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ENVIRONMENTAL IMPACT STATEMENT

BOTSWANA TRANSMISSION LINES FOR THE MMAMABULA ENERGY PROJECT

BOTSWANA POWER CORPORATION

MARCH 2007

DRAFT FOR COMMENT BY STAKEHOLDERS AND AUTHORITIES

VOLUME 1 OF 3: TRANSMISSION LINE EIS

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Executive Summary

Digby Wells & Associates (DWA) has been appointed by CIC Energy Corp (CIC) as independent environmental consultants to investigate the environmental and social aspects of a proposed transmission line project in Botswana.

Meepong Resources (Pty) Ltd (Meepong Resources) and Meepong Energy (Pty) Ltd (Meepong Energy) are Botswana based companies wholly owned by CIC Energy Corp (CIC). Meepong Resources has the rights to explore for coal resources in the Mmamabula coal field, situated in the Central District of Botswana, adjacent in the vicinity of the villages of Mmaphashalala and Dovedale. Meepong Energy is the Environmental Impact Statement (EIS) applicant for the power plant while Meepong Resources will be applying for the coal mine. This proposed combined project is called the Mmamabula Energy Project (MEP) and, if approved, would include the development of coal mines; the construction of a power plant and the development of transmission lines to carry power to various areas of Botswana and South Africa. Although the funding for the transmission lines will be included in the MEP, ownership will ultimately rest with the Botswana Power Corporation (BPC). BPC is thus the EIS applicant for the proposed transmission lines.

This report is an EIS, which will identify the positive and negative environmental impacts and feasible alternatives. In addition, it will provide management plans to mitigate predicted adverse impacts, manage residual effects as well as deal with relocation and compensation frameworks. These plans will be implemented during construction, project operation and closure.

Legal Requirements

Botswana has seen significant changes to the environmental legislative and administrative frameworks within the last few years culminating in the promulgation of the Environmental Impact Assessment Act, Act 6 of 2005, and the creation of the Ministry of Environment, Wildlife and Tourism (MEWT) with a mandate to coordinate environmental conservation and protection. The Department of Environmental Affairs (DEA) is mandated to implement the Environmental Impact Assessment Act which requires that an Environmental Impact Assessment (EIA) be completed for the project area and an Environmental Impact Statement (EIS) subsequently approved. In addition to the DEA, several additional permits and licenses will be required from several Botswana Government Departments for the successful implementation of the MEP.

Project Description

A separate EIS will be submitted for the proposed Mmamabula mine and power plant as well as for the MEP ancillary activities such as the potential wellfield project. This EIS has been compiled for the proposed transmission line project only.

The proposed transmission line project includes:

- A 400kV line running north past Mahalapye to the proposed Morupule B power station outside Palapye. From there it will go on to the Phokoje substation, outside Selebi Phikwe.

- In addition there will be four 400kV lines running east, from the Mmamabula power plant to the Limpopo River and the South African border.

- Although this report only covers the lines within Botswana, these lines will continue in South Africa to the proposed Delta substation.

- A corridor for a 400kV line to the proposed Mosaditshweni substation, north of Mochudi was also included in the assessment, although the development of this line will not form a component of the MEP.

- The EIA also evaluated a proposed 66kV line from Phokoje to the mine and power plant area, which will be used to supply power for construction and commissioning.

Project Alternatives

Project alternatives are different means of meeting the general purpose and need of a proposed activity. Alternatives may include process or technology alternatives, location or site alternatives, activity alternatives, temporal alternatives or the no-go alternative.

In order to transmit power from the proposed Mmamabula Power Plant, transmission lines are the only available technology and, in this regard, there are no alternatives.

A number of route alternatives were, however, considered in this study. Two alternatives were provided for the lines between the proposed Mmamabula Power Plant and the proposed Morupule B as well as between the proposed Mmamabula Power Plant and the proposed Mosaditshweni substation. As the 66kV lines will share corridors with the 400kV lines, similar route alternatives

will apply. Four alternative corridors, with an additional fifth Limpopo River crossing point, for the lines to South Africa were assessed.

Fewer impacts are anticipated for the route alternative running adjacent to the existing 220kV lines between Gaborone and Selebi Phikwe and this is recommended as the preferred route alignment for this section of the transmission lines. As the environmental impact assessment (EIA) for the South African section of the transmission lines is in an early stage, the final route alignment for these lines has not been identified. Although a number of aspects will have to be taken into account in deciding on the preferred alternative, there is no fatal flaw for any of the alternatives within Botswana and all the options will remain a possibility until the South African EIA is complete.

Alternative line voltages are also another variation that was considered for the project but increasing the line voltage will not affect the number of lines as this has been determined by risk of failure rather than carrying capacity.

Alternative land uses for the project area have been identified as housing, livestock grazing, various crops and tourism. Although the aesthetics of the area will be affected by the transmission lines, which may impact on tourism, all these land uses can continue relatively undisturbed once the lines have been strung.

The no project option would mean the Mmamabula Power Plant would not be constructed and therefore this alternative can only be considered in conjunction with the MEP no project alternative. If this occurred there would be none of the negative impacts associated with the project but there would also be no benefit to the Botswana economy, which would be substantial.

<u>Project Benefits & Motivation</u>

Although a separate EIS has been compiled for the transmission line component of the MEP, these lines have a direct co-dependence with the development of the Mmamabula Power Plant and the motivation for them cannot, therefore, be considered in isolation.

Energy plays a pivotal role in economic growth and improving livelihood of people. In the near future it is expected that there will be more electricity needed by people living in Southern Africa than can be supplied by existing power plants. The development of the MEP would therefore provide a new and important source of power supply for Botswana and South Africa.

The MEP will benefit the local, regional and national Botswana economy in terms of job creation, economic growth, social development, skills development and the provision of infrastructure and services. The MEP and associated activities will provide a boost to the district economy through

the establishment of a range of businesses, services, public transport and improved access. Employment opportunities will be created with an additional benefit of community upliftment. The resulting economic multiplier effect will ensure that new businesses are created and the wage economy in the area is substantially enhanced.

Additionally, the MEP will contribute towards skills development and technology transfer, while the project would greatly benefit the Southern African Development Community (SADC) through addressing some of the region's power needs. The energy demand in the Southern Africa region is expected to exceed the available supply by 2007.

Public Participation Process

A Public Participation Process (PPP) has been followed for the MEP. The process has been incorporated into a Public Consultation and Disclosure Plan (PCDP) which includes the findings of the authorities and public participatory meetings held at the national and district levels as well as meetings in the villages along the proposed transmission line routes.

The PPP is not aimed at avoiding conflict but rather at facilitating a process in which people feel heard and included in decision-making and project design and where satisfactory outcomes are identified. Although this process has been initiated during the EIA phase of the project, it will continue through construction and operation.

Environmental Status

The baseline environmental aspects that were studied included climate, topography, soil, surface and groundwater, air quality, noise, visual assessment, fauna and flora, archaeology, social aspects and economics.

Climate

The climate of the region, through which the proposed transmission line will pass, is semi-arid. Though it is hot and dry for much of the year, there is a rainy season, which runs through the summer months. Rainfall tends to be erratic, unpredictable and highly regional. Showers are often followed by strong sunshine so that large volumes of rainfall do not penetrate the ground but are lost to evaporation and transpiration. The prevailing wind direction of the region is northeast. On average, the temperature ranges between 2.65°C in winter and up to 41.35°C in summer. Rainfall occurs between the months of October and March, with the dry season commencing in mid April continuing until September. The annual average rainfall recorded for the study area is 445 mm. The annual total evaporation is observed to be in the region of ~2 520 mm.

Topography

Apart from the Tswapong and Maifala Hills, the study area is dominated by a low relief plain and featureless veld. There are a number of perennial rivers draining the area that will have to be spanned by the transmission lines. These are the Bonwapitse, Limpopo, Ramatanka, Mhalatswe, Thangwane, Mahunwane, Dikabeya and Mmaitsokwane Rivers.

Soil

The major soil groups that will be crossed by the proposed transmission routes are mostly Arenosols and Luvisols, with small areas of Lixisols. They are mostly found on fine-grained and coarse-grained sedimentary rocks e.g. sandstone. Luvisols have an accumulation of clay (15-25%) and a higher fertility, while Arenosols are coarse, sandy soils with weak structure and low fertility. In general the soils are sandy with a low clay content (<10%); this results in high water infiltration rates, low water holding capacity and fairly poor fertility. Lixisols are highly weathered and strongly leached soils and also have a zone of clay accumulation which may occur at some depth below the soil surface.

Land Capability and Land Use

Soils are mostly sandy, with poor structure and are extremely low in all essential nutrients especially phosphate. These soils are thus seldom farmed on a large scale, mainly due to the high cost of fertilization and low rainfall. The entire study area is classified as being veld or grazing land for purposes of its “pre-project” land capability. The land in the study area is used for grazing cattle, goats and sheep, with small areas of subsistence agriculture practised along the proposed routes. There is also a growing amount of focus on tourism within the Tuli block over which the proposed lines will cross.

Surface Water

There are eight rivers that will have to be spanned by the transmission lines. These all experience a zero flow during dry weather conditions and most only flow temporarily after large storms. Flood lines and volumes have been calculated and are presented in the report. A unique feature of this project is its transboundary nature i.e. it involves crossing the Limpopo River, which is the national border between Botswana and South Africa. The Limpopo River catchment is of interest to various government departments in the countries that border the river, namely Botswana, South Africa, Mozambique and Zimbabwe.

The surface water quality in the area is unaffected by industrial activity and care must be taken to control all dirty surface water runoff generated by the proposed project and minimise the impact

on surface water quality. Samples taken in standing pools showed the surface water to be slightly saline but, due to low rainfall during the 2006/2007 wet season, no samples could be taken in the rivers under flow conditions.

Groundwater

The sand layer associated with most of the study area has a high infiltration rate and a low storage capacity but can be considered an aquifer with sufficient water supply throughout the year. Hand dug wells along the riverbeds indicate that this aquifer is a good source of water supply for the local cattle farmers. The aquifer potential of the basalts in the study area has been described by Cheney (1981) and it was concluded that the basalts give a consistent yield of potable water within the fractured zone. The sandstones along the proposed routes are porous, but secondary permeability is required to produce high yielding boreholes. Cheney (1981) found hydrological continuity between the basalts and the underlying Ntane (termed cave sandstone) in the Dibete area. The block faulting of the sandstones allow the transmission of water across them where the Ntane sandstones are juxtaposed against one another, otherwise they act as boundaries to groundwater flow (Geotechnical Consultants, 1999).

This contact between the dolerite dyke and the Lower Karoo formation being intruded is also a source of groundwater, depending on the age of the dolerite and the amount of weathering that has taken place. The faults are another source of groundwater as these structures open spaces between the formation to allow water to be collected and stored. One such fault that is considered to have a very high yield in the area of interest is the Zoetfontein Fault.

Air Quality

Existing sources of emissions include industrial sources and power generation; mining operations in the region; vehicle tailpipe emissions; household fuel combustion; agricultural activities; biomass burning and fugitive dust sources. Emissions arising from two operational coal-fired power stations fall within the region of concern, one located near Lephalale in South Africa (~100 km to the east) and one near Palapye in Botswana (~ 111 km north-northeast).

Biomass burning; crop-residue burning and general wild fires represent significant sources of combustion related emissions associated with agricultural areas. Fugitive dust emissions may occur as a result of vehicle entrained dust from local paved and unpaved roads, and wind erosion from open areas.

Noise

The topography of the area of the proposed development is very flat, i.e. there is little screening against the propagation of noise from the source to the receiver. The vegetation is, however that of densely grown bush and trees and the ground conditions are to a large degree very sandy. These conditions provide excess attenuation of noise sources as sound is absorbed as the noise propagates across the ground.

The general description of the ambient noise climate, in the area, that will be affected by the proposed transmission lines is rural. Ambient levels in this rural environment are therefore low, and ranged from LAeq values of between 40.1 dB(A) and 51.4 dB(A) in the day to between 28.8 dB(A) and 42.9 dB(A) at night. The more urban areas along the route will have higher ambient noise levels, above which the noise from the transmission lines will have little impact.

Flora and Fauna

The typical vegetation in this region is savanna, containing a tree and shrub layer as well as a grass layer. Due to the extensive grazing by livestock in some areas along the proposed routes, the relationship between these two layers has been unbalanced, resulting in the tree and shrub layer becoming dominant over the grass layer. This then allows the tree and shrub layer to continually out-compete the grass layer, resulting in a dense tree and shrub layer and limited grass cover. The vegetation is in differing stages of succession, and this is reflected by the species that were found. The herbaceous component of the sampled area consisted mostly of pioneer or sub-climax species. These were mostly increaser 2 species, which are grasses that are typically associated with overgrazed veld. The tree component encountered, varied between different degrees of bush encroachment to proper Savanna, depending on the proximity to human settlements. *Acacia tortillas*, *Dichrostachys cinerea*, *Grewia flava*, were the most common species found.

Areas of potential significance are those where the transmission lines cross the rivers and streams. All the rivers and streams in this region are non-perennial. The vegetation supported by riparian environments differs from the surrounding vegetation. This is due to the increased availability of a water supply and different soil forms. Larger trees tend to be found in these zones. These zones are important as they provide habitat for animal species and generally support abundant bird life.

Due to anthropogenic pressure, there is very little wildlife occurring along most of the proposed routes. The exceptions to this are the relatively healthy birdlife as well as the higher game counts in the privately owned Tuli block area, where smaller mammals as well as species such as impala, wildebeest, kudu, zebra and warthog are abundant.

Archaeological and Cultural

There are a number of archaeological sites located along the various transmission line routes. The located sites are representative of all the broad archaeological periods, namely the Stone Age, Iron Age and Historical period. The first Iron Age communities arrived in the central Limpopo valley during the Early Iron Age, around 500AD. These communities were predecessors of larger Iron Age farming communities who settled in the Limpopo River valley between AD 800 and AD 1400 (Mitchell 2002). At approximately 700 AD, a group of communities often associated with gold mining, new settlement layouts and cattle ranching established settlements in east central Botswana. Their ceramic tradition has since been named the Toutswe tradition (Denbow 1984).

The majority of documented archaeological and cultural sites are concentrated towards the north eastern border of Botswana, where the country shares rich archaeological legacies with South Africa and Zimbabwe in the region of the World Heritage Site, Mapungubwe. This stage was succeeded by the rise of centralized kingdoms, as exemplified by the Zimbabwe and successor states in the north and the Tswana merafhe essentially in the south. The proto and historic period sees the penetration of Europeans into the interior. Although the Project area is not located in close proximity to the Mapungubwe and K2 sites or Great Zimbabwe, the definite cultural association of the proposed development area with the renaissance of southern African civilization confirms the importance of the development area in furthering our understanding of this complex period of our past.

Socio-Economic

With a GDP of P48.6 billion in 2005 (about US$ 7.6 billion), Botswana's economy is viewed as one of the strongest in Africa, bolstered mainly by revenues from mining, particularly diamond mining. Income per head has reached US$8,700 on a purchasing power parity basis, making the country a middle income nation and one of the wealthiest in per capita terms in Africa (GDP on a purchasing power parity basis is over four times the sub-Saharan Africa average). Over the past three decades, Botswana's economy has recorded impressive growth rates. The economy grew at an annual average growth rate of 8.8% over this time, culminating in a real growth rate of 8.3% from 2003/04 to 2004/05. The investment in the MEP is likely to contribute to the sustained growth of the economy in future

The study area is predominantly rural so most of the residents are engaged in both arable and livestock agriculture. Most arable operations are at subsistence level, while cattle are farmed on a more commercial basis. In addition to agriculture there are commercial operations such as butcheries, shops, bars, bottle stores, wholesalers (existing in major villages), as well as hawkers and vendors. The idea of community based wildlife management areas has also gained momentum. Currently, the Nata Sanctuary and the Khama Rhino Sanctuary are in operation. Research is being conducted to establish viability of similar activities along the Tswapong Hills.

A survey was undertaken by ERM and BIDPA in November 2006, focussing on businesses along the transmission lines. The survey included Mahalapye, Palapye, Serowe, Selebi-Phikwe and Mookane in the Central District, as well as Gaborone. The survey found that most businesses are small-scale and not well established. There is an extremely limited industrial and business base in the Central District. Almost 60 percent of businesses surveyed are in the wholesale and retail sector, with the majority of products and services sourced from South Africa or other countries and distributed within Botswana. Only a third of the businesses surveyed have any experience in dealing with mining, engineering or energy companies.

In terms of weaknesses and constraints, competition from larger companies (41%) and availability of finance (23%) are cited as the major constraints of doing business in the Central District according to surveyed companies. Although goods and services produced by these businesses are mainly for domestic use and not for export, the bulk of the raw materials are imported from South Africa. These businesses are faced with high transaction costs for importing inputs, which limit their profitability and their capacity to meet the demand that would be generated by the transmission line project.

Environmental Impacts & Issues

It is anticipated that the majority of the environmental impacts associated with the transmission lines will occur during the construction phase. These will include vegetation clearing and cutting, movement of vehicles, increased presence and activity of construction personnel as well as the establishment of servitudes and access roads. Associated with the increase in vehicle and people activity there will also potentially be an impact of dust as well as pressure on the fauna, both domestic and wild, along the proposed corridors. Although some of these impacts will be significant, they will all be short term or temporary and are relatively straightforward to manage and mitigate during or after construction.

There should be fewer impacts resulting from the operation of the lines, however, due to the long term nature of such a development, the significance of these impacts will potentially be greater. Although only affecting a small section of the total distance covered by the transmission lines, one of the major impacts will be the visual impact on the tourism potential of the area. Following farm boundaries, rather than dissecting farms is recommended as a means to lessen this impact as well as mitigate the effect of dividing farms. Concern from both communal and private pastoralists is the loss of grazing land, however, apart from a relatively narrow servitude, there should be no permanent loss of grazing or browsing and this impact is not, therefore, considered significant. One of the more significant impacts recorded on existing transmission lines is bird fatalities. The large clearance on 400kV lines means that electrocution is not an issue in this regard. Collisions are, however, responsible for a large number of avifauna fatalities. A fair amount of research has been conducted on reducing this impact and several mitigatory mechanisms have been developed. These are detailed in the respective specialist report and will

need to be implemented on areas of high bird movement such as near rivers, wetlands, roosting sites and open lands. Another concern often raised in relation to transmission lines is the health impact of electromagnetic fields (EMF). No experimental evidence exists to substantiate this impact, although anecdotal evidence may suggest otherwise. In order to err on the side of caution, safety limits for both occupational and environmental exposure have been established by the International Commission for Non-Ionising Radiation Protection (ICNIRP) and will be adhered to.

Environmental Management Plans

There are a number of management and policy responses that may be implemented to help mitigate negative impacts and maximise benefits, thus minimising negative impacts on the economy and stakeholders, maximising positive impacts, decreasing risks to the transmission line project and maximising opportunities for the MEP to add to their triple bottom line (ERM & DWA, 2006).

The EMP serves as a framework for implementing the mitigation measures during each phase of the project. A number of plans have been developed for the EMP. These plans will serve as a legally binding management plan for the project and each plan will be further developed and detailed prior to the project commencing.

As the majority of impacts will be associated with the construction phase a management plan for this phase has been outlined in the EIS, however, a final design profile will only be available once the necessary environmental approvals have been obtained. When this information becomes available, a profile specific EMP will be required before construction commences. This should be to a level of detail that identifies and provides management recommendations for specific sensitive sites such as graves, river crossings habitats and for red data species.

Project Timing and Implementation

Construction of the transmission lines should begin in 2008, with the final MEP commissioning anticipated for mid 2011. Construction will begin on the 66kV lines as these will be required for construction of the mine and power plant as well as commissioning. The 400kV lines will, however, have to be complete in order to transmit power generated by the Mmamabula Power Plant.

Although the planned life of the coal mine is 50 years, the transmission lines may well remain in use as a component of the regional power grid after closure of the mine.

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List of Abbreviations Used

ABET	Adult Basic Education and Training
AIA	Archaeological Impact Assessment
AIDS	Acquired Immune Deficiency Syndrome
ARV	Anti-Retroviral
BFS	Bankable Feasibility Study
BOS	Botswana Bureau of Standards
BPC	Botswana Power Corporation
CIC	CIC Energy Corp
CKGR	Central Kalahari Game Reserve
DDA	Department of District Administration
DEA	Department of Environmental Affairs
DGS	Department of Geological Survey
DL	Department of Lands
DLGD	Department of Local Government and Development
DLSS	Department of Labour and Social Security
DM	Department of Mines
DNMMAG	Department of National Museums, Monuments and Art Gallery
DoM	Director of Mines
DR	Department of Roads
DRTS	Department of Road Transport and Safety
DSS	Department of Social Services
DTA	Department of Tribal Administration
DWA	Department of Water Affairs
DWMPC	Department of Waste Management and Pollution Control
EAD	Energy Affairs Division
EHS	Environmental, Health and Safety
EIA	Environmental Impact Assessment
ESIA	Environmental and Social Impact Assessment
EIS	Environmental Impact Statement
EMP	Environmental Management Programme
EPFI	Equator Principles Financial Institution
ERM	Environmental Resources Management
GHG	Greenhouse Gas
HIV	Human Immune Deficiency Virus

HAZOP	Hazard and Operability Study
IAP	Interested and Affected Party
IFC	International Finance Corporation
LED	Local Economic Development
MEP	Mmamabula Energy Project
MEWT	Ministry of Wildlife and Tourism
NACA	National AIDS Coordinating Agency
NCS	National Conservation Strategy
NCSAB	National Conservation Strategy Advisory Board
NCSCA	National Conservation Strategy Coordinating Agency
NDP	National Development Plan
NSC	North South Carrier
NSC2.1	North South Carrier Phase 2.1
NWMP	National Water Master Plan
OHS	Occupational Health and Safety
OHSMS	Occupational Health and Safety Management System
PCDP	Public Consultation and Disclosure Plan
PEIA	Preliminary Environmental Impact Assessment
POP	Persistent Organic Pollutant
PPA	Power Purchase Agreement
PPAH	Pollution Prevention and Abatement Handbook (1 July 1998)
PPE	Personal Protective Equipment
ROM	Run of Mine
SADC	Southern African Development Community
SDP	Social Development Plan
SEATP	Social and Environmental Awareness Training Plan
SEMS	Social and Environmental Management System
SLDP	Social and Labour Development Plan
SMME	Small, Medium and Micro Enterprise
TDS	Total Dissolved Solids
ToR	Terms of Reference
UWP	UWP Pty Ltd
VDC	Village Development Committee
WHO	World Health Organisation
WMP	Waste Management Plan
WUC	Water Utilities Corporation

Project Notes

In undertaking the Environmental Impact Assessment, Digby Wells & Associates were assisted by a number of specialists in order to comprehensively identify both potentially positive and negative environmental impacts (social and biophysical) associated with the project, evaluate the significance of the identified impacts, and propose appropriate mitigation measures, where required. The specialist team identified and evaluated the potential impacts for the nominated preferred sites. The following companies were involved in the EIS:

Company	Role in MEP
Airshed	Air quality
Cave Klapwijk & Associates	Visual impact assessment
Trans Africa Projects	Infrastructure design
Eco Law	Environmental law
Ekoinfo	Fauna & Flora
Envirosoil	Pedology
ERM	Environmental Advisors
Sad-Elec	Transmission Integration
Endangered Wildlife Trust	Bird Studies
MetroGIS	GIS data management
National Museum Bloemfontein	Archaeology
Acoustic Consulting CC	Noise
Andy Spitz	PPP
InfoTox	Community Health

1 INTRODUCTION

1.1 Project Context

Meepong Resources (Pty) Ltd (Meepong) and Meepong Energy (Pty) Ltd are Botswana based companies wholly owned by CIC Energy Corp (CIC). Meepong has the rights to explore for coal resources in the Mmamabula coal field, situated in the Central District of Botswana. This proposed project is called the Mmamabula Energy Project (MEP) and, if approved, would include the development of underground coal mines; the construction of a power plant and associated infrastructure as well as the development of transmission lines to carry power to various areas of Botswana and South Africa.

Digby Wells & Associates (Digby Wells) has been appointed as consultants to investigate the environmental aspects for the proposed 400kV transmission lines associated with the Mmamabula Energy Project in Botswana. This work includes all aspects such as the bio-physical and social environmental aspects and includes an evaluation of the status of the pre-development environment, as well as the potential impacts of the project on this environment.

The MEP has been split into various activities, for which separate Environmental Impact Assessments (EIA) are being conducted. This Environmental Impact Statement (EIS) refers only to the transmission lines in Botswana, however, the development of the transmission lines is dependent on the construction of the power station and it is impossible to consider the two in isolation. Reference to the independently submitted EIS for the mine and power station is therefore frequently made throughout this document.

The Mmamabula transmission integration includes the section of the lines in South Africa connecting into the proposed Delta substation. Although this is an integral component of the MEP, this falls under the responsibility of the South African power utility, Eskom and will therefore be investigated in a separate EIA.

1.2 Definition of Activity

Meepong's exploration activities have revealed a large deposit of high quality coal in the Mmamabula Project area. Studies show that there is enough coal in the Mmamabula area to fuel the proposed power plant for 40 years. The electricity would then be carried along the transmission lines to supply both Botswana and South Africa.

The MEP will develop a power plant in the Mmamabula East area and power lines would carry this power to parts of Botswana including a route southwards towards Gaborone and north towards the Morupule Substation near Palapye and the Phokoje Substation close to Selebi Phikwe. The excess power would be sold to South Africa and transmitted along power lines from the power plan to a point within South Africa. The scope of work proposed does not consider the impact in South African but deals with impacts in Botswana. The impacts of the mine and power station are not included in this EIS, however studies have been undertaken and a separate EIS will be submitted.

A separate EIA is being conducted for the power lines in South Africa. As far as possible, this investigation has attempted to integrate with the South African EIA but approval is required in the different countries and the consultation process was not run concurrently.

Legal requirements and clearly defined criteria must be applied in order to accurately determine the significance of the predicted impact or benefit on the surrounding natural and/or social environment. For this to be done, the context of the project must be considered according to the area and the people that will be affected. Of necessity, impact assessment will always contain a degree of subjectivity, as it is based to an extent on the value judgment of various specialists and members of society. The evaluation of significance is thus contingent upon values, and dependant upon the environmental and community context. Therefore, ultimately, impact significance involves a process of determining the acceptability of a predicted impact to society.

Within this EIS, environmental and social impacts are discussed according to different stages of the proposed project, namely: the construction phase, the operational phase, the decommissioning phase and post closure. The holistic environment that will be affected by the project is considered and includes a combination of all social, cultural, historical, economic, political, and ecological aspects. The various environmental impacts and benefits for any proposed project will be specifically discussed according to: the status of impact, nature, duration, scale, likelihood and significance as well as whether or not mitigation will be required.

Once the EIA has been completed, it becomes apparent which aspects will require mitigation measures. The aims of the mitigation measures are to find methods and techniques to minimise the negative impacts and enhance the positive aspects of the project, as well as to inform and involve the local communities. The EMP section is divided into objectives and management measures. The purpose of the management measures is to, as far as possible, mitigate the negative impacts and enhance the positive impacts of the development. The monitoring and compliance section goes on to detail the annual monitoring and audits that will be implemented around the project.

1.3 Documentation Developed

The initial documentation submitted to the Department of Environmental Affairs (DEA) was a Preliminary Environmental Impact Assessment (PEIA) which officially alerted the DEA to the project and defined the scope of the project. Prior to this EIS being submitted, a Terms of Reference Report (ToR) was compiled and submitted to the DEA, as well as an application for a mining right to the Department of Mines. A meeting was held with relevant authorities to discuss the ToR and comments on the ToR were recorded. The amended ToR was re-submitted and approved by the DEA. The ToR outlines the actions to be taken to meet all legal, procedural, and technical requirements of the developer for an EIS report. Following the inclusion of alternative transmission line corridors from the MEP to the Limpopo River, a revised ToR was submitted to the DEA. The revised ToR document is included as Appendix B and includes the scopes of work for all specialist studies, and the preliminary impact assessment. The approvals for the PEIA and ToR are included in Appendix C. Table 1.1 lists the documentation that will be developed for the MEP transmission lines.

This EIS will also form a component of the Environmental and Social Impact Assessment (ESIA) that will be submitted to the lenders who have been approached for project financing.

Table 1.1: MEP Transmission Line Environmental Documentation developed

EIA Phase	Responsible Party	Completion Date	Relevant Authority / Stakeholder
Completion and submission of PEIA	DIGBY WELLS	June 2006	Department of Environmental Affairs in Botswana.
Completion and submission of ToR	DIGBY WELLS	November 2006	Department of Environmental Affairs in Botswana
Submission of revised ToR	DIGBY WELLS	March 2007	Department of Environmental Affairs in Botswana
Completion of the EIS	DIGBY WELLS and subcontractors	March 2007	Department of Environmental Affairs in Botswana
Incorporation into the international ESIA	ERM and subcontractors	July 2007	Potential lenders for the project as well as interested and affected parties

The focus of the EIA and Environmental Management Programme (EMP) are to give a full impact assessment, with mitigation measures and to rate the impacts according to their

significance. This EIS has been compiled based on the guidelines provided by the Botswana DEA, and the relevant chapters in the EIS Act of 2005. The EIA refers to the process by which the environmental aspects of the project are investigated. The information obtained during the EIA allows for the compilation of an EIS, which includes the EMP.

1.4 Assumptions

All information provided by CIC and interested and affected parties (I&APs) to the environmental team was accepted as correct and valid at the time it was provided. The consultants and specialist investigators do not accept any responsibility in the event that additional information comes to light at a later stage of the process that could not have been reasonably obtained by Digby Wells & Associates.

It is assumed that all data from unpublished research is valid and accurate.

It is not always possible to involve all I&APs individually. Every effort was, however, made to involve as many broad based representatives of the stakeholders in the nominated area. The assumption has, therefore, been made that those representatives with whom there has been consultation, are acting on behalf of the parties which they represent.

1.5 MEP Transmission Lines EIS Objectives

The overall objectives of the EIS report are to:

- Provide a single complete document which will satisfy the Botswana authorities requirements;
- Identify and meet all legal and legislative environmental requirements;
- Give motivation for and benefits of the proposed development;
- Provide information on the environmental factors and constraints considered in the project options;
- Describe the biophysical, cultural and social environmental baseline conditions of the current environment;
- Identify and quantify the impact project activities will have on the biophysical, cultural and social environment;
- Identify mitigation methods available to minimise the potential of adverse environmental impacts;

- Identify constraints associated with the mitigation methods recommended, and allow provision for modification;
- Identify the residual environmental impacts expected to arise and evaluate their impact on the environment;
- Provide information on the consideration of alternatives to possibly avoid and minimise the potential of adverse environmental impacts;
- Design an environmental monitoring programme which will ensure the effective implementation of recommended environmental controls and mitigation measures.
- Describe the public participation process undertaken as part of the EIA process.

1.5.1 Environmental Objectives for the MEP Transmission Lines

The environmental objectives for the construction, operational, and decommissioning phases of the project are:

- Avoid impacts on the biophysical environment where possible, otherwise minimise, mitigate or compensate for unavoidable impacts as appropriate;
- Ensure the project is undertaken in adherence to social responsibilities.
- To ensure that activities are carried out so as to facilitate rehabilitation and the return of current or improved land use.
- To ensure a safe environment for people to live in.

1.5.2 Socio-Economic Objectives for the MEP Transmission Lines

The socio-economic objectives of the construction, operation, and decommissioning phases of the project are to:

- Adhere to an open and transparent communication procedure with stakeholders at all times;
- Ensure that accurate and regular information is communicated to I&APs;
- Ensure that information is communicated in a manner which is understandable and accessible to I&APs;
- Enhance project benefits and minimise negative impacts through intensive consultation with stakeholders;

- Assemble adequate, accurate, appropriate, and relevant socio-economic information relating to the context of the operation;
- Contribute to the development of a self-reliant (not dependent on the project) community surrounding the area of operation;
- Adhere to principles of international best practice in all socio-economic activities.

In order to honour the above objectives during the construction, operation and decommissioning phases of the project, the developer must adhere to the principles of sound corporate governance, responsible corporate citizenship and trusted business partner. Business must be practiced in a transparent and accountable manner, and the company must strive to honour its social licence to operate at all times.

1.5.3 Archaeological and Cultural Objectives for the MEP Transmission Lines

Sites of historical and cultural significance may have to be removed or relocated before the onset of construction. If there are significant findings then they could change the positioning of infrastructure. The objectives to be met are:

- To comply with the national legislation governing the conservation of heritage resources within Botswana.
- To instil a sense of value for the relevant artefacts and structures by the treatment afforded to them;
- To deal with I&APs in a sensitive manner with regard to the relocation of graves and the potential destruction of farm infrastructure;
- To ensure that relocation is done in such a way to retain the relevant context of the artefacts and structures;
- To compile an inventory and description of resources found;
- Assess the positive and/or negative impacts of the project relative to the culture and heritage of the area.
- Make recommendations for alternatives or mitigation to reduce negative impacts such as remove, record or preserve.
- To encourage the preservation of cultural structures not affected by the project.

2 BRIEF PROJECT DESCRIPTION

The Mmamabula Energy Project is the development of the Mmamabula coal field. Analysis of the core samples from the close pattern on site drilling indicate that the development of a coal mine would produce coal of sufficient quantity and quality to supply a thermal power station with an output of 2400MW for at least 40 years. Due to the scarcity of water the design of the power station would use forced draught electrically driven fans to cool the steam condensate instead of natural draught cooling towers which would consume considerable amounts of water due to evaporation.

Mmamabula Power Station with an initial sent out base load capability of 2400MW requires to be integrated with a new strong transmission network capable of transporting the full output power even when there are line outages due to faults or for necessary maintenance. Since the total electrical load in Botswana will be in the order of 800MW when the power station construction is complete it is necessary to extend the transmission lines beyond Botswana to export electrical power for consumption in South Africa.

The decision by Botswana Power Corporation to increase the generating capacity of their existing Morupule Power Station by 1200MW will have an influence on the transmission integration of Mmamabula Power Station. Due to the limitations of both the electrical current carrying capabilities and the fault interruption capabilities of the Botswana Power Corporation networks connected to the existing 120MW Morupule Power Station it is not proposed to mesh these existing networks with the new transmission networks required to integrate the new Mmamabula and Morupule B Power Stations. Power from the new transmission networks will be injected into the Botswana Power Corporation networks at the existing Phokoje 400/220kV Substation and a proposed new 400/220kV Substation, Mosaditshweni which is North of Gaborone. This will provide secure power injection to both the northern and southern Botswana electrical power networks.

The new transmission lines are proposed to be similar to the existing 400kV line from Matimba Power Station in South Africa to Phokoje Substation and the 400kV line from Phokoje Substation to Insukamini Substation in Zimbabwe. These 400kV lines are single circuit lines supported by guyed V towers carrying triple Tern conductor bundles. Although similar, the new lines are, proposed to be quad conductor bundles.

The number of power lines required to integrate power stations of this magnitude is dictated by the electrical current carrying capability of the circuits, voltage regulation limits as well as static and dynamic planning criteria for network performance under contingencies resulting from either

planned outages or forced outages due to faults on the network. Static condition criteria require the transmission system to be able to transport the full output of the power station when any one connecting line is out of service and to be able to transport the output of the power station with one generator shut down when any two connecting lines are out of service. Dynamic condition criteria require the integration of the power station to be such that it retains transient stability capability with full generation for a three phase fault cleared in normal protection times or with full generation a single phase busbar fault or stuck breaker condition cleared in back up protection time or with any one line out of service a single phase fault cleared in normal protection time with the power station loaded to 90% capability. In order to mitigate the risk of failure impacting on the ability to continue exporting power from the power plant, four lines in two corridors separated by a minimum of 2km is required between Mmamabula and the proposed Delta sub-station in South Africa is the preferred option for CIC and Eskom. The option of placing all four lines within one corridor is currently being investigated.

Transmission planning studies are presently in progress but the indications are that in order to adequately integrate the 2400MW Mmamabula and 1200MW Morupule B Power Stations the following new 400kV lines will be required:

a) from Mmamabula power station to Morupule B power station (about 160km)
b) from Morupule B power station to Phokoje substation (about 105km)
c) from Mmamabula power station to Mosaditshweni substation (about 100km)
d) from Morupule B power station to Mosaditshweni substation (about 230km)
e) from Mmamabula power station to Delta 765/400kV substation in South Africa (about 4 x 60km, with approximately 4 x 25km in Botswana)

It has been assumed that Morupule B power station will be constructed adjacent to but not electrically interconnected with Morupule Power Station.

Mosaditshweni will be a new site to accommodate a 400/220kV substation.

Mmamabula power station will be constructed on the Mmamabula coal fields site.

Phokoje substation is an existing 400/220kV substation in Botswana near Selebi Phikwe.

In addition to the 400kV lines required for the export of power from the power plant, a 66kV line will be required to supply power for the construction and commissioning activities of the MEP. This line is proposed to run within the 400kV servitude from Phokoje to the Mmamabula power plant. As the 66kV and 400kV line will share a common servitude, the corridors assessed during the EIA were analogous.

Associated with the project construction phase will also be a construction camp of approximately 1ha, currently proposed for the vicinity of the Morupule power station. In addition a 40mx40m

tower erection area will be required at every tower position. Cable drum lay down areas as well as winch and cable tensioner stations will also be required along the route. The specific positions for these sites will be detailed in the profile design.

3 LEGAL REQUIREMENTS

EcoLaw, a South African based Environmental Law firm, was appointed to conduct studies into the legal requirements of the MEP. Their contact details are listed and their full report has been appended as Appendix D.

Company	EcoLaw
Aspect	Environmental Law
Contact Person	Lucy Koeslag
Postal Address	Unit 40, Private Bag X16, Honeydew, 2040, South Africa
Physical Address	No. 8 Fern Isle Building, 359 Pretoria Avenue, Randburg, South Africa
Telephone Number	+27 11 886 6268
Fax Number	+27 11 886 6268
Email Address	lucy@ecolaw.co.za

3.1 Administrative Framework

The Republic of Botswana (Botswana) is a landlocked country, covering an area of 581,730 km^2.The country is bordered by South Africa to the south and south east, Namibia to the west, Zambia to the north, and Zimbabwe to the northeast. Botswana attained independence on 30 September 1966 as a constitutional democracy. Legislative power lies with the National Assembly.

The dominant ethnic/cultural group in Botswana is the Tswana comprising approximately 80% of the population. They are followed by smaller groups such as the Kalanga, Kgalagadi, Himbukush, Herero, Bayeyi, Batswapong, Basubiya, Basarwa, Babira and the Khoi, as well as relatively small numbers of Whites and Asian people. Serving as a ‘second chamber’ to the National Assembly, the House of Chiefs represents the main Tswana subgroups in the country. Its constitutional function is to advise the National Assembly on all draft bills affecting custom and traditions. The House of Chiefs is made up of the hereditary chiefs of Botswana's eight principal tribes as set out in the Constitution, in addition to four sub chiefs representing those districts/administrative divisions where other tribes are in the majority.

The President of the Republic of Botswana is also the Head of State. The executive power of Botswana is vested in the President. He exercises the powers either directly or through other officers subordinate to him. The following Ministries and related Departments were identified as having bearing on the transmission line development and are being consulted during the EIA process (Table 3.1):

Table 3.1: Botswana Ministries and Departments

Ministry	Department
3.1.1.1 Ministry of Environment, Wildlife and Tourism	Department of Environmental Affairs (DEA) Department of Waste Management and Pollution Control (DWMPC) Department of Meteorological Services (DMS)
Ministry of Labour and Home Affairs	Department of Labour and Social Security (DLSS) Department of National Museums, Monuments and Art Gallery (DNMMAG)
Ministry of Health	Department of AIDS Prevention and Care Department of Clinical Services Department of Public Health
Ministry of Lands and Housing	Department of Lands (DL) Department of Town and Regional Planning (DTRP)
Ministry of Local Government	Department of Social Services (DSS) Department of District Administration (DDA) Department of Tribal Administration (DTA) Department of Local Government and Development (DLGD)
Ministry of Mines, Energy and Water Affairs	Department of Mines (DM) Department of Water Affairs (DWA) Department of Geological Survey (DGS) Energy Affairs Division
Ministry of Works and Transport	Department of Roads (DR) Department of Road Transport and Safety (DRTS)

Additional governmental and parastatal stakeholders involved in the consultation process are listed below:

- Central District Council

- Ngwato Land Board
- Botswana Water Utilities Corporation
- Botswana Telecommunications Corporation

Administratively, Botswana is divided into ten districts (the Central District, Ghanzi, Kgalagadi, Kgatleng, Kweneng, North-west, North-east, South-east, Chobe and the Southern District), as well as five town councils, namely Jwaneng, Selebi-Phikwe, Lobatse, Mahalapye and Gaborone. Districts are regions with regional administration through the council secretariat. Central Government is represented in the districts by the office of the District Commissioner and assisted by district councillors and development committees. Central Government liaises with the District Commissioner to assess and evaluate progress of government projects on district level.

Local authorities in Botswana consist of urban and rural local government bodies such as district and town councils in terms of the Local Government (District Councils) Ch: 40:01 and the Townships Ch: 42:03 respectively. The district and local authorities are responsible for the delivery of basic municipal services/facilities. In this they are supported, amongst others, by Planning Boards and Land Boards respectively.

Administrative decentralisation furthermore involves the district and tribal administration centres, including field offices/agencies of government ministries, as well as sub-districts and subordinate Land Boards.

The MEP is located in the Mahalapye Sub-District of the Central District of Botswana. Villages potentially affected by the proposed transmission lines are Mmapashalala, Mookane, Bonwapitse, Dibete, Mosomane, Dinokwe, Mahalapye, Lose, Tewane, Radisele, Palapye, Dikabeya and Tamasane see plan in Appendix A.

3.2 Legislative Framework

The *Botswana Constitution Ch: 1* does not include a constitutional provision relevant to environmental or conservation matters. There is also at present no comprehensive or consolidated environmental statute applicable to Botswana and pollution prevention and environmental management is found in a variety of laws, and administered by several government departments. Institutional reforms within Government have, however, culminated in the creation of the Ministry of Environment, Wildlife and Tourism (MEWT) with a mandate to coordinate environmental conservation and protection. A rationalization of all environment-related functions transferred to MEWT should lead to a clearer identification of the core functions of the Ministry.

The Department of Environmental Affairs (DEA) has been mandated with the implementation of the Environmental Impact Assessment Act 6 of 2005. Since specific regulations and final guidelines have not yet been promulgated in order to assist consultants and project proponents in the implementation of the requirements of the EIA Act, regular consultation with the DEA is necessary to ensure Departmental requirements are being met during the EIA process.

The concepts of sustainable development and the efficient, fair and sustainable usage of natural resources are accepted in the Botswana Government's National Development Plan or NDP 9 (2003) and the National Policy of Natural Resource Conservation and Development (1990). Sustainable development requires that the exploitation of natural resources for present generations should not compromise the needs of future generations.

It is in light of the overarching principles of sustainable development that the MEP Transmission lines should be approached. The main social and environmental legislation pertinent to the project includes the following:

- Acquisition of Property: Chapter 40:05
- Botswana Power Corporation: Chapter 74:01
- Constitution of Botswana Chapter 1
- Electricity Supply Chapter 73:01
- Environmental Impact Assessment Act 6 of 2005
- Herbage Preservation Chapter 38:02
- Monuments and Relics Act 2001
- Public Safety Chapter 22:03
- Road Traffic Chapter 69:01
- Road Transport (Permits) Chapter 69:03
- State Land Chapter 32:01
- Tribal Land Chapter 32:02
- Waste Management Act 15 of 1998

A summary of the main environmental permitting and licensing requirements relevant to the MEP Transmission Lines are provided in the table below:

Table 3.2: Permits, Licenses and Authorisation Requirements relevant to the MEP Transmission Lines.

MAIN AUTHORISATIONS	LEGISLATIVE PROVISION	GOVERNMENT DEPARTMENT
Archaeological Impact Assessment Report (AIA) approval and permits for the disturbance of archaeological sites	Monuments and Relics, Chapter 59:03	Department of National, Museums, Monuments and Art Gallery (DNMMAG) Commissioner of Monuments and Relics
Electricity Generation and Supply Licence	Electricity Supply, Chapter 73:01	Ministry of Minerals, Energy & Water Affairs Energy Affairs Division (EAD)
Acquisition of private land (MEP area)	Negotiations, willing seller willing buyer or expropriation in terms of the Acquisition of Property, Chapter 40:05	Department of Lands
Acquisition of land or rights over land, necessary for the purpose associated with the generation or supply of electricity by a licensee	Electricity Supply, Chapter 73:01 Acquisition of Property, Chapter 40:05	Ministry of Minerals, Energy & Water Resources Energy Affairs Division (EAD)
Waste Carrier Authorisation for transboundary movement of hazardous waste	Waste Management Act, No 15 of 1998	Director, Department of Waste Management and Pollution Control (DWMPC)
Road Construction Permits for Roads, Culverts and T-junctions	Road Traffic, Chapter 69:01	Principal Road Engineer, Department of Roads (DR)
Transportation permits for Bulk Carriers and Abnormal Loads	Road Transport (Permits) Chapter 69:03	Department of Road Transport and Safety (DRTS)
Authorisations to utilise borrow pits for building and road construction materials should this material be sourced outside of the mining concession area.	Mines and Minerals Act, No 17 of 1999	Department of Mines (DM)

It is important to ensure through the authorisation and application process that all procedural requirements are carefully adhered to and a very thorough public consultation process needs to be conducted to avoid challenges from I&APs on procedural grounds. The consultation strategy must at a minimum include the requirements for consultation as set out in the EIA Act.

