the power stations are constructed and if the Sasol coal-to-liquid plant is constructed. The full results of these developments are presented in another paragraph; however the number of projected employment opportunities is presented below:

- Medupi related mining- 1 600[11]
- Per Power Station – 1300, in total 3 900,Mining for Sasol "Coal to Liquid" plant - 3200[12]

3.2.3.6.3 Current Economic Parameters

Economic Activities in Lephalale Local Municipality

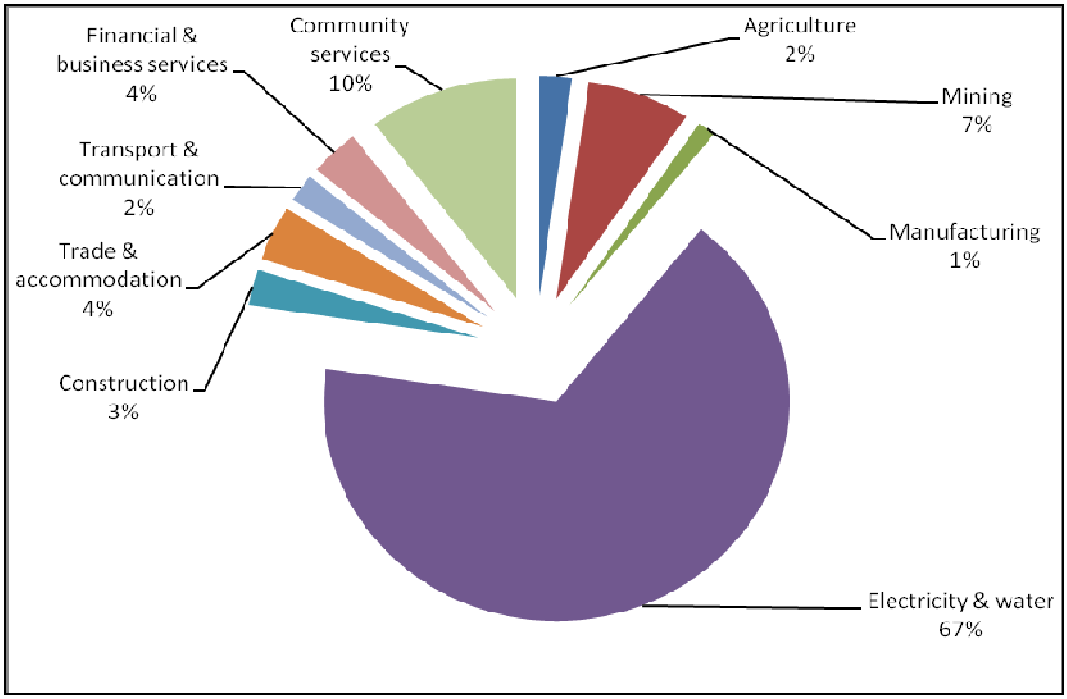
In the chart below the present economic activities are shown.

[10] Mokolo EWR Study – Water for Africa, 2010

[11] Social Impact Assessment and Skills Audit – Matimba Brownfields Extension Project by Dr Neville Bews, 2006

[12] Sasol- Verbal communication

Chart 1: Present Economic Activity in Lephalale



The Lephalale Local Municipality is mainly a mining and industrial town. Its economy is dominated by electricity generation which currently contributes approximately 67% of the local gross domestic product with the trade and accommodation, mining and services sectors at 4%, 7% and 10% respectively. Due to the possible Sasol petro-chemical development the manufacturing sector will grow significantly. However, as far as the other economic sectors (excl. electricity and Sasol) are concerned, the growth will only occur as a result of their dependency on these anchor projects, namely electricity and petro-chemicals. The more employment is created by the anchor projects, the larger the demand for trade, financial and business services will be.

The future development of the other economic sectors is discussed under the section on Macro-Economic Impact – Sectoral Impact.