3.3 Permitting, Licensing and Authorisation Requirements

3.3.1 Environmental Impact Assessment and Environmental Management Plan in terms of the Environmental Impact Assessment Act 6 of 2005

The Environmental Impact Assessment Act No 6 of 2005 came into operation on the 27th of May 2005 and governs Environmental Impact Assessments (EIAs) to be undertaken to assess the potential effects of planned development activities on the environment.

The MEP Transmission Line assessment has followed the procedural requirements relevant to the submission of the PEIA, the Terms of Reference and Scoping Document, conducted a comprehensive Environmental Impact Assessment and Public Participation Process and the final submission of the EIS and EMP for approval by the Department of Environmental Affairs.

3.3.2 Power Generation Licence

The establishment of a power plant as part of the MEP must be considered in light of broader energy planning and policies on national and regional scale as well as international developments in the energy sector.

The Energy Affairs Division (EAD) was established in 1984 under the Ministry of Minerals, Energy and Water Resources (MMEWR). The Division's portfolio is to direct, co-ordinate and formulate the national energy policy and related issues. The Botswana Power Cooperation (BPC), is a parastatal under MMEWR, and is responsible for generation and transmission of electricity.

National energy policy objectives for Botswana can be found in the following main policy documents:

- National energy policy objectives as spelled out in the National Development Plan 9 and Vision 2016;
- Botswana Energy Master Plan (BEMP, 2004) and
- Botswana National Energy Policy.

At the regional and international level the following issues will be of importance in the consideration of the establishment of a thermal power plant in Botswana:

- Botswana's current energy cooperation arrangements in the SADC Energy protocol and Southern African Power Pool (SAPP);
- International cooperation on combating global warming and climate change;
- The international drive for sustainable energy development and environmental management;
- Aggressive global promotion of renewable sources of energy; and
- General movement from coal to natural gas for power generation and adoption of clean coal technologies.

The National Energy Policy aims at providing a least cost mix of energy supply, which reflects total life cycle costs and externalities, such as environmental damage. The energy policy objectives are mainly that:

- energy users should have access to appropriate and affordable energy services;
- energy should be used efficiently;
- the energy supply industry should be economically sustainable and efficient;
- all users should have security in their access to energy;
- Energy extraction, production, transport and use should not damage the environment or people's health and safety.

In the long term sustainable energy usage needs to be implemented. The EAD is tasked in meeting efficiently and effectively the national energy policy objectives. The EAD acknowledges that Botswana has vast deposits of coal (total coal resources stand at 212 billion tonnes of which 7.2 billion tonnes are measured reserves.) and is challenged to put this abundant locally available resource to use to save foreign exchange.

In doing so the EAD is focussing on clean coal technologies and in light of the global concern about climatic change issues, the EAD is also promoting coal treatment to improve efficiency and heat content per unit/mass and to reduce environmental impacts.

The Electricity Supply Act (Chapter 73:01) makes provision for the licensing and control of undertakings for the generation and supply of electricity. A licence is required to use, work or operate any plant, apparatus or works designed for the supply or use of electricity.

In terms of the Electricity Supply Regulations (Part II regulation 4) an application for a licence must be made to the Minister in writing giving the information called for in the First Schedule and such other information as he may require.

3.3.3 Acquisition of Surface Rights

3.3.3.1 Acquisition of Land for Electricity Purposes in Botswana

The Electricity Supply Act (Chapter 73:01) makes provision for the licensing and control of undertakings for the generation and supply of electricity. A licence is required to use, work or operate any plant, apparatus or works designed for the supply or use of electricity.

A licensee may place any transmission line above or below ground across any land provided that the licensee serves on the owner of the land and on any person lawfully occupying it, notice of intention, together with the description of the lines proposed to be placed.

The Act makes provision for the President to acquire in accordance with the Acquisition of Property Act, so much land or rights over land, as he may consider necessary for the purpose associated with the generation or supply of electricity by a licensee, which purpose must be deemed to be a public purpose.

Before acquiring land in terms of the Acquisition of Property Act, the President must be satisfied that the licensee concerned has taken all reasonable steps to acquire on reasonable terms, by agreement with the owner, the land which he wishes to use and has been unable to do so and that the acquisition of the land is necessary for the purposes of the undertaking carried on by the licensee concerned.

3.3.4 Archaeological Impact Assessment and Permits

In terms of the Monuments and Relics Act 21 of 2001 section 19(2) both an archaeological pre-development impact assessment and an environmental impact assessment study must be undertaken by any person wishing to undertake a major development such as construction or excavation, for the purposes of mineral exploration and prospecting, mining, laying of pipelines, construction of roads and dams, or erection of any other structure, which will physically disturb the earth's surface.

The Archaeologist engaged by the consultant to undertake an Archaeological Impact Assessment (AIA) must be a Botswana citizen and must be registered with the Department of National, Museums, Monuments and Art Gallery (DNMMAG) before he or she may commence with an AIA. The archaeologist is required to utilise the methods approved by the Department of National, Museums, Monuments and Art Gallery (DNMMAG) in undertaking the assessment and to liaise with the DNMMAG. The Archaeological Impact Assessment Report (2 copies) and the written application for a Development Permit must be submitted to the Commissioner of Monuments and Relics for approval at the National Museum. Written permission of the Commissioner is required before development may commence and conditions attached must be complied with. The Commissioner will decide whether or not to accept the mitigation recommendations and may either issue a Development Permit, with mitigation requirements as conditions, or may require that the mitigation be carried out prior to issuing a Development Permit. Only once approved by DNMMAG should the report be submitted as a sub-component of the EIA report for submission to the DEA.

BPC as responsible for the operation and maintenance of the lines will have the option to preserve the sites if they are located outside the areas of actual impact, or to fence the sites and divert development around them. No site may be disturbed without an Impact Permit for that site. CIC as responsible for construction will be responsible for the preservation or mitigation of the sites during this phase and will need to make sure that contractors and sub-contractors are also made aware of this.

3.3.5 Registration of Immobile and Mobile Treatment Plants and Waste Storage Areas

No person is permitted to operate a waste disposal site unless the waste disposal site is registered in terms of section 14 of the Waste Management Act or unless an exemption has been obtained from the Minister in terms of section 14(6).

Mobile or immobile waste treatment plant and temporary waste storage areas and waste transfer stations must also be registered. This will include any incinerators, scrap and salvage yards or waste skip areas, including sewage treatment plants.

3.3.6 Road Construction & Transport Permits

The construction of culverts and T-junctions and the designs of the access roads must be permitted by the Department of Transport in terms of the Road Traffic Act. A sixty one metre road reserve measured from the centre of the road to comprise 30.5 meters on both sides of the road is required. Botswana Road Design Manual and Botswana Road Specification Document should be used as reference documents when designing the access road. A slip way and holding lanes should be included in the design. The designs must be sent to the Department of Roads for approval.

The movement of bulk carriers and abnormal loads within the jurisdiction of Botswana must be conducted in accordance with a transportation permit provided by the Department of Road Transport and Safety.

3.3.7 Borrow pits

The holder of a mineral concession in terms of section 58 of the Mines and Minerals Act 17 of 1999 is provided special rights with regard to the exploitation of industrial minerals. The holder is authorized to mine industrial minerals without a minerals permit provided it is within the mining lease area and the minerals are used solely for building, road making or agricultural purposes.

Industrial minerals include barite, basalt, clay, dolomite, feldspar, granite, gravel, gypsum, laterite, limestone, mica, magnetite, marble, phosphate, rock, sand, sandstone, slate and talc, when used for agricultural, building, road making or industrial purposes.

3.3.8 Central Government Social and Environmental Policy Development

The last decade has seen extensive policy and legislative reforms as well as institutional and planning interventions aimed at promoting sustainable development, reducing environmental degradation, increasing efficiency in natural resource utilisation and reducing poverty, especially in rural areas.

The National Strategy on Natural Resources Conservation and Development, also known as the NCS, was adopted in 1990. The Strategy has the twin objectives of increasing the effectiveness of natural resources use and management to maximise the benefits and minimise undesirable side effects; and of integrating environmental work and considerations throughout the operations of all Ministries. To oversee the implementation of the Strategy, and to coordinate the various environment and natural resources institutions of Government, the National Conservation Strategy Advisory Board (NCSAB), was established, with the National Conservation Strategy Coordinating Agency (NCSA) as its Secretariat.

The government has developed over twenty-five separate laws related to environmental and resource management issues as well as many national policies, some of which are listed below.

- Wildlife Conservation Policy (1986): Allows for the management and utilization of wildlife resources.
- Energy Policy (draft): The policy aims to lessen deforestation caused by fuel-wood collection, and ensure that all households and community services have access to adequate and affordable energy services.

- Agriculture Policy (1991): Seeks to utilize the country's land resources, both grazing and arable, without long-term damage to the environment.

- Indigenous Livestock Species Policy (draft): Ensures the conservation of indigenous livestock species to achieve food security and to guarantee a future supply of animal products and biodiversity in Botswana.

- Tourism Policy (draft): Promotes low-volume, high-value tourism in Botswana aimed at a market of middle- to high-income patrons. Ensures relatively fewer disturbances to the natural environment with less tourist traffic.

- Water Master Plan (1992): A set of plans arising from the extensive analysis options for the development and management of water resources of Botswana until 2020. The plans not only outline the basic physical and engineering developments, but also take into account economic, social, environmental, institutional and legal factors.

- Wetlands Policy (draft): To promote the conservation of Botswana's wetlands in order to sustain their ecological and socio-economic functions and benefits for the present and future well being of the people.

- Forestry Policy (draft): Will support (1) the development of sustainable forest management options based on sound ecological principles, (2) domestication and commercialization of forest products such as fruits and medicines and (3) restoration of degraded land using afforestation and plantations to make the land reusable.

3.4 International Socio-Environmental Guidelines

Project financing of the MEP requires that CIC demonstrate that the company has identified all potential environmental, social and health impacts associated with the project and that these will be managed and monitored in accordance with the Equator Principles. A key element of the Equator Principles is the requirement that the Environmental and Social Impact Assessment (ESIA) must be compiled and must address compliance with applicable host country laws, regulations and permits required by the project and must make reference to the minimum standards applicable under relevant international standards. As part of the International standards, a numerical guideline document has been compiled (Appendix D) which includes all the numerical standards and guidelines which should be applied to the design, construction and operation of the project.

An environmental and social impact assessment (ESIA) is required by the Lenders before financial closure. This is not a regulatory requirement but is a requirement of Equator Principle Banks who collectively account for 85% of loans to projects in developing countries such as Botswana. The Equator Principles are based on Performance Standards issued by the

International Finance Corporation (IFC), the private sector financing arm of the World Bank. The MEP ESIA, which will incorporate the Transmission Line assessment, must therefore comply with the following requirements:

- Applicable IFC Performance Standards that provide guidelines for environmental and social issues and specify disclosure requirements;
- World Bank Group environmental, health and safety guidelines which are contained in the World Bank Pollution Prevention and Abatement Handbook (PPAH);
- Sector specific IFC and World Bank environmental, health and safety guidelines for particular industries or types of activities and
- Host country laws, regulations and permits required by the project.

4 PROJECT APPLICANT DETAILS

Although funding for the transmission line project within Botswana will be provided through CIC and the MEP, who will also be responsible for construction, the Botswana Power Corporation (BPC) will take ownership of the transmission lines and will be responsible for the operation and maintenance of the lines. The EIA applicant is thus BPC. The applicants contact details are given below in Table 4.1:

Table 4.1: Applicant contact details

Project Name	Mmamabula Energy Project - Transmission EIA
Company Name	Botswana Power Corporation
Contact Name	Jimson Lekanyang
Postal Address	P.O. Box 48, Gaborone, Botswana
Physical Address	Motlakase House, Macheng Way, Gaborone, Botswana
Telephone	+(267) 3603240
Fax	+(267) 3908674
Email Address	lekanyangj@bpc.bw
Botswana Contact Details	N/A

4.1 Memorandum of Understandings

As of the date of this application, the following Memoranda of Understanding (MoUs) that relate to the EMP have been signed:

- MoU between CIC Energy Corp and Eskom signed on 18 May 2006;
- Inter-Governmental MoU between Botswana and South Africa signed on 18 August 2006;
- MoU between CIC Energy Corp and Government of Botswana signed on 7 September 2006; and
- Inter-Utility MoU between Eskom and Botswana Power Corporation signed 13 November 2006.

The various MoUs signed reflect the intention of the Governments of the Republic of South Africa and the Republic of Botswana, Eskom and BPC to pursue the implementation of the MEP. However, in order to implement the MEP, a number of additional contracts will be required.

4.2 Details of Land Owner and Title Deed Description

The majority of the transmission line/s will span tribal land used by a number of different farmers. Where the lines run in an easterly direction to the Limpopo River and the South African border, they cross privately owned land in the farming area known as the Tuli block. The final route alignment of these lines will be determined once the EIA for the transmission lines on the South African side of the Limpopo River has been completed and acceptable corridors and river crossing points have been defined. Land owners in this area who may possibly be affected are as follows:

Name	Farm	Address	Telephone
Mr D Brink	Limpopo 28 LQ Saas Post 34 LQ Annex Craignair 9 LQ Deepdale 6 LQ	P O Box 2 Gaborone Botswana	+267 211 4400
Mr Mokama	Keward 29 LQ Holmlea 30 LQ		+267 71307248
Mr W M Biemond	Basinghall 31 LQ	P O Box 884 Mahalapye Botswana	+267 494 0009
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5 REGIONAL SETTING

5.1 Regional Location

Botswana's economy is dominated by mining (particularly diamonds) and livestock production, while tourism represents a growing economic sector. Major industries include mining (diamonds, copper, nickel, salt, soda ash), livestock processing and exports.

Botswana's rapid economic growth began in the 1970's and continues to date. Much of this growth can be attributed to the country's successful program of mineral exploration and development. Botswana has one of the most stable economies in Africa for investment by mining companies. Known mostly for its successful diamond industry, the country is still dependent upon South Africa for importing up to 70% of its electricity needs. Botswana hosts large resources of high ash medium calorific coal, which were delineated in the early 1980's. One of these resources is the Mmamabula coalfield, which is a greenfield site of coal deposits located strategically close to the largest power sink in the region, South Africa.

The proposed MEP is located in the Mahalapye Sub-District of the Central District, Botswana (Appendix A, Plan 5 – regional setting). Mmamabula is the name of an existing railway siding on the country's main railway line which runs parallel with the national road between Ramatlabama in the south and Ramokgwabwe in the north. The Mmamabula station is no longer in use. Instead, the train stops at the village of Dibete, which is situated on the boundary of the south-western block of the project.

The proposed transmission lines will run in a northerly direction from the power plant to the Morupule sub-station at Palapye and then in a north easterly direction to the Phokoje sub-station near Selebi-Phikwe. The lines will also go in a south westerly direction to the Mosaditshweni sub-station, north of Gaborone. The corridor alternatives are illustrated on Plan 1 in Appendix A. Between Morupule and Mosaditshweni two route alternatives are under consideration. The first alternative (western route) runs alongside the existing transmission lines, adjacent to the A1 highway, while the second alternative (eastern route) is a more direct line but traverses less disturbed, more pristine regions. In addition there will be four 400kV lines from the power plant to South Africa. Four route alternatives with an additional, fifth river crossing were considered during the EIA. These are illustrated in plan 2, Appendix A and consist of 2 routes south of the mineral rights concession area as well on both the northern and southern boundaries of the concession. In the case of these four lines, a maximum of two lines will traverse a single corridor and these corridors need to be separated by a minimum of 2 km in order to reduce the risk of a

supply failure, therefore it is likely that at least two of these alternatives will eventually be utilised.

The study area is dominated by a low relief plain or a featureless veld with only gentle slopes towards the principal drainage courses. These are areas of relative geological simplicity with little lithological variation and a ubiquitous blanket of superficial deposits. There is a range of low hills known as the Tswapong Hills that occur east of Palapye as well as another smaller, less prominent range known as the Maifala Hills approximately 20km south of Tswapong. The line alternatives have, however, taken these into consideration and have been routed to avoid this area.

5.2 Direction of and Distance to Neighbouring Towns or Major Settlements

The proposed MEP transmission line corridors are located in a rural area of Botswana, passing in the vicinity of a number of small villages and communities. Apart from these communities, the proposed routes pass close to a number of large villages, town and one major city. These are listed in Table 5.1 below together with their respective distances from the point of origin i.e. the proposed power plan (plan 1, Appendix A). .

Table 5.1: Distance from MEP to neighbouring towns and settlement

Town/ Settlement	Distance Away from MEP
Mahalapye	49 km
Gaborone	143 km
Palapye	110 km
Selebi Phikwe	213 km

5.3 Existing Surface Infrastructure and Servitudes

There is some existing infrastructure along the proposed routes. The A1 national road runs north easterly from Gaborone to Serule. The North-South Carrier, which is the bulk water supply pipeline, runs from Gaborone to Selebi-Phikwe. Other transmission lines currently run parallel and to the west of the A1 from just north of Gaborone to just north of Palapye. The proposed western alignment would run adjacent to these existing servitudes. The dirt road linking the A1 and the Paars Halt border post can be used to access the Tuli farms.

Although there are a number of villages that occur within the study corridors, it will be possible to route the lines so as to avoid these settlements. In a few isolated cases, detailed later in this report, cattle posts and small households will be directly in the path of the proposed transmission

lines. The smaller villages that occur within the proposed corridors are as follows: Mookane, Mmapashalala, Dibete, Mosomane, Tewane and Dikabeya (plan 1, Appendix A).

5.4 Land Tenure

There are three land tenure systems in Botswana, namely Freehold Land, State Land and Tribal/ Customary Land. The majority of the study area is Tribal/ Customary land, owned by the Botswana Government while the remainder, approximately 14% is privately-owned land (known as the Tuli Block).

6 PROJECT MOTIVATION

Although separate Environmental Impact Statements have been compiled and studies conducted specific to the transmission lines, the motivation for the project cannot be considered in isolation as the transmission lines are directly dependant on the construction of the power plant.

The Southern African Development Community (SADC) region is expected to experience significant electricity shortages in the coming years and major new base load power generation projects will be required from around 2011. Major new industrial and metallurgical projects could be put on hold pending security of tenure of electricity supply. The Mmamabula Energy Project is being proposed to help meet these electricity requirements and the project is being vigorously pursued to complete an EIS in order to meet the requirement to produce power by 2011.

The principal power consumer is expected to be Eskom, South Africa's national utility, and one of the largest power utilities in the world. Botswana Power Corporation (BPC) will also have an off take of power from the MEP for as much as 20% of generation.

6.1 Energy Deficiency

In the near future it is expected that more electricity will be needed by people living in Southern Africa than can be supplied by existing power plants. The development of the MEP would therefore provide a new and important source of power supply for Botswana and South Africa.

Energy plays a pivotal role in economic growth and improving livelihoods. Although an increased supply of energy does not automatically guarantee an acceleration of human development, it is a prerequisite. Energy is essential for preparation and preservation of food, for sanitation, acceptable standards of living and for all productive activity. Finding effective means of providing safe, affordable and reliable energy services is therefore of critical importance to governments and organisations endeavouring to promote sustainable development.

There is an urgent need to address the energy deficit problem in Southern Africa and to provide an affordable solution at a minimum cost to the environment. The Botswana National Energy Policy aims to provide a least cost mix of energy supply which reflects total life cycle costs and externalities, such as environmental damage. The energy policy objectives are mainly that:

- Energy users should have access to appropriate and affordable energy services;

- Energy should be used efficiently;
- The energy supply industry should be economically sustainable and efficient;
- All users should have security in their access to energy; and
- Energy extraction, production, transport and use should not damage the environment or people's health and safety.

In the long term sustainable energy usage needs to be implemented. Conducting the EIS will help determine the necessity, effectiveness, impacts and benefits that an energy project, such as the MEP will have on Botswana in a regional and local context.

6.2 Project Benefits

The MEP will result in numerous benefits to Botswana, of which the foremost is the major direct foreign investment. With the development of mines and the associated power station, there will be a significant generation of export revenue (about 4.8 billion Pula per year for phase 1 only, in real terms based on 2007 valuations) over at least 40 years, counting Phase 1 only (CIC, 2006).

The power station will also be an additional source of electric power generation for Botswana, such that together with other investments in the sector planned by BPC, Botswana will become entirely self-sufficient in this regard.

Significant employment opportunities will be created with the additional benefit of community upliftment. The project can promote sustainable local economic development in the surrounding areas, which are currently remote from existing development nodes. The resulting economic multiplier effect will ensure that new businesses are created and the wage economy in the area is substantially enhanced.

Economic development in the project area and diversification of the local economy will take place as the project will introduce an opportunity for economic diversification through the mine (together with associated power station and transmission lines) and supply chain, as well as retailing and business opportunities associated with the increased population and the employee's residential village. The counterpoint to this is that the proposed project may result in increased prices locally, which may strain local economic conditions in the short term.

Additionally, the MEP will contribute towards skills development and technology transfer, while the project would greatly benefit the SADC through addressing some of the region's power needs.

As suggested by the BPC, some of the comparative advantages of Botswana as a host of the next thermal power plant include the following:

- It will encourage political stability and high sovereign rating;
- Availability of vast coal resources which are unexploited;
- Botswana currently has relatively low emission loading;
- Proximity of Mmamabula to the South African transmission network;
- Low tax rates.

There are thus various benefits which are generated by the MEP on both a national and regional level.

6.3 Estimated Financial Cost

The EIS is based on the construction of a large coal-fired power station at Mmamabula with three units of 800 MW (net) capacity each, resulting in a total capacity of 2,400 MW (net). The power station project cost based on this configuration would amount to in excess of US$8.0 billion which is planned to be project financed, with 80% of the total project costs to be covered by debt and 20% by the Sponsors' own equity (B&V, 2006).

7 PROJECT ALTERNATIVES

Alternatives are different means of meeting the general purpose and need of a proposed activity. Alternatives may include location or site alternatives, activity alternatives, process or technology alternatives, temporal alternatives or the no-go alternative.

7.1 Corridor Route Alternatives

7.1.1 Northern Route to Phokoje Sub-station, outside Selebi Phikwe

During the pre-feasibility studies, four route options were looked at to connect the Mmamabula power plant with the Phokoje sub-station, outside Selebi Phikwe. Two of these options were excluded, for reasons described below, at this initial stage. The route proposed to run north-east to Mokepeng, Lerala and on to Phokoje was excluded because, for a large portion of its length, it would run parallel with the Tuli Block, which has the highest current or potential eco-tourism land usage of the entire study area. In addition this option was the longest distance between the two points. The most direct route would potentially have travelled in a straight line due north from the power plant to Phokoje. This was initially considered but was abandoned early on in the project as it would mean crossing both the Maifala and Tswapong Hills which are nesting grounds for a number of threatened bird species, particularly one of the few remaining breeding sites of the Cape Vulture in Botswana. In addition the rough terrain and hilly topography would have increased the costs of construction and tower type.

The two remaining route alternatives, illustrated in plan 1, Appendix A, were thus considered for the EIA. The first of these travels north from the power station, directly to Mahalapye and then follows the existing 220kV line servitude along the A1 to the Morupule power station, outside Palapye. From Morupule it heads north east to Phokoje, along the existing 220kV servitude. The other alternative runs north north-east from the Mmamabula power plant to a point approximately 20km east of Mahalapye in the region of the Paars Halt/Mahalapye road. From here it heads due north to Morupule, from where the two alternatives have a common corridor to Phokoje.

7.1.2 Southern route to the Proposed Mosaditshweni Sub-station

Although not integral to the MEP, the EIA covered the proposed transmission line routes to the proposed Mosaditshweni Sub-station, approximately 30km north of Mochudi. The construction of these lines, if viable, will be undertaken by BPC to strengthen the Botswana grid and are not necessary for exporting power to South Africa. Two alternative corridors shown on plan 1, Appendix A were considered for this section of the line, one running south west to intersect the

A1 near Dibete and then following the A1 southwards to Mosaditshweni and the other running south south-west, directly to Mosaditshweni.

7.1.3 Eastern Route to the Limpopo River and South African Border

In order to efficiently supply power to the South African grid it has been proposed to connect the Mmamabula power plant directly to the proposed Delta sub-station approximately 60km to the east in South Africa. The complete project area, including the possible route alternatives within South Africa, for these lines is shown on the base map in Appendix A. Although the environmental impact studies on the South African side of the border are excluded from the scope of this report, the approximately 25km of transmission line within Botswana was evaluated during the EIA. Four route alternatives, with an additional fifth river crossing, shown in plan 2, Appendix A, have therefore been assessed. These consist of a routes running along the northern and southern boundary of the Mmamabula mineral rights concession as well as two additional routes running south of this area and intersecting the Limpopo River at two potential crossing points, between the Mmamabula area and the old Buffels Drif border post. If a maximum of two lines can be constructed in one corridor, two of the four corridor alternatives will be required for the current phase of the project. The northern deviation illustrated on the base map has been disregarded as it will require an approximately 40% increase in line length, with the associated increase in cost as well as in environmental and social impact.

7.2 Alternative Tower Designs

The cross rope suspension (CRS), guyed V and the self supporting tower are three main tower designs employed in Southern Africa for 400kV lines. Only two of these, the self supporting type structures and the guyed V are utilised in Botswana. BPC have indicated that in order to align new developments with their current operational and maintenance capacity and equipment, they would prefer to continue with these two types, however, for the discussion of alternatives, all three are illustrated below.

The CRS type (Figure 7-1), which is not favoured by BPC, consists of two masts and four anchor cables for support. These towers have a reduced steel component and are, therefore, both less expensive and less visually intrusive than conventional self supporting or guyed V structures. In addition, as there is no horizontal structural steel, they do not provide a roosting attraction for large birds and there is thus less danger of power line related bird fatalities with these types of towers.

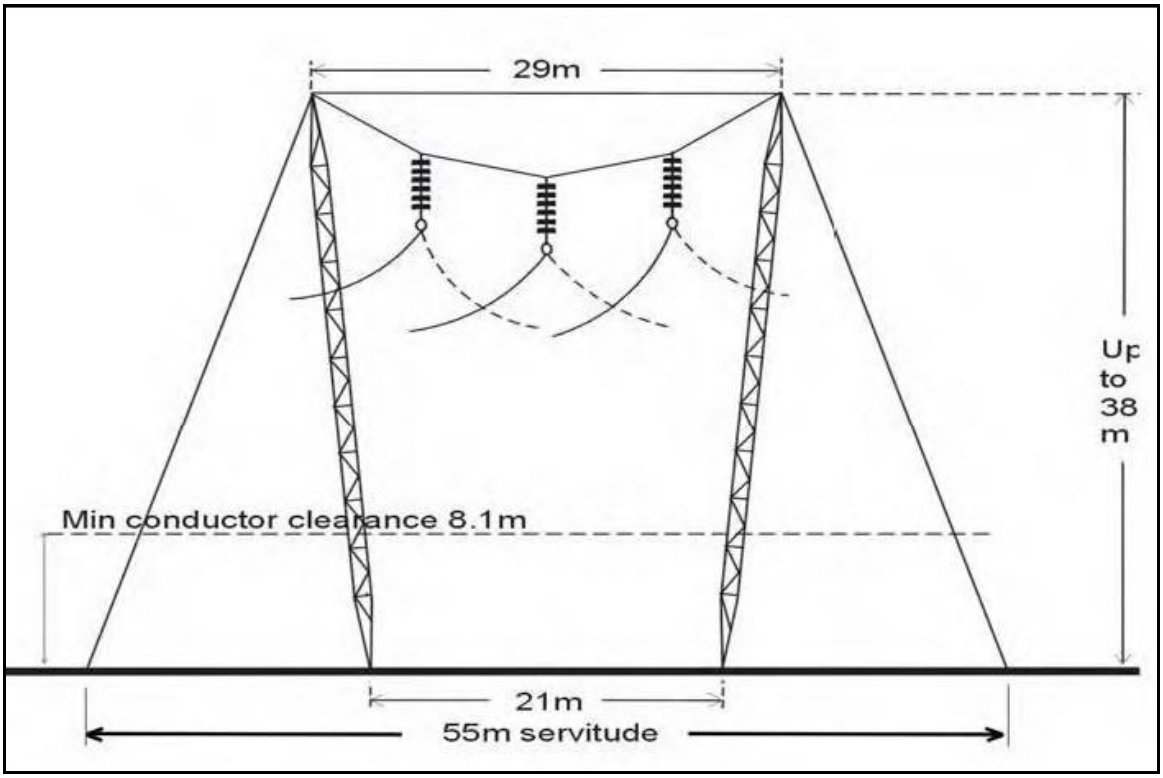

Figure 7-1: Cross rope suspension type tower design after Dunsmore et. al. 2007.

The most likely tower design for this project is the guyed V, which has the advantage that it is in common use in Botswana and BPC are familiar with the operation and maintenance of these types. In terms of structural steel, cost and visual intrusion, these types fall somewhere between the CRS and the self supporting type.

Both the CRS and the guyed V are limited in that they cannot be used in bends greater than 3° nor on steep surfaces or large river crossings. In these instances, the self supporting tower will be used (Figure 7-2 and Figure 7-3).

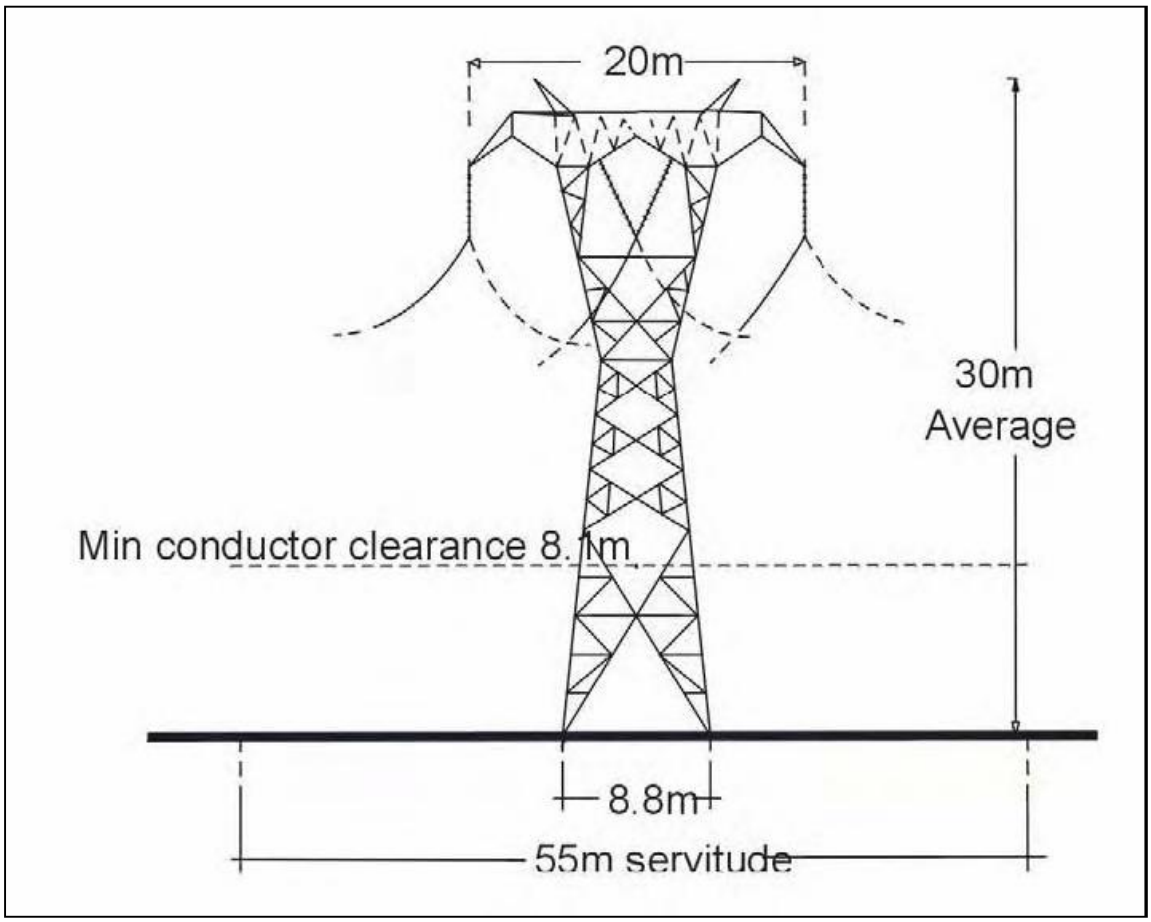

Figure 7-2: Self supporting type tower design

Figure 7-3: Self supporting type tower

7.3 Alternative Line Voltage

In order to transmit the required power output, smaller voltage lines are not technically feasible; however, the use of larger 765kV lines would be possible. The EIA considered whether it was possible to reduce the number of lines required between the MEP and the proposed Delta sub-station in South Africa by constructing 765kV lines rather than 400kV lines. In the case of this project however, the necessity for four lines is determined by Eskom and CIC regardless of their carrying capacity to ensure that if there is a fault on any one or two of the lines, export of the full power output from the Mmamabula power station would still be possible on the other two lines. Four lines is thus the minimum number of lines possible, irrespective of the voltage.

7.4 Corridor Separation Alternatives

In the case of the four lines running between Mmamabula power station and Delta sub-station in South Africa, the possibility of constructing all four lines within a single 220m wide corridor is being considered. The motivation for this option would be to "contain" the impacts within one area, rather than spreading impacts across two separate corridors. However, placing all four lines in a single corridor increases the potential risk of system failure if lightening or bush fires in this corridor cause all lines to fault simultaneously. The feasibility of having four lines in one corridor is therefore dependent on whether or not these risks are significant and manageable. This is currently being investigated by a working group within Eskom.

7.5 Land Use Alternatives

When considering the allocation of land for development and in deciding applications for planning permission affecting agricultural land, the agricultural implications must be considered together with the environmental, cultural and socio-economic aspects. In particular, prime quality land should normally be protected against permanent development or irreversible damage.

Consideration of land use alternatives is one of the cornerstones of community planning. Land use decisions must be evaluated in terms of sustainability, broadly defined as balancing environmental, economic and social equity concerns. The primary land use categories that encompass basic functions are residential, commercial, industrial, recreational, institutional, and agricultural uses. Land use is determined by a number of factors. These include climate, resources, population growth, economic activity and topography. In the east of Botswana, land use is limited due to the semi-arid environment, lack of water and lack of economic development.

When considering a new development for an area, it is required that other alternatives are considered to ensure that the development is justified and viable. In the MEP area, present land use includes subsistence farming, grazing and cattle farming. Agricultural potential is considered an important land use in Botswana but this land use is often hampered by drought conditions and poor soils.

Game farming is one of the viable alternatives to the current land use in the study area, although this may be in conflict with settlement of people in the some of the villages, depending on the types of game stocked. Game farming and cattle ranching are presently taking place in the Tuli Block. Drought and overgrazing may hinder the potential for game farming although built up in conjunction with eco-lodges; there is tourism potential which could improve the socio-economics of the area.

Although transmission lines could be detrimental to eco-tourism due to their negative aesthetic impact, most other alternative land use in the area such as subsistence agriculture and grazing can

continue under the lines and thus will not be displaced by the transmission project. Certain forms of agriculture such as forestry and sugar cane may not be a compatible land use due to the fire risk, however neither of these land uses are currently practised in the study area and it is unlikely that these may be viable future land uses due to the limitations posed by the climate.

Residential use is an exception as dwellings will not be allowed under the lines and thus this is one of the current land uses that can't be realised simultaneously with the transmission lines. It has been assessed as low density farm dwellings and cattle posts. In this case the impact on the environment is limited due to the low use of local resources and the minimal destruction to the environment. Residential land use, however, does not result in high economic benefits and is therefore not of a great benefit to the local community. The impacts may be the same as farming if the residents make extensive use of crop or livestock farming.

Due to the spatial layout of residences, the cumulative impacts are minimal. Each residential homestead occupies a small space and does not consume large quantities of natural resources. The only possible cumulative impact is if more high density houses are built which would require more infrastructure and use more resources. . The main impact which would arise would be from the agricultural activities used to support residents. The poor soils and lack of water limit the intensive use of the land.

7.6 No Project Alternative

The no go alternative entails the maintenance of the status quo. Without transmission lines, the proposed power station would not be constructed and electricity would not be generated in this area. The current land use and capability would remain and the coal resource would remain untapped. The regional economic benefits associated with the project would not occur but there would be no need for the construction activities and servitudes associated with the development of the lines.

When considering the no go alternative, it must be noted that assessment of potential impacts of the transmission lines would be made against the status quo, thus allowing the "impact" of the no go alternative to be inferred. If the project were not to proceed, the foreign revenue, economic activity and available jobs would not be created.

8 DESCRIPTION OF CURRENT ENVIRONMENT

8.1 Physical Features and Characteristics

8.1.1 Climate

Airshed Planning Professionals (Pty) Ltd was appointed by ERM Southern Africa to do an air quality assessment of the proposed power station operations in the eastern part of Botswana. As this study included analysis of data from Mahalapye, Selebi Phikwe and Gaborone, the information is also considered representative of the transmission line study area.

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A summary of their findings is presented here, however the full report is included in the Mine and Power EIA. A meteorological station was recently installed at the project site (beginning of September 2006) with data available from September through to 7 December 2006. The Department of Meteorological Services in Botswana were kind enough to provide data for Gaborone, Mahalapye and Selebi Phikwe for inclusion into the study.

Meteorological data was also obtained from the South African Weather Services for Lephalale. The locations of the weather stations are indicated in Figure 8-1. Sir Seretse Kama Airport is located near Gaborone approximately 155 km to the southwest of the site. Mahalapye and Selebi Phikwe are also located some distance away, with Mahalapye ~ 48 km directly north and Selebi Phikwe 200 km away (north northeast). Lephalale on the South African side is ~90 km to the east of the proposed site.

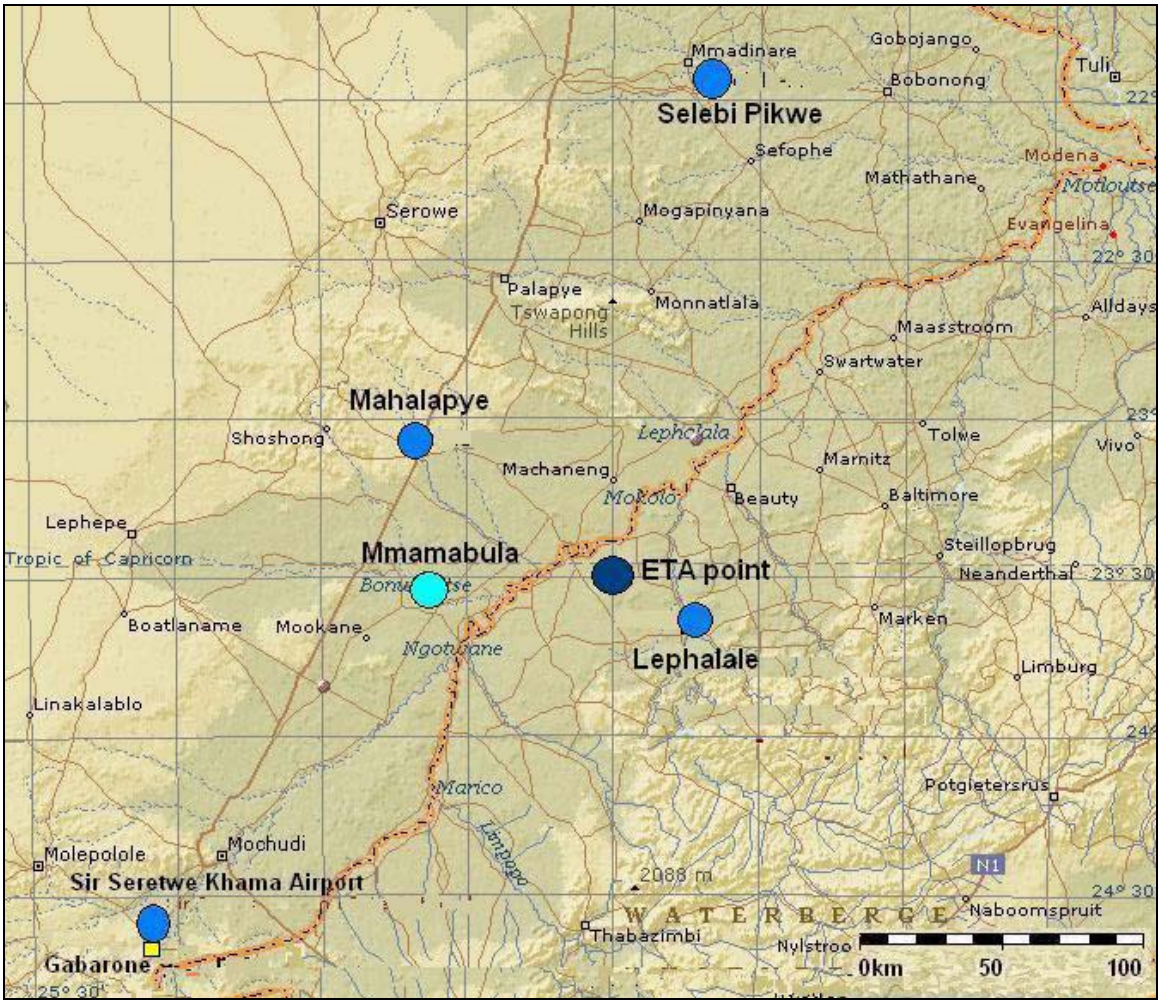

Figure 8-1: Location of meteorological stations included in the study

8.1.1.1 Wind Field

The vertical dispersion of pollution is largely a function of the wind field. The wind speed determines both the distance of downward transport and the rate of dilution of pollutants. The generation of mechanical turbulence is similarly a function of the wind speed, in combination with the surface roughness. Wind roses comprise 16 spokes which represent the directions from which winds blew during the period. The colours reflect the different categories of wind speeds, the grey area, for example, representing winds of 1 m/s to 3 m/s. The dotted circles provide information regarding the frequency of occurrence of wind speed and direction categories. For the current wind roses, each dotted circle represents 5% frequency of occurrence. The figure given in the centre of the circle described the frequency with which calms occurred, i.e. periods during which the wind speed was below 1 m/s.

Meteorological data for the year 2005 was used in the study since data was available from all the relevant stations for this year (only four months of data was available for Mahalapye for 2004).

The prevailing wind directions between Lephalale and Mahalapye are remarkably similar with winds from the northeast dominating. Northerly and easterly winds occur less frequently with wind flow from the west and south almost non-existent. Although the north-easterly winds dominate for all four seasons the frequency of occurrence of these winds vary. During winter, the percentage of north-easterly winds decreases due to the northward shift of the high-pressure belt. East-north-easterly and north-easterly winds increase in frequency during summer months, with the continental high pressure and tropical easterlies having resumed their influence over the region.

The CALMET output data were used to extract a singe point of simulated wind field information representing the Mmamabula site (Figure 8-2).

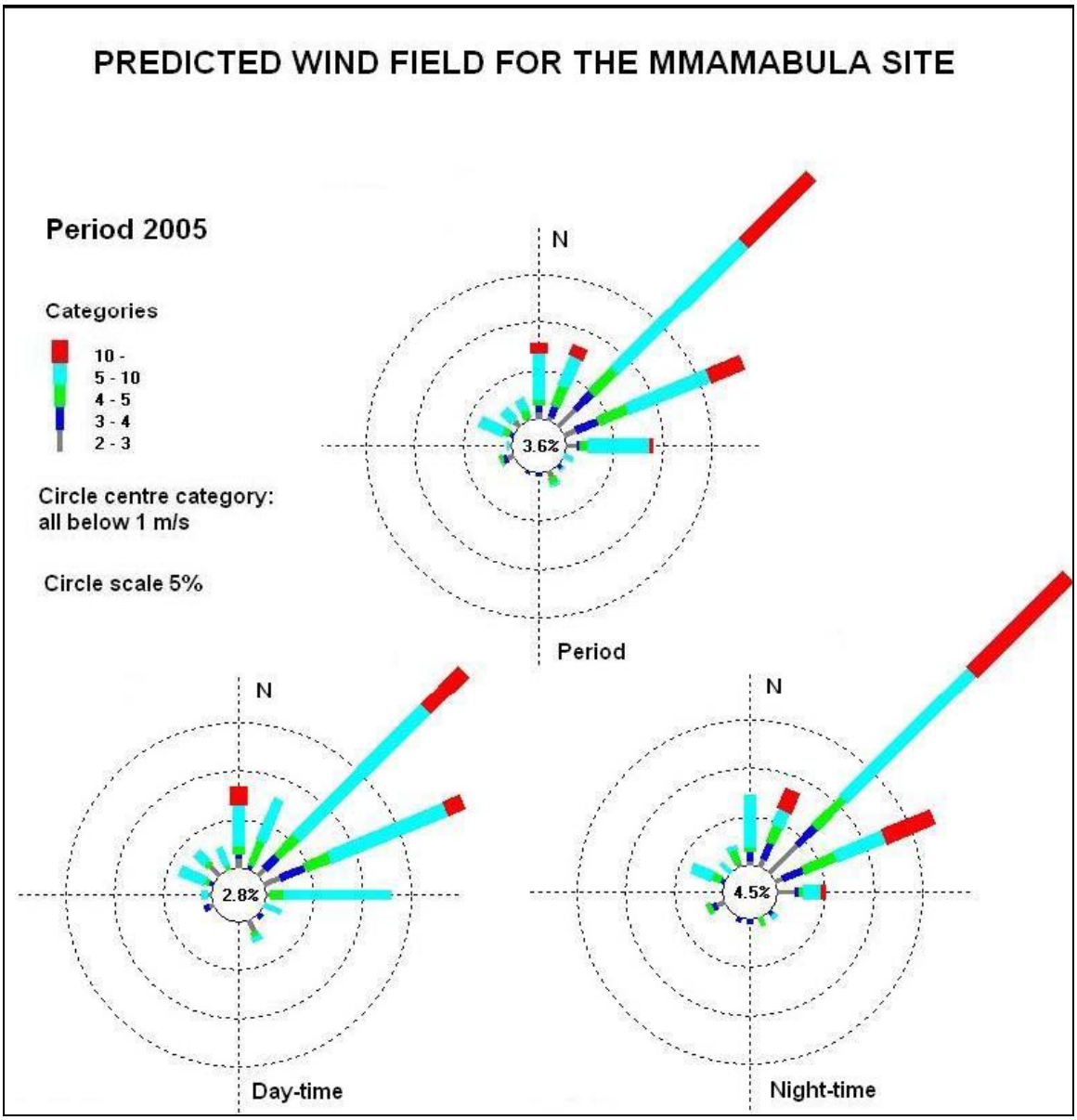

Figure 8-2: Predicted wind field for the Mmamabula site for the period 2005

8.1.1.2 Temperature

The nearest meteorological recordings was at Lephalale and Mahalapye. On average, temperature recorded at Lephalale ranged between 2.65°C in winter up to 41.35°C in summer.

8.1.1.3 Rainfall and Evaporation

Most of the rainfall occurs between the months of October and March, with the dry season commencing in about April and continuing until September. Maximum, minimum and mean monthly average precipitation for the period January 1991 to December 2002 is depicted in Figure 8-3. The annual average rainfall recorded at the study site for this period is 445 mm. Rainfall recorded for the station placed at the Mmamabula station totals 121mm for the period 7 September through to 14 December 2006.

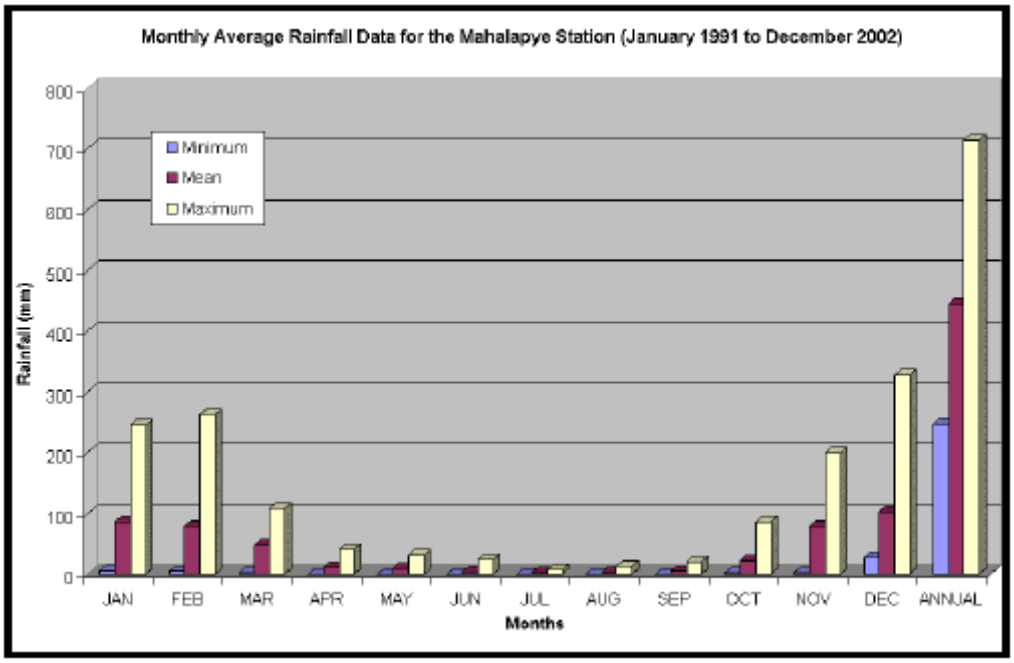

Figure 8-3: Maximum, minimum and mean monthly rainfall recorded for the period January 1991 to December 2002.

Precipitation is important to air pollution studies since it represents an effective removal mechanism of atmospheric pollutants. Due to the relatively low rainfall experienced, and the long period for which little or no rainfall occurs, wet deposition is anticipated to be relatively unimportant in the removal of pollutants from the study area.

Evaporation is a function of ambient temperature, wind and the saturation deficit of the air. High levels of evaporation occur as a result of the high levels of solar radiation experienced. The annual total evaporation is observed to be in the range of ~2523 mm. Total monthly evaporation rates range between ~122 mm and ~303 mm.

The low temperatures and absence of rainfall during winter months is offset by the large uninterrupted incidence of sunshine. Rising temperatures in September and October,

accompanied also by the windiest conditions of the year, result in increased evaporation rates during these months, which increases the risk of fires that could pose a problem to the transmission lines.

8.1.2 Topography

Botswana is a generally a broad and level country lying at the centre of the Southern African plateau. It is one of the flattest countries in Africa with the average elevation of the plateau is 1,000 m above sea level, although in the east the countryside is more undulating, with hills rising to 1,400 m.

The route of the Mmamabula transmission line will run from the proposed Mosaditshweni sub-station in the south to Selebi-Phikwe in the north of Botswana, as well as east from the Mmamabula power plant into South Africa. As stated above, the eastern half of Botswana characteristically is undulating with low lying tableland hills and outcrops sloping towards the east. The transmission line route will run on an average elevation of 900m above sea level and will be flanked by the low lying tableland hills between Mahalapye and Palapye.

8.1.3 Geology

The area were the proposed transmission line will be constructed along consists of different formations that is covered by a thick layer of sand.

8.1.3.1 Ramolsewana basalts

The Ramoletswana (Stormberg) basalts are present over portions of the study area. The contact between the basalts and the underlying formations is not uniform due to the tectonic activity of the study area. The thickness generally increases towards the west of the study area.

8.1.3.2 Ntane sandstones

The Ntane blocks vary in thickness but generally attain a thickness of 120 m, with up to 200 m being mapped in the Southern portion of the Mmamabula well field (BRGM, 1994). The Ntane sandstones are separated from the underlying formations by the Mosoletsane mudstones which act as an aquiclude. The Ntane is capped by Basalts over the portions of the study area resulting in confining conditions.

8.1.3.3 Lower Karoo formations

The Mmamabula formations are cemented with clay and have a low primary porosity. These formations are differentiated from each other by faults and dolerite dykes intruding through the

formations. Another two major fault systems is also present the Khurutse Fault and the Bokwete Fault which together with the Zoetfontein Fault cut across the transmission line area in a North-west South-east direction.

8.1.4 Soil

Envirosoil, whose details are given below, compiled the soils report, which is attached in Appendix E.

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8.1.4.1 Methodology

The soils were investigated on a regional basis using the Soil Map of Botswana 1 : 1,000,000 scale (Soil Mapping & Advisory Services, 1990) and interpolated according to the soil groups that occupied the proposed route(see soil map, Appendix E)

Soils were classified according to the FAO-UNESCO-ISRIC (1990) Soil Classification System in order to maintain continuity with the historical soil studies completed in the area as well as complying with World Bank Standards.

Table 8.1describes the soils along the transmission line route from Mosaditshweni to Selebi Phikwe, covering both East and West options, as well as the route from Mmamabula Power Station to the Limpopo River (where the Botswana/South Africa border is crossed). The soil groups are described as well as general characteristics of the soils which might influence construction.

8.1.4.2 General description soils of the area

The following soil groups are described in Table 8.1 –

- ARl: Luvic Arenosols;
- CLp: Petric Calcicols;
- ARo: Ferralic Arenosols;
- LVk: Calcic Luvisols;
- LVf: Ferric Luvisols;
- LVx: Chromic Luvisols;
- LVh: Haplic Luvisols;
- LXh: Haplic Lixisols;
- LXf: Ferric Lixisols;
- W – Western transmission route
- E – Eastern transmission route

The major soil groups that will be crossed by the proposed transmission routes are mostly Arenosols and Luvisols, with small areas of Lixisols. They are mostly found on fine-grained and coarse-grained sedimentary rocks e.g. sandstone. Luvisols have an accumulation of clay (15-25%) and a higher fertility, while Arenosols are coarse, sandy soils with weak structure and low fertility. In general the soils are sandy with a low clay content (<10%); this results in high water infiltration rates, low water holding capacity and fairly poor fertility. Lixisols are highly weathered and strongly leached soils and they also have a zone of clay accumulation which may occur at some depth below soil surface.

Table 8.1: Description of soils along the transmission line route

Distance (km)	Soil Group	General Soil Description	Possible Limitations for Construction of the Transmission Lines
Start @ Mosaditshweni	Route W Both E	Deep to very deep, moderately to well drained, yellowish brown to red, fine and fine-medium sands to loamy fine sands	NONE - Deep, well drained
0 - 20	[1]ARl	Moderately deep, moderately well to well drained, greyish brown to pale brown, fine sandy loams to silt loams.	Calcrete may outcrop in some areas
20 - 25	CLp	Deep to very deep, moderately well to excessively drained, yellowish brown to dark red, coarse sands to loamy fine sands	NONE – deep, well drained
25 - 50	ARo [1]ARl	Deep to moderately deep, imperfectly to well drained, dark greyish brown to red, sandy loam to sandy clay loam.	Calcrete outcrops may occur
50 - 90	LVk [2]LVf	Deep to very deep, moderately to well drained, yellowish brown to red, fine and fine-medium sands to loamy fine sands	NONE - Deep, well drained
90 -120	ARl	Moderately deep to very deep, moderately well to slightly excessively drained, strong brown to dark red, sandy loams to clay loams	NONE - Deep, well drained Higher clay content.
120 - 130	[2]LVf *LVx	(* see below) Moderately deep to very deep, imperfectly to well drained, very dark grey to yellowish red, sandy loams to clays.	Lixisols highly weathered, less stable than Luvisols
130 - 160	*LVx LVh LXh	Moderately deep to very deep, moderately well to slightly excessively drained, strong brown to dark red, sandy loams to clay loams	NONE – deep, well drained
160 - 205	LVx	Deep to very deep, moderately well to excessively drained, yellowish brown to dark red, coarse sands to loamy fine sands Deep to moderately deep, imperfectly to well drained, dark greyish brown to red, sandy clay loams to clays.	NONE - Deep, well drained Calcrete outcrops may occur
105 - 215	ARo	Moderately deep to very deep, moderately well to slightly	NONE – deep, well drained

Distance (km)	Soil Group	General Soil Description	Possible Limitations for Construction of the Transmission Lines
	LVk	excessively drained, strong brown to dark red, sandy loams to clay loams	
215 - 225	LVf	Moderately deep to very deep, imperfectly to moderately well drained, dark brown to red, loamy coarse sands to fine sandy loams.	Highly weathered soil , may not be as stable as other soil
225 - 275	LXh	Moderately deep to very deep, imperfectly to well drained, very dark grey to yellowish red, sandy loams to clays.	NONE - Deep, well drained Higher clay content.
275 – 290 @ Selibe Phikwi	LVh	Deep to very deep, moderately well to excessively drained, yellowish brown to dark red, coarse sands to loamy fine sands	NONE - Deep, well drained Calcrete outcrops may occur
0 – 25 Mma - RSA	ARo ARl ,LVk	Deep to very deep, moderately well to excessively drained, yellowish brown to dark red, coarse sands to loamy fine sands	NONE - Deep, well drained Calcrete outcrops may occur

8.1.5 Land Capability

The topography, climate and parent material across the entire proposed transmission route does not differ much, with the result that the soils and vegetation are fairly homogeneous throughout the area. The vegetation is mostly suitable for grazing of cattle and goats, although areas are frequently cleared and the soil cultivated for the planting of crops such as maize, sorghum, millet and vegetables. This does not necessarily qualify the land capability as being arable as the crops are planted for subsistence and could not be cultivated on an economically sustainable basis. This is because the soils are mostly sandy, with poor structure and extremely low in all essential nutrients especially phosphate. These soils are thus seldom farmed on a large scale, mainly due to the high cost of fertilization.

The entire transmission route should be classified as being veld or grazing land for purposes of its pre-construction land capability.

8.1.6 Land Use

The land in the study area is used for grazing cattle and sheep, with small areas of subsistence agriculture along the different transmission line routes. Although the soils are not well suited for cultivation, they provide the local land user with maize, sorghum and vegetables for their own consumption. These cultivated lands are mostly close to the villages and are only utilized during the short rainy season.

8.1.7 Surface Water

Digby Wells & Associates whose details are given below compiled the surface water report.

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8.1.7.1 Methodology

The hydrology study consisted of a desk study using available rainfall and topography data to determine flood events that may occur in the area of interest.

Water Quantity

Water quantity in the relative catchments is necessary for calculating flood volumes which are required to determine the floodlines for the respective river crossing points. This will have relevance to the final positioning of transmission towers. Copies of numerous relevant documents were obtained from internet sites i.e. Ashton et al, 2001, Arntzen et al, 1999 and FAO, 2004. The FAO report contains details of the river catchment sizes, mean annual run-off (MAR) and mean annual precipitation (MAP). This information, together with a 1:250 000 topographical map indicating 5 m contour intervals, obtained from the Botswana Department of Surveys and Mapping were used to determine the expected flood magnitude for the 20 year, 50 year and 100 year return periods along the respective rivers.

Additional 2 m contour interval topographical information became available from a flown survey which was carried out for the mine and power station area of interest only. This survey was used to determine the floodlines which will be associated with a 100 year and 20 year rainfall events along the Bonwapitse River. Unfortunately detailed information for the remainder of the rivers traversed was not available and calculations were therefore based on 5m intervals.

During a site visit to the Tuli block, information was gathered from the farmers who have erected high level markers on the bank of the Limpopo River after the floods in the year 2000.

The Rational Method which is generally used to determine expected flood events is not considered to be very accurate for large catchment areas such as the Bonwapitse River. A more appropriate method was thus selected for determining this catchment's characteristics. The Standard Design Flood Method (SDF) which was developed by Prof. Alexander of the University of Pretoria in South Africa was used (Alexander, 2002). Due to extensive damage to the bridges that cross the Limpopo River which was caused by the 2000 floods (caused by tropical cyclones) a study was initiated by the South African National Roads Agency which ultimately resulted in the development of the SDF method for determination of flood magnitudes for large catchments.

During the site visit to the Tuli block as well as a subsequent visit to the Serorome River, the local residents in the area reported that the flooding in the Bonwapitse River is usually caused by high rainfall events in the Bonwapitse catchment and not the Serorome catchment. The SDF and the Rational Method specify that the longest stream be used in the calculations. It was therefore

necessary to do a run of hydrograph analysis using the flood peaks of the two streams separately to obtain the results from the SDF for the total catchment area.

Water Quality

Where possible, surface water quality samples were taken and analysed. Due to the low rainfall and the resulting ephemeral nature of the rivers in the area, very few samples could be taken, and samples taken were from standing pools and ponds within river beds. These samples will most likely not be representative of baseline water quality conditions as factors such as evaporation of standing water will influence the results. The results obtained were, however, compared to the Botswana and World Health drinking water guidelines. Additional samples will be taken in the wet season where water quality results will be more representative of baseline conditions and a detailed monitoring program will be set up to be followed during the life of project.

Interaction with other specialists, especially the soils and biophysical teams, were necessary to identify wetland and pan areas. Wetland delineation in the proposed project infrastructure area will be conducted during the wet season fauna and flora investigations. Soils characterisation was used in conjunction with aerial photographs to identify pans in the proposed project area.

8.1.7.2 Surface water quantity

The Catchment

A number of rivers are crossed along the proposed routes. These include the Limpopo, Bonwapitse, Mhalatswe, Lose, Tewane, Taupye, Ramatanka, Morupule, Dikabeya, Tshakana, Mahunwane, Mmadlkopka and Moswane Rivers. All of these are non-perennial and only flow after heavy rains, although the Limpopo River will contain water in pools throughout the year. The Limpopo catchment is of interest to various government departments in the countries that border the river, namely Botswana, South Africa, Mozambique and Zimbabwe.

The 5 m contour interval topography map obtained from the Botswana government was used to determine the catchment boundaries of the respective rivers. The catchment areas were measured by hand using a planimeter and verified using the Autocad computer drawing package and are provided in Table 8.2

Table 8.2: Catchment areas of river crossed by the proposed transmission lines

River	Catchment Size (km^2)
Bonwapitse	11 500
Mhalatswe	839
Ramatanka	613.77
Mmaitsokwane	3 006.2
Thangwane	232
Dikabeya	1 442.27
Mahunwane	124.6

The MAR from the different catchments within the project area is summarised in Table 8.3.

Table 8.3: Mean annual runoff for rivers along the proposed route.

River	MAR (million m3)
Bonwapitse	15
Mhalatswe	13
Mmaitsokwane	19.1
Ramatankwa	3.9
Thangwane	1.48
Dikabeya	9.17
Mahunwane	3.03
Limpopo (in project area)	111
Total	175.68

Normal dry weather flow

Reports and publications which were obtained from the internet and the Botswana government indicate that the normal dry weather surface flow in all the rivers along the proposed route is zero, as indicated in Figure 8-4. The Limpopo also experiences periods of zero normal dry weather flow, as seen in Figure 8-5.

Figure 8-4: Bonwapitse in March, at the bridge between Dovedale and Mmapashalala

Figure 8-5: The Limpopo River in October 2005, with no surface water present

Flood peaks

The flood volumes for the rivers along the proposed roués were determined using the SDF method.

Apart from the Limpopo River, the longest stream in the catchment area is the Serorome River which joins the Bonwapitse River approximately 3.5 km upstream of the area of interest. The total stream length was measured to be 209km with a height difference along its length of approximately 299m. The results obtained from the SDF method and the Rational Method (taken from pre-feasibility report for comparison) are summarised below.

Table 8.4: Expected flood magnitudes as calculated with the Standard Design Flood method for the rivers along the proposed route.

River	Return Period 1:20 years	Return Period 1:50 years	Return Period 1:100 years
Bonwapitse	1 820.0 m3/s	2 722.0 m3/s	3 486.0 m3/s
Mhalatswe	448.2 m3/s	670.4 m3/s	858.4 m3/s
Mmaitsokwane	878 m3/s	1 313.6 m3/s	1 682.0 m3/s
Ramatankwa	407.3 m3/s	609.2 m3/s	780.0 m3/s
Thangwane	245.1 m3/s	366.6 m3/s	469.4 m3/s
Dikabeya	574.6 m3/s	859.4 m3/s	1 100.4 m3/s
Mahunwane	165.3 m3/s	247.3 m3/s	316.7 m3/s

The flood lines have been determined using cross sections drawn perpendicular to the river at 200 m intervals using the 2 m contour data, and applying Manning's formula to determine the depth of flow for the 100 year flood event. The floodlines are shown on the relevant surface water plans, Plan 3-5, Appendix A.

River Diversions

There are currently no river diversions planned for the project.

Wetlands and Pans

To date, no wetlands that can't be avoided have been identified that occur in the transmission line project area; however an intensive wetland delineation along the streams will be conducted for inclusion in the profile designs.

There are a number of pans that occur in the project area, although they are not currently expected to be impacted by the infrastructure. As ephemeral wetlands, these pans have a significant

environmental value and should be protected if possible. The project planners are advised in order to avoid these pans during construction and operations.

8.1.8 Groundwater

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The area along which the proposed transmission line will be constructed, consists of different formations that are covered by a thick layer of sand. The sand alone has a high infiltration rate and a low storage capacity but can be considered an aquifer with sufficient water supply throughout the year. Hand dug wells along the riverbeds indicate that this aquifer is a good source of water supply for the local cattle farmers.

8.1.8.1 Ramolsewana basalts

The Ramoletswana (Stormberg) basalts are present over portions of the study area. The contact between the basalts and the underlying formations is not uniform due to the tectonic activity of the study area. The thickness generally increases towards the west of the study area. The aquifer potential of the basalts was evaluated by Cheney (1981) and it was concluded that the basalts give a consistent yield of potable water within the fractured zone. Previously only areas of weathering were targeted for the purposes of water supply. The typical yields are below 15 m3/h (95th percentile) with a yield of 25 m3/hr being the recorded maximum within this formation. It is not clear if these yields are estimated or sustainable.

8.1.8.2 Ntane sandstones

The Ntane sandstones are the most important aquifer within the MEP area (Geotechnical Consultants, 1999). The Ntane blocks vary in thickness but generally attain a thickness of 120 m, with up to 200 m being mapped in the Southern portion of the Mmamabula well field (BRGM, 1994). The Ntane sandstones are separated from the underlying formations by the Mosoletsane

mudstones which act as an aquiclude. The sandstones are porous, but secondary permeability is required to produce high yielding boreholes. The Ntane is capped by Basalts over the portions of the study area resulting in confining conditions. Cheney (1981) found hydrological continuity between the basalts and the underlying Ntane (termed cave sandstone) in the Dibete area. The block faulting of the sandstones allow the transmission of water across them where the Ntane sandstones are juxtaposed against one another, otherwise they acts as boundaries to groundwater flow (Geotechnical Consultants, 1999). The preferred target areas are areas where the Ntane sandstones are under confining conditions due to the presence of the overlying basalts (Aquatech, 1988).

8.1.8.3 Lower Karoo formations

The Mmamabula formation is cemented with clay and has a low primary porosity. Flow along fractures occurs, but due to the limited interconnectivity these fractures are generally isolated (Williamson, 1991).

The Lower Karoo formations are differentiated from each other by faults and dolerite dykes intruding through the formations. This contact between the dolerite dyke and the formation being intruded is also a source of groundwater, depending on the age of the dolerite and the amount of weathering that has taken place. The faults are another source of groundwater as these structures open spaces between the formation to allow water to be collected and stored. One such fault that is considered to have a very high yield in the area of interest is the Zoetfontein Fault. Another two major fault systems also present are the Khurutse Fault and the Bokwete Fault which together with the Zoetfontein Fault cut across the transmission line area in a North-west South-east direction.

8.1.9 Air Quality

Apart from vehicle entrained dust generation and tailpipe emissions, which will be greatest during construction, no significant air quality impact will be associated with the transmission lines. A specific air quality assessment was therefore not conducted along the entire length of the proposed transmission line, however, information obtained for the mine and power station studies can be used as an indication of background ambient conditions and existing sources of air pollution.

Airshed, Planning Professionals conducted the baseline air quality assessment (for contact details see section on climate).

As part of the scope for this project, a meteorological station has been implemented near the proposed Mmamabula site (~ 5 km to the southeast) during the fist week of September 2006. The station is a continuous monitor comprising of the following components:

- Wind monitor recording hourly average wind speed and wind direction (cover a wind speed range of up to 60 m/s);
- Relative humidity and temperature probe measuring hourly average data;
- Rain gauge (a rain gauge usually has a tipping bucket for simple and effective rainfall measurements);
- Pressure sensor (800 to 1100 mBar);
- Solar radiation sensor to measure global radiation;
- Tripod for mounting the instrumentation on;
- Data logging software and cell phone connection for information download;
- Solar panel and solar panel mast (should no electricity be available);
- Secure site for safety.

Ecoserv Consulting was appointed by Airshed Planning Professionals to implement and operate the meteorological station for a period of 1 year before it will be handed over to the project proponent. Meteorological data for the period 7 September to 14 December 2006 has been successfully downloaded from the monitoring station.

8.1.9.1 Existing sources of emissions

Industrial Sources and Power Generation

Two operational coal-fired power stations fall within the region of concern, one located near Lephalale in South Africa (~100 km to the east) and one near Palapye in Botswana (~ 111 km north-northeast).

The power stations are large sources of sulphur dioxide. Sulphur dioxide oxidises in the atmosphere to particulate sulphate at a rage of between 1 and 4% per hour. Fine particulate sulphate has been used to trace the transportation of power station plumes across the Southern African sub-continent.

An EIA was recently conducted for the expansion of the Matimba operations with the addition of a second power plant namely Matimba B. The Matimba Power Station was indicated to be the likely main source of SO_2 emissions in the region around Lephalale. Measured and predicted sulphur dioxide concentrations were within the EC annual sulphur dioxide limit of 20 µg/m³, with

local and international NO_x and NO_2 concentrations also predicted and measured not to be exceeded. PM10 concentrations were measured to exceed the more stringent SANS limit values and European Community (EC) limit values for highest daily averages. For Matimba B, the predicted NO and NO_2 concentrations were within local and international air quality limits. The predicted PM10 concentrations were also within the SA daily and annual standards but exceeded the SANS and EC limit values in the vicinity. Predicted SO_2 concentrations from the existing Matimba Power Station exceeded the SA Standards of 125 µg/m³ for highest daily and 50 µg/m³ for annual averages. The cumulative predictions also resulted in non-compliance with the SA standards.

For the Morupule Power Station in Botswana it was found during an air quality assessment conducted for the power station that the stack emissions from the future boiler operations would exceed the World Bank and European Community (EC) emission limits. Based on the scoping work undertaken it was concluded that mitigation measures were likely to be required for current operations in order to bring the plant into compliance and to reduce the potential for air quality impacts. The degree of air quality impacts associated with current operations required further investigation in order to determine the exact extent of mitigation/management required.

Mining Operations in the Region

Mining operations represent potentially significant sources of fugitive dust emissions (PM2.5, PM10 and TSP) with small amounts of NO_x, CO, SO_2, methane, and CO_2 being released during blasting operations. Fugitive dust sources associated with mining activities include blasting and drilling operations, materials handling activities, vehicle-entrainment by haul vehicles and wind-blown dust from tailings impoundments and stockpiles.

Experience has shown that fugitive dust emissions due to on-site operations are typically only of concern within 3 km of the mine boundary. This is the reason for the current manner in which atmospheric emissions are treated for mining operations. Dust suppression methods that are most frequently used in local mining operations include the wet suppression and the chemical stabilization of haul roads and storage piles, and the vegetation or rock cladding of tailings impoundments.

Vehicle Tailpipe Emissions

Air pollution from vehicle emissions may be grouped into primary and secondary pollutants. Primary pollutants are those emitted directly into the atmosphere, and secondary, those pollutants formed in the atmosphere as a result of chemical reactions, such as hydrolysis, oxidation, or photochemical reactions. The significant primary pollutants emitted by motor vehicles include carbon dioxide (CO_2), carbon monoxide (CO), hydrocarbons (HCs), sulphur dioxide (SO_2), oxides of nitrogen (NO_x), particulates and lead. Secondary pollutants include: nitrogen dioxide

(NO_2), photochemical oxidants (e.g. ozone), HCs, sulphur acid, sulphates, nitric acid, nitric acid and nitrate aerosols. Toxic hydrocarbons emitted include benzene, 1.2-butadiene, aldehydes and polycyclic aromatic hydrocarbons (PAH). Benzene represents an aromatic HC present in petrol, with 85% to 90% of benzene emissions emanating from the exhaust and the remainder from evaporative losses.

Vehicle tailpipe emissions are also localised sources and unlikely to impacts far-field. The A1 in the vicinity of the proposed MEP transmission lines is associated with high traffic volumes and is likely to be a larger source of air pollution than vehicles along the transmission line routes.

Household Fuel Combustion

Domestic coal combustion has been identified, based on both qualitative and quantitative observations, as being potentially the greatest source of airborne particulates within poor urban residential areas in South Africa. Quantitative indirect source apportionment of particulate, SO_2 and NO_x concentrations confirmed the predominance of the contribution of domestic coal combustion emissions to airborne particulate concentrations (Annegarn and Kneen, 1994). Coal burning emits a large amount of gaseous and particulate pollutants including sulphur dioxide, heavy metals, total and respirable particulates including heavy metals and inorganic ash, carbon monoxide, polycyclic aromatic hydrocarbons, nitrogen dioxide and benzo(a)pyrene. Pollutants arising due to the combustion of wood include respirable particulates, nitrogen dioxide, carbon monoxide, polycyclic aromatic hydrocarbons, particulate benzo(a)pyrene and formaldehyde. Particulate emissions from wood burning within South Africa have been found to contain about 50% elemental carbon and about 50% condensed hydrocarbons (Terblanche et al., 1992).

Agricultural Activities

The main activity within the Mmamabula region is farming, both small and localised to large commercial farms.

Crop farming and mixed crop farming include land tilling operations, fertiliser and pesticide applications, and harvesting. By applying fertiliser and pesticides use are typically made of vehicles (tractors) driving on unpaved roads and exposed soil. Land tilling include dust entrainment on exposed surfaces, wind blown dust and scraping and grading type activities resulting in fugitive dust releases. Both particulate matter (PM) and gaseous air emissions (mainly NO, NO2, NH3, SO2 and VOCs) are generated from the application of nutrients as fertilizers or manures (EPA, 1999). There are primarily 3 harvesting operations resulting in particulate emissions: (1) crop handling by the harvest machine, (2) loading of the harvested crop into trucks,

and (3) transport by trucks in the field. Particulate matter, composed of soil dust and plant tissue fragments (chaff), may be entrained by wind (EPA, 1995).

Cattle farms are also significant sources of fugitive dust especially when feedlots are used and the cattle trample in confined areas. Pollutants associated with dairy production for instance include ammonia (NH_3), hydrogen sulphide (H_2S), Methane (CH4), Carbon dioxide (CO_2), Oxides of Nitrogen (NO_x) and odour related trace gasses. According to the U.S.EPA, cattle emit methane through a digestive process that is unique to ruminant animals called enteric fermentation. The calf-cow sector of the beef industry was found to be the largest emitter of methane emissions. Where animals are densely confined the main pollutants of concern include dust from the animal movements, their feed and their manure, ammonia (NH_3) from the animal urine and manure, and hydrogen sulphide (H_2S) from manure pits.

Organic dust includes dandruff, dried manure, urine, feed, mould, fungi, bacteria and endotoxins (produced by bacteria, and viruses). Inorganic dust is composed of numerous aerosols from building, materials and the environment. Since the dust is biological it may react with the defence system of the respiratory tract. Odours and VOCs associated with animal manure is also a concern when cattle are kept in feedlots. The main impact from methane is on the dietary energy due to the reduction of carbon from the rumen. Dust and gas levels are higher in winter or when ever animals are fed, handled or moved (http://www.cdc.gov/nasd/docs).

Biomass Burning

Crop-residue burning and general wild fires (veld fires) represent significant sources of combustion related emissions associated with agricultural areas. Emissions are greater from sugar cane burning that for savannas wild fires due to sugar cane areas being associated with a greater availability of available material to be burned. The quantity of dry, combustible matter per unit area is 25 ton per hectare for sugar cane, whereas it is on average 4.5 ton per hectare for savannas areas.

Biomass burning is an incomplete combustion process with carbon monoxide, methane and nitrogen dioxide being emitted during the process. About 40% of the nitrogen in biomass is emitted as nitrogen, 10% remains in the ashes and it is assumed that 20% of the nitrogen is emitted as higher molecular weight nitrogen compounds. The visibility of smoke plumes from vegetation fires is due to their aerosol content.

Fugitive Dust Sources

Fugitive dust emissions may occur as a result of vehicle entrained dust from local paved and unpaved roads, and wind erosion from open areas. The extent of particulate emissions from the

main roads will depend on the number of vehicles using the roads and on the silt loading on the roadways. The extent, nature and duration of agricultural activities and the moisture and silt content of soils is required to be known in order to quantify fugitive emissions from this source. The quantity of wind blown dust is similarly a function of the wind speed, the extent of exposed areas and the moisture and silt content of such areas.

The pollutants listed above are released directly by sources and are therefore termed 'primary pollutants'. 'Secondary pollutants' which form in the atmosphere as a result of chemical transformations and reactions between various compounds include: NO_2, various photochemical oxidants (e.g. ozone), hydrocarbon compounds, sulphur acid, sulphates, nitric acid and nitrate aerosols.

8.1.10 Noise

Acoustic Consulting cc, whose details are given below compiled the noise report, refer to Appendix F for a copy of the complete noise report.

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8.1.10.1 Methodology

A site visit was conducted between the 11th and 14th of September 2006 concurrent with the baseline noise study for the Mmamabula mine and power station. The purpose of the site visit was to familiarise the consultant with the typical environment of the area through which the transmission line will be constructed.

Sampling measurements were carried out as part of the Mmamabula Energy Project baseline study. The results of these measurements were assumed to be representative of the noise sensitive areas that will be affected by the construction and operation of the transmission line.

8.1.10.2 Description of the environment

The topography of the area of the proposed development is very flat, i.e. there will be no screening against the propagation of noise from the source to the receiver.

The vegetation is that of densely grown bush and tree land and the ground conditions are to a large degree very sandy. These conditions will provide excess attenuation of the noise as it propagates from the source to the receiver.

8.1.10.3 Identified noise sensitive areas

The following noise sensitive areas were identified:

- Mosomane

This village lies at the southern end of the transmission line development and is similar to the village of Dibete further north where the ambient noise level was sampled during the day.

- Dibete

This village is typical for those that occur at regular intervals along the B1 that connects Gaborone to the North of the country. Traffic on the main road determines to a large extent the ambient noise level together with other community noises. The ambient noise level that was measured here during the day complied with the guideline level of 55 dBA set by the World Bank for residential areas.

- Mookane

This village is typical for a rural setting, e.g. there are no tarred roads, and ambient noise levels can be quite low. Those measured fell well within the guideline levels set by the World Bank for residential areas.

- Mahalapye

This is a larger town and the guideline levels set by the World Bank 1, i.e. 55 dBA during the day and 45 dBA during the night were exceeded.

- Dikabeya

This village is north of the town of Palapye and is similar to Dibete and similar ambient noise levels can, therefore, be expected.

8.1.10.4 Measured ambient noise levels

The ambient noise levels that were measured as part of the Mmamabula Energy Project baseline study and that are applicable to this project are repeated here in Table 8.5.

Table 8.5: Measured ambient noise levels.

Measurement point	Period	World Bank [2] requirement dBA	L_{Aeq} (15 min) dBA	Remarks
Mookane	Day	55	47,5	Community noise, i.e. people talking, children playing and shouting. Banging noises. Bird song. Car passes measurement point and people talking.
	Night	45	42,9	Insect noise, i.e. crickets. Cattle in close proximity cause some noise at intervals. Very quiet at times.
Dibete	Day	55	51,4	Generator at filling station clearly audible. Traffic on main road as well as local. Community noise.
	Night	45	-	-

The following remarks are applicable to the results:

- Mookane

The measured ambient noise levels fall well within the requirements set by the World Bank Guidelines 1, although the measurement results during the night were higher than expected. This is due to the noise events caused by the cattle in close proximity to the measurement point. In the absence of these noise events and the constant noise caused by the crickets the ambient noise level was very much lower.

- Dibete

The ambient noise level remains fairly constant at the measured level of between 50 dBA and 52 dBA. It is to be expected that the ambient noise level will drop by approximately 10 dBA during the night. In this case the measured ambient noise levels fall well within the requirements set by the World Bank Guidelines 1.

8.2 Biological Features and Characteristics

8.2.1 Flora and Fauna

Digby Wells & Associates, whose details are given below, compiled the flora and fauna for the Transmission Line; refer to Appendix G for a copy of the complete flora and fauna report.

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8.2.1.1 General Description of the Vegetation

Apart from the large wetland areas in the north west of the country, Botswana officially falls within the savanna biome. The tree density and height varies from sparse low shrubs (frequently *Acacia* species) in the more arid regions to taller, near-closed canopy *Baikaea plurijuga* woodlands in the more moist regions. There are substantial areas covered by stands of *Colophospermum mopane*. The area of the proposed development show strong similarities to Vegetation Type 17, namely the Sweet Bushveld, as described by Van Rooyen & Bredenkamp (In Low and Rebelo, 1996) and the Arid Sweet Bushveld (Veld Type 14) as described by Acocks (1988) within the adjacent boundaries of South Africa. Crop agriculture is confined to a relatively small area on the eastern and northern margin of the country, with the principal crops being maize, sorghum, millet and pulses (Global Terrestrial Observing Systems, 2001)

Historically this vegetation supported a large, migratory ungulate community with obvious attendant predators. The erection of veterinary fences and the encroachment of cattle into these former wildlife areas have, however, greatly reduced this phenomenon. (Global Terrestrial Observing Systems, 2001)

The Vegetation Map of the Republic of Botswana (Soil Mapping and Advisory Services Project, 1991) shows that the proposed transmission line crosses a number of different vegetation units. These units are referred to as map units. The relevant map units are described below:

- **B8a**: The major vegetation grouping is Hardveld. The alliance is typified by *Colophospermum mopane* and *Acacia nigrescens*. The key species of the association are *Combretum apiculatum* and *Acacia tortilis*. The vegetation structure consists of Shrub Savanna, Savanna and Tree Savanna.

- **B7a**: The major vegetation grouping is Hardveld. The dominant and prominent species are *Combretum apiculatum*, *Acacia nigrescens* and *Acacia tortilis*. The vegetation structure consists of Shrub Savanna, Savanna and Tree Savanna.

- **B6b**: The major vegetation grouping is Hardveld. The alliance is typified by *Peltophorum africanum* and *Acacia tortilis*. The key species of the association is *Terminalia sericea*. The vegetation structure consists of Shrub Savanna and Savanna.

- **G16b**: The major vegetation grouping is Transition Sandveld – Hardveld. The dominant and prominent species are *Terminalia sericea*, *Acacia tortilis* and *Acacia mellifera*. The vegetation structure is Savanna.

- **H17b**: The major vegetation grouping is Mopane dominated. The alliance is typified by *Colophospermum mopane* and *Terminalia sericea*. The key species of the association is *Sclerocarya caffra*.

The typical vegetation in this region is savanna, containing both a tree and shrub layer and a grass layer. Due to the extensive grazing by livestock in some areas, the relationship between these two layers has been unbalanced, resulting in the tree and shrub layer becoming dominant over the grass layer. This then allows the tree and shrub layer to continually out-compete the grass layer, resulting in a dense tree and shrub layer and limited grass cover.

During the field investigation, where sites were surveyed along each of the proposed route alignments, the vegetation was found to be relatively uniform, which confirmed the results of the literature study. There appear to be only a few vegetation types, each dominated by a specific group of tree species and grass species, which occur repeatedly over the region. This corresponds with the trends shown in the Vegetation Map of the Republic of Botswana (Soil Mapping and Advisory Services Project, 1991). The land is tribal land so the land use remains generally the same in this region (plan 1and plan 2, Appendix A, illustrate the study area) resulting in similar vegetation types. In this region the differing soils seem to be the main influence on the different vegetation types.

In Botswana the arable land area is small. This is due to the low rainfall and the sandy, infertile soils. The maintenance of the productive potential is a key issue and soil erosion and bush encroachment are perceived as significant threats (Global Terrestrial Observing Systems, 2001).

8.2.1.2 Description of the vegetation found during the field surveys

Sites were surveyed along each of the alternative transmission line routes as described in the project description above. Surveys were conducted in both the dry season (August 2006) and wet seasons (May 2006 and January 2007)

The vegetation is in differing stages of succession, and this is reflected by the species that were found. The herbaceous component of the sampled area consisted mostly of pioneer or sub-climax species and these were mostly increaser 2 species, which are grasses well known to be present in overgrazed veld. These species are opportunistic and tend to colonise an area that has been disturbed. They produce a lot of viable seed and can thus quickly establish on newly exposed ground. They are also more common in lower rainfall areas. Disturbances can be caused by overgrazing, road construction and homesteads, or excessive use of an area. They have physiological adaptations which allow them to colonise cleared areas and they generally reproduce efficiently, eventually spreading over the whole disturbed area. Once these species have established themselves they create an environment suitable for other species, facilitating succession.

The tree component encountered, varied between different degrees of bush encroachment to proper Savanna, depending on the proximity to human settlements. *Acacia tortillas, Dichrostachys cinerea, Grewia flava,* were the most common species found. All three these tree/shrub species are known indicators of bush encroachment.

Some of the sample plots displayed a greater variety in their herbaceous layer; however the species composition of these plots showed all these grass species to be pioneer or sub-climax species.

Areas of potential significance are those where the transmission lines cross the rivers and streams. All the rivers and streams in this region are non-perennial. The vegetation supported by riparian environments differs from the surrounding vegetation. This is due to the increased availability of a water supply and different soil forms. Larger trees tend to be found in these zones. These zones are important as they provide habitat for animal species and generally support abundant bird life.

8.2.1.3 Plant species recorded during the surveys

Using Fabian & Germishuizen (1997), Pooley (1998) and Van Wyk & Malan (1988) to identify certain herbaceous species the following observations were made. The areas visited during the sampling were mostly overgrazed, which has resulted in bush encroachment. High grazing pressure reduces the growth rate and reproductive potential of individual plants and so influences the competitive relations among the different species. Overgrazing of the grass sword is the main reason for increased woody plant density in the eastern areas of Botswana (Tainton 1999).

Skarpe (1990), cited in Tainton (1999), indicated that in non-grazed and moderately grazed areas shrub densities showed no consistent trend, but densities increased where grazing was heavy. Tree species whose abundance increased were shallow rooted tree species such as *Acacia mellifera* and *Grewia flava*. This suggests that the depletion of the grass layer removed competition for water between the tree and grass layer, resulting in accelerated bush encroachment.

During the field surveys four Climax Decreaser species of grass were encountered, these were *Brachiaria nigropedata, Heteropogon amplectus, Panicum deustum* and *Setaria sphacelata sphacelata* and one decreaser species namely *Panicum repens*, these species decrease in over utilised and under utilised veld. Most species however were sub-climax increaser 2 species and these are indicators of stressed veld, possibly due to overgrazing (Van Outdshoorn 1999).

The fact that Climax decreaser species were found only where grazing animals could not reach them i.e. under low growing thorn trees and dead branches, indicates that the specific stressor in this case was possibly overgrazing.

Not all areas surveyed showed evidence of bush encroachment. The areas that showed signs of over-utilisation were those areas along the major transport routes, such as the A1 road, and those areas associated with the villages. The further one moves away from these areas the less disturbed the vegetation becomes. There are some areas that are slightly further away from these roads and villages that have been less intensively grazed. These areas tended to show a more balanced xeric savanna system with both a developed tree and shrub layer and a grass layer.

With *Dichrostachys cinerea* being one of the most dominant plant species observed during the survey (Figure 8-6), and the fact that this species is well known to increase in overgrazed veld, the assumption is made that the sites where this tree species were found in abundance have been overgrazed. Certain species considered encroachers that were recorded along the proposed routes are however diagnostic of the Mopane bushveld; these include *Acacia tortilis*, *Combretum apiculatum* and *Colophospermum mopane.*

Figure 8-6: Dichrostachys cinerea dominated vegetation indicating bush encroachment on previously disturbed land.

Acacia tortilis and *Grewia flava* was the second most dominant species along with *Acacia erubescens*, both of which are declared indicators of bush encroachment (Figure 8-7). Although *Acacia tortilis* is a key species in many of the vegetation units described above it is also indicative of bush encroachment.

Figure 8-7: Acacia spp. dominated vegetation

The Vegetation Map of the Republic of Botswana (Soil Mapping and Advisory Services Project, 1991) is a fairly recent publication in terms of the history of the vegetation in this region. The tribal grazing practices were in existence prior to 1991. According to Bose (2002) frequent fires, overgrazing and fuel wood collection has rendered most of the natural forests around human settlements to conform to the definitions of secondary forests. Secondary forests are defined in this publication as "...forests regenerating largely through natural processes after significant human disturbance of the original forest vegetation at a single point in time or over an extended period, and displaying a major change in the forest structure and / or canopy species composition with respect to nearby primary forest on similar sites".

Grewia flavescens, Grewia flava and *Combretum apiculatum* were all common along the proposed routes and are also listed as declared indicators of bush encroachment. Although *Combretum apiculatum* is a key species of vegetation unit B8a it is increasing in abundance as a result of the over-utilisation of the vegetation by livestock.

Many of the areas sampled and many areas observed visually were *Mopane* dominated. Although this species does naturally occur in this area and is diagnostic of the vegetation unit B8a described above, here it is increasing in abundance as a response to over grazing and is indicative of an over-utilised environment. It is evident in Figure 8-8 that the individuals growing here are small, young trees which have recently established themselves.

Figure 8-8: Mopane dominated vegetation. The uniform, shrub-like height of the vegetation indicates bush encroachment. More mature trees, although of the same species would be characteristic of later stages of succession.

Refer to Appendix G for the complete list of plant species recorded during the field surveys.

8.2.1.4 Red Data plant species

No red data plant species were recorded during the field surveys. This does not, however, mean that no red data species occur in the area. In the fauna and flora survey conducted for the Mine and Power Plant at Mmamabula (De Frey & Kampher, 2006) three species with red data status were listed. These species are associated with rocky outcrops and wetlands. The transmission line will connect to the power plant in this surveyed area.

8.2.1.5 Endemic plant species

No endemic plant species were recorded during the field surveys.

8.2.1.6 Exotic and invasive plant species

The alien invasive species encountered were *Elephantorrhiza elephantina, Solanum panduriforme, Dicerocyum eriocarpum* and *Datura stramonium* (Bromilow 1995). *Solanum panduriforme* was encountered in large numbers. Small stands of juvenile plants were found in a number of areas during the follow-up wet season survey. The other species were not encountered in large numbers and only sparsely distributed single plants were found. In the vicinity of villages the occurrence and density of weed species were considerably higher than away from them. This could be because of the tendency of these species to colonise bare ground, something that is abundant around villages. Furthermore, these plant species are fast growing and could be used to form natural barriers where villagers could herd their livestock in, or protect their crops from animals.

8.2.1.7 Medicinal plant species

From the list of plant species identified during the field surveys (App.1) there are 29 species (Table 8.6) officially recognised as having medicinal value. Medicinal plants are important to many people and have been used traditionally for centuries to cure many ailments. Plants have also been used traditionally for other cultural uses, such as building material, and for spiritual uses such as charms.