Lephalale Local Municipality (LLM)

The demand for infrastructure, financial planning, governance capacity and institutionalisation of legally enabling processes are vast and deserves priority status in the impacted area. The Lephalale Local Municipality (LLM) will have to act as a facilitator and catalyst for the envisaged developments in its vicinity.

The new developments as discussed previously in the report will set in motion additional economic activity apart from the inherent growth potential of the Lephalale Local Municipal area. This study captures the development in the Lephalale Local Municipal area that will ensue over the next two decades. The total economy of Lephalale will probably quadruple (see the section on Macro-Economic Impact Assessment), and it is estimated that the current population to grow from 100 000 to over 400 000 in 2030 (see the section on Population and Socio-economic Profile). It is important to understand that the need for service delivery (water, sanitation, electricity, etc.) by the municipality will have to grow accordingly.

The extent to which the large investment envisaged can take place with the local communities living in harmony and functioning in an appropriate and efficient way will, to a large extent depend on the effectiveness of the Lephalale Local Municipality. It is important that additional priority be given the extension of the capacity of the municipality. This will be a function of the Department of Provincial and Local Government (DPLG), the Limpopo Province and Government Developmental Agencies such as the Development Bank of Southern Africa (DBSA).

The Social Accounting Matrix (SAM) for Limpopo was used as basis for simulating the economic interaction in the Lephalale Local Municipal area. For further detail refer to Appendix D.

3.2.4 Crocodile River (West) Catchment

The Crocodile River (West) impacts will be discussed in the Phase 2 version of this report under the headings as listed below.

- Irrigation.
- Dry-land Cultivation.
- Livestock.
- Game Farming, Nature Conservation and Other Related Activities.
- Tourism.
- Mining and Industry.

4 Cost Benefit Analysis

A standard Cost Benefit Analysis was applied to evaluate the appropriateness of locating power stations in the Limpopo Province (Lephalale) compared with other alternative workable choices. The analysis does not have a specific bearing on the MCWAP water supply project but is included as additional background information. The objective of the analysis is to calculate the difference in costs to develop at Lephalale relative to the alternative sites. The alternative sites are the following:

- The development of additional power stations on the Highveld where the nation's main electricity generating capacity near where existing coal mines are currently located; or
- The development of power stations near the Vaal Dam, the main water source of Gauteng.

Although there is still coal available on the Highveld, the available coal pockets are of such a nature that it is necessary for a substantial portion of the coal to be transported (by road or by rail) to any new coal-fired power stations. This will add significantly to the cost of the coal inputs.

The theoretical location of the power stations at the Vaal Dam could have the advantage of sufficient water supply, it is necessary for coal to be transported from the Lephalale coal fields. Such coal supplies will need to be transported primarily by a new, dedicated rail line at very high costs.

According to the analysis (which takes into account the total cost to provide water at Lephalale, including all visible ecological impacts), the costs to transfer the coal to the alternative sites, far outweigh the economic costs to develop these power stations at Lephalale by R 13 724 million and R 25 902 million for the Highveld and the Vaal Dam Scenarios respectively.

It is important to note that to develop at the other theoretical alternative sites will also have major negative ecological impacts.

4.1 Economic CBA for the Lephalale *versus* Highveld Location

The location at Lephalale is confirmed as cost beneficial. This is confirmed by evaluating the results of the economic CBA. The Net Present Value (NPV) reflects a significant excess of benefits over costs for the Lephalale location.

4.2 Economic CBA for the Lephalale *versus* Vaal Dam

Also, the location at Lephalale is confirmed as cost beneficial and is confirmed by evaluating the results of the economic CBA. The Net Present Value (NPV) reflects a significant excess of benefits over costs for the Lephalale location.