Table 8.6: Medicinal plant species recorded during the field surveys

Species	Common name	Ecological status	Growth form
Acacia gerrardii	Red Thorn	Medicinal	Tree
Acacia melifera	Black thorn	Medicinal	Tree
Acacia tortillis	Umbrella thorn	Medicinal	Tree
Boscia albitrunca	Sheperds tree	Medicinal	Tree
Colophospermum mopane	Mopane	Medicinal	Tree
Combretum apiculatum	Red Bushwillow	Medicinal	Tree
Combretum hereroense	Russet Bushwillow	Medicinal	Tree
Combretum imberbe	Leadwood	Medicinal	Tree
Dichrstachys cinerea	Sickle bush	Medicinal	Tree
Euclea crispa	Gwarrie	Medicinal	Tree
Grewia flava	Velvet raisin	Medicinal	Tree
Grewia flavescens	Sandpaper raisin	Medicinal	Tree
Gymnosporia senegalensis	Red Spikethorn	Medicinal	Tree
Lannea discolor	Live long	Medicinal	Tree
Peltophorum africanum	African wattle	Medicinal	Tree
Rhus tenuinervis	Kalahari current	Medicinal	Tree
Sclerocarya birrea	Marula	Medicinal	Tree
Terminalia sericea	Silver cluster leaf	Medicinal	Tree
Ximenia americana	Blue sourplum	Medicinal	Tree
Ziziphus mucronata	Buffalo thorn	Medicinal	Tree
Asparagus virgatus	Broom asparagus	Medicinal	Shrublet
Burkea africana	Wild seringa	Medicinal	Tree
Combretum zeyheri	Large-fruit bushwillow	Medicinal	Tree
Kyphocarpa angustifolia		Medicinal	Herb
Merremia tridentata	Merremia	Medicinal	Herb
Momordica balsamina	African cucumber	Medicinal	Herb
Mundulea sericea		Medicinal	
Phyllanthus reticulatus	Potato bush	Medicinal	Shrub
Sansevieria hyacinthoides	Mother in laws tongue	Medicinal	Herb

8.2.1.8 Mammals

Mammal desktop study: Mammals that could occur in the area

Appendix G lists the species of mammals that could potentially occur in the area of interest, based on distribution maps, the Department of Wildlife and National Parks Aerial survey data for Botswana. (2006, Gaborone, Botswana) and the availability of suitable habitat. It is, however, unlikely that many of these species will occur in the study area as most of them are restricted to protected areas such as national parks.

Mammals observed and recorded in the area

Due to the fact that the land use in this region is primarily tribal grazing land, the potential for wild animals to occur here is very low. The identification of areas of importance that could support natural wildlife, especially red data species, was difficult due to the fact that the majority of the land is disturbed. The natural vegetation is disturbed due to human interference and the grazing and browsing of domestic animals. The local people also hunt in these areas. As a result very few wild animals were expected to occur here. The very low numbers of actual wild animal sightings confirmed this. The wetland areas would provide watering points for the existing wildlife but due to the climate and surface water patterns in this region these are not permanent water sources. These small wetlands were generally located in areas utilised by humans and livestock so did not support a large variety or abundance of wildlife. The table below presents the list of mammals that were seen during the field surveys.

A small herd of Impala (*Aepyceros melampus*) was seen in an area that was particularly sparsely populated. The vegetation in this area consisted of larger trees and had a fairly well developed grass layer. It did not appear to be as overgrazed as the other areas.

Table 8.7: Mammals recorded during the field surveys

Order:	Family:	Subfamily:	Species	English name	Status
Artiodactyla	Bovidae		*Aepyceros melampus*	Impala	Least concern
Artiodactyla	Suidae		*Phacochoerus africanus*	Warthog	Least concern
Artiodactyla	Bovidae	Cephalophinae	*Sylvicapra grimmia*	Grey /Common Duiker	Least concern

Order:	Family:	Subfamily:	Species	English name	Status
Carnivora	Herpestidae	Herpestinae	*Cynictis penicillata*	Yellow Mongoose	Least concern
Carnivora	Herpestidae		*Herpestes ichneumon*	Large Grey Mongoose	Least concern
Carnivora	Herpestidae		*Ichneumia albicauda*	White-tailed Mongoose	Least concern
Carnivora	Mustelidae	Mustelinae	*Ictonyx striatus*	Striped Polecat	Least concern
Carnivora	Herpestidae		*Mungos mungo*	Banded Mongoose	Least concern
Lagomorpha	Leporidae		*Lepus saxatilis*	Scrub/Savanna h Hare*	Least concern
Primata	Cercopithecid ae		*Cercopithecus aethiops pygerythrus*	Vervet Monkey	Least concern
Rodentia	Sciuridae		*Paraxerus cepapi*	Tree Squirrel	Least concern
Rodentia	Sciuridae		*Paraxerus palliatus*	South African Ground Squirrel	Least concern
Rodentia	Pedetidae		*Pedetes capensis*	Springhare	Least concern

Red Data mammals

No mammals with Red Data status were observed during the field survey. From the list of mammals that could potentially occur in the area of interest one is listed as Endangered, three are listed as Vulnerable, and eight are listed as Near-Threatened.

8.2.1.9 Birds

An independent survey was conducted by Mr. Chris van Rooyen from the Endangered Wildlife Trust to assess the impacts of this proposed project on the bird life in the area and to suggest mitigation measures where necessary. The full study has been included in Appendix (van Rooyen, 2006). It should however be noted that five individuals of the Southern ground hornbill (*Bucorvus leadbeateri*) which is categorised as vulnerable were observed during the second wet season survey. Table 8.8 lists the rare species impacted by transmission lines that may occur along the proposed corridors.

Table 8.8: Rare species impacted by transmission lines that may occur along the proposed corridors.

Species	Suggested conservation status (Tyler& Borello 2000)*	Expected locality
White Stork	Not endangered Protected under Wildlife Conservation and National Parks Act, 1992	The species could occur sporadically anywhere in the study area, depending on availability of food. Most likely interactions will be in cultivated areas.
Black Stork	Not endangered Protected under Wildlife Conservation and National Parks Act, 1992	The species could occur sporadically anywhere in the study area, depending on availability of food. Most likely interactions will be near dams and pools in rivers.
Abdim's Stork	Not endangered Protected under Wildlife Conservation and National Parks Act, 1992	The species could occur sporadically anywhere in the study area, depending on availability of food. Large concentrations can be expected at agricultural clearings.
Marabou Stork	Not endangered Protected under Wildlife Conservation and National Parks Act, 1992	The species could occur sporadically anywhere in the study area, depending on availability of food. Attracted to large carcasses and wetlands.
Yellowbilled Stork	Not endangered Protected under Wildlife Conservation and National Parks Act, 1992	The species could occur anywhere in the study area, depending on availability of food. Most likely interactions will be near dams and pools in rivers.
Greater Flamingo	Threatened or declining species. Protected under Wildlife Conservation and National Parks Act, 1992	Unlikely to occur along the alignments.

Lesser Flamingo	Globally near-threatened species. Protected under Wildlife Conservation and National Parks Act, 1992	Unlikely to occur along the alignments.
Secretarybird	Not endangered Protected under Wildlife Conservation and National Parks Act, 1992	Anywhere in the study area, particularly in agricultural clearings and open country.
Cape Vulture	Not endangered Protected under Wildlife Conservation and National Parks Act, 1992	Anywhere in the study area. Interactions likely where carcasses are close to the line. Could also gather at temporary waterbodies.
African Whitebacked Vulture	Not endangered Protected under Wildlife Conservation and National Parks Act, 1992	Collisions: Anywhere in the study area. Interactions likely where carcasses are close to the line. Could also gather at temporary waterbodies. Disturbance of breeding pairs most likely near river courses with large trees.
Lappetfaced Vulture	Bird of concern in Botswana. Scarce. Protected under Wildlife Conservation and National Parks Act, 1992	Anywhere in the study area. Interactions likely where carcasses are close to the line. Could also gather at temporary waterbodies. Disturbance of breeding pairs most likely near river courses with large trees.
Tawny Eagle	Not endangered Protected under Wildlife Conservation and National Parks Act, 1992	Anywhere in the study area. Interactions likely when scavenging close to the line. Disturbance of breeding pairs most likely near river courses with large trees.
Martial Eagle	Bird of concern in Botswana.	Anywhere along the route, breeding

	Widely dispersed but not uncommon. Protected under Wildlife Conservation and National Parks Act, 1992	usually in large trees along river courses.
Brown Snake Eagle	Not endangered Protected under Wildlife Conservation and National Parks Act, 1992	Anywhere in the study area, breeding usually in large trees
Blackbreasted Snake Eagle	Not endangered Protected under Wildlife Conservation and National Parks Act, 1992	Anywhere in the study area, breeding usually in large trees
African Fish Eagle	Not endangered Protected under Wildlife Conservation and National Parks Act, 1992	The species could occur anywhere in the study area, depending on availability of food. Most likely interactions will be near dams and pools in rivers.
Whitewinged Black Korhaan	Bird of concern in Botswana. Widely dispersed but not uncommon.	The species could occur in open country anywhere in the study area.

8.2.1.10 Reptiles

<u>Reptiles observed and recorded in the area</u>

No reptiles were observed during the field surveys.

<u>Red Data reptiles</u>

No reptiles with Red Data status were observed during the field surveys. One species of reptile, the Southern African Python (*Python natalensis*) could potentially occur in the area of interest. This species is listed as Vulnerable.

8.2.1.11 Frogs

<u>Frogs observed and recorded in the area</u>

No frogs were observed in the area of interest during the field studies. No in-depth aquatic surveys were done.

Red Data frogs

No species of frogs with Red Data Status were observed during the field survey. The only threatened species that could potentially occur in areas where water occurs along the transmission line route is the Giant Bullfrog (*Pyxicephalus adspersus*).

8.2.1.12 Terrestrial invertebrates

Invertebrate desktop study

The literature survey indicated that six IUCN Red Data invertebrates (excluding Least Concerned category as these are not currently endangered) occur in Botswana (IUCN, 2006). These include five dragonflies (Odonata) and one millipede (Diplopoda) and have been listed with their Red Data status in Table 8.9. Their specific distributions are unknown and they may potentially not occur in the region of interest. Most species fall within the Data Deficient Red Data category, which lists animals that may be endangered but not enough information is known about them.

No CITES invertebrates are listed for Botswana (www.cites.org).

Table 8.9: IUCN Red Data invertebrates (excluding Least Concerned Category)

Class	Order	Family	Species	Red Data Status
Insecta	Odonata	Aeshnidae	*Anax bangweuluensis*	Data Deficient
Insecta	Odonata	Libellulidae	*Trithemis aequalis*	Data Deficient
Insecta	Odonata	Libellulidae	*Trithemis brydeni*	Data Deficient
Insecta	Odonata	Protoneuridae	*Elattonuera cellularis*	Data Deficient
Insecta	Odonata	Synlestidae	*Chlorolestes elegans*	Near Threatened
Myriapoda	Diplopoda	Spirostreptidae	*Doratogonus stephensi*	Data Deficient

Invertebrate field survey

The insect survey is a relatively simple process which can support information on ecological conclusions drawn from flora surveys and the two together give a good indication of the health of the environment. A comprehensive list of invertebrates collected from various sample plots in the

area has been included in Appendix G. The list indicates in which plot each species was found and how many individuals were collected.

All the common orders of **insects** were represented in the area. With sweep-net surveying, most species caught are plant dwellers or species foraging on or around plants. This will result in very few ground-dwelling insects being caught. Ground-dwelling insects were physically caught when observed. The ideal would be to place pitfall traps in the area, however, due to time constraints, the vastness of the area and the cost implications these were not conducted. The sweep-net surveys gave a good indication of the type of invertebrates occurring in the area and indicated that the insect biodiversity in the area is relatively healthy, with most of the larger insect orders well represented (Appendix G). This suggests that, although, there is an impact from grazing, relatively high plant diversity exists.

Most species were collected from the Hemiptera (true bugs and cicadas), Orthoptera (grasshoppers, locusts and crickets), Lepidoptera (moths and butterflies), Coleoptera (beetles), Hymenoptera (wasps and ants) and Diptera (flies). Most of the species collected in the first orders are herbivorous species, feeding on plant tissue, plant sap or decaying plant material. The species collected in the latter orders can be herbivorous, carnivorous, parasitic or saprophagous. These are the larger insect orders and it is expected that these should dominate in this area. Other orders represented by fewer species included the Mantodae (mantids), Phasmatodae (stick insects), Neuroptera (lacewings), Isoptera (termites) and Odonata (dragonflies and damsel flies).

Nineteen species of **spiders** representing five separate families were observed in the area. The spiders collected represent fairly common groups and are frequently caught in sweep net surveys as they reside in vegetation. None of the spiders collected are specialists with regard to the type of environment they occur in.

No **ticks** were collected from the area, which is surprising for an area utilised for grazing. The grass cover was sparse which may have reduced the chance of collecting ticks.

<u>Red Data terrestrial invertebrates</u>

Butterflies and dragonflies are currently the main Red Data invertebrates due to the greater awareness of butterflies by the public and the fact they are caught for various collectors globally. Many Odonata species have been recognised as specialist habitat users and bio-indicators, hence the Red Data listing of some of these species.

Nine butterfly species were collected in the area and none were Red Data species. A single Odonata specimen was collected which also was not a Red Data species.

8.3 Cultural Characteristics

8.3.1 Sites of Archaeological and Cultural Interest

Nick Walker & Karen van Ryneveld, whose details are given below, compiled the Archaeological and Cultural Interest report; refer to Appendix H for a copy of the complete Archaeological and Cultural Interest report.

Company	Nick Walker Achilles Investments Pty Ltd Karen van Ryneveld Archaeology Contracts Office, National Museum
Aspect	Archaeology
Contact Person	Nick Walker / Karen van Ryneveld
Telephone Number	Nick: (00267) 71378415 Karen: +27 (0)51 447 9609
Email Address	nwalke@telkomsa.net karen@nasmus.co.za

8.3.1.1 Contextual description

Archaeological heritage resources that were anticipated to be found along the transmission line corridors included sites and artefacts associated with the Stone Age (SA), Iron Age (IA) and Historical timeframe. These can be defined as follows:

- Stone Age

The Stone Age is divided into the Early (ESA); Middle (MSA) and Late Stone Age (LSA) and refers to the earliest people of Southern Africa who mainly relied on stone for their tools. Hunter-gatherers of the Stone Age roamed the river flood plains and adjacent interior of the Limpopo valley periodically, often depositing stone tools and other artefacts to be discovered in coming years.

The ESA may well date back to approximately 2Mya (Millions of years ago) and lasted until 500-250kya (thousand of years ago) (Mitchell 2002). The ESA is characteristically divided into the earlier Oldowan and the later Acheulean Complexes, focusing primarily on core technology. In southern Africa, a few assemblages in the Sterkfontein valley, South Africa represent the Oldowan. The geographically widespread Acheulean is identified by handaxes and cleavers as prime lithic fossils directeurs (Sampson 1974).

MSA (500/250kya to 40/27-23kya) lithic assemblage fossils directeurs include blade and flake technology, often in association with prepared platforms. Formal tools include retouched points, blades, segments, knives and a variety of scraper forms (Mitchell 2002; Sampson 1974).

LSA (40/27-23kya to the early 19th Century) deposits comprise of macro- and microlithic Industries. Composite tools production is a feature particularly of microlithic industries. The LSA is further associated with symbolic human behaviour, including jewellery and formal burial of the dead. Paintings and engravings are often associated with Later Stone Age San hunter-gatherer communities (Mitchell 2002; Sampson 1974).

Figure 8-9: Prototypes of typical Middle and/or Late Stone Age artefacts from the Northern Cape, near the Botswana border (Matakoma, 2006)

- Iron Age and Historic period

The Iron Age as a whole represents the migration of Bantu speaking people into Southern Africa and includes both Pre-Historic (0 – 1400 AD) and Proto-Historic/Historic (1500 AD – present) stages. Similar to the Stone Age it to can be divided into three periods, i.e. Early (EIA), Middle (MIA) and Late Iron Age (LIA). Iron Age technology was practiced by farming communities (animal husbandry and agriculture) alongside LSA hunter gatherer technology of later San communities, and, after 1500AD, Historic western occupation of the landscape (Mitchell 2002). Evidence of ceramics and metal working are characteristic of this period.

The first Iron Age communities arrived in the central Limpopo valley during the Early Iron Age, around 500AD. These communities were predecessors of larger Iron Age farming communities who settled in the Limpopo River valley between AD 800 and AD 1400 (Mitchell 2002). At approximately 700 AD, a group of communities often associated with gold mining, new

settlement layouts and cattle ranching established settlements in east central Botswana. Their ceramic tradition has since been named the Toutswe tradition (Denbow 1984).

The majority of documented archaeological and cultural sites are concentrated towards the north eastern border of Botswana, where the country shares rich archaeological legacies with South Africa and Zimbabwe in the region of the World Heritage Site, Mapungubwe.

This stage was succeeded by the rise of centralized kingdoms, as exemplified by the Zimbabwe and successor states in the north and the Tswana merafhe essentially in the south. The proto and historic period sees the penetration of Europeans into the interior. A summary of the history and timeline of the area is shown is Figure 2.

Although the MEP Project area is not located in close proximity to the Mapungubwe and K2 sites or Great Zimbabwe, the definite cultural association of the proposed development area with the renaissance of southern African civilization confirms the importance of the development area in furthering our understanding of this complex period of our past.

8.3.1.2 Site significance assessment

The site significance assessment was done according to the standards prescribed by the National Museum of Botswana (NMB) and the South African Heritage Resources Agency (SAHRA) and approved by ASAPA. Associated site mitigation recommendations were done according to the 5-tier (1-5) system prescribed by the NMB.

Table 8.10: Site significance and mitigation recommendations

Field Rating (ASAPA)	Grade (ASAPA)	Significance (ASAPA)	NMB Category	NMB Recommended Mitigation
National Significance	Grade 1	High Significance	1	Conservation; mitigation not advised
Regional Significance	Grade 2	High Significance	1 / 2	Conservation; mitigation not advised
Local Significance	Grade 3A	High Significance	2	Site preservation or extensive sampling – mitigation before destruction
Local Significance	Grade 3B	High Significance	2	Site preservation or extensive sampling – Mitigation before destruction
Generally Protected A	-	High / Medium Significance	2 / 3	Site preservation or test excavation / extensive sampling – Mitigation before destruction

Generally Protected B	-	Medium Significance	3 / 4	Test excavation / systematic sampling – Recording before destruction
Generally Protected C	-	Low Significance	5	No archaeological mitigation required – Site destruction

8.3.1.3 Methodology for assessment of the 25km "South Line"

The assessment was done by foot and vehicle (2 x off-road motor cycles) over a two-day period (2006-11-24 to 25) by two field members. Site locations were recorded with a Garmin e-Trex Vista GPS. Photographic documentation was done with a Casio Exilim EX-S2 camera.

8.3.1.4 25km "South Line" AIA assessment findings

A total of five archaeological and cultural heritage sites were located during the 25km 'South' transmission line survey. Sites located are situated within the 80m assessed development corridor.

- SITE MM-Trans-001- LOWER GRINDER

Recorded locality MM-Trans-001 (S23º37'00.6"; E26º48'54.8") consists of a single broken lower grinding stone. The stone was extensively used on both sides. No signs of cultural habitation associated with the stone were found. It is thus inferred that the artifact was carried to its current location. Vegetation clearing to accommodate road construction is ongoing in the area. It is most likely that the artifact was transported to, and used by, contemporary people to sharpen their axes.

Figure 8-10: Site MM-Trans-001: A lower grinder, utilised on both sides

Site MM-Trans-001 comprising of a single ex-situ artifact is assigned a Low Significance and a Generally Protected C field rating. .

- SITE MM-Trans-002- MIDDLE & LATER STONE AGE

A relatively high density of artifacts was recorded scattered around a pan (S23º37'40.0"; E26º50'52.2"). Artifact ratios (artifacts: m²) approximated 3:1. Artifacts were produced from a mixed raw material. The assemblage consists mostly of rough flakes with very few formal tools. Identified types are representative of the Middle and Later Stone Age.

Figure 8-11: General view of site MM-Trans-002: A scatter of Middle and

The Stone Age of the general area is poorly understood and recorded. Artifact deposits may well have surface depth, heightening the importance of the find. Site MM-Trans-002 is thus assigned a Medium Significance and a Generally Protected B field rating.

- SITE MM-Trans-003 - IRON AGE (LATE MOLOKO)

Vegetation change, characterized by a large open area, demarcates the locality of the site's associated cattle enclosure (S23º39'50.4"; E26º58'03.0"). Animal burrows exposed the anthropic level; situated approximately 20cm below the surface. Artifact remains include a number of undecorated ceramic pieces scattered around the cattle enclosure deposit. In the absence of decorated ceramics the site is preliminary classified as Late Moloko. Spatial distribution conforms to the Central Cattle Pattern, with the central cattle enclosure measuring approximately 100m in diameter.

Figure 8-12: General view site MM-Trans-003: Disturbed vegetation

Figure 8-13: Undecorated ceramics from site MM-Trans-003

With limited knowledge of the Iron Age tradition in the development area and the closest identified Moloko site situated on Basinghall Farm (Biemond 2006), site MM-Trans-003 is assigned a Medium Significance and a Generally Protected B field rating.

- SITE MM-Trans-004 - MIDDLE STONE AGE AND IRON AGE (LETSIBOGO)

Site MM-Trans-004, a multi-component site representative of cultural overlay, is situated on a small rise of the Limpopo floodplain (S23º40’08.9”; E26º58’22.0”). The site is characterised by numerous disturbances caused by burrowing animals, within which a number of Middle Stone

Age artifacts were identified. Stone Age artifacts were produced from a mixed raw material source. Identified types consisted of flakes, waste, cores and a number of formally retouched samples. Artifact ratios (artifacts: m²) are inferred to approximate 7:1.

Mixed with surface stone tools is an abundance of Letsibogo type ceramics. Decoration is characterized by dragged punctuates separating red ochre and black graphite decoration. An identified midden yielded ceramic and bone. The location of the cattle enclosure may have been identified, approximating 70m in diameter. Spatial distribution seems to conform to the Central Cattle Pattern.

Figure 8-14: Site MM-Trans-004: Stone Age artefacts

Figure 8-15: The Letsibogo midden deposit at site MM-Trans-004

Figure 8-16: Letsibogo type surface ceramics from site MM-Trans-004

Further investigation at site MM-Trans-004 may well further our understanding of the Middle Stone Age as well as the Letsibogo Iron Age tradition. The site is assigned a Medium Significance and a Generally Protected A field rating. The site should be conserved.

- SITE MM-Trans-005 - IRON AGE / HISTORIC PERIOD

Site MM-Trans-005 (S23º36’34.8”; E26º47’11.5”) is situated immediately adjacent to a modern agricultural field. Artifacts found included 2 undecorated ceramic pieces and evidence of a cattle enclosure. Site conditions and vegetation are indicative of a historical, rather than archaeological element.

Figure 8-17: General view of site MM-Trans-005

Figure 8-18: Undecorated ceramics from site MM-Trans-005

Site MM-Trans-005 is representative of a relative late maraka (cattle post). The site is thus of historical / social, rather than archaeological importance. Archaeologically the site is ascribed a Low Significance with a Generally Protected B field rating. A NMB mitigation requirement 5 is recommended. The site may be destroyed without further archaeological mitigation requirements.

The developer should however take cognisance of the fact that the maraka site also falls within the MEP, M&P development area (Van Ryneveld et al. 2006a). Ethno-archaeological information contributed to the sites' identity by indicating that the site may well represent the old maraka of Orhehile Ratswabi and Madala Bi. They may both be buried at the site. Development in the vicinity of the site may thus yield human remains (Van Ryneveld et al. 2006b). Local consultation is recommended prior to development in the vicinity of the site. Archaeological monitoring is recommended at the time of development impact on site.

8.3.1.5 Methodology for the AIA assessment area for the Boswelakgabo Hill in the Phokoje (Phikwe) area to the existing sub station at Mogaditshwane / Mpepu Halt in the south

Proposed transmission line routes for Phase 1 of the development, from north of Boswelakgabo Hill in the Phokoje (Phikwe) area to the existing sub station at Mogaditshwane / Mpepu Halt in the south, are indicated in

Figure 8-19. The AIA covered indicated route sections C-D-E and G-H-I. The assessment covered approximately 160 km of the 350km proposed alignment route. Assessment of covered route sections concentrated on the 2km development corridor. [Republic of Botswana 1:50,000 Map references for the assessed portion of the proposed transmission line route: 2227C1; 2226D4; 2236B2; 2326D2; 2326D1; 2326C2; 2326C4 and 2426A2.]

Due to time constraints, only preferred routes for the transmission lines were assessed, indicating that route sections A-B-C, D-F-G-I and E-G was not assessed. Route sections A-B-C, D-F-G-I and E-G is located in close proximity to existing transmission lines, signifying that surface development has already taken place in the region. Route sections C-D-E and G-H-I proved to be more susceptible to new development. Consequently, route sections C-D-E and G-H-I was considered the preferred route for archaeological assessment. Should it be required, a full AIA will be conducted for alternative routes and/or additional extensions.

AIA fieldwork was conducted by one person over a six day period (2006-09-21 to 23 and 25 to 27). The assessment was done by vehicle and foot. Time constraints allowed only for a single line assessment; where power service roads or tracks are in existence, spot assessments were done at varying intervals (2-7km) within the 2km development corridor. In the absence of (access to) roads the line assessment was done in a criss-cross manner across the development corridor. The area was surveyed for potential discoveries of archaeological and cultural sites of significance. At the time of the assessment no bush clearing had started: Surface visibility varied from very good to poor. Vegetation proved the major factor in accessibility; some areas were easily accessible, others impenetrable. Poor road conditions negatively affected access to parts of the proposed development area. Site locations were recorded with a Garmin E-trex Vista GPS (datum – WGS84). Photographic documentation was done with a Casio Exilim EX-S2 camera.

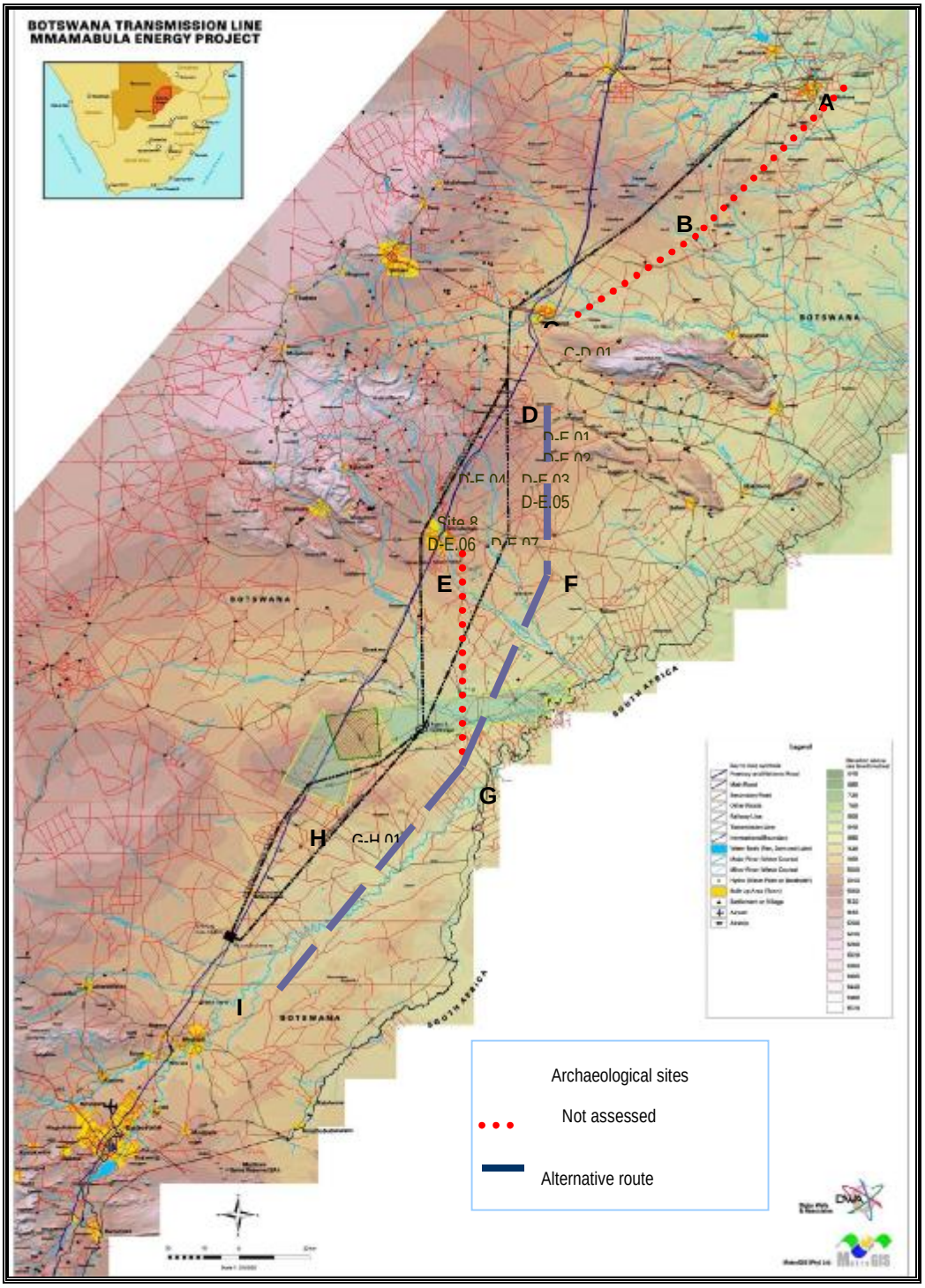

Figure 8-19**: The Mmamabula Energy Project: Proposed Phase 1 transmission line routes indicating a relative distribution of identified sites in relation to assessed route portions C-D-E-G-H-I**

8.3.1.6 AIA assessment findings for the Boswelakgabo Hill in the Phokoje (Phikwe) area to the existing sub station at Mogaditshwane / Mpepu Halt in the south

In total, ten archaeological sites have been located within the 2km development corridor of the approximate 160km assessed route line.

- Area A-B-C

Due to time constraints at the time of the assessment, Area A-B-C was not assessed.

- Area C-D

Area C-D was assessed over a one day period. Vehicle access could not be arranged; assessment was therefore carried out on foot. Surface visibility was good. Vegetation clearing by the Botswana Power Corporation (BPC) provided for partial shallow sub-surface interpretation. Development co-ordinates were not available at the time of the assessment. The existing BPC service road was adopted as a base line; the 2km assessed development corridor was measured in approximate 1km sections east and west of the existing service road. One archaeological site (1 x Stone Age) was located within assessed Area C-D (See 5.2.1)

- Site C-D.01 – Middle and Later Stone Age

A low density of Stone Age artifacts were recorded (S22°33’54.3”; E27°01’44.1”) along the dry riverbeds of the Lotsane River. Artifacts were produced from a mixed raw material and found in small surface concentrations. Artifact ratios (artifacts: m²) varied from ≥7:1 to ≤1:25. Degraded riverbed sections did not allow stratigraphic interpretation, but the assemblage is inferred to be restricted to the topmost levels of the riverbed section. Based on typology and stone tool size the assemblage is assigned to the later Middle Stone Age (MSA) and the Later Stone Age (LSA). The Stone Age occurrence is inferred to run along the banks of the Lotsane River and across the 2km development corridor.

Low quantities of artifacts may not hold the potential to classify deposits to Industrial Complex level. Stratigraphic sequencing and dating may well prove valuable, considering existing limited Stone Age data from eastern Botswana. Site C-D.01 probably relates to the low density Stone Age occurrence located at S22°33’33.4”; E27°01’44.1” (artifact ratio ≤1:100). MSA and LSA artifacts were located in the existing BPC quarry and dump material.

No artifact layer could be discerned in quarry sections, but artifacts are inferred to come from the deposit overlying calcrete deposits. Artifact quantities in the quarry area are too low to be of archaeological value but the area does attest to the relative surface restricted Stone Age presence in the area. Site C-D.01 is assigned a Medium Significance and a Generally Protected B field rating (Recording before destruction).

Figure 8-20: General view Site C-D.01 on the banks of the Lotsane River

Figure 8-21: Stone Age artefacts from Site C-D.01

Figure 8-22: The existing BPC quarry site

Figure 8-23: BPC quarry site - artefacts are inferred to come from the overlying level

Area C-D is archaeologically relatively sterile with a single low density Stone Age occurrence recorded on the banks of the Lotsane River. Water seems to have been an important draw card to the area during later MSA and LSA times. Low artifact quantities are however indicative of limited Stone Age presence in the general area.

- Site D-E.01 – Middle Iron Age

Two large middens were located atop the hill (S22°47’05.7”; E27°00’54.9”), but further remains may well be present. Surface finds included a number of decorated and undecorated ceramic pieces, representing the Middle, and to a lesser degree, Later Iron Age traditions. Middle Iron Age ceramic decoration is representative of the Toutswe phases. The hill forms part of the greater

Makoro Hills (an identified and recorded Toutswe site series) but is situated west of the A1 Main Road. The hill is thus situated on the eastern perimeter of the 2 km development corridor. Despite the modern day divide the hill forms part of the greater Makoro Hills cultural landscape, enhancing its significance. Site D-E.01 is rated as Medium to High Significance with a Generally Protected A or Local Significance (Grade 3A / 3B) field rating. (The site should be mitigated before destruction; part of the site should be conserved).

Figure 8-24: General view Site D-E.01

Figure 8-25: Ceramic shards from Site D-E.01

- Site D-E.02 – Middle Iron Age

A midden deposit characterises the top plateau of the small hill (S26°59’50.2”; E22°46’30.4”) also known as Radisele Hill. Surface finds included ceramic shards (decoration representative of the Toutswe phases) as well as a number of identified dwellings demarcated by daga deposits. The site is situated on the eastern perimeter of the 2km development corridor. Assessment of the adjacent hill (situated immediately west of the base line) resulted in no archaeological finds. Site D-E.02 is rated as Medium Significance and ascribed a Generally Protected A field rating. (The site should be mitigated before destruction).

Figure 8-26: General view of Site D-E.02

Figure 8-27: The anthropic sterile hill adjacent to Site D-E.02

- Site D-E.03 – Unidentified Iron Age

Two large midden deposits are situated on the eastern slope of the hill (S26°58’34.8”; E22°48’12.3”) generally known as Sapolamarori Hill. A number of ephemeral stone features characterise general site locations and may well include grain bins and other structural foundations. Further surface finds included cattle enclosure deposits, ceramic pieces (decoration indicative of the Middle Iron Age) and daga. The site is preliminary described as unidentified Iron Age, but may well be representative of cultural overlay.

The site is situated within the eastern portion of the development corridor. Site D-E.03 is of Medium Significance and ascribed a Generally Protected A field rating. (The site should be mitigated before destruction).

Figure 8-28: General view of Site D-E.03 with middens showing up as white areas on the hill slope

Figure 8-29: In situ artefacts at Site D-E.03

- Site D-E.04 – Later Iron Age

No clear midden or cattle enclosure deposits could be identified on the low rising hill (S22°52'13.9"; E26°55'26.1"). The general area is characterised by a low density undecorated, probably grass tempered pottery. The site is situated within the western portion of the development corridor. Site D-E.04 is of Medium Significance and ascribed a Generally Protected B to A field rating. (The site should be recorded and limited / test pit excavations be explored before destruction).

Figure 8-30: Undecorated LIA ceramic sherds from Site D-E.04

- Site D-E.05 – Middle Iron Age

Site D-E.05 / Lose is one of the few excavated and internationally published sites in Botswana (Kiyaga-Mulindwa, 1990), situated immediately adjacent to the development corridor. The site (S22°56'56.1"; E26°54'23.9") comprise of a series of adjacent hills displaying a number of varying sized midden deposits. Stone has been used at the site to define cattle enclosures. Stone features indicating hut foundations and other activity areas are also present. Surface ceramic is present in high quantities. Ceramic decoration represents various temporal phasies – particular cultural stratigraphic units or components within a layer/assemblage – within the Toutswe tradition. Sections of rich daga deposits are indicative of the earlier built environment. The site is situated just east of the 2 km development corridor and east of the A1 Main Road, on a property of the Botswana Quarries. The site is formally protected and open to the public. Site D-E.05 is of High Significance and assigned a Provincial / National field rating. (No development impact - the site should be conserved).

Figure 8-31: General view of Site D-E.05/Lose

Figure 8-32: In situ daga remains at Lose (D-E.05)

Figure 8-33: Surface ceramics from Lose (D-E.05)

- Site D-E.06 – Middle and Later Stone Age

A low density of Stone Age artifacts were recorded (S22°52’52.6”; E26°55’26.1”) in the Mankatau River dongas. Artifacts were produced from a mixed raw material. Artifact ratios approximated 1:49. No definite artifact layer could be discerned from donga sections. The assemblage can typologically be assigned to the later MSA and LSA Periods. The Stone Age occurrence is inferred to be present at various intervals along the banks of the Mankatau and by inference across the width of the 2km development corridor. Low artifact quantities at the site may well not hold the potential of classification to Industrial Complex level. Based on the typological composition of the surface collection, stratigraphic sequencing may well be possible. Site D-E.06 is assigned a Medium Significance and a Generally Protected B field rating. (Recording before destruction).

Figure 8-34: General view of Site D-E.06

Figure 8-35: Middle and Later Stone Age artefacts from the Site D-E.06

- Site D-E.07 – Middle Iron Age

The only located site situated on the flats (S23°02’45.8”; E26°51’20.1”), comprise of a small midden and a single identified residential unit. Surface ceramics included both decorated and undecorated pieces. Decoration would assign the site a Toutswe association. The site is situated within the eastern portion of the development corridor. Site D-E.07 is assigned a Medium to High Significance with a Generally Protected A field rating. (Mitigation before destruction)

Figure 8-36: Midden deposit at Site D-E.07

Figure 8-37: Surface ceramics from Site D-E.07

- Other Sites

Located sites situated outside the development corridor, but within the general D-E assessment area include:

Site 1	Mogomi Hill	-S22°46’24.7”; E26°53’06.9”	MIA
Site 2		-S22°49’06.3”; E26°55’18.0”	IA/ MIA
Site 3		-S47°47’09.9”; E26°55’40.8”	IA/ MIA
Site 4	Makoro Hills	-S22°48’00.0”; E27°02’30.0”	IA/MIA
Site 5	Malepe Hill	-S23°04’15.5”; E26°46’02.3”	MIA
Site 6	Mmitle Hill	-S23°02’39.7”; E26°46’51.7”	MIA
Site 7		-S23°05’31.2”; E26°50’27.2”	IA

Sites will not be impacted on by the proposed transmission line development. Their presence serves as a general indicator of the archaeological sensitivity within Area D-E.

One site, recorded in the National Museum of Botswana’s database and reported on by Ketlhalefile (2006a) is situated within the development corridor. The site (Site 8) could not be relocated during the archaeological fieldwork. The site is recorded as Mahalapye 2 and described as an Iron Age / Toutswe type site situated at S23°01’01”; E26°50’42”. The site will be situated within the western side of the development corridor.

Two sites reported on (Ketlhalefile, 2006b) and located within general assessment area D-E could not be relocated. The sites have been described as two house floors, one of which yielded undecorated ceramics. Both sites are inferred to be of relatively recent origin.

- Site G-H.01 – Late Iron Age

The Late Iron Age site (S23°42’17.9”; E26°35’34.3”) was identified by the presence of a central cattle enclosure and a number of undecorated ceramic pieces. A large degree of cultural overlay is present at the site with part of the archaeological cattle enclosure currently used for livestock farming. Present day agricultural fields evidently damaged significant parts of the site. The site is situated within the southern portion of the 2km development corridor.

Modern day impact reduced the archaeological significance of the site. The site is assigned a Low Significance and a Generally Protected C field rating to the site. (Development destruction without further archaeological recording or mitigation)

Figure 8-38: Undecorated ceramic pieces from site G-H.01

Figure 8-39: Impact of modern day agricultural fields on Site G-H.01

- Site 9 - Later Stone Age

The Later Stone Age site (S23°45’42.6”; E26°29’35.0) was identified and reported on by Ketlhalefile (2006c). The site is situated within the southern portion of the development corridor. Ketlhalefile (2006c) ascribed a low significance to the site and recommended no further development compliance prior to destruction.

- Site 10 - Late Iron Age/Recent

The site (S23°42’51.8”; E26°36’00.9”) was identified and reported on by Ketlhalefile (2006c). The site is described as a low density undecorated ceramic scatter. Lack of ceramic decoration does not allow further classification and site has classified as Later Iron Age / Recent. The site is situated within the southern portion of the development corridor. Ketlhalefile (2006c) ascribed a low significance to the site and recommended no further development compliance prior to destruction.

- Site 11 - Stone Wall (Late Iron Age/Recent)

The site (S23°37’05.7”; E26°43’37.0”) is described as a semicircular stone structure. No artifacts were associated with the site; no Period association could thus be assigned (Ketlhalefile, 2006c). Ketlhalefile (2006c) assigned a low significance to the site and recommended no further development compliance prior to destruction.

- Other Sites

Located sites situated outside the development corridor, but within the general G-H assessment area include:

Site 12	Mmitle Hill	- S23°43’53.1”; E26°34’54.8”	LIA / RECENT
Site 13		- S23°46’25.9”; E26°3053.0”	LSA

Sites were located and reported on by Ketlhalefile (2006c). Sites will not be impacted on by the proposed transmission line development. Their presence serves as a general indicator of the archaeological sensitivity within Area G-H.

8.4 Socio-Economic Characteristics

8.4.1 Social Impact Assessment

Digby Wells & Associates, whose details are given below, compiled the SIA report; refer to Appendix I for a copy of the complete SIA report.

Company	Digby Wells & Associates (DWA)
Aspect	SIA
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8.4.1.1 The National Context

The Republic of Botswana is a landlocked country covering an area of 581,730 km2. The country attained independence on 30 September 1966 as a multiparty constitutional democracy. Legislative power lies with the National Assembly.

The country's dominant ethnic and/or cultural group is the Tswana (Batswana), comprising approximately 80% of the total population. The 'Chieftainship Act' classifies Botswana's principal tribes as the Setswana-speaking Bamangwato, Batawana, Bakgatla, Bakwena, Bangwaketse, Bamalete, the Barolong and the Batlokwa. The Tribal Territories Act defines the territory of these eight groups.

Serving as a 'second chamber' to the National Assembly, the House of Chiefs represents the principal subgroups in the country. Its constitutional function is to advise the National Assembly on draft bills affecting custom and traditions. The House of Chiefs is made up of the hereditary chiefs of the abovementioned eight principal tribes in addition to four appointed sub-chiefs who represent the administrative divisions where other tribes are in the majority.

The Batswana are followed by a number of smaller ethnic groups, such as the Bakalanga, Baherero, Bakgalagadi, Bayeyi, Batswapong, Basarwa Basubiya, Himbukush, Babira and Khoi, as well as small numbers of Whites and Asians.

Botswana's total population counted 1,680,900 people during the 2001 census, while this figure was estimated at 1.8 million people in 2005. The population increased at an average growth rate of 2.4% per annum between 1991 and 2001. More than 50% of the population is regarded as urbanised while children under 15 years of age constitute approximately 40% of the total population.

Average population density has increased from two to three persons per km2 between 1991 and 2001. Population densities for towns such as Gaborone and Francistown, however, are estimated at more than 1,000 people per km2.

In addition to an increasing process of internal and inward migration, Botswana is experiencing growing "immigration" from its neighbouring countries such as Zimbabwe, with the majority of these immigrants settling on the outskirts of major towns and along service corridors.

Table 8.11 provides an overview of trends in the population growth between 1998 and 2002. The process of urban sprawl has created an informal land market, in addition to the self-allocation of land and encroachment of urban settlements onto surrounding arable and grazing land.

Table 8.11: Overview of Trends in the Population Growth, 1998-2002 ('000)

Population Growth	1998	1999	2000	2001	2002
Total population	1,614,190	1,646,640	1,675,000	1,695,000	1,711,770
Population growth (annual %)	2	2	1	1	1
Urban population (% of total)	48	49	49	49	50
Urban population growth (annual %)	3	3	2	2	2
Population ages 0-14, total	687,352	697,105	707,000	707,200	707,400
Population ages 15-64, total	873,447	899,809	927,000	936,972	947,057
Population ages 65 and above, total	36,992	36,995	37,000	37,765	38,548

Source: Whitehouse & Associates, 2004

The diverse range of population densities in Botswana indicate an important spatial feature in the growth patterns of the population, namely rapidly increasing urbanisation and growing concentration of people around a few selected towns. Population distribution is affected by rural-urban migration patterns caused by factors such as uneven distribution of employment opportunities, educational services and income differentials.

Botswana's unofficial unemployment rate was estimated at between 35% and 40% in 2005. The country's unemployment problems are at least partially the result of limited economic diversification (Whitehouse & Associates, 2004).

Administrative Framework

Administratively, Botswana is divided into nine districts (the Central District, Ghanzi, Kgalagadi, Kgatleng, Kweneng, as well as the North-west, North-east, South-east and the Southern District).

Currently there also five town councils, (Jwaneng, Selebi-Phikwe, Lobatse, Francistown and Gaborone), which hold the same administrative status as a district. Each district is represented by a District Commissioner, who is appointed by the government and assisted by a Council Secretary, district councillors and various executive committees.

Traditional leaders (chiefs) fall under the authority of a district commissioner, but exercise their authority through the kgotla (village council), while they also preside over customary or traditional courts. Sub-chiefs and headmen represent the chiefs (dikgosi) in their particular villages and wards. They are responsible for upholding Tswana custom and traditions, and they are expected to assume a leading role in planning and implementing local development programmes.

Local authorities in Botswana consist of both urban and rural local government bodies such as district and town councils in terms of the 'District Councils Act' and 'Townships Act' respectively. District and local authorities are responsible for the delivery of basic municipal services and facilities. In this they receive assistance from, amongst others, planning boards and land boards respectively.

Administrative decentralisation entails district and tribal administration centres, including field offices and/or agencies of government ministries as well as sub-districts and subordinate land boards. At village level, the chiefs and headmen collectively form the tribal administration supported by a Village Development Committee (VDC), the local police service and customary courts.

The National Planning Framework

"Vision 2016" provides Botswana with its long term socio-economic planning perspective, which guides the formulation of national development goals and targets, and provides the basis for measuring government's achievements over time. These goals form the framework for national, district and local planning.

National Development Plan 9 (NDP-9) covers the period April 2003 to March 2009 and is sub-titled: Towards Realisation of Vision 2016: Sustainable and Diversified Development through Competitiveness in Global Markets. The underlying policy objectives of NDP-9 incorporate economic diversification, employment creation, rural development, poverty alleviation, environmental protection, and the fight against HIV/AIDS (Gaolathe, 2002).

Accordingly, several policies and strategies have been implemented since the approval of NDP 9. These include the implementation of the 'National Master Plan for Arable Agriculture and Dairy Development', the establishment of a national Tourism Board, the implementation of a National

Privatisation Policy, establishment of the Local Enterprise Agency, Public Enterprises Evaluation and Privatisation Agency and Citizen Entrepreneurial Development Agency.

Botswana's National Health Policy stresses primary health care and sustainable health service provision. The National AIDS Coordinating Agency facilitates and co-ordinates country-wide HIV/AIDS interventions, such as the provision of Anti-Retroviral (ARV) therapy, support to orphans, and home-based care.

The NDP-9 is committed to strengthening the current land management system through improving the operations of the land boards, undertaking water point surveys and ground water resource assessment studies, (c) reviewing past land use plans, and (d) preparing Integrated Land Use Plans for remaining districts.

Poverty eradication and rural development are addressed through the Revised National Policy for Rural Development and the National Strategy for Poverty Reduction. The government acknowledges in NDP-9 that the decentralisation of responsibilities to local authorities and the community require the transfer of adequate resources. This will necessitate improved revenue generating capacity and an enabling legal framework to generate these resources.

The Impact of HIV/AIDS

The Botswana Government's response to HIV/AIDS is outlined in its national HIV/AIDS Policy and in the National HIV/AIDS Strategic Plan for the period 2003-2009. Both documents highlight the multi-sectoral nature of the response, facilitating the participation of people living with HIV/AIDS.

Botswana has had a deliberate policy and programme approach to "Health and HIV/AIDS" since the late 1980s. Despite these interventions Botswana had one of the highest HIV/AIDS infection rates in 2002 with a prevalence rate of 35% among adults. Botswana's National Strategic Framework 2003-2009 considers the AIDS epidemic a national disaster.

Health statistics for 2002 indicated that the leading cause of patient mortality in Botswana was AIDS, followed by pneumonia and pulmonary tuberculosis. The proportion of deaths from AIDS was approximately 18% in 2000. There are an estimated 78,000 AIDS orphans in Botswana, while projections indicate that about 20% of all children will be orphaned by 2010.

A study undertaken by the Botswana Institute for Development Policy Analysis in 2001 indicated that HIV/AIDS would have a significant impact on the labour force. The study forecasts that AIDS will have the effect of shifting the labour force to a slightly younger generation by about

three years and, generally, will negatively impact on work experience due to absenteeism and illness.

Box 1: Botswana AIDS Update

"Botswana's epidemic appears to be stabilizing -- but national HIV prevalence among pregnant women has stayed between 35% and 37% since 2001. Among pregnant women aged 15–24 years, HIV infection levels have remained steady since 1999, but among their counterparts 25 years of age and older, prevalence has been rising constantly since 1992 and reached 43% when last measured in 2003. Preliminary data from a new household survey in Botswana have given hope that the country's epidemic might be smaller than previously indicated (National AIDS Coordinating Agency, Botswana 2005). The survey estimated that some 25% of 15–49 year-olds were estimated to be living with HIV—considerably lower than the 37% estimate derived from antenatal clinic data (UNAIDS, 2004).

However, that estimate should be interpreted with caution, since its very high non-response rate (44% of participants refused to be tested for HIV) could have skewed the results toward underestimations of HIV prevalence. Nevertheless, the survey found that more than 6% of children, aged 18 months to four years, were HIV-positive, most of which are likely due to mother-to-child transmission of the virus. Infection levels among older men and women were unexpectedly high: 29% for those 45–49 years-old, and 21% for those in their early 50s. The gaps in HIV knowledge seem to persist. One in four respondents did not know that consistent condom use prevents transmission, and only 13% knew three ways for preventing sexual transmission of the virus (National AIDS Coordinating Agency, 2005)."UNAIDS/WHO: AIDS Epidemic Update: 2005

8.4.1.2 The Regional Context

Population

The proposed transmission line routes traverse through two districts, namely: the Central District and the Kgatleng District. The Central District is divided into five administrative sub districts. The proposed transmission line routes will run through the Mahalapye Sub-District, the Serowe/Palapye Sub-district and a small portion of the Bobirwa Sub-District.

Botswana's Central District is the largest district in the country, covering an area of 146,531 km2 - with a total population of 501,381 in 2001. The District is divided into six administrative sub-districts. Population densities in the Central District show marked differences, with the Mahalapye Sub-District having the highest density, around seven persons per km2. The sub-district had a total population of 109,811 people in 2001 (56,489 females and 53,322 males).

With the exception of Mahalapye, all sub-districts have experienced a net out-migration between 1991 and 2001. This is the result of changing employment opportunities in the broader area, as well as Mahalapye Town's location along the national road and its role as railway centre and administrative capital.

Kgatleng district corresponds with the homeland of the Bakgatla people covering an area of 7,960 km². Its capital is Mochudi. According to the 2001 Census, Kgatleng had a population of 73,507 people. In the south, Kgatleng borders the North West Province of South Africa, and to the east it borders South Africa's Limpopo Province. Domestically, it borders with the South-East district, Kweneng district and Central District.

Human Settlement

Botswana's National Settlement Policy (August 1998) makes provision for a national settlement hierarchy in order to better facilitate planning and service delivery. According to this hierarchy all towns, villages and smaller settlements are ranked as primary, secondary or tertiary centres, with scheduled criteria for the provision of infrastructure and services to these centres.

Primary centres have a population of at least 20,000 (for example Mahalapye Town), and secondary centres have a population of between 10,000 to 19,999 people. Tertiary centres (such as the affected villages), are grouped into four categories (Tertiary I-IV) based on population size. The delivery of services such as roads, schools and clinics are directly linked to the status of the village (Botswana National Settlement Policy, 1998).

Each municipality acts as a joint planning authority in its area of jurisdiction and is responsible for administering state land allocated to low-income groups in urban areas under the Self-Help-Housing-Agency. Approximately 50% of the population live in rural areas where this housing scheme does not apply.

While population densities in most districts have increased between 1991 and 2001, areas that are experiencing rapid population increases are located in the south-eastern part of the country where only 5% of the land is suitable for agriculture. Moreover, the continual flow of people out of the rural subsistence agricultural sector is contributing to rapid rural-to-urban migration. This is reflected in land scarcity and increased demand for infrastructure, housing and basic services.

Land Use Management

There are three land tenure systems in Botswana, namely Freehold Land, State Land and Tribal/Customary Land. The MEP project area falls mainly into the latter category. The Land Control Act, the State Land Act and the Tribal Land Act are the primary acts dealing with the

preparation of development plans, land acquisition and subdivision control. The Tribal Land Act (1968) provides for the establishment of main Land Boards for granting customary land rights. Section 3 of the Act states the powers vested in the chiefs under customary law. The Act, however, effectively transferred the powers previously vested in the tribal chiefs to the Land Boards.

The Land Boards are non-political bodies composed of members from the local community to take over the land administration functions from chiefs and other tribal authorities. Subordinate Land Boards assist the main Land Boards at the local level to make land boards more accessible and closer to the people.

All customary land is held by a land board or eligible applicants in the form of grants and/or leases. The main functions of land boards include land allocation and registration, land use planning and monitoring, as well as land acquisition and adjudication (including compensation).

Subordinate land boards allocate land for customary uses, impose restrictions on use, and recommend cancellation of customary land rights to District Land Boards. They also make recommendations to District Land Boards in respect of borehole applications. Subordinate land boards cannot allocate grazing land, commercial or industrial land and they cannot authorise a change of land use.

A major change in land allocation and land use started with the introduction of Wildlife Management Areas (in 1974) and Tribal Grazing Land Policy (1975). Total communal land reportedly decreased with more than 20% and resulted in increased pressure on land in rural areas.

The areas affected by the transmission lines are mainly tribal, communal land with only a small number of private farms in the Tuli Block. When looking at the impacts emanating from the construction, operation and decommissioning of the transmission lines, a distinction has to be made between tribal, communal land and the private farms. Each area has their own unique associated impacts during the different stages of the project, as will be seen in the subsequent sections.

Economic Activity

Botswana's economy is dominated by mining and livestock production, while tourism represents a growing economic sector. Major agriculture products are livestock, sorghum, maize, millet, beans, sunflowers, cow peas or ground-nuts. Beef production is still an important export earner but recurring and prolonged droughts have had a significant impact on this sector.

Despite substantial socio-economic improvements in the country over the past decades, many households are still living in poverty, which is most severe in the rural areas and among female-headed households. Government support for poverty and drought relief includes labour intensive public works programmes, orphanage support and feeding programmes. For a discussion on the Botswana national economy relative to the MEP, refer to the EIA specialist study.

Tourism

The transmission line study area covers large geographical regions containing cultural and natural attractions, including parts of the Tuli Block and the Limpopo Valley. Approximately 80% of Botswana's population are concentrated in the eastern and south-eastern regions, while the tourism industry is primarily concentrated in the northern and western parts of the country.

The Tuli Block region is home to one of the largest concentrations of privately owned game conservation areas in Southern Africa, covering some 120 000 ha. With regard to the tourism industry's status in the broader study area, the proposed transmission line corridors are located in a region with medium tourism significance. (Refer to the Tourism Impact Assessment)

8.4.1.3 The Local Context

The Affected Population

Settlements located in the transmission lines' area of influence are Selebi-Phikwe, Mahalapye, Mookane, Dibete, Mosomone, Dikabeya, Palapye, Tewane, Lose, Dinokwe, Mmapashalala, Leshibitse, Temesele, Pitsetshweu, Radisele and Tamasane.

There are six privately owned farms along the eastern boundary in the Tuli Block that will be directly affected. These farms are Deepdale 6 LP, Annex Craignair 7 LP, Craignair 9 LP, Eloffsdale 8 LP, SaasPost 34 LQ and Riversdale 10 LP. The farms Darnaway, Teesdale 11 LP and Annex Palla 5 LP are in close proximity to the proposed corridors, but would most likely only be influenced as far as visual and aesthetic impacts are concerned.

Settlement Pattern

Usually, crop and livestock activities of farming households are kept separate. The village or settlement forms the spatial core of economic activities, around which household and communal fields would be situated. Beyond these fields one would find the grazing areas where livestock (mainly cattle and goats) are kept depending on the availability of water and grazing.

The current situation has changed significantly in terms of legislation, land use planning, land allocation, local administration, and participation in traditional economic activities. The physical lay-out of the villages still roughly follows a similar pattern showing a concentration of houses (organised in wards) around the senior kgotla. Typically, the settlement is surrounded by communal fields on the more productive land, with communal grazing on the periphery.

The steady flow of people out of the subsistence agricultural sector, however, coupled with increasing land scarcity, wage employment and self-employment, has changed the face of rural settlements. Similarly, village administration has changed over time and involves a complex set of rules and control measures.

Currently, residential sites are commonly 40 to 50 m2 (older sites are much bigger), while agricultural fields are, reportedly, limited to 400 m2 per eligible household member given the increasing scarcity of arable land. While many households migrate to the outskirts of the bigger towns in search of work, some do not have the means or family support to make this move.

The public cemetery is typically situated outside the settlement. Respondents, however, reported that the remains of deceased children are normally buried inside the main dwelling structure of the homestead. Some older graves (before 1980) are scattered around the villages and cattle-posts.

Settlement Hierarchy

Table 2 provides an overview of the population size of towns, villages and cattle-posts that might potentially be affected by the transmission lines. There are some potentially affected cattle-posts not listed below that were identified during the aerial survey. Some parts of the proposed lines traverse through very inaccessible terrain, which made it impossible to reach and to identify by name. Nonetheless, an estimation of the number of settlements, cattle-posts, agricultural fields and other structures of value to the community that were identified during the aerial survey are outlined in Section 4.

Table 8.12: Population size of potentially affected villages

Settlement name	Settlement type	Total Population size	Male	Female
Selebi-Phikwe	Urban	49,849	24,334	25,515
Mahalapye	Urban	43,538	21,120	22,418
Palapye	Urban	26,293	12,087	14,206
Mookane	Village	2,297	1,028	1,269

Maphashalala	Village	1,027	506	521
Dibete	Village	1,002	453	549
Mosomane/Artesia	Village	1462	708	754
Dikabeya	Mixture of Lands Area and Cattle-post	318	161	157
Tewane	Village	126	55	71
Lose	Cattle-post	11	9	2
Dinokwe	Village	1,053	505	548
Leshibitse	Village	407	193	214
Temesele	Cattle-post	26	24	2
Pitsetshweu	Cattle-post	0	0	0
Radisele	Village	2,741	1,305	1,436
Tamasane	Village	1,012	451	561

Source: Central Statistical Office, 2001

Local Administration

Local administration in the affected villages consists mainly of two institutions, namely (a) the local chief and his tribal administration, which fulfils a variety of traditional, cultural and ceremonial duties, and (b) the Village Development Committee (VDC) which is the key institution for planning at grassroots level. In this they are assisted by the Village Extension Team (VET) which mostly consists of government officials (teachers, agricultural officials, police officers) who have been transferred to the villages in question.

Together, the above institutions, their associated development sub-committees and government department officials are responsible for the administration and development of the village. It is noted that officially Botswana's Tribal Land Act did not change customary law other than transferring authority over land from the chief to the land boards.)

Depending on the settlement hierarchy, a village chief (who is the chairperson of the kgotla or village council) will form part of either a senior or subordinate tribal administration, generally assisted by headmen of record (with their own sub-kgotla) and headmen of arbitration.

It is evident from the available literature that the prevailing system of land use, land administration and land tenure in the broader MEP study area represents a complex, multifaceted system. This situation requires specialist knowledge in order to adequately identify and assess the impacts of the proposed MEP on the management of land use systems and on the livelihoods of affected people.

Community Services and Facilities

All urban areas and villages concerned are served by a primary school and a clinic/health post, in addition to several community facilities and services, such as shops, general dealers, liquor stores and beer halls, shebeens (private households who provide alcohol to the public), and tuck shops.

Other facilities or services include churches, boreholes, community standpipes (for domestic water supply), public telephone, community hall, cattle dip, stock watering dams, veterinary services, local police, agricultural extension officers, as well as a cemetery and a community dumping site.

With the exception of Dinokwe and Mosomane, none of the villages are served by regular and reliable public transport, including taxis. Neither do residents have access to acceptable sport facilities. Some cultural activities are present, such as dance groups, while some villages have organised self-help groups for AIDS victims, orphans and the destitute.

A network of gravel roads, some of which were constructed under the Public Works Programme, services the affected villages. In addition, cattle-posts scattered through the entire area are serviced by a network of minor roads linking the cattle-posts with the main road and surrounding villages.

Economic activity

Economic activities in the study area consist mainly of subsistence agriculture, sorghum, maize, beans, cow peas, nuts and watermelon, communal livestock production (cattle and goats), migrant labour and small business enterprises. A significant number of people in the rural villages are employed as government officials.

Livestock production for the beef market, private sales and personal use in the study area seems fairly common although 'formal' commercial crop production appears to be relatively low. Many households are dependent on low input subsistence farming, in addition to migrant remittances/pensions.

The area under crops varies from year to year and, reportedly, so do the areas planted as against areas harvested. Crops are produced for local consumption, i.e. subsistence use or local sale. Indications are, however, that the broader project area is home to a number of relatively wealthy and successful farmers.

Many villagers make a living, or augment their income, from small businesses such as tuck shops, hair salons, recycling businesses and sewing. Others make a living out of beer brewing, selling

thatch, brick-making or building activities. Some homesteads have a small vegetable garden on the residential stand.

Respondents emphasised that they make extensive use of the natural resources in the areas surrounding the villages for, among others, herbs, medicinal plants, food, firewood, hunting, building material and thatch, sorghum, water melons (for beer), while fallow lands serve as fodder for their animals.

Migrant labour is a common phenomenon in the project area, resulting in high levels of male absenteeism. The absence of males in the economically active age groups seems to account for the high number of female-headed households.

Many households observed during the SIA study appear to be living in severe poverty, which is most critical among female-headed households. Some individuals live from drought relief, orphan support, feeding schemes and the government's poverty alleviation programme.

Local livestock production appears to be dominated by the so-called cattle-post system, where a group of farmers share a central borehole or watering point for their livestock (see Box 2 below). In some instances livestock owners share the cost of a borehole and herd livestock jointly. Other forms of collaboration also take place where individuals have only a few animals each.

Often household members would move between the home village and their fields during the ploughing, planting and harvesting seasons and then return home during the fallow season, while the cattle herders would remain in the grazing areas.

Box 2: Cattle-post production systems

"Cattle-post" production systems refer to unfenced rangeland where there are central watering points. The cattle owner, or more often, a herdsman, lives in a small hut near a borehole, and provides water to livestock. The water is most commonly pumped from a borehole, but in areas where there is a shallow water table - such as in pans and dry river beds, water is taken from hand dug wells. The post often has a holding kraal, which was traditionally made of thorn fence, or upright tree trunks dug into the ground. Nowadays, the kraals are most commonly built with poles and wire - as in commercial ranching. The cattle are let out in the day-time, and may roam for several days, before returning to drink. In winter when temperatures are mild, and in the rainy season, cattle can wander far from their home kraal. Goats and sheep, are generally found closer to the kraals, and tend to return every night, while non-lactating cattle tend to stay out from time to time - except where there are large predators. Cows with calves at foot tend to remain closer to the kraal, as the calves are kept in the kraal until they are old enough to fend off predators, mainly jackals - but in some areas they are also preyed upon by larger predators such as leopard, lion,

wild dog and cheetah. The cows with calves also stay closer as they need to drink water more regularly than dry cows and other types of livestock. Cattle-posts also have donkeys - mainly for transport, and sometimes horses. Jeremy Burgess

http://www.fao.org/ag/AGP/AGPC/doc/Counprof/Botswana/botswana.htm

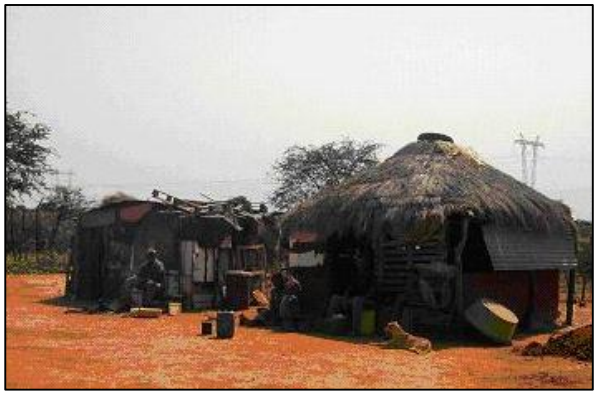

Figure 8-40: Potentially affected homestead next to existing transmission line between Selebi-Phikwe and Palapye

Figure 8-41: Cattle grazing under the existing transmission line

Figure 8-42: Existing transmission line between Selebi-Phikwe and Palapye

8.4.2 Visual Aspects

Due to time constraints, two different sub-consultants assessed different section of the transmission lines. Cave, Klapwijk & Associates, whose details are given below, compiled the visual assessment report for the north south corridors and MetroGIS assessed the eastern corridors to the Limpopo River, refer to Appendix J for a copy of the complete visual aspects reports.

North South Transmission Line Consultants

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8.4.2.1 Method

In order to address the objectives of the study the following method has been used:

- A site visit to determine the setting, visual character and land uses of the areas was undertaken;
- Determine the setting, visual character and land use of the area surrounding the route, and the Genius Loci (sense of place);
- Discussions and meetings with the specialist consultant team to identify specific aspects of the construction and development which would affect the visual quality of a setting;
- Define the extent of the affected visual environmental, the viewing distance and the critical views;
- An evaluation was made of the landscape characteristics against which impact criteria ratings were applied;
- The viewshed, the area within which the proposed transmission line can be visible, was determined using digital topographic maps analysed by the Geographic Information System (GIS) algorithms, available in the Arcview Software Suite.

The visual impact assessment statements in this report are based on the expert opinion of the authors and attitudes that are generally accepted worldwide.

The assessment is based on the agreed alternative routes, ground truthed during field inspections held during August 2006.

8.4.2.2 Limitations, Constraints and Assumptions

The following assumptions and limitations are applicable to this study:

- The basis for this assessment is that scenic wilderness areas form the base line against which the potential impact is assessed;
- The assessment does not consider the ancillary project infrastructure and components such as roads, borrow pits, spoil dumps, etc. These components will be assessed in detail during the design phase once the position and layout have been determined and the mitigation thereof included in the environmental management plan should the project be implemented;

- The assessment is based on assumed demographic data. No detailed study was done to determine accurate data on potential viewers of the project components. If necessary these studies could be undertaken during the design phase of the project;

- The location and extent of the construction and labour campsites, as well as material lay-down areas will only be determined during the design and construction phases. These are, however, of a relatively temporary nature and can effectively be controlled through the Environmental Management Plan;

- Determining a visual resource in absolute terms is not achievable. Evaluating a landscape's visual quality is both complex and problematic. Various approaches have been developed but they all have one problem in common: unlike noise or air pollution, which can be measured in a relatively simple way, for the visual landscape mainly qualitative standards apply. Therefore subjectivity cannot be excluded in the assessment procedure (Lange 1994). Individually there is a great variation in the evaluation of the visual landscape based on different experiences, social level and cultural background. Exacerbating the situation is the inherent variability in natural features. Climate, season, atmospheric conditions, region, sub-region all affect the attributes that comprise the landscape. What is considered scenic to one person may not be to another (NLA, 1997).

- The locality of game farms, lodges and homesteads was not available at the time of study and was therefore assumed. Aerial photography was also not available.

- The transmission line pylons have a higher visual impact than the cross over suspension pylon due to the increase in steel and the compactness of the structure.

Localised visual perceptions of the economically depressed communities of the population have not been tested as these may be influenced rather by the economic and job opportunities that will exist rather than the direct visual perception of the project.

If the study, however, determined that the negative visual impact is of such a magnitude and significance that it will seriously influence the decision on whether or not to build, it will then be necessary to test and determine the visual perceptions of neighbouring communities. Such a study is involved, costly and time consuming.

8.4.2.3 Description of the baseline conditions

<u>Description of the Works</u>

In the absence of detailed design data the following has been assumed.

- Power line and Pylons

The pylons that will support the 400 kV transmission lines will consist of two steel support structures supported by guy wires forming a 'V' fixed at the base where the two structures are fixed (Figure 8-43). The transmission lines will be suspended between and either side of the supports. These 35 m tall pylons use far less steel in their structure than the commonly seen self-supporting pylons. The self-supporting pylons will only be used where the ground is unstable, where the line changes direction or where the terrain is too steep to accommodate the cross-rope suspension structure. The reduced steel quantity has the added benefit in that they are less visible and obtrusive within the landscape.

Self-supporting suspension pylons will be used where there is a change in direction greater than 3°, where space is limited or on steep slopes. These pylons contain considerably more steel than the cross-rope suspension pylons and are more visible in the landscape.

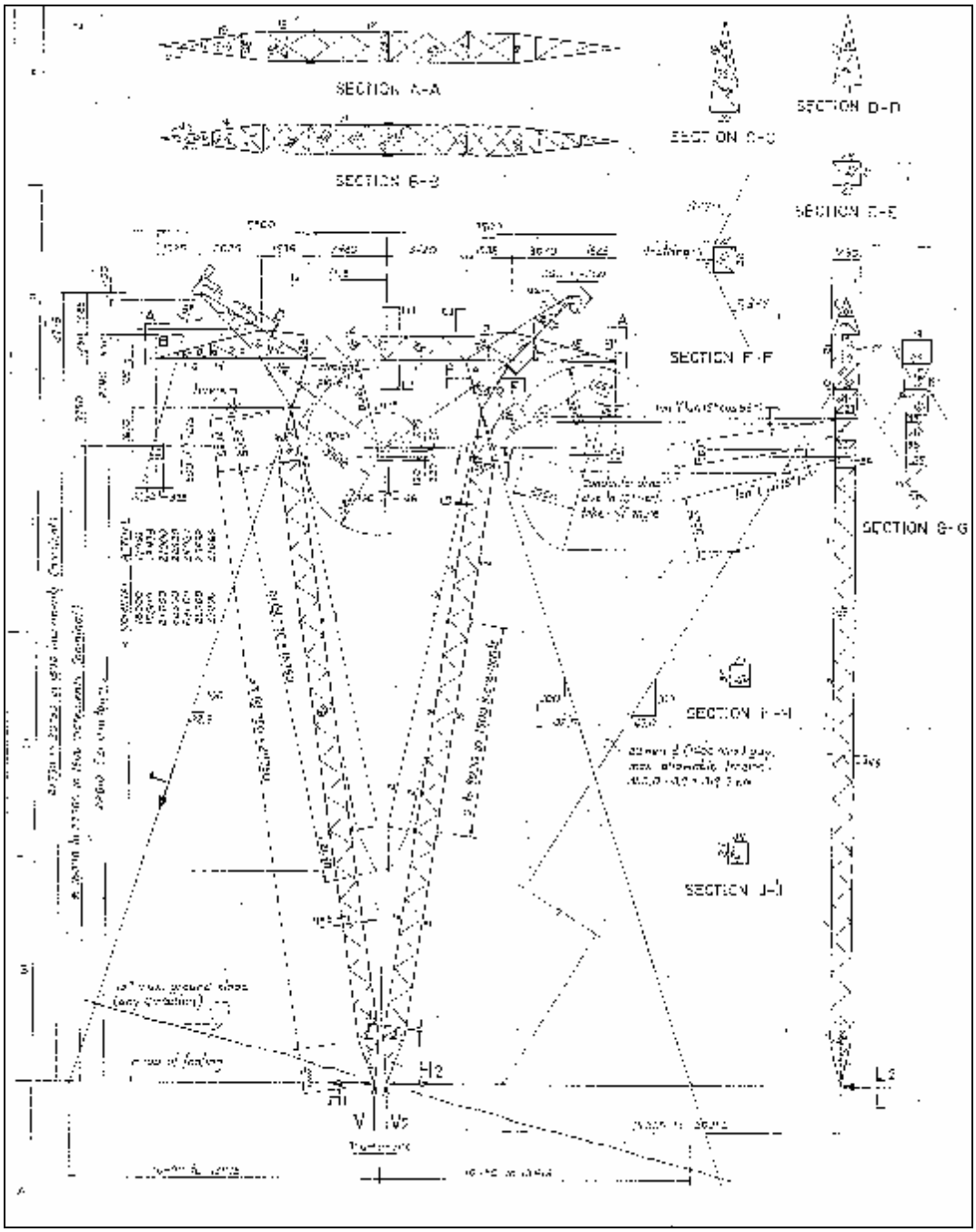

Figure 8-43: 400 kV Transmission Line Pylon

- Access Roads and Construction Camps

Access roads will be required to transport personnel to site and for maintenance purposes. In areas that are inaccessible, materials are brought in by helicopter. During this period all gates are installed and the tower positions pegged.

Construction camps will need to be developed in strategic positions where they provide the optimum access to as much of the construction route as possible.

- Construction

Large scraper equipment will be used to establish the access roads. Back actors are generally used to excavate for the foundations.

Helicopters are used to deliver material and personnel to areas that cannot be accessed by road.

Construction takes place in phases. The foundations of the towers are laid first, followed by the assembly of the towers on the ground, then the erection of the towers and finally the stringing of the conductors. These operations are not always continuous and each phase would involve a return to the site by the contractors.

Once the construction is complete, this same representative will ensure that all restoration work has been completed satisfactorily. The landowner will be asked to sign a release from, providing written confirmation that rehabilitation was completed to his satisfaction.

All areas that will be disturbed such as construction camps, access roads and the construction area around the pylons will be stripped of topsoil which is stockpiled for later use.

- Decommissioning

Decommissioning of a major transmission line has yet to be undertaken in Southern Africa. It is assumed that the physical removal of the lines and pylons will be a reversal of the construction phase and that a rehabilitation programme of the land will need to be undertaken.

<u>Description of the Natural Physical Elements</u>

The extent of the visual impact of the linear development will depend on the following characteristics of the receiving environment for the eastern and western corridor.

- Landform

The northern section from Selebi-Phikwe to Palapye is relatively flat punctuated in the central area by minor ridges and koppies. The elevation gently rises from both the south and the north towards the central area.

The eastern and western alignments for the rest of the study area generally follow the lower and flatter areas between the rising landform to the west such as Shoshong and Serowe and the Tswapong and Maifala Hills. The eastern alignment immediately south of the northern point of divergence crosses a small but prominent ridge.

Implications for the project:

Due to the flat topography and lack of raised or elevated viewpoints the line will not be readily seen as a result of the screening effect of the existing vegetation. However, the line will be very visible where it crosses the ridge south of Palapye.

Vegetation

The routes traverse three distinct vegetation associations (Vegetation Map, 1991). These consist of the:

- *Colophospermum mopane, Acacia nigrescens / Combretum apiculatum, Acacia tortilis* hardveld in the north
- *Combretum apiculatum, Acacia nigrescens, Acacia tortilis* hardveld in the central region
- *Terminalia sericea, Acacia tortilis, Acacia melifera* transition sandveld-hardveld in the south.

The northern and central associations are classified as treed savanna to savanna while the southern association is classified as being savanna to shrub savanna. In general, the vegetation height of the south has been thus assumed to be approximately 3 m high while the rest is averaged at 6 m high.

Critical Views and Visibility

Critical views have been considered from the A1 National Road (North-South Road) where the line runs parallel with it, the major towns and villages along the A1 Road, cross roads linking the main centres with outer lying centres and the game farms that form part of the Tuli Block. These points were determined by assessing, during the site visit, the areas where the majority of viewers would experience the visual affect of the transmission lines and assuming that the land owners of the Tuli Block properties would be affected by the impact of the line due to their land use.

Genius Loci

The spirit, or sense of place, is that quality imparted by the aspects of scale, colour, texture, landform, enclosure and in particular, the land use. According to K. Lynch (1992) "it is the extent to which a person can recognise or recall a place as being distinct from other places as having a vivid, or unique, or at least a particular, character of its own."

The quality of Genius Loci is a function of attributes such as the scenic beauty or uniqueness and distinctive character of the built and cultural landscape.

The spirit of place is fairly constant along the route. The vegetation is relatively monotonous with little landform of visual diversity to impart a definite scenic ambience. The area, therefore, has relatively low visual interest or character and can be described as rural agriculture.

Visual Quality and Character

The visual quality is the visual significance given to a landscape, determined by cultural values and the landscape's intrinsic physical properties (Smardon, et al, 1986). While many factors contribute to a landscape's visual quality, they can ultimately be grouped under three headings: vividness, intactness and unity.

Land Use

The entire study area is predominantly cattle grazing. Commercial activity is generally restricted to most urban areas that are located along the A1.

Small rural villages and cattle posts are located within the study area. Game farms and tourism related enterprises are located between the cut line (the western edge of the Tuli Block farms) and the Limpopo River to the east of the study area.

The western alignment follows a corridor that is visually modified for extended sections by existing transmission lines within the corridor, major roads, railway lines, towns, villages, settlements and subsistence agriculture.

The Scale of the Landscape

Visual scale is the apparent size relationship between landscape components or features and their surroundings (Smardon, et al, 1986).

The vertical and horizontal scale can be regarded as broad, expansive and flat for much of the study area due to the flat to rolling landscape. There is no relief to enhance the vertical scale, which would provide a visual backdrop that would limit viewing the transmission line in silhouette.

Eastern Limpopo Transmission LineConsultants

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8.4.2.4 Methodology for the assessment of visual impact

The methodology for this visual impact assessment is based on extensive spatial analysis using GIS techniques, incorporating the information obtained during a two-day site visit of the area. In this regard the interpretation of photographs will be relied on.

A series of independent spatial analysis operations are conducted, which will be integrated as a synthesis to arrive at a visual impact index as a final conclusion.

8.4.2.5 Status Quo: Regional Overview & Visual Character

The visual character of the study area has been assessed by means of two processes, i.e.

- An analysis of GIS data, and in particular the following:

  Land cover data captured from aerial photography and satellite imagery;

  Topographic data derived from contours.

- The interpretation of photographs taken during the site visit in association with a scenic preference model.

The general character of the study area is shaped by rural residential land use with subsistence farming practices to the west, and commercial cattle and game farming in the area east, up to the Limpopo river.

In terms of the scenic preference model, the visual character is classified as High, Medium or Low. The model provides for a visual quality rating of 1 – 10 for different land cover types, as indicated in Table 8.13.

Table 8.13: Visual Quality Classification of Land Cover Types in the Study Area

Land Cover	Visual Quality	Visual Quality Class
Water course	10	High
Riverine Vegetation	10	High
Pan/Dam	10	High
Floodplain	10	High
Dry Pan	8	Medium
Bushveld	8	Medium
Town / Village	5	Low
Rural Settlement	5	Low
Ruin	5	Low
Kraal	5	Low
Homestead	5	Low
Irrigated Agriculture	4	Low
Dry-land Agriculture	4	Low
Disturbed Land	4	Low

The visual quality of the study area in general is Medium. High visual quality is associated with the rivers to the north and to the east. Low visual quality is mostly associated with human activity where natural vegetation or land is disturbed (Figure 8-44 and Figure 8-47).

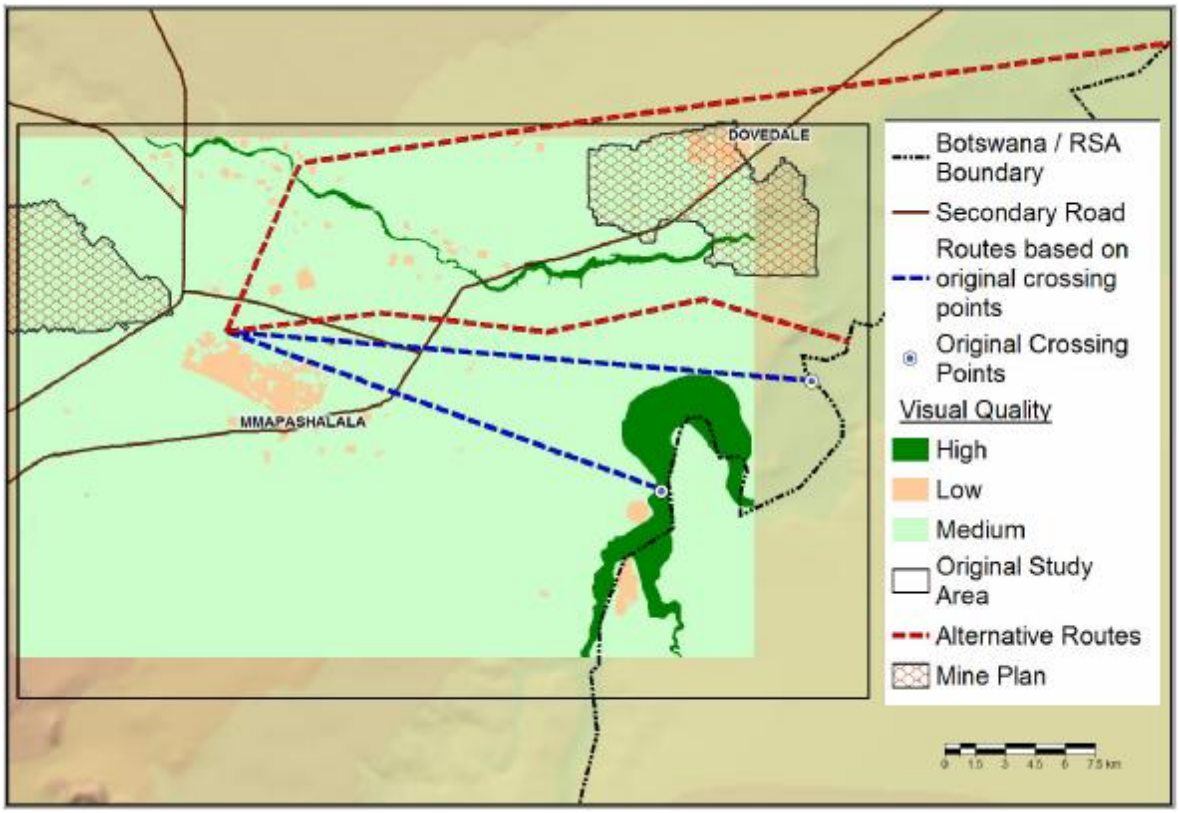

Figure 8-44: Visual Quality of the Study Area

8.4.2.6 Potential Visual Exposure

Potential visual exposure is determined by means of a viewshed analysis of the transmission lines. A series of points are taken along the line, and the visibility of each point is calculated across the study area, taking into account the topography and the height of the transmission line.

The topography of the study area is modelled into a digital terrain model, based on the contour data (Figure 8-45). The study area is characterised by a very flat slope of less than 1%. The highest terrain occurs in the south-western part from where it gradually slopes down into river valleys to the north and to the west. This renders a high degree of visibility to the proposed transmission lines, as indicated on Figure 8-46.

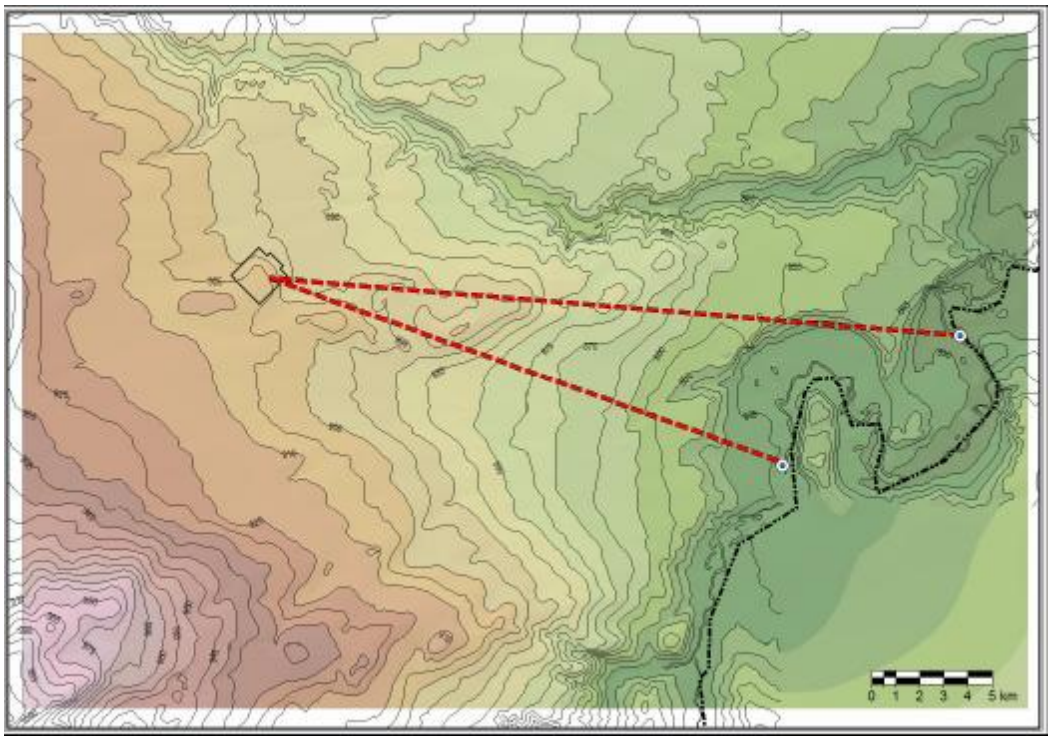

Figure 8-45: Shaded Relief Model of the Study Area

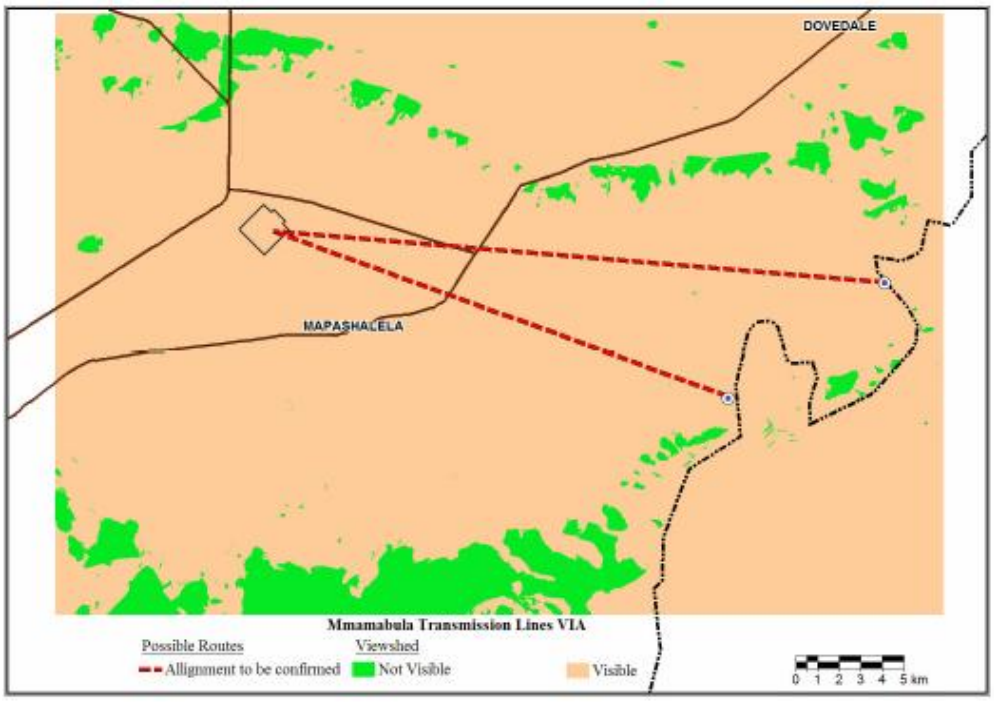

Figure 8-46: Viewshed Analysis of the Planned Transmission Lines Route Alternatives

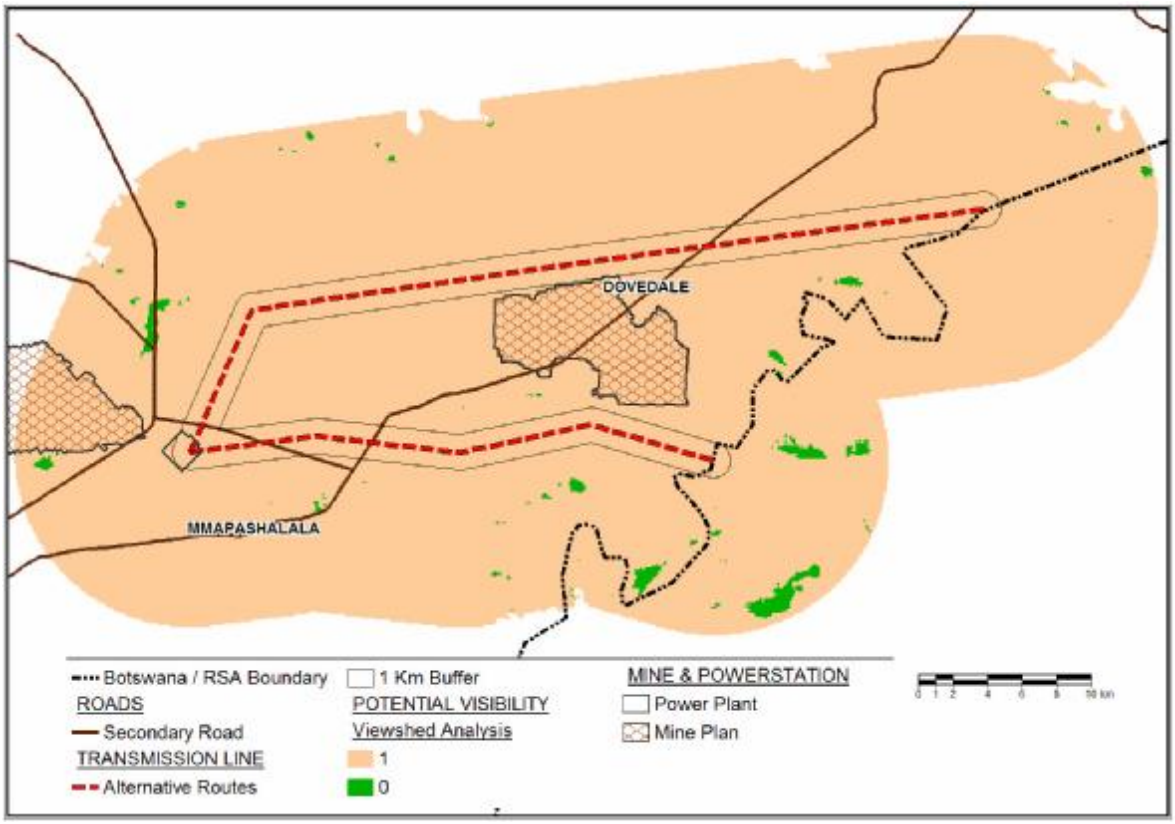

Figure 8-47: Viewshed Analysis of the Planned Transmission Lines Route Alternatives

8.4.2.7 Visual Distance / Observer Proximity to the Transmission Lines

The principle of reduced impact over distance is applied in order to determine the core area of influence for the transmission lines. Figure 8-48 illustrates the relative exposure of an object at increasing distance from a viewing location. At 100m from the viewing location the relative exposure decreases to 50%, and decreases to 25% at a distance of 300m. This effect is clearly illustrated by the photograph in Figure 8-49.