4.3 Regional and Local Impact of the Project

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

The macro-economic impact analysis was conducted at a provincial and local (regional) level. However, the main focus of the analysis is the Limpopo Province and to a lesser degree the Lephalale area. The impact analysis is based on the contribution that the construction of augmentation pipelines and weirs, irrigation effects and the game farming, hunting and tourism is expected to make towards the provincial and local economies in terms of the following macroeconomic aggregates:

- Gross Domestic Product (Economic Growth).
- Employment Creation.
  - *Skilled Labourers.*
  - *Semi-Skilled Labourers*.
  - *Unskilled Labourers*.
- Household Income
  - *Low Income*
  - *Medium Income*
  - *High Income*

The macro-economic impact analysis was so structured to reflect the full magnitude of activities in the period when the composite augmentation pipeline and weir project achieves full production/capacity utilization. Furthermore these macro-economic impacts will also reflect the ultimate or total outcome, i.e. through the direct, indirect and induced linkages of the construction and operational parts of the augmentation pipeline and weir project in question.

4.3.1 Water Augmentation Infrastructure Development Impacts Mokolo Catchment (Phase 1)

In the table below the emphasis was made on the final year being 2030 where the operational phase is in full swing and the construction phase is completed (the combined impact) for the construction of augmentation pipelines and weirs, irrigation effects and game farming, hunting and tourism.

Table 28: Macro-Economic Impacts over the Time Span of the Construction and Operation of the Augmentation Pipelines and the Weirs, Irrigation, Game Farming, Hunting and Tourism in the Mokolo Catchment for Limpopo Province (2009 Prices)

	Limpopo (2009 prices)			
	2009	**2015**	**2020**	**2030**
Impact on GDP (R millions)	**94**	**87**	**75**	**97**
Impact on Capital Formation (R millions)	**828**	**940**	**103**	**151**
Impact on Employment [numbers]:	**2 221**	**2 077**	**716**	**766**
Skilled impact on employment [numbers]	816	806	231	243
Semi-skilled impact on employment [numbers]	764	716	272	294
Unskilled impact on employment [numbers]	641	554	212	229
Impact on Households (R millions):	**51**	**47**	**41**	**54**
Low Income Households (R millions)	17	15	13	17
Medium Income Households (R millions)	10	9	8	10
High Income Households (R millions)	25	23	20	27

Source: Conningarth Economists' Macro Economic Impact Model, 2009

According to the above table, the total impact on GDP for Limpopo Province in 2009, is approximately R94.0 million on an annualised basis (in constant 2009 prices), of which the direct impact on GDP is estimated at R58.7 million.

The total impact on employment amounts to 2 221 employment opportunities (2009) that will be sustained on an annualised basis over the period involving the construction of augmentation pipelines and weirs, irrigation effects and the game farming, hunting and tourism effects combined. Of this number, 2 043 are associated directly with the project *per se* whether in construction or when in operation.

In the next table the impact on selected economic activities are presented for the Lephalale area, which includes the Mokolo catchment.

Table 29: Macro-Economic Impacts (2009 – 2030) on the Lephalale Area including the Mokolo Catchment Economy of all the Identified Capital Investment on the Construction and Operation of the Augmentation Pipelines and the Weirs, Irrigation Impacts, Game Farming, Hunting and Tourism (2009 prices)

	Lephalale Area including Mokolo Catchment (2009 prices)			
	2009	**2015**	**2020**	**2030**
Impact on GDP (R millions)	**62**	**56**	**46**	**59**
Impact on Employment [numbers]:	**2 051**	**1 930**	**584**	**600**
Skilled impact on employment [numbers]	617	580	176	181
Semi-skilled impact on employment [numbers]	757	712	215	221
Unskilled impact on employment [numbers]	677	237	193	198

Source: Conningarth Economists' Macro Economic Impact Model, 2009

According to the above table, on an annualised basis the total impact on the GDP of the Lephalale area in 2009, is estimated to amount to approximately R61.7 million (in constant 2009 prices). The direct part of this impact on GDP is estimated at R58.7 million. It can be seen that it decreases to a low of R46 million in 2020.