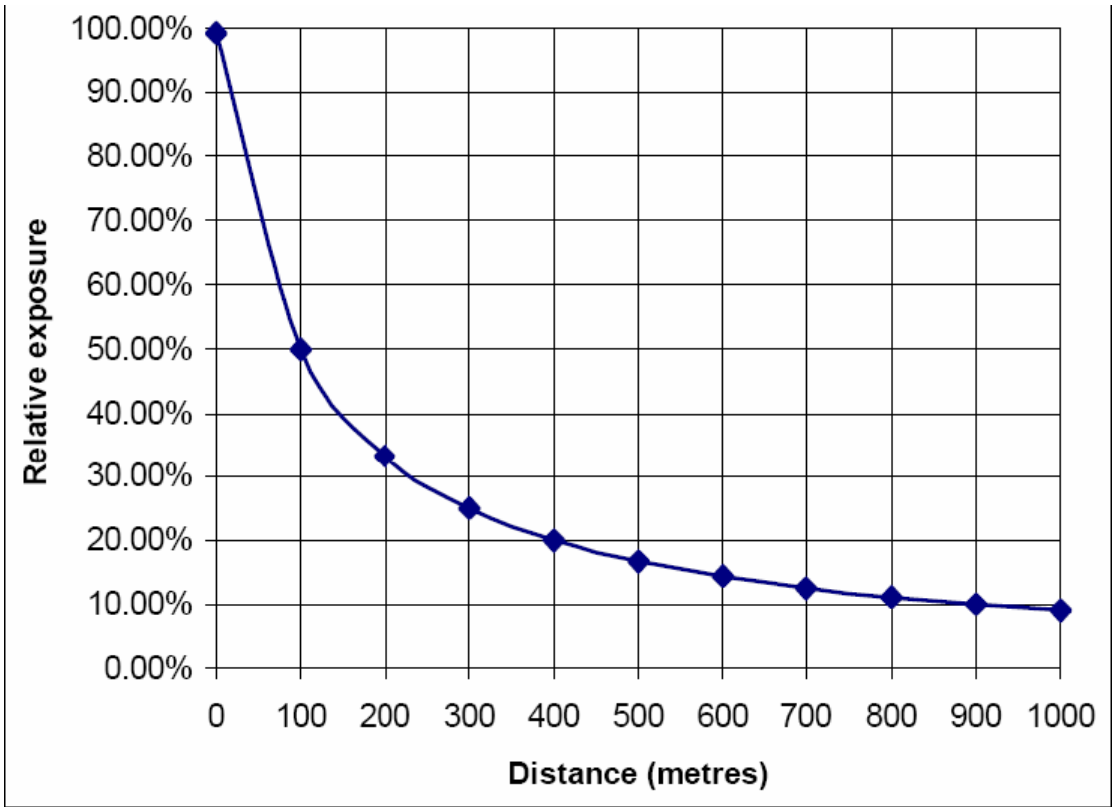

Figure 8-48: Relationship between exposure and proximity

Recognising that the impact of development is affected by a number of factors such as the slope of the terrain, the size and construction of the development, it is still important to recognise the sensitivity of the zone at a longer distance from the transmission lines.

It is envisaged that the nature and structure of the pylons and overhanging conductor cables and the relatively natural state of the surrounding area would create a significant contrast that would make the feature visible and recognizable from a great distance. This would especially be true where the observer has an elevated vantage point.

- Based on this, the following proximity buffers were created for the transmission line routes:
- 0 – 500 meters. Short distance view where the transmission line structures will dominate the frame of vision and constitute a very high visual prominence.
- 500 – 1000 meters. Medium distance where the transmission line structures would be easily and comfortable visible and constitute a high visual prominence.

- 1 km – 2 km. Medium to longer distance where the transmission line structures would become part of the visual environment, but would still be visible and recognizable. This zone constitutes a medium visual prominence.

- Greater than 2 km. Long distance view of the transmission lines where it would still be visible but not as easily recognizable. This constitutes a low visual prominence.

The proximity buffers created for the two routes are indicated on Figure 8-51 to indicate the scale and viewing distance. (It is important to note that the screening effect of vegetation is ignored in this analysis).

Figure 8-49: The effect of distance on the exposure of transmission line structures.

Figure 8-50: Transmission lines observed from a distance of 800 meters

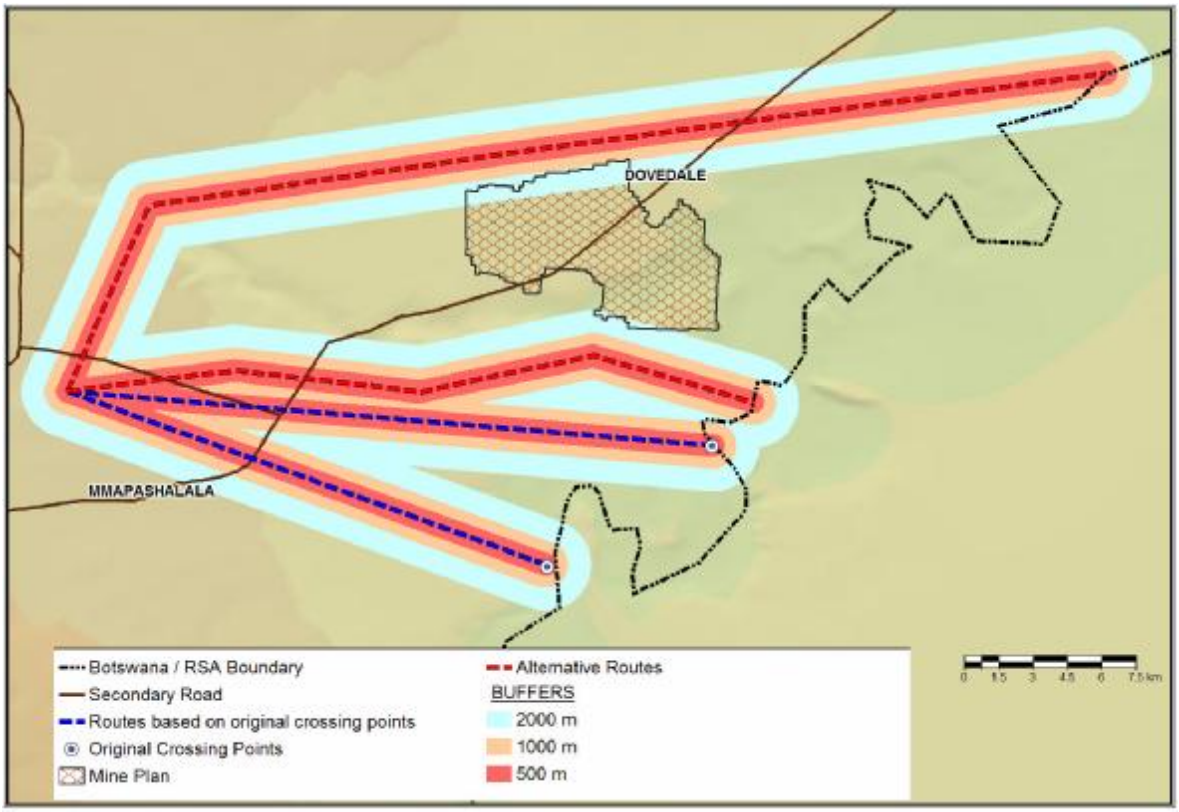

Figure 8-51: Viewer Proximity

8.4.2.8 Viewer Incidence / Viewer Perception

The number of observers and their perception of a structure determine the concept of visual impact. If there are no observers, or if the visual perception of the structure is favourable to all the observers, there would be no visual impact.

It is necessary to identify areas of high viewer incidence and to classify certain areas according to the observer's visual sensitivity towards the transmission lines. It is also necessary to generalise the viewer incidence and sensitivity to some degree, as there are many variables when trying to determine the perception of the observer. This includes regularity of sighting, cultural background, state of mind, purpose of sighting, etc. which would create a myriad of options.

For the purpose of this study four areas have been classified as having differing observer incidences and/or perceptions. These are:

- Roads. Roads concentrate people who use it to reach a routine destination (e.g. work, or shopping), a holiday or recreational destination, or just as part of a leisure experience. Thus roads have a potentially high incidence of observers. Although the roads in the study area

are secondary and do not carry large volumes of traffic, the potential of the roads must be recognised, especially in terms of the variety of people travelling through the area. The envisaged perception of the observer will be predominantly negative, as the contrast between the general natural environment and the transmission lines will be significant.

- Residential Areas (Villages). The village Mmaphashalala is situated approximately 2.5 km south of one of the plotted routes. The village is set in a rural environment with no electricity and tarred roads. The peripheral view is of natural veld (bushes and trees), which will be contrasted by the sight of transmission line structures. Although it is doubted that the transmission lines will be visible from within the village, it must be taken into account that the village is linked to the main road by a north / south dirt road, thus exposing the transmission line to residents traversing this road. A negative viewer perception is likely, especially since the village will not benefit from the electricity itself. (Indications are that the rural villages will not be electrified and that the electricity will be exported to South Africa).

- Commercial Farms. The area to the west of the Limpopo River is subdivided into a number of farms with cattle and game farming being the primary activities. The farm owners are generally objecting to the planned coal mine and power station, which creates a negative perception towards the transmission lines. This perception however is more contributed to a perceived financial impact, and it is envisaged that the visual impact will ultimately be neutral.

- The Rest of the Study Area. This zone is characterised by natural bushveld serving as pasture for cattle. Dry land farming occurs close to the villages. Observers will be limited to locals herding the cattle or working the fields and moving between settlements on foot. A neutral perception is envisaged for this area.

In addition certain sensitive receptor points have been identified. These are points within visible range of the transmission lines sudden exposure to the transmission lines can be experienced. These are normally associated with a turning point in a road or elevated terrain. These points constitute negative visual impacts, since a sudden change in scenic amenity is experienced.

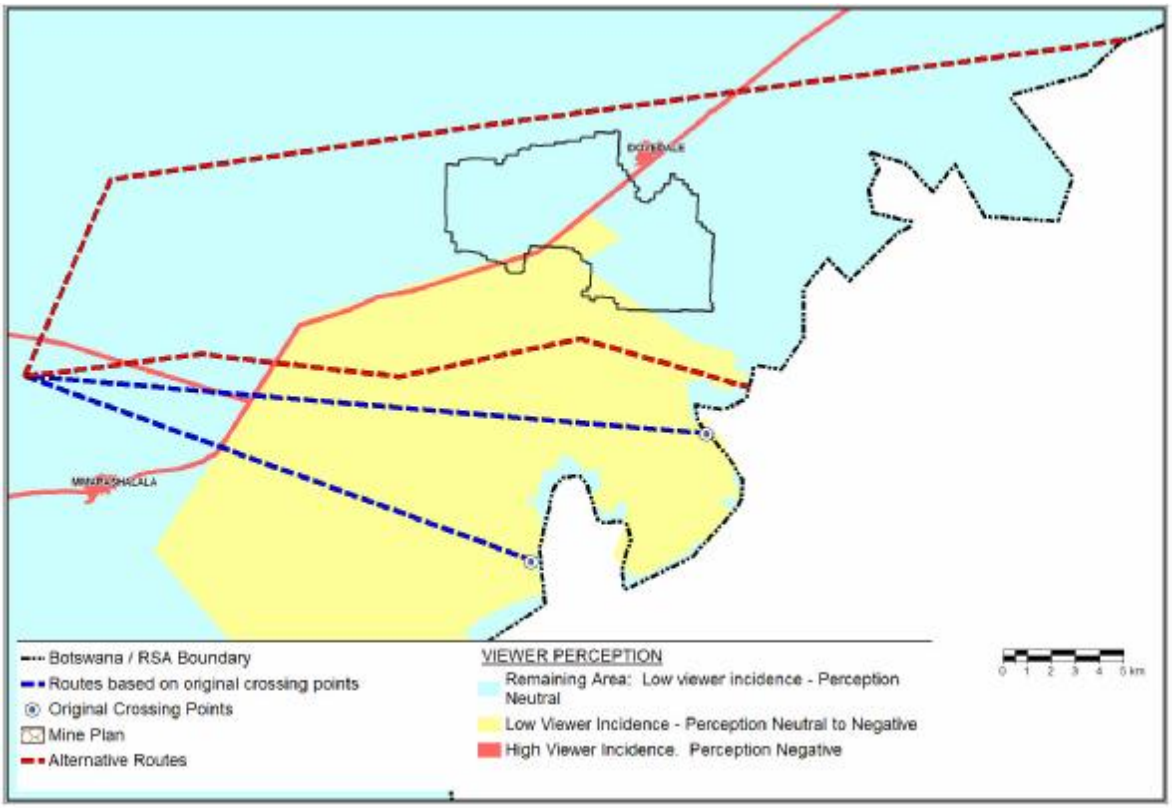

Figure 8-52: Viewer Incidence & Perception

8.4.2.9 Visual Absorption Capacity

Visual absorption capacity (VAC) indicates the relative ability of the landscape to accept the changes brought about by human alteration, with the least loss of landscape character and scenic value. These indicators are based on characteristics of the immediate landscape. The following factors are taken into account:

- land use / land cover,
- topography,

Transmission lines are largely visible due to the height, texture and linear shape of the construction, and the fact that they normally appear in contrast with the immediate surroundings. The most effective way of "hiding" them is to implement the screening effect of natural vegetation and the absorption effect of the topography.

The area transected by the proposed routes is characterised by trees, shrubs and bushes with varying densities. The observer is shielded effectively from the transmission lines where dense

bush occur (Figure 8-53). It is however less effective where the vegetation is less dense and where the road is elevated, opening up the horizon in the far distance (Figure 8-54).

Figure 8-53: Effective screening capabilities of vegetation on both sides of the road

Figure 8-54: Less effective screening capabilities of vegetation

The effect of topography depends on the type of terrain. On flat terrain an object such as a transmission line, is elevated above the horizon. Viewed from the ground, the pylons and overhanging conductor cables will be highly visible against the backdrop of the sky, especially when it is clear. This effect is illustrated in the photograph to the right. The sloped terrain behind the transmission lines tends to absorb the structures by virtue of colour, texture and transparency.

Note the base of the pylons being camouflaged / absorbed by the distant sloped terrain, and how the same features stand out above the horizon, silhouetted by the contrasting skies.

It is envisaged that the transmission lines will be screened from observers to a large extent, due to the dense cover of trees, shrubs and bushes. However, the screening effect will be interrupted occasionally where the cover is less dense and deeper viewing penetration is allowed (refer to Figure 3b).

A visual absorption index was created, based on the land cover data (Map 2) and the above findings. The spatial expression of the index is presented in Map 7. As mentioned under Section 2

above, individual trees and shrubs could not be mapped, hence the generalisation of bushveld as having Medium to High visual absorption capacity.

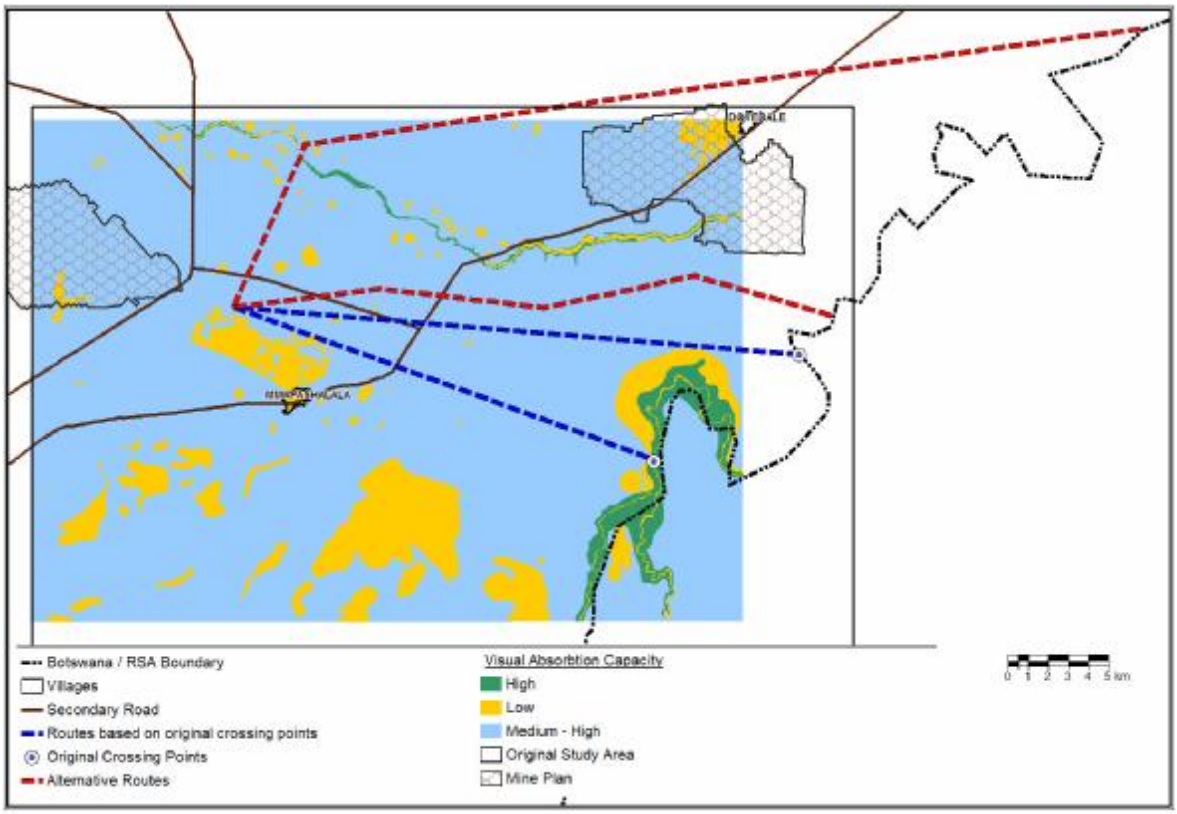

Figure 8-55: Visual Absorption Capacity

8.4.3 Economic Environment

ERM, whose details are given below compiled the economic report, refer to Appendix K for a copy of the complete report.

Company	Environmental Resources Management (ERM)
Aspect	Economic
Contact Person	Libby Schroenn
Postal Address	Postnet suite 624, private bag X29 Gallo Manor 2052
Physical Address	Building 23, The Woodlands, Woodmead, Woodmead Drive, Johannesburg, South Africa

Telephone Number	+27 11 802 8263
Fax Number	+27 11 802 8299
Email Address	Libby.schroenn@erm.com

8.4.3.1 The national economy

Economic Performance

With a GDP of P48.6 billion in 2005 (about US$ 7.6 billion), Botswana's economy is viewed as one of the strongest in Africa, bolstered mainly by revenues from mining, and diamond mining in particular. Income per head has reached US$8,700 on a PPP basis, making the country a middle income nation and one of the wealthiest in per capita terms in Africa (GDP on a PPP basis is over four times the sub-Saharan Africa average).

Over the past three decades, Botswana's economy has recorded impressive growth rates. Figure 8-56 shows that the economy grew at an annual average growth rate of 8.8% over this time, culminating in a real growth rate of 8.3% from 2003/04 to 2004/05. The investment in the Mmamabula coal mine and power plant is likely to contribute to the sustained growth of the economy in future. However, the increased contribution of the mining sector will ensure that the economy remains subject to mineral price fluctuations.

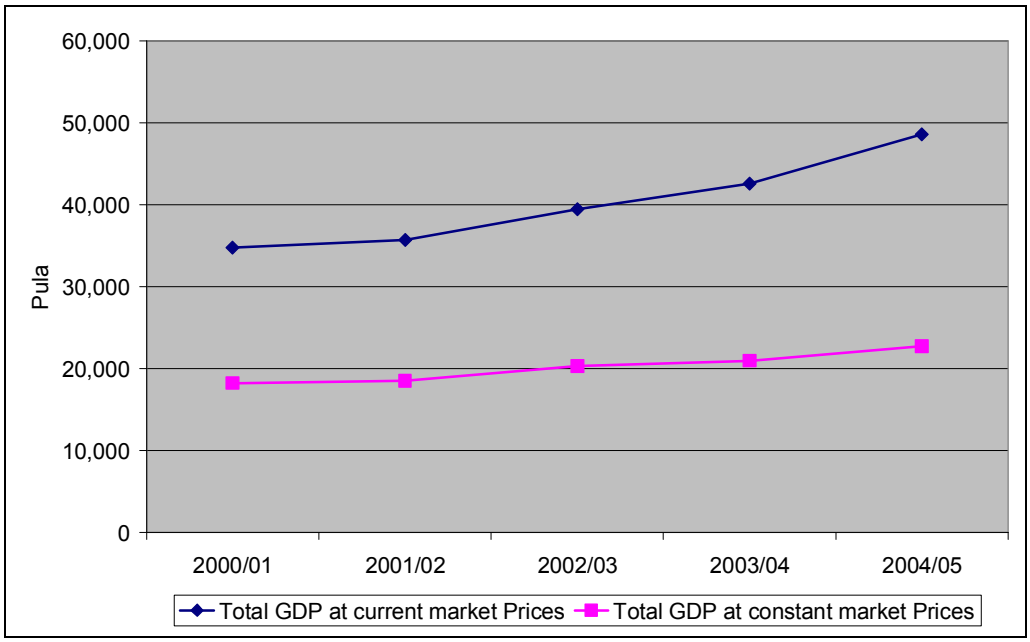

Figure 8-56: GDP Growth, 2000/01 to 2004/05 at Current and Constant Prices

The strong growth rate as illustrated above is mainly due to the sustained and rapid expansion of the mining sector (including diamonds, copper, nickel, salt, coal, gold and soda ash) and of Government, which has largely been financed by the proceeds of mineral revenues. This is illustrated in *Figure 8-57*, which shows that the mining sector grew by an average of 8.6% per annum from 2000/01 to 2004/05, while the Government sector grew 7.6%. The water and electricity sector also showed strong growth over this period, with 5.7% growth. The agricultural sector has performed relatively poorly, with only 3% growth, largely due to the drought that occurred in Botswana during this time.

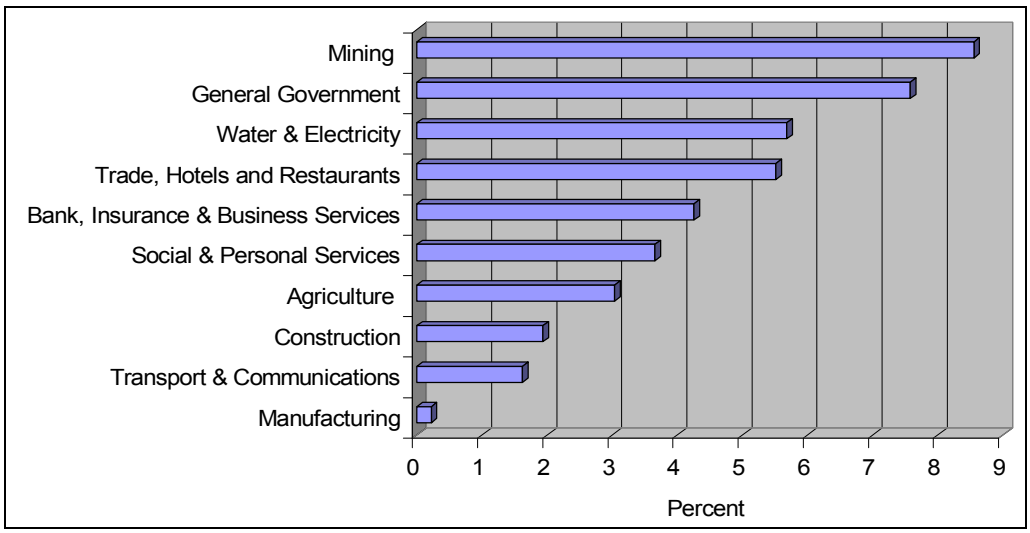

Figure 8-57: Average Economic Growth 2000/01 – 2004/05 by Economic Sector

Figure 8-58 shows that mining's contribution to the economy in 2004/05 was 40%, followed by the Government sector at 17%. The contribution of the water and electricity sector is only 3%, and the Mmamabula power plant is likely to increase this sector's share of GDP, as well as that of Mining. Manufacturing, constituting mainly livestock processing and exports and vehicle manufacturing, represents only 4% of economic activity.

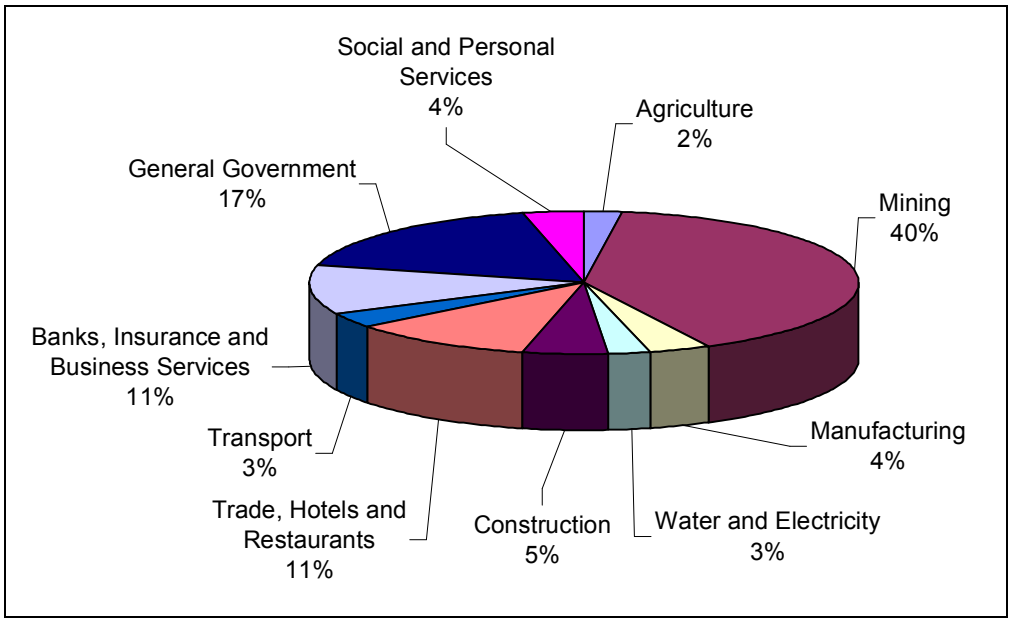

Figure 8-58: Sectors of the Economy - Contribution to Economic Activity

Distribution of Wealth

Despite the strong GDP and economic growth, accompanied by substantial socio-economic improvements in the country over the past decade, many households are still living in poverty. This is due to the very uneven distribution of wealth in Botswana. The majority of non-tax benefits from the mining sector accrue to a relatively limited number of individuals, most of whom are mining company employees (who are well paid by Botswana standards). However, taxation, the Botswana government's 50 percent ownership of Debswana (with De Beers owning the balance), and its 15 percent ownership of the De Beers group means that the government receives significant revenues from diamond mining. These revenues have been used to provide Botswana's high levels of free education and healthcare availability.

Botswana's Development Plans and Strategies

The two key development policies and plans in Botswana are Vision 2016 and the National Development Plan 9 (NDP-9). Vision 2016 provides Botswana with a long term socio-economic planning outlook, which guides the formulation of national development goals and targets. These goals and targets form the framework for national, district and local planning programmes.

NDP-9 covers the period April 2003 to March 2009, and is based on the following fundamental objectives:

- economic diversification;

- employment creation;
- rural development;
- poverty alleviation;
- environmental protection; and
- The fight against HIV/AIDS.

Accordingly, several policies, strategies and implementing agencies have been established with the task of achieving the objectives of NDP-9. This has resulted in increased emphasis on, and resources allocated to, entrepreneurship and small business development.

Prices and Inflation

Botswana's economy was characterised by double digit inflation in the 1970's and 1980's. However, tight monetary policy has meant that in the last two decades, inflation has slowed. Botswana's average annual inflation was 8.6% in 2005, an increase from 7% in 2004. Progress towards lower inflation has been impeded in recent years due to the introduction of VAT (at 10%) in 2002, and the currency depreciation of 7.5% in 2004, which resulted in a sharp jump in imported tradeable goods prices. The devaluation added an estimated 2% to consumer price inflation in 2004.

Government Revenue

Revenue and Grants to the Botswana Government are estimated to amount to around P23.8 billion in 2006/07, increasing from P21.5 billion in 2005/06 and P17.6 billion in 2004/05. Mineral tax amounts to around 25 percent of all tax revenue, while mineral royalties and dividends amount to around 80 percent of non-tax revenue. In total, mineral taxes, royalties and dividends amount to around 50 percent of all Government Revenues. Mineral revenues accrue to Central Government, and are then redistributed to the various districts according to their planned development needs.

Table 8.14: Botswana Revenue and Grants (Pula, Million)

Million Pula	**2004/05**		**2005/06 (Revised)**		**2006/07 (Estimates)**	
	Pula	**US$**	**Pula**	**US$**	**Pula**	**US$**
Tax Revenue	10,072	1,712	11,509	1,957	13,944	2,370
- Mineral Tax	2,509	427	3,259	554	3,417	580

Million Pula	2004/05		2005/06 (Revised)		2006/07 (Estimates)	
- Other	7,564	1,286	8,250	1,402	10,527	1,790
Non Tax Revenue	7,537	1,281	9,969	1,694	9,837	1,672
- Mineral Royalties and Dividends	6,173	1,049	7,630	1,297	7,972	1,355
- Other	1,364	232	2,339	398	1,865	317
Grants	348	59	220	37	363	62
TOTAL REVENUE & GRANTS	17,609	2,994	21,477	3,650	23,781	4,042
Source: Ministry of Finance and Development Planning 2006 Annual Report						

Exports from Botswana

The total value of exports from Botswana amounted to P13.4 billion (US$2.3 billion) (provisional) in 2004, with an average of P14.5 billion (US$2.5 billion) from the year 2000 to 2004 Botswana's economy is highly dependent on mining and diamonds in particular. This is reflected in Botswana's exports, where diamonds contributed between 80% and 86%to the total value of exports, as shown in *Figure 8-59*.

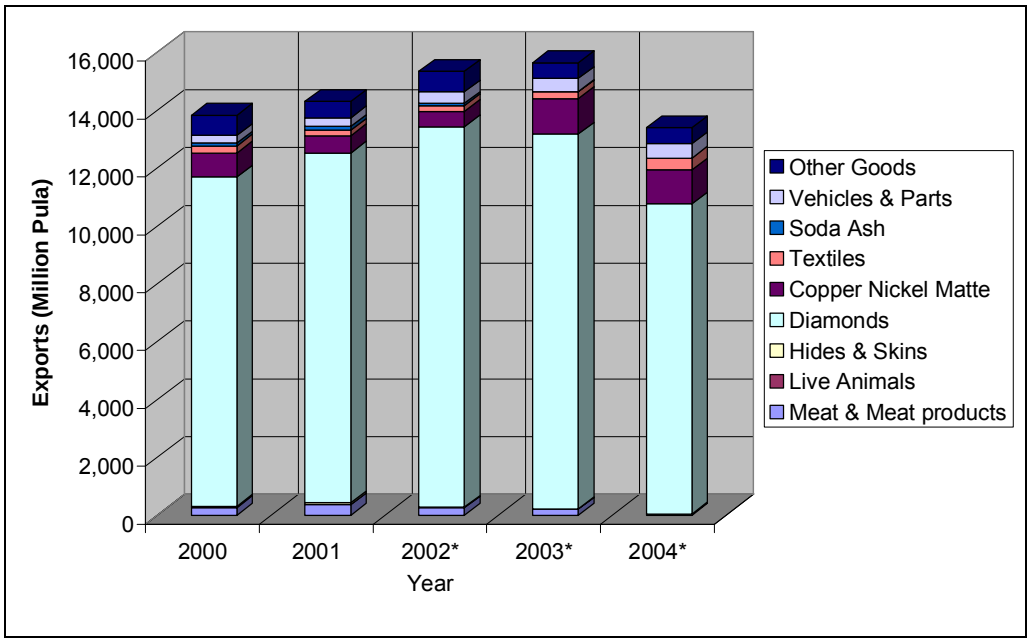

Figure 8-59: Exports by Commodity

8.4.3.2 The labour market

Characteristics of the Labour Market

Employment and Unemployment

The level of unemployment in Botswana is high, estimated to be around 23.8%, although unofficial estimates put it closer to 40%. There are also indications of significant underemployment, as many workers' main economic activity is subsistence agriculture and informal employment, which does not provide full-time employment. The unemployment and underemployment in the country are directly linked to poverty and the unequal distribution of wealth in the country.

The Structure of Employment by Sector

According to the Central Statistics Office, there were 300,000 paid employees in Botswana in 2005, evidence that a substantial proportion of the labour force is rather involved in informal activities such as agriculture, communal livestock production and small informal retail and service businesses. The majority of employment is in the public sector, with 32% (96,700) of paid employees in Central Government and 8 % (24,700) in Local Government. Another major employer is wholesale and retail trade, hotels and restaurant, employing 19 % (56,000) of paid employees in Botswana. Mining, which contributes 45% to Botswana's GDP and is a very

capital intensive sector, employs only 3% (9,300) of paid employees. (It must be noted that this does not include the mining supply chain, but only refers to direct employment in the mining industry). This reveals the significance of the lack of diversification of the economy and the effect it has on employment and unemployment in Botswana. The structure of employment by sector is illustrated in *Figure 8-60*.

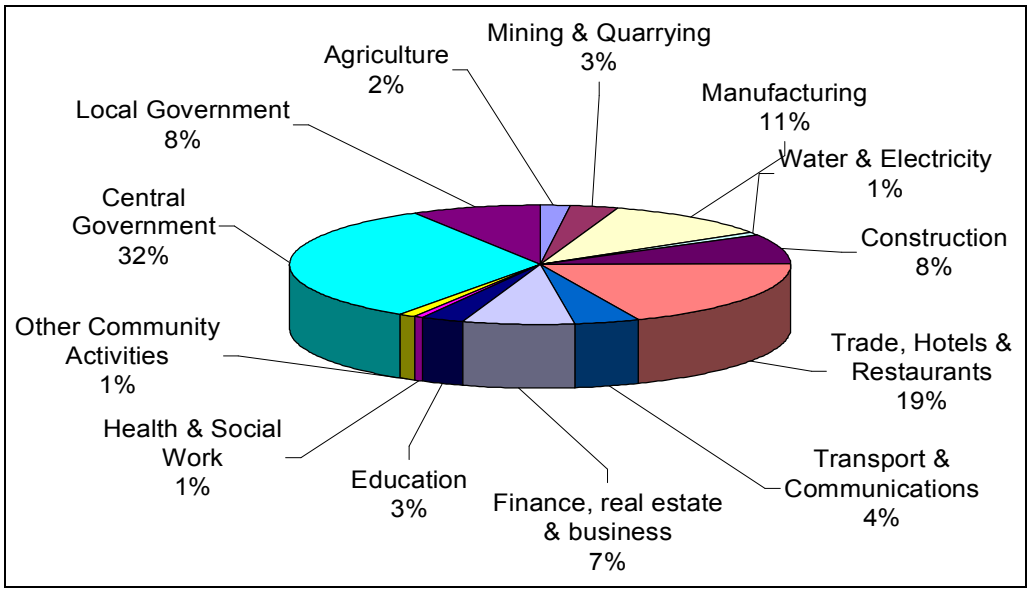

Figure 8-60: The Structure of Employment by Sector, March 2005

Average Income

According to the Botswana Central Statistics Office, the average income across economic sectors is 2,584 pula per month in 2004. The sector with the highest average earnings is the financial sector at 7,704 pula per month, followed by the water and electricity sector at 5,850 pula per month, education (4,926 Pula per month and mining (3,751 pula per month).

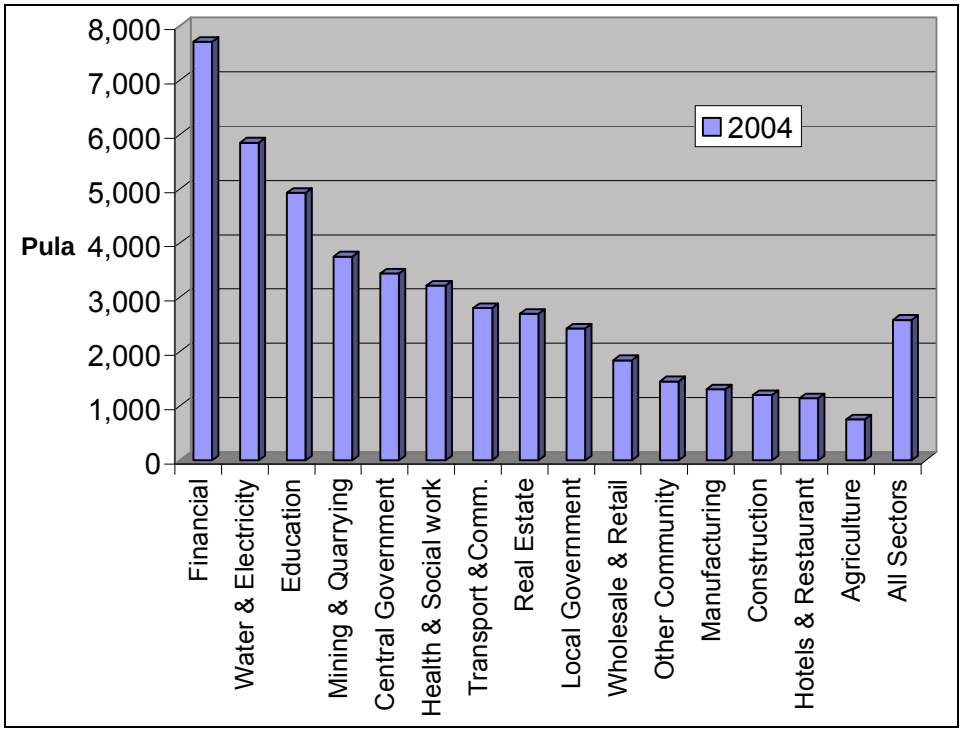

Figure 8-61: Average Earnings per Sector, 2004

8.4.3.3 Local business and the local business environment

Introduction

Botswana has a small private sector, composed mostly of small scale enterprises, alongside a number of large multinational companies with operations in Botswana. The industrial and manufacturing sector is very limited, with a substantial amount of inputs being sourced from outside the country, in particular South Africa. This has in part been responsible for Government's focus on economic diversification, as per the objectives of NDP-9.

Constraints and Characteristics

A number of studies have been conducted that examine the capacity of, and constraints to, businesses in Botswana, examples are:

- BIDPA & CIDA, 2006 Performance and Competitiveness of SMEs in Botswana
- BIDPA, 2003 Botswana Administrative and Regulatory Cost Survey
- BIDPA, 2004 The Global Competitiveness Survey

- BIDPA, 2006 Macroeconomic Policies and their Impacts on Botswana
- Department of Mines, 2005, Consumer Satisfaction Survey
- GEM, 2006, Entrepreneurship Monitor Report 2005
- South African Institute of International Affairs (SAIIA), 2005 The Business in Africa Project
- World Bank Group, 2006 Doing Business – Explore Economies – Botswana

Each of the studies set out in Appendix K highlight characteristics, constraints and positive aspects of doing businesses in Botswana, for small to large companies and new enterprises. A review of these studies shows that there are certain characteristics and constraints that are prevalent for businesses.

From a positive perspective, Botswana is seen to be characterised by limited corruption in comparison to a number of other countries, and according to the World Bank Group study, scores highly in the transparency of transactions, with an index of 8 out of 10 in this category.

Constraints to businesses identified in these studies include:

- Access to finance is a severe constraint to businesses, particularly for small enterprise development. According to the study 'Macroeconomic Policies and their Impacts on Botswana', commercial banks tend to impose stringent conditions and requirements which make finance inaccessible to small scale enterprises. Where finance is available, it is too expensive for the business's economic viability. A number of policies and programmes have recently been put in place to assist in the provision of finance to Small and Medium Enterprises, including: Financial Assistance Policy (FAP), the Citizen Entrepreneurial Development Agency (CEDA), National Development Bank (NDB), Botswana Export Credit Insurance (BECI), and Botswana Development Corporation (BDC).

- The bureaucratic processes, permits and regulations associated with licensing and setting up businesses are inefficient and extremely time consuming. According to the World Bank Group study, it takes on average 108 days for entrepreneurs to set up a business, while the application of licenses takes around 169 days. This is exceptionally slow and a major constraint to entrepreneurship in the country. In addition, it is stated that the labour and competition laws in the country are highly restrictive. Obtaining work permits for foreign employees is further seen as a constraint to good business.

- Labour productivity, poor work ethic and lack of education, training and skills in the workforce were cited as a constraint in a number of studies. These affect overall company costs, efficiency and productivity.

- Lack of infrastructure and technological advancement was also continuously cited as a constraint to business. Conversely however, the 'Doing Business – Explore Economies – Botswana' study stated that good infrastructure was cited as a positive factor for businesses investing in Botswana. This is likely to be relative to doing businesses in other countries in Africa.

- A limited market for goods and services, as a result of the small business community and small population, is seen as a constraint.

The Global Entrepreneurship Monitor (GEM) in 2004 found that generally fear of debt is the single largest barrier to entrepreneurship. The current support that the businesses obtain from government is that of giving tenders to these businesses as a way of empowering local businesses. Other than tenders, there is no other assistance.

Businesses in the Broader Project Area

A survey was undertaken by ERM and BIDPA in November 2006, focussing on businesses close to the Mine and Power Station, and which would be close to the transmission lines. The survey included Mahalapye, Palapye, Serowe, Selebi-Phikwe and Mookane in the Central District, as well as Gaborone. The survey found that most businesses are small-scale and not well established. There is an extremely limited industrial and business base in the Central District. Almost 60 percent of businesses surveyed are in the wholesale and retail sector, with the majority of products and services sourced from South Africa or other countries and distributed within Botswana. Only a third of the businesses surveyed have any experience in dealing with mining, engineering or energy companies.

Capacity and Experience

Following the wholesale and retail business sector, the construction sector is second largest with 9 percent of companies surveyed in this category, followed by 7 percent in the hotel/ restaurant sector.

The village located closest to the project area, Mookane, has the least number of businesses of those villages/ towns sampled. This implies that the project would need to source its products and services from towns located further away although businesses in these areas also lack capacity.

The businesses in the project area are relatively new with over half being less than 5 years old and only 12 percent older than 26 years. Almost all (93 percent) of the businesses indicated that their customers are limited to the sub-district where the business is located.

Ownership and Structure

Almost 83 percent of businesses surveyed are private enterprises and sole proprietorships. The remainder are partnerships (10 percent) and public limited enterprises (7.5 percent). Almost two-thirds of businesses surveyed were citizen owned, while 20 percent are foreign owned. Just less than 8 percent have joint ownership between foreigners and citizens. The majority of businesses covered by the study are independent, with only 5 percent of the businesses being subsidiaries of larger companies. Foreign companies have their head office in their countries of origin, while local companies, which operate from more than one location, have their headquarters in Gaborone.

Size of Businesses

Almost 50 percent of businesses have an annual turnover of over 500,000 pula ($85,000) and the average annual turnover is P240,000 ($40,800). In general, the citizen owned companies have a lower turnover than foreign owned companies. Similarly, businesses managed by people with a university or vocational training perform better than businesses managed by people without these credentials.

Over 90 percent of the companies surveyed have 10 or less permanent employees, of which 40 percent employ 5 or less people. Only 2 percent of companies have more than 50 employees.

Source of Capital

It is clear from the survey that there is a limited culture of loaning money for business start-up and development, with a very small percentage of businesses that get loans from banks for business start-up. For most businesses surveyed, initial capital was sourced from personal savings and government grants such as from CEDA and the Department of Youth and Culture. This corroborates the findings of the Global Entrepreneurship, which found that '*fear of debt is the single largest barrier to entrepreneurship'*.

Gender in Management

Almost three quarters of managers in the businesses surveyed are male, with females accounting for less than a quarter. When comparing male and female business managers, several differences were found, including:

- men have attained higher levels of education than women, with approximately 51% of the men and 14% of women having completed a university education;
- businesses operated by male managers have been in operation for 20 years on average, compared to less than 10 years for those managed by women; and
- A higher percentage of men than women started their own businesses (90% for men vs. 65% for women).

Quality Systems and Business Affiliations

Over three quarters of businesses do not use a formal quality standard in their businesses, as shown in *Table 8.15*. Those who use formal quality standards use BOBS (Botswana Bureau of Standards) standards, South African standards and trade standards. A clear trend is that those who use South African and trade standards are foreign-owned, meaning that only a small percentage of citizen-owned companies use any form of formal quality standard.

Table 8.15 Quality Standards Used in the Businesses Surveyed

Types of Standards Used	Percent (%)
BOBS Standards	11.5
South African Standard	9
Unwritten	46.2
Internally Specified	23.1
Customer Specified	6.4

A large percentage (65%) of local business is not associated with any local, district or national business association. The remaining 35% are predominantly associated with the Botswana Chamber of Commerce and Industrial Management (BOCCIM). Associations are perceived to facilitate networking, staff training, support and guidance as well as sharing business ideas. Overall an association is seen as a basis for providing a single voice to shape economic and public policy.