The annualised positive impact on employment amounts to 2 051 employment opportunities for 2009 that will decrease over the lifespan period for the project to 600. Of this number, 2 043 will be directly linked to the project concerned.

4.3.2 Overall Macro-Economic Impacts if all the Projects Materialise

It was requested from the client for the economic consultants to include a table providing the provincial macro-economic impact of the total development project (power stations, mines, Sasol, etc.). The table below provides a summary of the total impacts for GDP, Employment and Household Income in the year 2030. It is evident that the overall development project will contribute a total GDP amount of R115 511 million (constant 2009 prices) to the province of Limpopo. The overall project will also create and sustain 288 281 employment opportunities in the Limpopo province. The percentage of low-income households to total income households amounts to 30% and therefore demonstrates the overall development projects ability to alleviate poverty in the province of Limpopo.

Table 30: Macro-Economic Impact of the Total Development Project for Limpopo Province in the Year 2030 (2009 prices)

	Limpopo (2009 prices)
	2030
Impact on GDP (R millions)	**115 511**
Impact on Employment [numbers]:	**288 281**
Skilled impact on employment [numbers]	*86 694*
Semi-skilled impact on employment [numbers]	*117 771*
Unskilled impact on employment [numbers]	*83 816*
Impact on Households (R millions):	**64 207**
Low Income Households (R millions)	*19 423*
Medium Income Households (R millions)	*11 553*
High Income Households (R millions)	*33 231*

Source: Conningarth Economists' Macro Economic Impact Model, 2009

5 Conclusion and Mitigation

5.1 Introduction

From the above different analyses, it is obvious that overall, the water augmentation projects to supply the Lephalale area with sufficient water to satisfy the future demands are necessary. The analysis also shows that the future development of the projects will be a huge benefit to the local and regional economy. Although the positive employment impacts by far exceed the negative impacts as reflected in Chapter 3, there are certain negative impacts associated with the projects which must be addressed, these are:

- Mokolo Catchment – Waterberg District and Lephalale Local Municipality;
- Mokolo Catchment – Risk of irrigators below the Mokolo Dam; and
- Mokolo Catchment – Game farming, eco-tourism and hunting.

5.2 Mokolo Catchment

The following table gives an indication of the impacts of the different projects on the economic activities in the Mokolo Catchment.

Table 31: Impacts of the Different Projects on the Economic Activities in the Mokolo Catchment

	Activity	Intensity of Impact	Duration
Water Augmentation - Construction	Cattle Farming	Low	Temporary
	Game farming and Related Activities	Low	Temporary
	Irrigation (water reduction)	None	Temporary
	Business Tourism	Medium	Temporary
	Lephalale Local Municipality	Medium	Temporary
Water Augmentation - Operational	Cattle Farming	Low	Permanent
	Game farming and Related Activities	Low	Permanent
	Irrigation Farming (water re-allocation risk)	Medium	Permanent
	Business Tourism	Low	Permanent
	Lephalale Local Municipality	Low	Permanent

The mitigation measures are discussed in the paragraphs below.

5.2.1 Cattle Farming Mitigation

The impact of the water augmentations projects, construction and operational phases will have a very low impact on cattle farming, if properly managed. The following mitigation measures are proposed to ensure that the processes do not intrude on the farming activities:

- The determination of the final pipeline route must be in consultation with the land owners.
- During the construction it must be ensured that the landowners are fully informed of where and when project related activities are taking place on their property.
- During the operational period it must be ensured that the land owners are informed of any access required to and duration of presence on their property.
- Farmers must be compensated for any loss of game, livestock and damage to their property or expenses incurred to prevent loss or damage due to the proposed project.

The impact of the additional power stations, mining and the proposed Sasol project will not impact on cattle farming.

5.2.2 Game Farming and Related Activities

The section will comment on game farming, eco-tourism on farms and hunting activities.