Opportunities and Constraints to Local Businesses

In terms of weaknesses and constraints, competition from larger companies (41%) and availability of finance (23%) are cited as the major constraints of doing business in the Central District according to surveyed companies. Although goods and services produced by these

businesses are mainly for domestic use and not for export, the bulk of the raw materials are imported from South Africa. These businesses are faced with high transaction costs for importing inputs, which limit their profitability and their capacity to meet the demand that would be generated by the Mmamabula Mine and Power Station. *Table 8.16* presents an overview of the constraints faced by local businesses in the project area, with constraints ranked according to the number of respondents that cited this as a major constraint.

Table 8.16 Constraints faced by local businesses

Constraints	Percent
Competition from larger companies	41.2
Availability of finances	23.5
Seasonality	7.4
Availability of skilled people for recruitment	5.9
Harsh legislative requirements	5.9
Labour productivity	4.4
Poor facilities	4.4
Availability of resources	4.4
Lack of capacity	1.5
Tendering system is unfair	1.5

The large customer base is perceived as a major strength of doing business in the project area. *Table 8.17* presents the opportunities/ strengths of doing business in the project area according to surveyed companies.

Table 8.17 Opportunities for local businesses

Strengths	Percent
Large customer base	63.6
Employment creation	11.4
Less competition	11.4
Good service provision	9.1
Affordable price & good quality	4.5

8.4.3.4 The Central District Economy

Economic Activity and Livelihoods

The dominant economic activities in the district are mining, agriculture (both arable and pastoral), industrial and commercial undertakings.

There are diamond mines in the district at Orapa, Damtshaa and Letlhakane, and soda ash mining at Sowa and a coalmine at Morupule. The district, like the rest of the economy, is faced with the challenge of diversifying its economy so to lessen reliance on mining. It is evident that the NDP 8 has been something of a turning point, during which new sources of growth had to be developed. Probably the main reliance could be placed on the expansion of the manufacturing sector, along with certain services such as tourism, micro-enterprises and finance.

The district is predominantly rural so most of the residents are engaged in both arable and livestock agriculture. Most operations are at subsistence level with a few commercial endeavours. In addition to agriculture there are commercial operations such as butcheries, shops, bars, bottle stores, wholesalers (existing in major villages), as well as hawkers and vendors. The idea of community based wildlife management areas has also gained momentum. Currently, the Nata Sanctuary and the Khama Rhino Sanctuary are in operation. Research is being conducted to establish viability of similar activities along the Tswapong Hills.

The Labour Market

According to the Central Statistics Office, 2001 Census Results, the labour force in the Central District is 67% of the population of the District of around 500,000 people. Of these, 27% have paid jobs, while 7% are involved in unpaid (assumed to be subsistence) labour and 9% are job seekers/ unemployed. The remainder of the population are home makers (26%), students (27%), retired (2%) and sick (3%).

Training

There are a number of tertiary training institutions in the Central District, categorised into colleges of education (Serowe College of Education & Tonota college of Education), institutes of health sciences, brigades and technical colleges.

- Colleges of Education: There are two colleges of education in the District: the Serowa College of Education for primary school teachers training, and Tonata College of Education which offers three-year post secondary diploma course in secondary education.

- Institute of Health Services: Nursing school in Serowe where trainee nurses are introduced to basic nursing skills.

- Technical Colleges: Palapye Technical College provides training to school leavers and students are equipped with the basic industrial skills.

- Vocational Training: Brigades provide general vocational training facilities and organise and arrange general educational activities to equip the people concerned with the highest degree of skills in their vocational fields. Central District has 16 brigades that offer a wide range of courses like certificate in Secretarial studies, certificate in accounting and business studies, office skills, certificate in computer studies, carpentry/joinery, bricklaying, plumbing electrical, fitter machinist, welding and fabrication, panel beating, auto mechanics, borehole mechanics, textiles/tailoring trades, furniture/cabinet making, draughting, horticulture, livestock farming and forestry. Table 8.18 sets out the enrolment figures for the Brigades in the Central District, as well as the towns and villages where they are located.

Table 8.18: Enrolment figures for Brigades in the District

Brigade	Academic Staff	Number of students
Palapye	21	209
Serowe	31	352
Tswapong North	9	115
Madiba	-	-
Mahalapye	11	127
Shoshong	8	82
Bobonong	27	221
Boteti	16	146
Gweta	20	163
Marapong	8	102
Marabela	15	141
Mosetse	11	136
Nkange	7	77
Nswazwi	18	224
Shashe	16	168
Tutume	20	198
Source: CSO Education Statistics 2001		

8.4.3.5 The Economy of kgatleng District

Labour Market

According to the Central Statistics Office Indicator Survey 2002, 50% of the population of around 55,000 people is in the economically active age group, as shown in *Table 8.19*. 20% of the economically active are formally unemployed.

Table 8.19: Employment statistics for Kgatleng District

Status	Population	Percentage (%)
Economically active	27,550	50%
Employed/involved in an economic activity	22,032	80%
Unemployed (without any form of employment)	5,518	20%
Total Population	**55,100**	

Of the employed, 57% are paid employees, while 8% are self employed and 15% are subsistence farmers, as shown in *Table 8.20*.

Table 8.20: Economically Active Population (Employed and Unemployed)

Economic Activity	**Total**	**Percentage (%)**
Paid employees	15,627	57%
Self Employed without employees	1,367	5%
Self Employed with employees	721	3%
Unpaid family helper	267	1%
Work on own lands	4,050	15%
Total employed	22,032	
Source: Central Statistics Office Indicator Survey 2002		

Economic activities and livelihoods

Economic activities in the district are diverse. These range from small agricultural holdings to tourism; real estate development, franchises like Spar, Friendly Grocers. Citizen Entrepreneurial Development Agency (CEDA) has also opened an office in Mochudi. Another economic activity is the trading sector comprising mainly small general dealers, restaurants, bottle stores and other commercial establishments.

Land uses in Kgatleng

According to the Government White Paper on the Tribal Land Grazing Policy of 1975, Kgatleng District was declared wholly communal with no other tenure, neither freehold nor state land. *Table 8.21* below shows the various land uses in square kilometres and as a percent of total land use.

Table 8.21: Land Use Types In Kgatleng

Types of Land Use	Area (KM2)	Percent (%)
Agriculture and Settlement		
Communal Grazing	3281.54	43.18
Settlements	2725.73	35.85
Mixed Farming	1035.25	13.62
Arable Land	524.94	6.91
Total	**7566.73**	**99.56**
Non-Gazetted Roads	19.34	0.26
Gazetted Roads	13.19	0.17
Total	**32.53**	**0.43**
Industrial		
Pilane	0.74	0.01
Total	**7600**	**100**

According to *Table 8.21*, 99.6%of the land use in the Kgatleng District is used for agriculture and settlement with 43% communal grazing and 36 percent settlements.

8.4.4 Community and Occupational Health

Infotox conducted studies into community health and the result are summarised below.

Company	Infotox (Pty) Ltd
Aspect	Community and Occupational Health aspects
Contact Person	Marlene Fourie
Postal Address	PO Box 98092 Waterkloof Heights 0065 South Africa
Physical Address	
Telephone Number	012 -460 0650/ 082 772 9633

Fax Number	012 -460 0650
Email Address	marlene@infotox.co.za

The main purpose in undertaking the baseline community health survey was to assess the current health status of adjacent communities and also to establish a point of reference for health improvements that may occur into the future as a result of the MEP.

The general health status of a community may be evaluated through specific measures, e.g. the nutritional status of children in the community, and mortality and morbidity data concerning the prevalence or incidences of specific diseases or health conditions.

8.4.4.1 General health status

The data indicates that the Botswana under-five and infant mortality rates are lower in comparison with the mean for Africa. Neonatal mortality rates are however practically equal.

The percentage of deaths due to HIV/AIDS in the Botswana under-five age group is almost 8-fold higher than the mean percentage for Africa. The high percentage of deaths due to HIV/AIDS reflects a serious potential vulnerability to secondary infections. The estimate of HIV prevalence for 2004 was 37.4% among pregnant women. This figure was adapted to present an estimate of 22% of adult prevalence. HIV/AIDS is thus a major contributor to deaths in Botswana, both in adults and in children. The impression gained in this regard is therefore that Botswana seems to compare badly in comparison with other African countries. This data may, however, be blurred by differences in estimation measures and poor record-keeping practices.

Immunisation coverage in Botswana compares highly favourably with the mean for Africa, indicating the successful implementation of immunisation regimes in the country.

It can be said that the Mahalapye Sub-district is not more vulnerable than the other sub-districts to the potential social- and lifestyle changes that might result from the MEP.

The most pertinent social health issues of concern that may potentially be exacerbated by the Mmamabula project are sexually transmitted diseases (STDs), HIV/AIDS, nutritional status and the emotional or psychological state of mind of the villagers.

Adult and child health in Botswana compares favourably with that of Africa, based on indices such as low birth weight, the under-five age group mortality due to diarrhoeal diseases, measles, pneumonia and malaria; infant- and neonatal mortality and immunisation coverage in 1-year olds.

The HIV/AIDS prevalence and the percentage of deaths due to HIV/AIDS are cause for concern and indicate a significant vulnerability to the spread of this disease, and also to related secondary infections associated with a compromised immune system and general health.

Data for various diseases related to social and lifestyle factors was available for Botswana and specifically for the Mahalapye Sub-district. This allowed comparison of the health status in the Mahalapye Sub-district with that of the Botswana population in general. Attention was focussed on statistics related to diseases associated with lifestyle changes, e.g. changes in alcohol use, eating habits and sexual behaviour. The prevalence of sexually transmitted diseases in a population is a broad indicator of sexual behaviour, and data on these were presented in detail. Chronic infections associated with sexually transmitted diseases often result in secondary reproductive disorders due to the formation of physical obstructions ("blocked tubes") in the female reproductive tract, which are reflected in statistics such as diseases of the menstrual cycle.

Statistics for outpatient and government clinic visits in the Mahalapye Sub-district with complaints of STDs, diseases of the urogenital and reproductive systems, diphtheria, and bilharzia and because of alcohol- and drug abuse compare favourably with the country as a whole. The conclusion may therefore be made that the Mahalapye Sub-district is not more vulnerable than the other sub-districts to the potential social- and lifestyle changes that might occur. An application to conduct a health baseline assessment of the MEP area has been submitted to the ethics committee in Botswana, and it is likely that such a study will be conducted later in 2007, and will follow the necessary guidelines provided by the committee.

9 PUBLIC PARTICIPATION PROCESS

Refer to Appendix L for a complete copy of the PCDP report.

Public participation is a key component of any EIA. It involves those interested in, or affected by, the proposed development in highlighting issues of concern and in assisting the project designers to take account of locally relevant conditions as opposed to imposing a socially and environmentally insensitive design onto an environment.

This Public Consultation and Disclosure Report includes the findings of the authorities and public participatory meetings held at the national and district levels as well as meetings in Palapye, Selebi Phikwe, Mahalapye, Mmaphashalala and Dibete. Meetings with authorities, the general public and directly affected communities were held in August 2006. Additional meetings were held in November 2006 with the directly affected communities to provide additional information requested during the scoping meetings in August.

9.1 Aims of Public Participation

Public Participation aims to create an environment of informed and constructive participation of all parties interested in, or affected by, a proposed development. It is not aimed at avoiding conflict but rather at facilitating a process in which people feel heard and included in decision-making and project design and where satisfactory outcomes are identified.

Public Participation aims to achieve the following:

- Identify all relevant Interested and Affected Parties (IAPs) for this project;
- Distribute accurate project information;
- Gather information that will contribute to the environmental and technical investigations;
- Form partnerships to promote constructive interaction between all parties;
- Address any potential conflicts that may arise;
- Record and address public concerns, issues and suggestions;
- Manage IAPs' expectations; and

- Fulfill Botswana and international requirements for consultation.

The IFC Performance Standard 1, as well as the Equator Principles, highlights the need for ongoing and appropriate communication between the developer and affected parties from an early stage of the project through implementation and until closure. To this end a Public Consultation and Disclosure Plan (PCDP) is being developed as part of the Social Management System for the MEP. The PCDP is an outcome of the EIA and is tailored to the project environment. In its final form the PCDP, which will form part of the Environmental and Social Impact Assessment (ESIA) for international financier requirements, will include roles, responsibilities and budgetary requirements, as well as a detailed Grievance Resolution Procedure, for the implementation of ongoing communication from construction through to closure of the MEP. However, recommendations of appropriate structures required in the EMP of the Botswana EIS have taken ongoing communications into account.

The following figure presents the Public Participation Process being followed for the EIS and for the development of the PCDP.

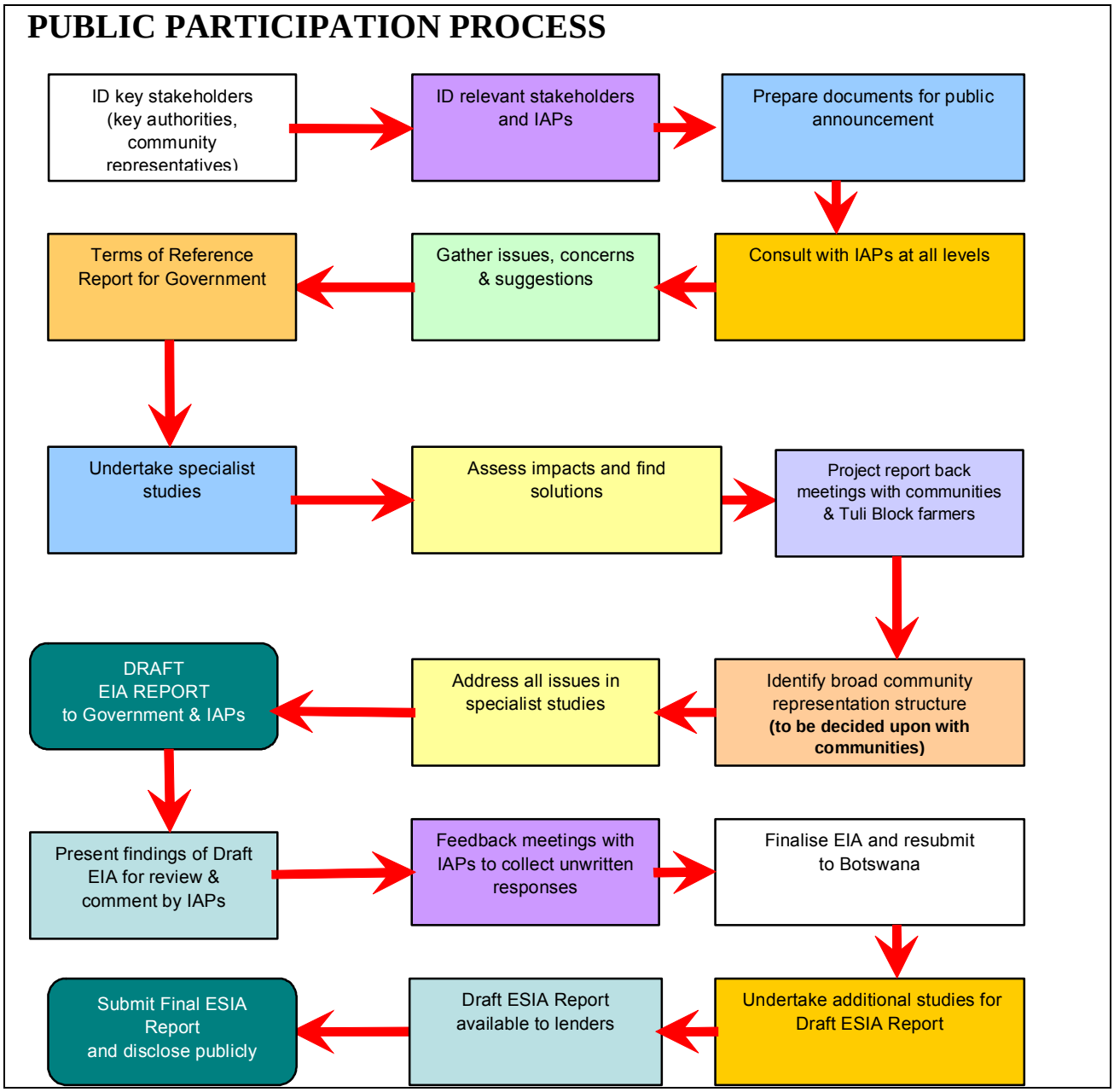

Figure 9-1: PCDP process

9.2 Approach and Methodology

Separate EIS's are being carried out for the Mine and Power Plant and for the Transmission Lines within Botswana. In the interest of access to information and for a more holistic understanding of IAP concerns and suggestions regarding the entire project, one integrated PCDP has been designed and is being implemented. This means that IAPs are presented with information relating to all aspects of the MEP even where they are only concerned with one. As a result of this

approach one PCDP report is being written for the Mine and Power Plant as well as the Transmission Lines. This PCDP is phase 1 and incorporates IAP comments and concerns applicable for the Botswana EIS. A Phase 2 PCDP will be developed as part of the ESIA for international financiers, and will include further consultation for the Calcrete and NSC activities.

In approaching the development of a PCDP strategy for this project the consultant team has aimed for a rigorous and methodical process that will not only be above scrutiny, thereby limiting project risks of resistance based on procedural grounds, but will encourage active engagement from stakeholders so that suggestions can be incorporated into project design and so that concerns and conflicts can be openly addressed in an ongoing manner.

The methodology to date has included:

- Stakeholder identification (including special interest and vulnerable groups);
- Site visits;
- Development of appropriate documentation;
- Stakeholder notification (through dissemination of information and meeting invitations);
- Participatory meetings with authorities, public and affected communities;
- Translation and distribution of minutes; and
- Social Impact Assessment field-work.

9.3 Assumptions

The following assumptions underlie the development of the approach and methodology for the PCDP:

- The developer has made, and will continue to make, all available project planning information accessible to the public participation team to share with IAPs;
- The process of public participation is entered into in good faith with the developer open to issues raised and concerns expressed, and willing to incorporate relevant suggestions into the project design;
- Responses from IAPs contained in this report are based on information available and provided during meetings in late August and early September 2006 as well as November 2006;

- The project will be developed in accordance with the highest international practices and will meet the Equator Principles and IFC Performance Standards as well as Botswana's legislative requirements; and

- The project has no intention of impacting on the physical villages so as to necessitate their resettlement. Resettlement of individual households may, however, be required.

9.4 Findings

Following the various participatory meetings held in August/September 2006 and then in November, a number of issues and risks were identified. The key issues will be addressed in the various specialist sections of the EIS. The impacts identified in the relevant sections will highlight the nature of these risks for the project and for the stakeholders. What is presented below is a table of issues from the perspectives of IAPs.

Although an inclusive PCDP for the MEP has been conducted, only key findings from participatory meetings relative to the transmission line project, together with their related risks are presented below (Table 9.1).

Table 9.1: Key finding of participatory meetings

Aspect and Issue	Risk Category
LAND	
Project footprint and loss of access to land	
Project infrastructure will reduce the availability of agricultural and grazing land. The placement of Transmission Lines will limit the choice of land use.	High
Construction and sites of cultural significance	
Construction along the river will put iron and stone age sites at risk.	Low
CULTURAL HERITAGE	
Project activities in relation to sites of cultural significance	
Project-related activities along the river will put iron and stone age sites at risk.	Low
SOCIAL CHANGE	

Aspect and Issue	Risk Category
Project-induced social change	
The area will change from a rural and natural environment to an industrial/developing one. A potential influx of outsiders during construction may affect local culture and traditional structures. People's values and behaviours may be undermined. Potential increase in crime related to the influx of outsiders.	Medium
The sense of place of the project area will change. There is likely to be a limitation of potential land-use. Visual impacts will affect the aesthetic attraction of the area.	Medium
CLOSURE AND REHABILITATION	
Closure and post-closure potential for degradation of physical and social environments	
The project will leave behind it a long-term legacy through permanent alterations to the landscape. Lack of capacity and resources to audit compliance may result in a number of breaches in procedures and contracts. Use of only outside auditors will risk inappropriate action taken as a result of inadequate local knowledge. A government underwritten guarantee is needed to ensure that, someone within the country is accountable for addressing impacts at closure.	Medium
EMPLOYMENT	
Project activities and local employment opportunities	
Give priority to local residents for employment where possible. Be sure to look for skills within tertiary institutions before importing existing skills.	High.
PUBLIC PARTICIPATION & COMMUNICATION	
Communication facilitates or hampers local participation	

Aspect and Issue	Risk Category
Inadequate information about the project reduces people's ability to make decisions about their futures. Inadequate information creates mistrust between local residents and the developer.	High

9.5 Forthcoming Participation

Information from the first and second rounds of public participation meetings has been fed into this report, after which the draft EIS will be made available to all IAPs and follow up meetings will be held to present a summary of the EIS's, including impacts identified and mitigation measures developed as part of the EMP. A process, through which a Community Liaison Committee can be established, as requested by affected communities, has also been initiated and will form the basis for ongoing liaison between the developer and affected communities prior to, and during project development.

9.6 Summary

A thorough PCDP has been initiated for the MEP. This will be continued throughout the EIS feedback process and through the ESIA communication requirements, and will present IAPs with relevant and accessible project information as it becomes available. Open and transparent communication has been identified by affected parties as central to the development of trust between all IAPs and will contribute to the facilitation of a project whose design and implementation, if approved, will be acceptable, and ideally beneficial, to stakeholders involved.

10 IMPACT ASSESSMENT METHODOLOGY

In order to adequately assess and evaluate the impacts and benefits that will be associated with a proposed project, it is necessary to develop a methodology that will achieve consistency in the approach to the impact assessment between different specialists and reduce the subjectivity involved in making such evaluations. Legal requirements and clearly defined criteria must be implemented in order to accurately determine the significance of the predicted impact or benefit on the surrounding natural and/or social environment. For this to be done, the context of the project must be considered according to the area and the people that will be affected.

Of necessity, impact assessment will always contain a degree of subjectivity, as it is based on the value judgment of various specialists and members of society. The evaluation of significance is thus contingent upon values, and dependant upon the environmental and community context. Therefore, ultimately, impact significance involves a process of determining the acceptability of a predicted impact to society.

The purpose of impact assessment and mitigation is to identify and evaluate the likely extent and significance of the potential impacts on identified receptors and resources according to defined assessment criteria, to develop and describe measures that will be taken to avoid, minimize, reduce or compensate for any potential adverse environmental effects and to report the significance of the residual impacts that remain following mitigation. An Impact Assessment Methodology has been developed by ERM (who will be compiling the ESIA to be submitted to potential project financiers) and has been implemented within this EIS by DWA.

The types of impacts and terminology to be used in the assessment are shown in Table 10.1.

Table 10.1 Impact Assessment Terminology

Term	Definition
Grouping of Impact	
Routine/Planned Impact	O Occur as a result of expected common or regular Project activities
Cumulative Impact	I Impacts that act together with other impacts (including those from concurrent or planned future third party activities) to affect the same resources and/or receptors as the Project.

Non-routine/Unplanned Impact	Occur as a result of exceptional events not expected to occur
Impact Type	
Direct Impact	Impacts that result from a direct interaction between a planned project activity and the receiving environment (e.g. between occupation of a site and the pre existing habitats or between an effluent discharge and receiving water quality).
Indirect Impact	Impacts that result from other activities that are encouraged to happen as a consequence of the Project (e.g. in-migration for employment placing a demand on natural resources).
Induced Impact	Third level impacts caused by a change in the Project environment (eg. employment opportunities created by the increased disposable income of workers hired by the Project or its suppliers)
Impact Magnitude	
Nature	Negative - an impact that is considered to represent an adverse change from the baseline, or introduces a new undesirable factor Positive - an impact that is considered to represent an improvement on the baseline or introduces a positive change.
Duration	Temporary - impacts are predicted to be of short duration and intermittent/occasional in nature. Short-term - impacts that are predicted to last only for a limited period (e.g. during construction) but will cease on completion of the activity, or as a result of mitigation/reinstatement measures and natural recovery (e.g. sediment suspension by capital dredging, construction workforce-local community interactions). Long-term - impacts that will continue over an extended period, but cease when the Project stops operating. These will include impacts that may be intermittent or repeated rather than continuous if they occur over an extended time period (e.g. repeated seasonal disturbance of species as a result of maintenance dredging, operational employment). Permanent - impacts that occur during the development of the Project and cause a permanent change in the affected receptor or resource (e.g. alteration of coastal morphology) that endures substantially beyond the

	Project lifetime.
Scale	Local - impacts that affect locally important environmental resources or are restricted to a single habitat/biotope, a single (local) administrative area, a single community. Regional - impacts that affect regionally important environmental resources or are experienced at a regional scale as determined by administrative boundaries, habitat type/ecosystem. National - impacts that affect nationally important environmental resources, affect an area that is nationally important/protected or have macro-economic consequences. International - impacts that affect internationally important resources such as areas protected by International Conventions. Trans-boundary - impacts that are experienced in one country as a result of activities in another.
Value/Sensitivity of Receptor (for environmental receptors)	Specific to receptors relevant to the project (see below).
Ability to adapt (for social receptors)	Low (-):Affected people can easily adapt Low (+): Potential beneficiaries have difficulty adapting High (-): Affected people have difficulty adapting High (+): Potential beneficiaries can easily adapt
Impact Likelihood In addition to predicted impacts, those impacts that could result in the event of an accident or unplanned event (non-routine) within the Project (e.g. fuel spill, traffic accident) or in the external environment affecting the Project (e.g. flooding, earthquake) are required to be taken into account. In these cases the probability of the event occurring needs to be considered. Likelihood also needs	

to be taken into account when considering socio-economic factors.	
Low	The impact has not occurred in transmission developments.
Medium	Impact has occurred occasionally in transmission developments.
High	Impact has previously occurred in similar projects in Botswana or southern Africa.

10.1 Assessing Significance

There is no statutory definition of 'significance' and its determination is therefore necessarily partially subjective. For the purposes of this EIS, the following definition of significance has been adopted:

"An impact is significant if, in isolation or in combination with other impacts, it should, in the judgment of the EIA team, be taken into account in the decision-making process, including the identification of mitigation measures (by the Project) and consenting conditions (from Regulators and Stakeholders)."

Criteria for assessing the significance of impacts stem from the following key elements.

- Status of compliance with relevant Botswana legislation, policies and plans and any relevant Project or industry policies, standards or guidelines.
- The magnitude (including nature, scale and duration as described above) of the change to the natural, socioeconomic or health environment (e.g. loss of, or damage to, habitats, an increase in noise, an increase in employment opportunities), expressed, wherever practicable, in quantitative terms. The magnitude of all impacts is viewed from the perspective of those affected by taking into account the likely perceived importance as understood through consultation.
- The nature of the impact receptor (physical, biological, or human). Where the receptor is physical (e.g. a watercourse) its quality, sensitivity to change and importance are considered. Where the receptor is biological, its importance (e.g. its local, regional, national or international importance) and its sensitivity to the impact are considered. For a human receptor, the sensitivity of the household, community or wider societal group is considered along with their ability to adapt to and manage the effects of the impact.

- The likelihood (probability) that the identified impact will occur. This is estimated based upon experience and/or evidence that such an outcome has previously occurred.

For this assessment, significance has been defined based on five levels described in Table 10.2 below. It is noted that positive impacts will vary in their significance from minor to major.

Table 10.2 Significance Definitions

Significance Definitions	
Positive impact	Positive impacts provide resources or receptors, most often people, with positive benefits. It is noted that concepts of equity need to be considered in assessing the overall positive nature of some impacts such as economic benefits, or opportunities for employment. Positive impacts can vary in magnitude.
Negligible impact	Negligible impact (or Insignificant impact) is where a resource or receptor (including people) will not be affected in any way by a particular activity or the predicted effect is deemed to be 'negligible' or 'imperceptible' or is indistinguishable from natural background variations.
Minor impact	An impact of minor significance is one where an effect will be experienced, but the impact magnitude is sufficiently small (with or without mitigation) and well within accepted standards, and/or the receptor is of low sensitivity/value.
Moderate impact	An impact of moderate significance is one within accepted limits and standards. Moderate impacts may cover a broad range, from a threshold below which the impact is minor, up to a level that might be just short of breaching a legal limit. Clearly to design an activity so that its effects only just avoid breaking a law and/or cause a major impact is not best practice. The emphasis for moderate impacts is therefore on demonstrating that the impact has been reduced to a level that is as low as reasonably practicable (ALARP). This does not necessarily mean that 'Moderate' impacts have to be reduced to 'Minor' impacts, but that moderate impacts are being managed effectively and efficiently.

Major impact	An impact of major significance is one where an accepted limit or standard may be exceeded, or large magnitude impacts occur to highly valued/sensitive resource/receptors. An aim of ESIA is to get to a position where the Project does not have any major residual impacts, certainly not ones that would endure into the long-term or extend over a large area. However, for some aspects there may be major residual impacts after all practicable mitigation options have been exhausted (i.e. ALARP has been applied). An example might be the visual impact of a facility. It is then the function of regulators and stakeholders to weigh such negative factors against the positive ones such as employment, in coming to a decision on the Project.

10.2 Residual Impacts

Clearly complete mitigation of an impact cannot always be achieved. A residual impact is the impact that is predicted to remain once mitigation measures have been designed into the intended activity. For this EIS these are the measures that have already been built into the planning and design of Project activities, together with those measures that would be expected as part of good industry practice. The significance of the residual impact will be evaluated against the criteria established for the assessment and reported in the EIS. To the extent possible, therefore, it is the significance of the residual impacts that will be reported in this EIS. The residual impacts will be described in terms of their significance in accordance with the categories identified above.

There is an iterative element to this process, so residual impacts initially judged to be ‘major’ or ‘moderate’, even with the application of mitigation measures, will receive ongoing management attention including further sequences of prediction, evaluation and additional mitigation measures being identified.

10.3 Cumulative Impacts

Cumulative effects are caused by the accumulation and interaction of multiple stresses affecting the parts and the functions of ecosystems, individuals or communities. Of particular concern is the knowledge that ecological systems sometimes change abruptly and unexpectedly in response to apparently small incremental stresses. For purposes of this report, cumulative impacts have been defined as “the changes to the environment caused by an activity in combination with other past, present, and reasonably foreseeable human activities”.

Where cumulative impacts are expected to be significant, these will be assessed and discussed in the EIS.

10.4 Dealing with Uncertainty

Even with a final design and an unchanging environment, impacts are difficult to predict with certainty. Potential impacts may be assessed using tools ranging from quantitative techniques such as hydrodynamic modelling to qualitative techniques based on expert judgment and historical information. The accuracy of these assessment tools depends on the quality of the input data and available information. Where assumptions have been made, the nature of any uncertainties associated with the assumption will be discussed. For qualitative predictions / assessment some uncertainty is removed through consultation.

In projects such as the MEP where the design process is in progress, uncertainty stemming from ongoing development of the project design is inevitable. When such uncertainties are material to EIS findings, they will be clearly stated and will be approached conservatively ('the precautionary approach') in order to identify the broadest range of likely residual impacts and necessary mitigation measures.

10.5 Mitigation Measures

The mitigation measures are developed to avoid, minimize, reduce, remedy or compensate for the negative impacts identified, and to create or enhance environmental and socioeconomic benefits. These measures are often established through legal or best practice standards.

Major negative impacts are generally considered to be unacceptable and are required to be mitigated (e.g. avoided, minimized, reduced or compensated for). In some instances a major negative impact may be offset by a positive impact of similar magnitude, and in such situations the relative importance of the impacts must be considered in assessing their acceptability. For moderate negative impacts, the focus of specific mitigation measures is to reduce these to as low as reasonably practicable. Minor impacts are generally controlled through the adoption of best practice management measures.

The objectives of mitigation are often established through legal or best practice standards such as those of the World Bank. Where standards are not available, objectives will be established based on international best practices. A goal of the project is to be consistent with IFC Performance Standards and appropriate international industry guidelines.

11 ENVIRONMENTAL IMPACT ASSESSMENT

The set of impacts that any specific transmission development will have on the environment, depends on:

- The scale of operations, with regards to both voltage and length;
- The efficiency and effectiveness of any environmental management systems that are deployed by the developer and operator; and
- The sensitivity of the receiving environment.

The following chapter details the impacts for each phase of the project. It is important o note that the impacts have been assessed based on the impact occurring without mitigation. Mitigation relative to each impact has, however, also been described in this chapter. A summary of the significant impacts is given at the end of the chapter, along with recommendations for those impacts which will remain, despite the mitigation measures.

11.1 Construction Phase

11.1.1 Geology

Objective:

- To assess and limit impacts on geology during construction.

Cause & Comment:

During construction, the geology may be impacted on through blasting and excavation activities undertaken to prepare foundations for transmission towers. This will however only affect a small area and will not be extensive.

Although the impacts on geology during construction are limited, they are permanent. There are no indirect negative impacts on the environment from the disturbance to the geology during construction.

Impact	Grouping	Type	Nature	Duration	Scale	Likelihood	Ability to Adapt	Significance	Mitigation (addressing all impacts)	Responsibility
Disturbance to the shallow geology through construction of foundations.	Direct	Routine	Neutral	Permanent	Local	High	Low	Minor (-)	• Not required due to small footprint of impact.	Contractor

11.1.2

11.1.3 Topography

Objective:

- To maintain the integrity of the landscape.
- To minimise disturbance to the natural topography
- To ensure drainage lines are not disturbed.

Cause & Comment:

No impact on topography is anticipated during construction.

11.1.4 Soil

Objective:

- To prevent losing soil quality through mixing of usable soil with subsoil horizons which will reduce rehabilitation potential.
- To prevent soil loss through erosion.

- To prevent reduction of soil quality through contamination with other substances such as hydrocarbons.
- To prevent loss of soil structure through compacting of soil.
- To prevent loss of soil fertility.
- To prevent water logging of any soils in the area.
- To preserve topsoil for future rehabilitation.

Cause & Comment:

The area where soils may be affected will be limited to an 8m wide servitude and a 40m x 40m area cleared for the construction and erection of each tower. There will be the potential for soil erosion, compaction and contamination in these areas. Another potential impact on soil will be the pulverisation of particles with excessive heavy vehicle movement, resulting in powder like dust.

Significance:

Loss of topsoil and hydrocarbon spillages can result in negative impacts on soil, but also cause an indirect impact on land use and capability. During construction, without proper mitigation measures, minor to moderate negative impacts on soil can be expected to occur.

Cumulative:

There may be a cumulative impact on soil along the length of the transmission line should the new lines run parallel with existing lines as this will result in additional servitudes adjacent to existing access roads.

Impact	Grouping	Type	Nature	Duration	Scale	Likelihood	Ability to Adapt	Significance	Mitigation (addressing all impacts)	Responsibility
Loss of topsoil	Routine	Direct	Negative	Long term	Local	Medium	Low	Minor (-)	• Number and extent of borrow pits should be kept to the minimum possible for the economic supply of construction materials. • Roads should be constructed with calcrete or laterite, which will maintain its form for longer. • All heavy machinery operators and truck drivers should be instructed to stay in designated areas, such as construction sites and roads. • Soils should be stockpiled separately according to their forms and their	Contractors, Engineers and site managers
Hydrocarbon spillages	Non-routine	Direct	Negative	temporary	Local	Medium	High	Minor (-)		
Soil pulverisation	Routine	Direct	Negative	Long term	local	Low	Low	Minor (-)		
Soil compaction	Routine	Direct	Negative	Long term	Local	Medium	Medium	Moderate(-)		

Impact	Grouping	Type	Nature	Duration	Scale	Likelihood	Ability to Adapt	Significance	Mitigation (addressing all impacts)	Responsibility
									potential use. Equipment should be used that will minimise compaction. • Berms should be placed around stockpiled soil to prevent soil loss due to erosion. • Storage and use of fuels and lubricants should be strictly confined to bunded areas. • Stockpiles should not exceed the designated height and should be shaped to reduce soil compaction, as per the rehabilitation guideline. • Accidental hydrocarbon spillages should be reported immediately, and then the affected soil should be removed, and rehabilitated or if this is not possible, disposed of at a waste sites designated to accept such waste. • Add fertilizers to soil where necessary.	

11.1.5 Land Capability

Objective:

- To preserve soil so that land capability class can be re-established post construction
- To minimise the footprint of construction activities so that impacts on land capability are minimised.

Cause & Comment:

As a result of the impact on the soils, the land capability may be affected negatively if the soil disturbance, contamination and pollution are not confined to small areas. If heavy vehicles and machinery are not confined to the permanent roads, widespread compaction may take place. Although the land capability will be reduced over a small area during construction, most of it will be re-established after construction.

Significance:

As with soil impacts, the impact on land capability will be negative and if not restructure to designated zones, could spread which would lead to a decrease in the land capability. There should not be any significant cumulative impacts, unless there is a significant growth in industry in the future, which will impact on the regional land capability.

Impact	Grouping	Type	Nature	Duration	Scale	Likelihood	Ability to Adapt	Significance	Mitigation (addressing all impacts)	Responsibility
Reduction in land capability	Routine	Direct	Negative	Short term	Local	Medium	Medium	Minor (-)	• Construction activities should be restricted to demarcated areas. • Movement of people, vehicles and equipment should be restricted to identified pathways, tracks and/ or access roads. • All areas outside designated construction areas	Contractor

Impact	Grouping	Type	Nature	Duration	Scale	Likelihood	Ability to Adapt	Significance	Mitigation (addressing all impacts)	Responsibility
									shall be regarded as “no go” areas	

11.1.6 Land Use

Objective:

- To maximise potential land use options for post construction
- To allow the use of un-mined land where practical.

Cause & Comment:

The construction activities will change the land use significantly in the areas surrounding the infrastructure, but should not impact to any significant extent on the overall project area. Most land use will be re-established post construction.

Significance:

The impact on land use is limited, but negative. During construction, the areas where activities are taking place will not be able to be used for grazing and agriculture and hence this impact will be experienced by the local farmers in the area.

Impact	Grouping	Type	Nature	Duration	Scale	Likelihood	Ability to Adapt	Significance	Mitigation (addressing all impacts)	Responsibility
Restricted land use	Routine	Direct	Negative	Short term	Local	Medium	Medium	Minor (-)	• Construction activities should be restricted to demarcated areas. • Movement of people, vehicles and equipment should be restricted to identified pathways, tracks and/ or access roads. • All areas outside designated construction areas shall be regarded as “no go” areas.	Contractor

11.1.7 Surface Water

Objective:

- To ensure minimal impact to the surface water resources.
- To ensure that the construction activities are carried out so as to aid rehabilitation.

Cause & Comment:

It is unlikely that there will be any impact on surface water quality or quantity during the construction of the transmission lines. The lines will, however, have to traverse a number of river courses and drainage lines. Alteration of stream banks or river beds should not be necessary during the project, however where towers are erected near rivers or floodplains care should be taken not to allow erosion of these sites, which may increase the silt loading of the river. Vehicle activity in these areas may also result in the hydrocarbon spills which could affect surface water quality. Inadequate sanitation facilities for workers along the route may also result in biological contamination of surface water.

Significance:

The overall significance of the impacts on surface water during construction is considered to be minor, with the exception of hydrocarbon spillages and pollution which, if not effectively mitigated, could result in an impact of moderate significance.

Impact	Grouping	Type	Nature	Duration	Scale	Likelihood	Ability to Adapt	Significance	Mitigation (addressing all impacts)	Responsibility
Disturbance to water courses from servitude construction	Routine	Direct	Negative	Short term	Local	Low	Medium	Minor (-)	• Plan and implement an appropriate water monitoring and management plan. • Materials capable of resulting in poor quality leachates will not be used for the construction of roads or other infrastructure. • Where possible, the disturbance of land during the construction phase will be confined to areas which will be utilised for the operation and maintenance of the	CIC, BPC and contractors.
Sedimentation of local streams	Routine	Direct	Negative	Short term	Local	Low	Medium	Minor (-)		
Sewage and waste disposal	Non-routine	Direct	Negative	Short term	Local	Medium	Medium	Minor (-)		
Hydrocarbon spillages	Non-routine	Direct	Negative	Short term	Local	Medium	Medium	Minor (-)		

Impact	Grouping	Type	Nature	Duration	Scale	Likelihood	Ability to Adapt	Significance	Mitigation (addressing all impacts)	Responsibility
									transmission line. • All roads need to be planned and constructed to minimise erosion. • The construction of new roads needs to be confined to an agreed plan and no new roads should be allowed unless they are essential for the project. • Erosion needs to be prevented from all cleared areas. • A water management plan needs to be compiled for all borrow pits, quarries and areas of excavation. • Chemicals and hydrocarbons capable of causing water pollution should be appropriately transported, loaded and unloaded and stored. • Design and implement an appropriate waste management plan. • Appropriate sewage management facilities need to be planned and constructed. • A hydrocarbon management system needs to be introduced. • Minimise construction impacts at all river crossing points. • Plan a sand winning operation with appropriate water management plans in place.	

11.1.8 Groundwater

Objective:

- To protect existing users of groundwater from impacts on water quality and quantity.
- To ensure effective management of any accidental spills.
- To ensure that adequate monitoring points exist to allow the monitoring of impacts on water quality and quantity during the operational phase.

Cause & Comment:

The only potential impact on groundwater during the construction phase is the possible contamination from hydrocarbon spillages.

Significance:

As the quantities of hydrocarbons used along the transmission lines will be limited for construction vehicles, it is unlikely that this impact will be significant.

Impact	Grouping	Type	Nature	Duration	Scale	Likelihood	Ability to Adapt	Significance	Mitigation (addressing all impacts)	Responsibility
Groundwater pollution due to hydrocarbon spillage.	Routine	Direct	Negative	short term	Local	low	high	Minor (-)	• All diesel and oil should be stored in suitable bunded area. • Maintenance of vehicles should only be carried out in designated areas within towns or in the construction camp.	CIC, contractors.

11.1.9 Air Quality

Objective:

- To maintain dust emissions from construction activities to acceptable levels.
- To reduce the nuisance factor of dust to neighbouring communities.

Cause & Comment:

Activities associated with this phase will comprise a series of different operations including land clearing, topsoil removal, material loading and hauling, stockpiling, grading, bulldozing and compaction. Each of these operations has its own duration and potential for dust generation. It is anticipated therefore that the extent of dust emissions would vary substantially from day to day depending on the level of activity, the specific operations, and the prevailing meteorological conditions. This is in contrast to most other fugitive dust sources where emissions are either relatively steady or follow a discernible annual cycle. It is therefore often necessary to estimate area wide construction emissions, without regard to the actual plans of any individual construction process. The table below gives some environmental impacts and associated activities during the construction phase. Vehicle-entrainment of dust from construction sites represents a relatively large source of fugitive dust emissions during construction. Gaseous and particulate emissions from vehicle tailpipes are far lower and therefore of less significance in terms of their impacts.

Table 11.1: Summary of air emissions during construction.

Impact	Source	Activity
TSP and PM10	Tower Sites	Clearing of groundcover
		Levelling of area
		Materials handling (loading and hauling)
		Wind erosion from stockpiles
		Establishment of infrastructure
	Roads	Dust entrainment on unpaved roads
		Clearing and levelling of roads
Gases and particulates	Vehicles	Tailpipe emissions from construction vehicles.

The main pollutant of concern from construction operations is particulate matter, including PM10, PM2.5 and TSP. PM10 and PM2.5 concentrations are associated with potential health impacts due to the size of the particulates being small enough to be inhaled. Nuisance effects are caused by the TSP fraction (20 µm to 75 µm in diameter) resulting in soiling of materials and visibility reductions (see Section 2.4). One of the main effects of nuisance dust is the annoyance at increase of cleaning required. This could in effect also have financial implications due to the requirement for more cleaning materials (MFE, 2001). From the proposed operations, the main construction activities likely to result in noticeable impacts of PM10 and TSP include vehicle entrainment from unpaved roads. Dustfall impacts are generally confined to the near-field (<1 km to 3 km) of sources. This is due to the fact that larger particles, which contribute most to dustfall rates given their mass, are likely to settle out in close proximity to the source (assuming a ground-based source). The area influenced by the operations off course depends on the dispersion potential of the site and the extent of the construction operations.

Wind blown dust from open and exposed surfaces could result in considerable emissions under high wind speeds. Significant emissions arise due to the mechanical disturbance of granular material from open areas and storage piles. Parameters which have the potential to impact on the rate of emission of fugitive dust, include the extent of surface compaction, moisture content, ground cover, the shape of the storage pile, particle size distribution, wind speed and precipitation. These incidences usually occur for limited time periods, but when it occurs the impacts could be significant. Health impacts associated with particulate emissions are given to be or distances of up to 1 km and nuisance dust due to fallout is given to be for up to 3 km.

Significance:

During construction activities such as debris handling, truck hauling and earth moving will increase the PM10 and TSP in the area, however the impact is likely to be of a minor significance and can be effectively mitigated.

Impact	Grouping	Type	Nature	Duration	Scale	Likelihood	Ability to Adapt	Significance	Mitigation (addressing all impacts)	Responsibility
Increase in respirable particulates (PM10)	Cumulative	Direct	Negative	Short term	Local	Medium	Low	Minor (-)	• Use recycled water to dampen roads, tracks and/ or stockpiled material especially under windy conditions. • Wind speed reduction through sheltering and wet suppression • Wet suppression or chemical stabilization of unpaved roads • Wet suppression and wet material being hauled	CIC & contractors
Increase in total suspended particulates (TSP)	Cumulative	Direct	Negative	Short term	Local	Medium	Low	Minor (-)		
Increase in tailpipe gaseous emissions	Cumulative	Direct	Negative	Temporary	Local	Medium	Low	Minor (-)		

Impact	Grouping	Type	Nature	Duration	Scale	Likelihood	Ability to Adapt	Significance	Mitigation (addressing all impacts)	Responsibility
									• Exposed surfaces that are not going to be utilised after construction should be rehabilitated and maintained. • All vehicles should maintain acceptable speed limits on gravel/ dirt roads. • Where necessary, haul vehicles should ensure that their loads are covered with tarpaulin	

11.1.10Noise

Objective:

- To reduce noise levels from the construction operations as far as possible.
- To reduce noise annoyance to the surrounding community as far as possible.