The construction and operation of the water infrastructure will have a low impact on game farming and related activities if properly managed. To attain this low impact the following mitigation measures are proposed:

- The determination of the final pipeline route must be in consultation with the land owner,
- During the construction it must be ensured that the landowners are fully informed of where and when project activities are taking place or are to take place on their property.
- During the operational it must be ensured that the land owners are informed of any access required to and duration of presence of contractors on their property.
- On farms where hunting takes place safety precautions must be observed and implemented. Liaison with landowners or the responsible person on the farm before and after visiting the farm is essential.
- Arrangements must be made with farmers to access farms with dangerous game both during the construction and operational (maintenance) periods.
- During the construction and operational (maintenance) phases ensure that contractors strictly adhere to the access and other rules imposed by farmers.
- Farmers must be compensated for any loss of game, livestock and damage to their property or expenses incurred to prevent loss or damage due to the proposed project.

The impact of the additional power stations, mining and the proposed Sasol project will impact on game farming. To minimise the impact on the different activities the following mitigation measures are proposed:

- Inform farmers timeously of projects to allow them to make alternative arrangements.
- In the case of power lines, the determination of the final route it must aimed at minimising the visual and social impact and to avoid impacting on accommodation facilities as far as possible. This also applies to rural subsistence communities.

5.2.3 Irrigation Farming

The construction phase will not impact on the water supply to the irrigation farmers downstream of the Mokolo Dam if, however, during the operational phase the augmentation out of the Crocodile West River is not in place, the farmers could lose water to the supply to Medupi. It could either be permanent or for a year or two. To minimise the impact on the irrigation activities the following mitigation measures are proposed:

- Inform the farmers regarding the possible risk.
- Negotiate the exact pipeline route with the farmers concerned to reduce the impact on individual farms.
- Prioritise areas next to roads and along farm boundaries for the pipeline in order to minimise the pipeline possibly crossing cultivated lands or other sensitive areas.
- During the construction and operational (maintenance) phases ensure that contractors strictly adhere to the access and other rules imposed by farmers.
- Farmers must be compensated for any loss of crop or game/livestock (if present on the farms) and damage to their property or expenses incurred to prevent loss or damage due to the proposed project.

- If temporary, an annual lease arrangement for the water must be paid.
- If permanent, the water must be bought.
- As at least 1 650 workers and their families will be involved, the necessary programmes be put in place to resettle those that become redundant on the farms and also to introduce social programs to assist the families.

5.2.4 Business Tourism

Both the water augmentation and future developments will be beneficial for the business tourist activities, the impact will be high and permanent. As this is a private sector activity no mitigation measures are proposed.

5.2.5 Lephalale Local Municipality

If the proposed projects materialise there is no doubt that the town and surrounding area will be exposed to a major population growth, which would put immense strain on the local authority to keep up with the changes and service delivery needs. To render support to the local authority the following mitigation measures are proposed as assistance to the local authority:

- The Lephalale Local Municipality will have to act as a facilitator and catalyst for the envisaged developments in its vicinity, therefore the relevant Limpopo provincial departments must timeously put structures in place to assist with planning.
- The Development Bank of Southern Africa has created a local authority advisory and training unit and it is recommended that the bank accept responsibility for the training of staff. It will therefore be necessary that the Development Bank of Southern Africa be part of the initial planning process.
- Eskom, Sasol and the mining companies must be sensitised to the social support role.

5.2.6 Macro-Economic Impacts

The Macro-economic impacts (2009 – 2030) on the Lephalale area, including the Mokolo catchment economy, of all identified capital investment on the construction and operation of the augmentation pipelines and the weirs, irrigation, game farming, hunting and tourism are positive impacts in terms of GDP and employment opportunities. See Table 29 in Chapter 4.

6 Appendix A: Socio-Economic Profile

6.1 District and Local Municipalities

6.1.1 Waterberg District Municipality

Aspect	Category	Number	%
Population	2001	614 142	
	2004	624 145	
	2006	630 904	
	2010	644 642	
	Annual % growth	0.54%	
Citizenship	South Africa	602 134	99%
	SADC Countries	5 246	1%
	Other	664	0%
Annual household income	No income	37 250	22%
	R1 - R4 800	20 537	12%
	R4 801 - R 9 600	38 684	23%
	R9 601 - R 19 200	27 241	16%
	R19 201 - R 38 400	20 986	12%
	R38 401 - R 76 800	12 557	7%
	R76 801 - R153 600	6 964	4%
	R153 601-R307 200	2 569	2%
	R307 201-R614 400	656	0%
	R614 401-R1 228 800	270	0%
	R1 228 801-R2 457 600	239	0%
	R2 457 601 , more	83	0%
	Not Applicable	158	0%
Employment status	Employed	140 374	38%
	Unemployed	62 622	17%
	Not Economically Active	165 480	45%
Work type	Paid employee	129 026	21%
	Paid family worker	1 660	0%
	Self-employed	8 844	1%
	Employer	2 599	0%

Aspect	Category	Number	%
	Unpaid worker	466	0%
	Not applicable	471 539	77%
Industry	Agric relate work	34 653	6%
	Mining, Quarrying	13 115	2%
	Manufacturing	8 394	1%
	Electricity/gas/water	1 228	0%
	Construction	7 040	1%
	Wholesale/Retail	16 971	3%
	Transport/ Communication	3 339	1%
	Business Services	5 403	1%
	Community Services	31 070	5%
	Private Household	0	0%
	Undetermined	471 539	80%
Spatial data	Area (square km)	49 518.82	
		Bottom of Form	
	Density	13.02	

6.1.2 Lephalale Municipality

Aspect	Categories	Number	%
Population	2001	96 104	
	2004	97 640	
	2006	98 678	
	2010	100 787	
	Annual % growth	0.53%	
Citizenship	South Africa	94 337	98%
	SADC Countries	1 691	2%
Annual household income	No income	5 081	18%
	R1 - R4 800	5 977	21%
	R4 801 - R 9 600	6 945	25%
	R9 601 - R 19 200	3 721	13%
	R19 201 - R 38 400	2 592	9%
	R38 401 - R 76 800	2 101	7%
	R76 801 - R153 600	1 136	4%
	R153601-R307200	478	2%
	R307201-R614400	126	0%
	R614401-R1228800	52	0%
	R1228801-R2457600	45	0%
	R2 457 601 , more	17	0%
	Not Applicable	30	0%
Employment status	Employed	28 673	49%
	Unemployed	5 273	9%
	Not Economically Active	25 039	42%
Work type	Paid employee	26 021	44%
	Paid family worker	724	1%
	Self-employed	1 239	2%

Aspect	Categories	Number	%
	Employer	579	1%
	Unpaid worker	110	0%
	Not applicable	30 314	51%
Industry	Agric relate work	9 488	33%
	Mining, Quarrying	1 724	6%
	Manufacturing	1 180	4%
	Electricity/gas/water	735	3%
	Construction	1 015	4%
	Wholesale/Retail	2 367	8%
	Transport/Communication	613	2%
	Business Services	906	3%
	Community Services	3 252	11%
	Private Household	5 713	20%
	Undetermined	1 677	6%
Spatial data	Area (square km)	19 601.41	
	Density	5.14	

6.1.3 Thabazimbi Local Municipality

Aspect	Categories	Number	%
Population	2001	63 919	
	2004	65 076	
	2006	65 860	
	2010	67 455	
	Annual % growth	0.60%	
Citizenship	South Africa	61 462	96%
	SADC Countries	2 401	4%
Annual household income	No income	3 529	14%
	R1 - R4 800	2 969	12%
	R4 801 - R 9 600	3 536	14%
	R9 601 - R 19 200	4 226	17%
	R19 201 - R 38 400	5 800	23%
	R38 401 - R 76 800	2 695	11%
	R76 801 - R153 600	1 464	6%
	R153 601-R307 200	535	2%
	R307 201-R614 400	119	0%
	R614 401-R1 228 800	40	0%
	R122 8801-R2 457 600	44	0%
	R2 457 601 , more	14	0%
	Not Applicable	19	0%
Employment status	Employed	26 248	57%
	Unemployed	7 046	15%
	Not Economically Active	12 617	27%
Work type	Paid employee	25 085	55%
	Paid family worker	77	0%
	Self-employed	877	2%

Aspect	Categories	Number	%
	Employer	152	0%
	Unpaid worker	58	0%
	Not applicable	19 664	43%
Industry	Agric relate work	5 691	22%
	Mining, Quarrying	9 531	36%
	Manufacturing	1 332	5%
	Electricity/gas/water	79	0%
	Construction	1 051	4%
	Wholesale/Retail	1 496	6%
	Transport / Communication	362	1%
	Business Services	617	2%
	Community Services	1 784	7%
	Private Household	3 001	11%
	Undetermined	1 305	5%
Spatial data	Area (square km)	9 862.59	
	Density	6.84	

6.2 Targeted Geographic Areas

6.2.1 Seleka Tribal Areas (North of Lephalale)

Aspect	Category	Number	%
Population	2001	26 906	
	2004	27 336	
	2006	27 627	
	2010	28 217	
	Annual % growth	0.53%	
Citizenship	South Africa	26 634	99%
	SADC Countries	269	1%
Annual household income	No income	1 791	24%
	R1 - R4 800	1 782	24%
	R4 801 - R 9 600	2012	27%
	R9 601 - R 19 200	886	12%
	R19 201 - R 38 400	428	6%
	R38 401 - R 76 800	334	4%
	R76 801 - R153 600	115	2%
	R153601-R307200	77	1%
	R307201-R614400	33	0%
	R614401-R1228800	20	0%
	R1228801-R2457600	8	0%
	R2 457 601 , more	5	0%
	Not Applicable	6	0%
Employment status	Employed	7 531	48%
	Unemployed	1 396	9%
	Not Economically Active	6 697	43%
Work type	Paid employee	7 000	45%
	Paid family worker	44	0%

Aspect	Category	Number	%
	Self-employed	271	2%
	Employer	163	1%
	Unpaid worker	54	0%
	Not applicable	8093	52%
Industry	Agric relate work	3 431	46%
	Mining, Quarrying	78	1%
	Manufacturing	359	5%
	Electricity, gas, water	26	0%
	Construction	246	3%
	Wholesale, Retail	637	8%
	Transport, Communication	74	1%
	Business Services	344	5%
	Community Services	541	7%
	Private Household	1 486	20%
	Undetermined	309	4%
Spatial data	Area (square km)	6 469.01	
	Density	4.36	

6.2.2 Lephalale Town

Aspect	Category	Number	%
Population	2001	1 838	
	2004	1 867	
	2006	1 887	
	2010	1 928	
	Annual % growth	0.53%	
Citizenship	South Africa	1 832	100%
	SADC Countries	4	0%
Annual household income	No income	76	8%
	R1 - R4 800	77	8%
	R4 801 - R 9 600	115	13%
	R9 601 - R 19 200	71	8%
	R19 201 - R 38 400	158	17%
	R38 401 - R 76 800	218	24%
	R76 801 - R153 600	144	16%
	R153601-R307200	36	4%
	R307201-R614400	5	1%
	R614401-R1228800	1	0%
	R1228801-R2457600	2	0%
	R2 457 601 , more	0	0%
	Not Applicable	3	0%
Employment status	Employed	1 048	71%
	Unemployed	74	5%
	Not Economically Active	356	24%
Work type	Paid employee	965	65%
	Paid family worker	16	1%
	Self-employed	48	3%

Aspect	Category	Number	%
	Employer	16	1%
	Unpaid worker	0	0%
	Not applicable	430	29%
Industry	Agric relate work	6	1%
	Mining, Quarrying	72	7%
	Manufacturing	68	6%
	Electricity, gas, water	236	23%
	Construction	63	6%
	Wholesale, Retail	95	9%
	Transport, Communication	22	2%
	Business Services	83	8%
	Community Services	182	17%
	Private Household	103	10%
	Undetermined	118	11%
Spatial data	Area (square km)	16.016	
	Density	120.35	

6.2.3 Thabazimbi Town

Aspect	Category	Number	%
Population	2001	20 678	
	2004	21 052	
	2006	21 306	
	2010	21 822	
	Annual % growth	0.60%	
Citizenship	South Africa	20 527	99%
	SADC Countries	127	1%
Annual household income	No income	466	7%
	R1 - R4 800	1 356	20%
	R4 801 - R 9 600	1 505	23%
	R9 601 - R 19 200	1 079	16%
	R19 201 - R 38 400	784	12%
	R38 401 - R 76 800	664	10%
	R76 801 - R153 600	506	8%
	R153601-R307200	202	3%
	R307201-R614400	44	1%
	R614401-R1228800	24	0%
	R1228801-R2457600	17	0%
	R2 457 601 , more	3	0%
	Not Applicable	9	0%
Employment status	Employed	8 835	62%
	Unemployed	1 033	7%
	Not Economically Active	4 321	30%
Work type	Paid employee	8 238	58%
	Paid family worker	37	0%
	Self-employed	435	3%

Aspect	Category	Number	%
	Employer	94	1%
	Unpaid worker	37	0%
	Not applicable	5 354	38%
Industry	Agric relate work	3 574	40%
	Mining, Quarrying	964	11%
	Manufacturing	226	3%
	Electricity, gas, water	25	0%
	Construction	392	4%
	Wholesale, Retail	447	5%
	Transport, Communication	116	1%
	Business Services	188	2%
	Community Services	780	9%
	Private Households	1 585	18%
	Undetermined	540	6%
Spatial data	Area (square km)	11.946	
	Density	1 826.70	

6.2.4 Brits Town, Bapong and Garankuwa

Aspect	Category	Number	%
Population	2001	58 399	
	2004	59 439	
	2006	60 142	
	2010	64 163	
	Annual % growth	0.59%	
Citizenship	South Africa	57 886	99%
	SADC Countries	458	1%
Annual household income	No income	3 216	21%
	R1 - R4 800	612	4%
	R4 801 - R 9 600	2 499	17%
	R9 601 - R 19 200	2 791	19%
	R19 201 - R 38 400	2 648	18%
	R38 401 - R 76 800	1 547	10%
	R76 801 - R153 600	960	6%
	R153601-R307200	479	3%
	R307201-R614400	156	1%
	R614401-R1228800	28	0%
	R1228801-R2457600	34	0%
	R2 457 601 , more	8	0%
	Not Applicable	10	0%
Employment status	Employed	10 358	43%
	Unemployed	13 815	57%
	Not Economically Active	0	0%
Work type	Paid employee	224	1%
	Paid family worker	1 079	4%
	Self-employed	107	0%

Aspect	Category	Number	%
	Employer	29	0%
	Unpaid worker	24 173	94%
	Not applicable	0	0%
Industry	Agric relate work	930	6%
	Mining, Quarrying	1 163	8%
	Manufacturing	3137	21%
	Electricity, gas, water	116	1%
	Construction	888	6%
	Wholesale, Retail	2 469	16%
	Transport, Communication	621	4%
	Business Services	1 006	7%
	Community Services	2 566	17%
	Private Households	1 203	8%
	Undetermined	966	6%
Spatial data	Area (square km)	143.31	
	Density	447.71	

Source: Naledi Development Restructured