Cause & Comment:

It is expected that during the construction phase, especially the initial earth works phase, there will be an increase in noise emissions due to the increase in construction vehicles and equipment.

For the impact assessment, it was assumed that construction would mainly take place during the day. The calculated noise impact contours are presented in the figures below.

Significance:

Although noise levels are expected to increase during construction, the total significance is deemed to be negligible.

Impact	Grouping	Type	Nature	Duration	Scale	Likelihood	Ability to Adapt	Significance	Mitigation (addressing all impacts)	Responsibility
Increase in noise levels during construction	Routine	Direct	Negative	Temporary	Local	High	High	Negligible	• Construction should be restricted to normal working hours. Should activities need to be undertaken at night, this should be done after consultation with the Engineer/ Engineer's Representative and potentially affected communities. • All vehicles and equipment should be monitored and maintained in good working order. • All sirens should have appropriate directional and volume settings. • Loud music should not be allowed on site. • On site generators should be clad in suitable materials or housed in structures that would reduce their noise impacts.	CIC & contractors

Impact	Grouping	Type	Nature	Duration	Scale	Likelihood	Ability to Adapt	Significance	Mitigation (addressing all impacts)	Responsibility
									• Maintain a site register to record complaints and responses thereto. • Reduce the noise at the source if possible. This includes ensuring silencers on vehicles, using rubber linings, enclosing sources if possible, etc. • Place a screen between the source and the receiver. • Enclose the source of the noise if possible. • Consider positions of infrastructure with regard to topography and noise transmission paths. • Create a service and maintenance plan for vehicles and equipment as faulty vehicles and equipment generate more noise	

11.1.11Flora

Objective:

- To prevent the loss of important species of vegetation (such as those with Red Data Status).
- To limit the destruction of the vegetative cover.
- To prevent the loss of a viable seed bank in the stockpiled topsoil.
- To monitor the impact of activities on the flora of the area.

Cause & Comment:

Construction phase activities that will impact on plant life in the area include:

- Increased human activity.
- Increased removal of vegetation for domestic use such a firewood and building material due to the increased number of people on the area.
- Increased traffic of trucks and heavy machinery.
- Increased dust levels due to construction activities.
- Stripping of vegetation and soil to clear and level areas for towers.
- Introduction of alien invasive species.

- Increased potential of soil erosion and contamination to soil, which will impact directly on vegetation.
- Potential pollution or siltation of downstream water in the area due to construction activities which will impact directly on plants relying on those water bodies or sources.

The removal of the vegetation is one of the greatest impacts on the ecology during the construction phase. If any of the three red data plant species occur in the area to be stripped of vegetation, their numbers will be reduced, decreasing the breeding potential of these plants in the area. Loss of any individuals will severely increase the significance of the impacts on vegetation in the area. If these species are encountered during construction, they will need to be relocated by qualified specialists. It is also suggested that any individuals occurring within 100 m of any activity also be relocated as dust generation, soil contamination and general truck and human activity may result in damage or loss of these individuals.

Significance:

The impact on plant life will be negative. The duration of the impact will be of long term duration and site-specific to local in extent. The impact will be severe, due to the relatively pristine nature of the area. The significance is minor as most infrastructure will occur in vegetation communities of low ecological significance but could be very high if any Red Data species are affected.

Impact	Grouping	Type	Nature	Duration	Scale	Likelihood	Ability to Adapt	Significance	Mitigation (addressing all impacts)	Responsibility
Removal of topsoil and vegetation for towers, access roads and servitudes.	Routine	Direct	Negative	Long term	Local	High	Low	Moderate (-)	• Any individual plants that have Red Data Status that are found growing in an area where the vegetation will be removed should be relocated to a safe place to avoid destruction. A nursery will be developed on site for this purpose. • The people involved in the construction phase should be educated on which plants have Red Data Status so they can notify the environmental officer should they see these plants in vulnerable areas. • The destruction of vegetation should be limited to the areas essential for the development of the MEP transmission lines. This should be the 8m wide servitude and 40m x 40m tower erection sites. • All persons involved in the construction phase should be prevented from entering areas of vegetation that are not included in the project. • All construction vehicles must be restricted to designated roads and lay down sites to prevent unnecessary destruction of vegetation. • Illegal waste dumping must be prohibited. • Any incidents causing disturbance of the natural areas such as hydrocarbon or chemical spills and illegal dumping must be reported immediately so measures can be taken to minimise the impact. • Appropriate measures should be implemented to prevent erosion.	CIC & contractors
Hydrocarbon spills & illegal waste dumping	Routine	Direct	Negative	Short term	Local	Medium	Low	Minor (-)		
Introduction or encroachment of alien invasive species to the area through disturbance of ecological integrity.	Non-routine	Direct	Negative	Long term	Regional	Low	Low	Minor (-)		

11.1.12Fauna

Objective:

- To prevent the injury and / or death of individual animals.
- To limit the disturbance caused by the construction activities.
- To preserve as much of the animals' habitats as possible.
- To monitor the impact of activities on the fauna of the area.

Cause & Comment:

Construction phase activities that will impact on plant life in the area include:

- Increased human activity and associated noise.
- Possible increase in hunting due to increased numbers of people in the area.
- Increased traffic of trucks and heavy machinery and associated noise.
- Increased noise levels due to construction activities.
- Increased dust levels due to construction activities.
- Introduction of alien species.
- Potential pollution or siltation of downstream water in the area due to construction activities which will impact directly on animals relying on those water bodies or sources.

Removal of vegetation has a direct effect on the food chain in the area, directly impacting on herbivores reliant on the vegetation for survival and indirectly impacting on carnivores and scavengers reliant on other animals for survival. Red Data animals face threats which include in many cases habitat destruction. Removal of vegetation can have severe and far-reaching impacts on animals, particularly sensitive animals dependent on specific vegetation types. Recommendations have, therefore been made in the EMP to preserve the vegetation as far as possible and avoid needless removal of vegetation. This will require good planning and strict monitoring during the construction phase, so that only the vegetation requiring removal is affected.

Significance:

The impact on animal life will be negative. The duration of the impact will be of medium duration and local in extent. The impact will be moderate and definite. Severity will increase if Red Data animals are disturbed or harmed in any way. The significance is moderate.

Impact	Grouping	Type	Nature	Duration	Scale	Likelihood	Ability to Adapt	Significance	Mitigation (addressing all impacts)	Responsibility
Increased removal of vegetation for domestic use such as firewood and building material and thereby habitat destruction	Cumulative	Indirect	Negative	Short term	Regional	High	Low	Moderate (-)	• Workers should be made aware of the importance of maintaining the animal life. • The construction activities should the limited to those areas allocated to infrastructure development. • In order to avoid hunting, domestic animals such as dogs should not have access to the wildlife. • Hunting by construction workers will be prohibited. • The destruction of the vegetative cover should be kept to a minimum, and limited to those areas allocated for infrastructure development. • Areas of importance, such as pans and stream banks, should be avoided, so as to preserve the necessary habitats.	CIC, contractors
Fatalities from hunting and traffic accidents.	Cumulative	Indirect	Negative	Short term	Regional	Medium	Low	Minor (-)		
Interruption of movement by roads	Routine	Direct	Negative	Long term	Local	Medium	Low	Minor (-)		
Disturbance during breeding periods of threatened species, particularly birds.	Routine	Direct	Negative	Short term	Local	Medium	Medium	Minor (-)		

11.1.13Sites of Archaeological and Cultural Significance

Objective:

- To deal with I&APs in a sensitive manner with regard to the relocation of graves and the destruction of farm infrastructure;
- To ensure that relocation is done in such a way to retain the relevant context of the artefacts and structures;
- To compile an inventory and description of resources found;
- To encourage the preservation of cultural structures not affected by the transmission line .

Cause & Comment:

The Monuments and Relics Act (MRA) of 1970 (as Amended, 2001) is administered by National, Museums, Monuments and Art Gallery (DNMMAG), Botswana, to provide provisions for the protection and management of cultural resources in Botswana. Section 19(2) of the Act provides that both an archaeological pre-development impact assessment and an environmental impact assessment study must be undertaken by any person wishing to undertake a major development such as construction or excavation, for the purposes of mineral exploration and prospecting, mining, laying of pipelines, construction of roads and dams, or erection of any other structure, which will physically disturb the earth's surface. Subsequently, archaeology does not seek to hinder development, but endeavours to ensure that developments take place in an appropriate cultural context.

The impact assessment methodology for the AIA differs from the one being applied in this EIA as the guidelines of the DNMMAG have been followed. Site significance assessment was done according to the standards prescribed by the National Museum, Botswana (NMB) and the South African Heritage Resources Agency (SAHRA) and approved by ASAPA. Associated site mitigation recommendations were done according to the 5-tier (1-5) system prescribed by the NMB [1 = Preserve at all cost; 2 = Preserve if possible, otherwise extensive salvage work, 3 = Test excavation to determine whether further work is necessary; 4 = Systematic representative sampling sufficient; 5 = No further archaeological work required].

An AIA has been undertaken and submitted to the DNMMAG for approval. The department will asses the findings and the impacts and advise the developers accordingly. A brief summary of the findings and the impacts are detailed here. Archaeological impacts need to be mitigated prior to construction taking place and hence the findings and mitigation measures are described in the construction phase.

Eighteen archaeological and cultural heritage sites were located during the assessment. These site records serve as a general indicator of archaeological sensitivity in the area. Of the located sites, nine fall within formally assessed areas that will be impacted on by surface development. The significance and recommendation for each site is given in the table below.

Should any human remains be uncovered accidentally during the course of development the developer should, without delay, cease operation in the immediate vicinity and report the find to the National Museum, Botswana.

Significance:

The magnitude of surface disturbance will be limited and due to the relatively small footprint of the towers structures, sensitive sites can be avoided. The overall significance of this impact is therefore minor. The full AIA is attached as Appendix H.

Impact	Grouping	Type	Nature	Duration	Scale	Likelihood	Ability to Adapt	Significance	Mitigation (addressing all impacts)	Responsibility
Disturbance or destruction of archaeological sites or artefacts from construction activities.	Routine	Direct	Negative	Permanent	Local	Medium	Low	Minor (-)	• Where sites have been identified access roads and servitudes should be rerouted so as to avoid these areas. • Towers positions should be placed so as to avoid identified sites. • Where appropriate, artefacts should be removed for preservation in the National Museum. • A chance find procedure should be developed for heritage resources identified during construction and should be communicated to all construction workers.	CIC, contractors

11.1.14 Visual Aspect

Objective:

- To limit the extent of the visual intrusion presented in the construction phase.

Cause & Comment:

The following lists the activities which could result in negative impacts on the visual environment:

- Excessive cleaning and stripping of topsoil for site offices, construction camps servitudes and temporary access roads;
- The relatively random and disorganised lay down of building materials, vehicles and offices;
- Cut and fill slopes of access roads become highly visible if not re-vegetated and shaped to blend in with the existing topography;

- The extent and intensity of the security and construction lighting at night;
- Dust from construction activities;
- Open and unrehabilitated landscape scarring;
- Uncontrolled exploitation of borrow pits and quarries without compliance to environmental controls related to aesthetic rehabilitation;
- Removing of existing trees in buffer areas that can act as a visual screen
- High seed bank of alien species in the topsoil can lead to the uncontrolled spread of exotic invader plant species. This could create an edge that is visually contrary to the existing vegetation; and
- Location and layout of construction workers camp.

Significance:

The visual impact of the construction phase will occur on a regional scale due to the regional extent of development. The effective screening in the form of existing landform and trees from critical viewpoints does assist in limiting the extent of the impact. Retaining broad strips of vegetation between public roads and villages and the transmission lines will help contain the extent of visual impact. The intensity of the visual impact during construction will be high within the 500 m to 1000 m zone wherever roads are encountered within the study area and in the more populated areas such as local villages due to the fact that the majority of viewers will be exposed to the impacts within this zone.

It is considered that the significance of the impact of the construction phase is moderate due to the fact that it is of a short, but intense, duration.

Impact	Grouping	Type	Nature	Duration	Scale	Likelihood	Ability to Adapt	Significance	Mitigation (addressing all impacts)	Responsibility
Visual impact during construction to communities and visitors to the area	Routine	Indirect	Negative	Short term	Regional	High	High	Moderate (-)	• Limit extent of construction area. • Rehabilitate all disturbed areas to reduce visual scarring. • Blend earthworks and road access cuttings into the landscape. • Limit footprint area to strip only the minimum area required to set up the construction area. • Reduce the height from which floodlights are fixed and identify zones of high and low lighting requirements with the focus of the lights being inward, rather than outward. • Retain vegetation buffer strip • Stockpiled overburden material (from the portal portals) should be shaped to present the minimal visual intrusion. • Bins with lids should be provided. • Night lighting should be minimised to that which is essential.	CIC & contractors

11.1.15Traffic and Safety

Objective:

- To create safe entry roads into the construction areas.
- To maintain safety to pedestrians, animals and motorists.

Cause & Comment:

Traffic and safety will be directly affected during construction as heavy construction vehicles and delivery vehicles will be entering the MEP transmission line areas to bring building materials, and equipment. The traffic will be entering the site predominantly from the A1. This increase in traffic will impact on existing vehicle movement, safety on the roads and increase in noise and dust. Certain roads will be upgraded during construction which may impact on vehicle movement from road diversions. Once these roads are upgraded, however, noise and dust will decrease.

Significance:

The increase in traffic will be short term and therefore the potential resulting direct and indirect impacts are considered negatively minor to major. Cattle and donkeys, which roam freely, will pose a safety hazard and may give rise to compensation issues if involved in an accident. Pedestrians who walk during the evening will be at risk and any potential fatalities are considered a major negative impact.

Impact	Grouping	Type	Nature	Duration	Scale	Likelihood	Ability to Adapt	Significance	Mitigation (addressing all impacts)	Responsibility
Increase in traffic	Routine	Direct	Negative	Short term	Regional	High	Low	Moderate (-)	• Entry into new construction sites, off the main roads, must be visible to motorists thus safety signs and rumble strips should be placed on both sides of the road approaching such turnoffs. If required, a 4 way stop will be put into effect. Speed limits can also be enforced. • Materials for the haul road will be sourced locally and the Department of Roads and Transport will be consulted with regard to the construction of haul roads. • Trucks are required to stay on designated roads and to adhere to speed restrictions. • The accommodation of traffic shall be undertaken in strict compliance with Section 1500 of the Botswana Standard Specifications for Road and Bridge works and failure to comply fully with these provisions shall constitute sufficient grounds for the Engineer to stop all works until such time that the non-compliances have been rectified. • The travelling public shall have the right of way on public roads and the contractor shall make use of approved methods to control the	
Increase in dust & noise	Routine	Indirect	Negative	Temporary	Local	Medium	Low	Minor (-)		
Increase in safety hazards	Routine	Direct	Negative	Short term	Local	Medium	Low	Major (-)		

Impact	Grouping	Type	Nature	Duration	Scale	Likelihood	Ability to Adapt	Significance	Mitigation (addressing all impacts)	Responsibility
									movement of his equipment and vehicles so as not constitute a hazard on the road. • Failure to maintain road signs, warning signs or flicker lights, etc, in a good condition shall constitute ample reason for the engineer to bring the works to a stop until the road signs, etc, have been repaired to his satisfaction	

11.1.16Social and IAP's

Objective:

- The MEP will endeavour to establish sound working relationships and collaborative effort with local government and tribal administrations in key matters that are mutually beneficial.
- Adhere to open and transparent communication procedures with stakeholders at all times;
- Ensure that accurate and regular information is communicated to Interested and Affected Parties (IAPs);
- Ensure that information is communicated in a manner understandable and accessible to IAPs;
- Enhance project benefits and minimise negative impacts through intensive consultation with stakeholders;
- Assemble adequate, accurate, appropriate and relevant socio-economic information relating to the context of the operation;
- Ensure that recruitment strategies for the construction prioritise the sourcing of local labour, and share in gender equality;
- Empower the workforce to develop skills that will equip them to obtain employment in other sectors of the economy;
- Contribute to the development of a self-reliant (not dependent on the project) community surrounding the area of operation;

Cause & Comment:

Social impacts relating to construction include job creation, loss of access and/or mobility, air, noise, traffic and dust pollution, crime, potential health risks, safety and security issues, informal settlement, increase in socially risky behaviour, increase in traffic volumes, small business development, skills development and training, as well as the impact of a foreign workforce on local culture and on local job-seekers. Various specialist studies (e.g. health impact assessment) are undertaken to assess these particular components.

The construction phase will mainly result in temporary community disruption, increased air, noise and dust pollution, inhibited mobility for people and animals, and safety risks related to increased traffic volumes. These impacts are related to the following activities:

- Site preparation, mainly bush clearing;
- Construction of access roads and borrow pits;

- Tower assembly and erection.

Impact	Grouping	Type	Nature	Duration	Scale	Likelihood	Ability to Adapt	Significance	Mitigation (addressing all impacts)	Responsibility
Population change and inflow and outflow of workers	Routine & cumulative	Direct & indirect	Negative	Short term	Local	High	Medium	Moderate – negative	• Construction camp should not be located in the vicinity of existing farm dwellings and or settlements, but near support services such as roads and shops • Construction camp should be managed in a manner to prevent intrusion on the privacy of existing residents and the prevalence of additional safety and security risks • Construction camp should have adequate water and sanitation facilities to prevent any health and environmental related impacts • Planning should make provision for local service providers to provide services such as domestic support services and catering • Illegal practices such as the selling of liquor, collection of firewood, cutting of fences, unauthorised entry (especially Tuli Block), poaching of game and sex worker trade should be eliminated through security practices • Where employment opportunities exist that would require low skills levels, local labour should be used to avoid conflict between outsiders and locals • It is strongly suggested the routes be aligned in a manner so as to avoid physical resettlement. TAP has, however, indicated that they would avoid the resettlement of people as far as possible • As far as the Tuli Block is concerned, construction activities should be limited to the summer months to ensure that hunting activities are not adversely affected • Location of the construction camp should be placed in areas that would result in minimum impact on the local residents • BPC should limit construction vehicle movement during peak hour periods • BPC is known to clear the entire area within the servitude. On the other hand, Eskom cuts 8m of vegetation in the centre for access and construction and then do 'selective cutting' of trees encroaching in the electric clearance below the outside conductors. It is therefore recommended that BPC adopts Eskom's approach and by doing so minimise the impact on arable- and communal grazing land. • In the unlikely event of economic resettlement, country-specific policies, regulations and procedures should be adopted as a minimum requirement • BPC should consult with the affected villages to identify exact	
Potential for relocation of people	Non-routine	Direct	Negative	Short term	Local	Low	High	Major-negative		
Disruption in daily living and movement patterns	Routine	Direct	Negative	Short term	Local	Medium	High	Moderate – negative		
Loss of arable land, agricultural land and communal grazing land	Routine	Direct	Negative	Short term	Local	High	Medium	Moderate – negative		
Loss of natural resources	Routine	Direct	Negative	Short term	Local	Medium	High	Moderate – negative		
Resettlement – loss of dwelling structures	Non-routine	Direct	Negative	Long term	Local	Low	Low	Major-negative		
Opportunities for employment creation	Planned	Direct & indirect	Positive	Short term	Local to regional	High	High	Moderate – positive		
Compensation pay-out and social investment programmes	Planned	Direct	Positive	Short term	Local	Medium	High	Moderate – positive		
Decreased property value in Tuli Block	Routine	Direct	Negative	Permanent	Local	High	Low	Moderate – negative		
Improved road network linking cattle-posts, water points, villages	Planned	Direct	Positive	Short term	Local	Low	High	Minor – positive		
Decrease in safety &security	Routine	Direct & indirect	Negative	Short term	Local	High	Low	Moderate – negative		
Decrease in personnel health	Routine	Direct	Negative	Short term	Local	Moderate	High	Moderate – negative		
Loss of sense of place (Tuli block farmers)	Routine	Direct	Negative	Short term	Local	High	Low	Moderate - negative		

Impact	Grouping	Type	Nature	Duration	Scale	Likelihood	Ability to Adapt	Significance	Mitigation (addressing all impacts)	Responsibility
									location of boreholes and avoid these where possible • BPC is known to clear the entire area within the servitude. On the other hand, Eskom cuts 8m of vegetation in the centre for access and construction and then do 'selective cutting' of trees encroaching in the electric clearance below the outside conductors. It is therefore recommended that BPC adopts Eskom's approach and by doing so minimise the impact on arable- and communal grazing land. • Construction camp should be provided with adequate water facilities for cooking or washing purposes • Construction camps should have proper and adequate sanitation facilities • It is strongly suggested the routes be aligned in a manner so as to avoid resettlement of dwelling structures. TAP has, however, indicated that they would avoid the resettlement of people as far as possible • Use local labour along the route as far as possible for the lower skilled jobs • Country-specific policies, regulations and procedures should be adopted as a minimum requirement in cases where compensation is due • Country-specific policies, regulations and procedures should be adopted as a minimum requirement in cases where compensation is due • No major access roads are envisaged for the construction of power lines. Contractors tend to drive over the veld along the route. • Community members with local knowledge regarding cultural practices and cultural heritage should be consulted prior to construction (Refer to the Archaeological Impact Assessment) • to limit the number of newcomers to the area • The placement of the construction camp should be finalised in consultation with representatives of the Local Authorities, Tribal Authorities and the Tuli Block farmers committee • Prior to construction, property owners and Local Authorities should be informed when construction activities will take place • General safety measures in terms of construction work should be implemented and relevant regulations be adhered to. • Unauthorised practices taking place at construction camps or illegal activities undertaken by contract workers should immediately be	

Impact	Grouping	Type	Nature	Duration	Scale	Likelihood	Ability to Adapt	Significance	Mitigation (addressing all impacts)	Responsibility
									reported • Construction workers should be easily identifiable by wearing uniforms • The placement of the construction camps should be thoroughly planned in consultation with local communities • HIV/AIDS awareness should be specifically focused on the contract workers • Construction sites should be fenced off where life stock or game occur • Identification of a local labour force should be done in consultation with local and tribal authorities	

11.1.17Economic Environment

Objective:

- To increase benefits for the local economy.
- To create national economic benefits.

Cause & Comment

There are additional minor negative and positive impacts associated with the MEP, and these are discussed in Appendix K.

Significance:

Impact	Grouping	Type	Nature	Duration	Scale	Likelihood	Ability to Adapt	Significance	Mitigation (addressing all impacts)	Responsibility
Indirect & induced employment during construction	Routine	Indirect and induced	Positive	Short term	Local, regional, national	Medium	Low - medium	Moderate (+)	• CIC/Meepong will attempt to maximise recruitment of people from the local communities, broader project area and from Botswana. This will be done at the initial recruitment stage (prior to both construction and operation), as well as throughout the construction period and life of the MEP. It will be implemented through a Recruitment Plan, and Social and Labour Development Plan. • CIC will manage expectations as part of the Recruitment Plan whereby criteria for employment are clearly communicated. The pre-employment and internal training efforts at the MEP will be well communicated, and the investment in education and training through the Social Development Programme.	
Community resentment for not being employed	Routine	Indirect	Negative	Medium term	Local	Low – medium	Medium – high	Minor (-)		
Economic development in the project area, diversification of the economy and increased value added	Routine, cumulative	Indirect	Positive	Permanent	Local – national	Medium	Medium	Moderate (+)		

Impact	Grouping	Type	Nature	Duration	Scale	Likelihood	Ability to Adapt	Significance	Mitigation (addressing all impacts)	Responsibility
Increased government revenue	Routine	Indirect & induced	Positive	Long term	National – local	High	N/A	Moderate (+)	• Social and Labour Development Plan, which includes a: • Training and Localisation Plan; • Skills Development and Training Plan; • Career Progression Plan; • Mentorship Plan; and • Internship and Bursary Plan; • Social Development Plan, covering • Social Investment; • Business Development; and • Local Economic Development; • Local/ National Content Strategy • Training will include environmental, health and safety training, and would be beneficial to include training in skills that are transferable to another project or industry • The Social Development Programme will focus on addressing economic vulnerability in the area. • The RAP process must meet legislative requirements, the requirements of Botswana's Compensation Guidelines for Tribal Areas, and best practice requirements, particularly the IFC Performance Standards and involve substantial consultation	
Procurement of local goods and services during construction	Routine	Direct, indirect & induced	Positive	Short term – long term	Local, regional, national	Medium	Low to medium	Moderate (+)		
Enhancement/ upgrade of skills and experience	Routine	Indirect	Positive	Long term – permanent	Local – national	High	N/A	Moderate (+)		
Impact on Prices and Exacerbation of Economic Vulnerability	Unplanned	Indirect & induced	Negative & positive	Short term – long term	Local – regional	Medium – High	High – low	Minor (+)		
Economic and/ or physical resettlement:	Planned	Direct	Negative	Long term - permanent	Local	High	Low - medium	Major (-)		

11.2 Operational Phase

11.2.1 Geology

Objective:

- To limit potential impacts on geology during operations.

Cause & Comment:

No impacts on the geology are anticipated during operations.

11.2.2 Topography

Objective:

- Maintain current topographical feature of the landscape.

Cause & Comment:

No impact on the topography is anticipated during operations.

11.2.3 Soil

Objective:

- To prevent any soil loss through erosion.
- To prevent reduction of soil quality through contamination with other substances such as hydrocarbons.
- To prevent loss of soil structure through compaction.
- To prevent loss of soil fertility.

Cause & Comment:

There should be minimal further impact son the soil during operation, however dirt servitudes could result in increased run-off and erosion. Maintenance vehicle activity will be minimal; however, the few vehicles that will be active could pose a risk of hydrocarbon spills, which will impact on the soil.

Significance:

During operations, impacts on soil can be reduced through effective mitigation measures, however, in the absence of these measures, impacts that are likely to occur may result in minor to moderate negative significance.

Impact	Grouping	Type	Nature	Duration	Scale	Likelihood	Ability to Adapt	Significance	Mitigation (addressing all impacts)	Responsibility
Loss of topsoil	Routine	Direct	Negative	Long term	Local	Medium	Low	Minor (-)	• Movement of vehicles and people should be restricted to defined pathways and roads. • Structures should not be built without giving careful consideration to possible water erosion. • Soil erosion is a potential impact for all sloping areas along the transmission lines. If required, suitable soil should be sourced for areas where soil loss by erosion is likely. The sourced soil should have similar characteristics to the soil on site. • All areas disturbed during construction that are not required for operation should be revegetated to prevent further erosion. • Storm water diversion berms should be built on steeply sloping roads to direct run-off into vegetated areas, where the flow velocity will be reduced and infiltration increased, thereby reducing erosion.	
Soil Contamination	Routine	Direct	Negative	Temporary	Local	Low	Medium	Minor (-)		

11.2.4 Land Capability & Land Use

Objective:

- To preserve soil for future restoration of land capability.
- To restore land capability as far as possible in rehabilitated areas.
- To minimise the amount of land excluded from normal agricultural and community use.

Cause & Comment:

Crop farming and grazing may continue under the lines after construction. The impact on tourism due to the negative aesthetic impact will, however, be more severe. No infrastructure development will be allowed under the lines, however, the area affected will be relatively small in relation to the greater study area.

Significance:

The only possible significant impact on land use will be the possible negative affect the transmission lines may have on tourism, however, apart from small areas in the Tuli block, this is not an area that attracts a large amount of tourism and therefore the significance of the impact is reduced.

Impact	Grouping	Type	Nature	Duration	Scale	Likelihood	Ability to Adapt	Significance	Mitigation (addressing all impacts)	Responsibility
Limit expansion of residential areas.	Routine	Direct	Negative	Long term	Local	High	High	Moderate (-)	• Where possible, restrict transmission lines to areas already occupied by linear infrastructure. • Maintain vegetation screening along transport routes and around visual receptor areas such as villages. • Ensure transmission line development is in line with town planning and other service delivery such as telecommunications.	CIC, regional planners.
Reduce tourism potential of the area.	Routine	Direct	Negative	Long term	Local	Medium	Medium	Moderate (-)		

11.2.5 Surface Water

Objective:

Cause & Comment:

The only possible impact on surface water during operation is a low likelihood of siltation from increased erosion. .

Significance:

Considering the small surface area that need to be exposed, the quantity of silt washed into rivers will be insignificant.

Impact	Grouping	Type	Nature	Duration	Scale	Likelihood	Ability to Adapt	Significance	Mitigation (addressing all impacts)	Responsibility
Increased siltation of rivers due to increased erosion.	Direct	Routine	Negative	Long term	local	low	High	Minor (-)	• Water will be encouraged to flow off any rehabilitated surface, as surface flow, as quickly as possible without causing erosion. • The replacement of topsoil (and re-vegetation) on the rehabilitated areas, will occur as soon as operationally possible. • Erosion of the topsoil will be prevented by using vegetation to control the surface flow velocity in conjunction with berms and drains. • Drainage trenches will be excavated in areas where the surface is slightly undulating to prevent ponding.	CIC & contractors

11.2.6 Groundwater

Objective:

- To protect existing users of groundwater from impacts on water quality and quantity.

Cause & Comment:

No impacts on groundwater are anticipated during operations

11.2.7 Air Quality

Objective:

- Minimise and control sources of emissions

Cause & Comment:

The only source of air pollution during operation will be continued vehicle entrainment of dust and the tailpipe emissions from vehicles. Both these emission sources will decrease greatly after construction due to the reduction in vehicle numbers during operation.

Significance:

The number of vehicle active on the lines during operation will be low and occasional; the significance of the impact is therefore negligible.

Impact	Grouping	Type	Nature	Duration	Scale	Likelihood	Ability to Adapt	Significance	Mitigation (addressing all impacts)	Responsibility
Vehicle entrainment of dust as well as particulates and gaseous tailpipe emissions.	Direct	Routine	Negative	temporary	local	High (but infrequent)	high	Negligible (-)	• Not necessary	

11.2.8 Noise

Objective:

- To reduce noise levels at the source of the operation as far as possible.
- To reduce noise annoyance to the surrounding community as far as possible.
- To ensure noise levels do not exceed guideline levels.

Cause & Comment:

During the operational phase any noise emissions from the transmission line will be due to electrostatic effects, such as the Corona-effect, or noise generated by the wind in the structure of the towers or cables. The consultant is of the opinion that the noise generated by these sources, should it occur, will be very much restricted to the immediate vicinity of the transmission line.

Significance:

Although there is very little mitigation that is possible for reducing noise emitted from the transmission lines, the noise will restricted to an extremely localised area and will not be severe. The impact is therefore not considered significant.

Impact	Grouping	Type	Nature	Duration	Scale	Likelihood	Ability to Adapt	Significance	Mitigation (addressing all impacts)	Responsibility
Increase in noise levels for operations phase	Routine	Direct	Negative	Long term	Local	High	High	Minor	• Not necessary.	

11.2.9 Flora

Objective:

- To prevent the unnecessary destruction of the vegetative cover.
- To protect plant species of importance, such as those with Red Data Status and medicinal uses.
- To maintain biological activity and a viable seed bank in the stockpiled topsoil.
- To monitor the impacts of operation on the flora of the area.

Cause & Comment:

Very little further disturbance to the flora is anticipated during the operation phase. The will not be a significant increase in activity in the area during operations. The only possible negative impact is servitudes might provide easier access and therefore greater movement of the general public through these areas. Although the servitudes will need to be maintained, the areas will not increase in size after construction. Vegetation directly under the lines will be kept below a maximum height of 4m, however this will not impact on many species in the area as the majority of the vegetation along the route is naturally lower than this. If correct rehabilitation is not implemented or unnecessary clearing of land is undertaken during construction, bush encroachment could occur during operation.

Operational phase activities that will positively impact on plant life in the area include:

- Reintroduction of indigenous plants to rehabilitate any disturbed areas such as areas that were initially disturbed for purposes of construction activities and are no longer utilised.

Annual monitoring programmes for soil, vegetation and animal life will provide information on issues arising from operation activities. Informing and educating individuals entering the property about animals and vegetation, particularly Red Data species, and about rules and regulations regarding speed limits, illegal dumping of waste and general behaviour on the property, will reduce risks to the environment. Contamination to soil will decrease soil quality and therefore impact directly on the vegetation in the area and indirectly on animals. Communication channels need to be set up to encourage reporting of such incidences and action plans put in place to clear up contamination immediately using the correct procedures.

Significance:

The overall impact on plant life will be negative. The impact could be moderate to major if red data species are still present in the area, and the impact is probable. The red data species hence need to be relocated. Impacts range from minor to moderate in significance.

Impact	Grouping	Type	Nature	Duration	Scale	Likelihood	Ability to Adapt	Significance	Mitigation (addressing all impacts)	Responsibility
Bush encroachment resulting in loss of grazing and decrease in diversity.	Routine	Indirect	Negative	Long term	Local	High	Medium	Moderate (-)	• Destruction of the vegetation should be limited to those areas allocated for the necessary infrastructure. • Vehicles must adhere to speed limits to prevent dust generation. • Illegal waste dumping must be prohibited. • Any incidents causing disturbance of the natural areas such as hydrocarbon or chemical spills and illegal dumping must be reported immediately so measures can be taken to minimise the impact. • Appropriate measures should be implemented to prevent erosion. • Topsoil should be stockpiled correctly according to the specifications detailed in the soil specialist report so as to maintain the biological activity and a viable seed bank. • The monitoring programme implemented during construction should be continued throughout operation.	CIC & contractors
Rehabilitation with indigenous species.	Routine	Direct	Positive	Long Term	Local	Medium	High	Minor (-)		

11.2.10Fauna

Objective:

- To prevent the injury and / or death of animals.
- To limit the disturbances, i.e. noise, transport and dust, to those areas allocated for certain operational activities. Mitigation measures specific for those disturbances should be implemented accordingly.
- To monitor the impacts of operation on the fauna of the area.
- To maintain the habitat for existing and future fauna.

Cause & Comment:

Operational phase activities that will negatively impact on animal life in the area include:

- Although the transmission lines will have negligible impact on ground dwelling animals, possibly one of the greatest impacts during operation of the transmission lines will be on the avifauna, particularly large species of birds:
- Electrocutions: Electrocutions are not an issue on most the proposed line, due to the large clearances on a 400kV tower. On the 66kV line, however, electrocutions of large birds may occur. This is a significant impact that will need mitigation.
- Collisions: The collisions threat in the present study is not of the same magnitude as for example those posed by transmission lines in the Karoo region of South Africa. Species most likely to be impacted are various waterbirds (wetlands and Limpopo river crossings), storks (pans, Limpopo river crossings and agricultural lands), Secretarybirds (old lands, open country) and Kori Bustard (old lands, open country). It would be preferable if the corridors could be placed close together instead of two kilometres apart, as the area of disturbance is more localised and a structure is created that will be more visible to bird species.
- Habitat destruction and disturbance: No large raptor nests were observed at the two proposed river crossings, but their existence can not be ruled out. Special care must therefore be taken to minimise the removal of large trees, not only for raptors but also for Southern Ground Hornbills, which breed within natural cavities in dead trees.

Operational phase activities that will positively impact on animal life in the area include:

- Reintroduction of indigenous plants to rehabilitate any disturbed areas such as areas that were initially disturbed for purposes of construction activities and are no longer utilised.

Significance:

The impact on animal life will be negative. The duration of the impact will be of medium to long term duration and local in extent. The impact will be moderately severe and possible. Severity will increase if Red Data animals are disturbed or harmed in any way. The significance is moderate.

Cumulative:

Due to the human presence and emphasis on the livestock farming in the area, the fauna, particularly the large mammals, have already been heavily impacted on and any further reduction in numbers could be severe. The cumulative impact in this regard is thus significant and any animals present in the area need to be protected. Areas set aside for conservation within the mineral rights boundaries would provide a suitable refuge for displaced fauna.

Impact	Grouping	Type	Nature	Duration	Scale	Likelihood	Ability to Adapt	Significance	Mitigation (addressing all impacts)	Responsibility
Hunting and fatalities from traffic	Cumulative	Indirect	Negative	Permanent	Regional	Low	Low	Minor (-)	• BPC employees involved with the operation and maintenance of the transmission lines should be educated about the importance of protecting the animal life. • Hunting of animals by MEP employees must be prohibited. • A speed limit should be stipulated and adhered to at all times to prevent road related deaths. • Vehicles should be restricted to the demarcated roads and areas around the operation. • Appropriate mechanisms should be placed on the overhead transmission lines in areas that are deemed high risk for bird fatalities. • The monitoring programme implemented during construction should be continued	CIC & contractors
Interruption of movement by roads and servitudes.	Routine	Direct	Negative	Long term	Local	Low	Low	Minor (-)		
Bird fatalities due to collision with lines.	Routine	Direct	Negative	Long term	Local	High	Low	Major (-)		
Bird fatalities due to electrocution on 66kV lines	Non-routine	Direct	Negative	Long term	Local	Medium	Low	Moderate (-)		

Impact	Grouping	Type	Nature	Duration	Scale	Likelihood	Ability to Adapt	Significance	Mitigation (addressing all impacts)	Responsibility
									throughout operation.	

11.2.11Sites of Archaeological and Cultural Significance

Objective:

- Minimise disturbance to archaeologically sensitive areas.
- Preserve, protect and enhance sites of archaeological and cultural significance.

Cause and Comment:

Regarding the proposed areas of infrastructure, during construction the sites will have been investigated and mitigation measures put in place. However, during operations, if any additional infrastructure is required, an AIA will need to be conducted prior to construction. Should any human remains be uncovered accidentally during the course of development the developer should, without delay, cease operation in the immediate vicinity and report the find to the National Museum, Botswana.

In order for legislative archaeological compliance to not delay development, the developer, under the guidance of the Department of Museums, should commission a continuous parallel Archaeological investigation where archaeological survey and recommended mitigation precede sub-surface development on an annual basis, signifying that an Archaeological and Cultural Management procedure/plan needs to be implemented. This relates particularly to the areas of subsidence.

Significance:

An AIA has been submitted to the NDMMAG who will give guidance as to the mitigation measures proposed and the way forward.

Impact	Grouping	Type	Nature	Duration	Scale	Likelihood	Ability to Adapt	Significance	Mitigation (addressing all impacts)	Cost	Responsibility
Potential impact on archaeological and cultural sites during operations	Routine	Direct and indirect	Negative	Short term – permanent	Site specific	Low	Low	Minor (-)	• Commission an archaeological study to run parallel to mining and power plant activities, particularly where additional infrastructure is planned and where development is going to take place.		

11.2.12Visual Aspect

Objective:

To limit the extent of the visual intrusion presented by the operational phase.

Cause & Comment:

The visual impact is potentially one of the more significant impacts of the operational phase. This impact will be greatest in areas where there is little development such as in the Tuli block, where the visual intrusion might affect land values, tourism potential and the sense of place. It is also for this reason that the route following the A1 between Mahalapye and Palapye is the preferred option as there is already linear developments along this route and the additional transmission line will not change the visual landscape greatly. The impact of the transmission lines on the visual quality of the area culminates in the clearing of vegetation to establish a servitude / right of way, and the physical appearance of pylons and overhanging conductor cables. Although only two of the routes are depicted in the figure, the possible impact of the transmission lines on visual quality in the area where visual sensitivity is considered highest due to the tourism potential is illustrated in Figure 11-1.

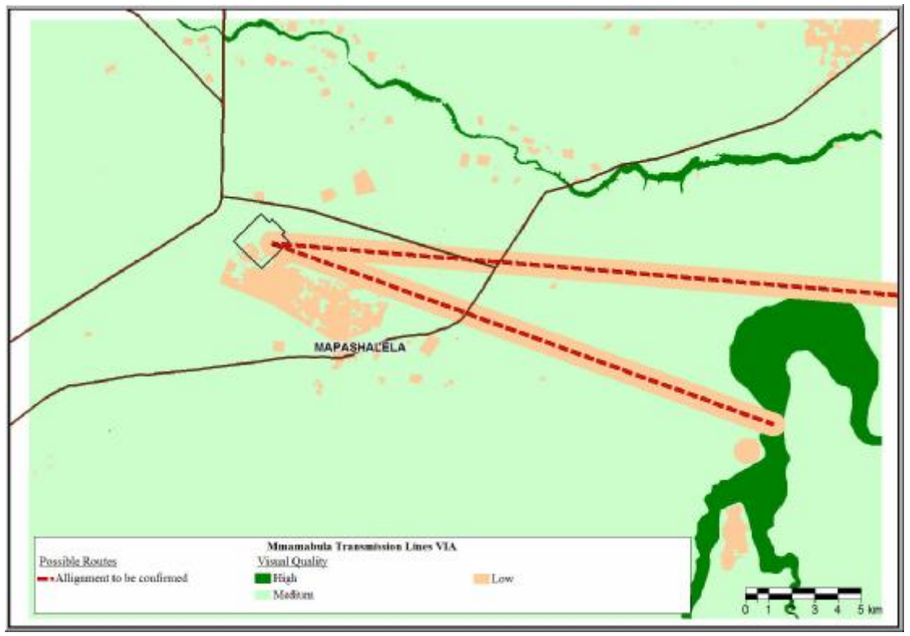

Figure 11-1: Impact of transmission line on visual quality

Significance:

In areas where tourism venture are planned, the significance will be higher than in grazing or industrial areas.

Cumulative:

Impact	Grouping	Type	Nature	Duration	Scale	Likelihood	Ability to Adapt	Significance	Mitigation (addressing all impacts)	Responsibility
Visual impacts during operations	Routine	Indirect	Negative	Long term	Local	High	High	Moderate (-)	• Where possible new lines should be constructed along existing linear structures such as railways or existing transmission lines. • Sculpturing or shaping the cut and fill slopes of platforms and access roads to angles and forms that are reflected in the adjacent landscape can reduce the visual impact. By blending the edges with the existing landforms the visual impression made, is that the project component has followed the natural shape of the landscape, rather than been 'engineered' through the landscape. • All existing large trees (if any) that fall outside the servitude area must be retained. These will assist in softening the forms of the structures and obscure views to them. Retain a vegetation buffer strip of 20m-30m along all major access roads to form a visual screen • Lines should cross roads at one point in the more pristine areas, rather than run parallel with them thus reducing the area from where they can be viewed.	•

11.2.13Traffic and Safety

Objective:

- To maintain high safety measures to prevent accidents.
- To keep roads in a good condition and avoid deterioration.
- To ensure local communities are not inconvenienced.

Cause & Comment:

The increase in traffic during operation sis expected to be insignificant.

11.2.14Social and IAP

Cause & Comment:

Most of the social impacts of the transmission line during operation are minor. Some of the more significant potential impacts are the effect the lines may have on land value, eco-tourism and sense of place. Another concern often raised in relation to transmission lines is the health impact of electromagnetic fields (EMF). No experimental evidence exists to substantiate this impact, although anecdotal evidence may suggest otherwise. In order to err on the side of caution, safety limits for both occupational and environmental exposure have been established by the International Commission for Non-Ionising Radiation Protection (ICNIRP) and will be adhered to.

Impact	Grouping	Type	Nature	Duration	Scale	Likelihood	Ability to Adapt	Significance	Mitigation (addressing all impacts)
Decreased in property value in Tuli Block.	Routine	Indirect	negative	Long term	Regional	Medium	Low	Moderate –	• BPC workers or contractors should inform the Tribal Authorities or Tuli Block farmers well in advance when they would require access to the property and for what reasons. Should they not manage to get in touch with the property owner or in case of an emergency, they should report directly to the property owner or farm manager when entering the property • A BPC representative should be appointed to whom the Tribal Authorities and Tuli Block farmers can direct their queries and concerns, e.g. reporting problems with the line or misconduct by contractors. • **Note:** The impacts associated with the management of the servitude are a very sensitive issue among the Tuli Block farmers and strong adherence should therefore be given to the mitigation measures • It is strongly suggested the routes be aligned in a manner so as to avoid physical resettlement. TAP has, however, indicated that they would avoid
Decrease in tourism potential in the Tuli Block.	Routine	Indirect	Negative	Long Term	Regional	Low	Medium	Minor (-)	
Decrease in personnel health from effects of EMF.	Routine	Direct	Negative	Long term	Local	Low	Low	Minor (-)	
Loss of sense of place (Tuli block farmers).	Routine	Direct	Negative	Long Term	Regional	High	Medium	Moderate (-)	

Impact	Grouping	Type	Nature	Duration	Scale	Likelihood	Ability to Adapt	Significance	Mitigation (addressing all impacts)

11.2.15Economic Environment

Objective:

The Economic assessment objectives include:

- Economic diversification;
- Promote the increase in local economic benefits;
- Contribute to national economy;
- Increase foreign currency earnings diversification.

Cause & Comment:

Increased business experience, training and skills: There is a limited number of national companies and businesses that will be able to feed directly into the MEP supply chain during construction. A higher percentage will be able to feed into the supply chain during operation, although this will be limited initially, with greater opportunities over time. For those national companies that do get the opportunity to be part of the supply chain, there will be long lasting and sustained benefits to the businesses and their employees through increased experience, capacity and training, particularly in having to meet more stringent international requirements.

Increased foreign currency earnings: CIC plans to export more than 85% of the power generated to South Africa. This will result in substantial foreign currency earnings as a result of export revenues. According to company reports and analysis by Westwind Partners the annual power generated from the power plant will be 28.4 billion kwh, at an estimated price of around $0.0425 per kwh. Thus on an annual basis, power sales will amount to around US$1.2 billion. Assuming that approximately 85% of this is exported to South Africa, this would amount to around US$1 billion in foreign earnings to Botswana per year.

As discussed in Section 3.6, the total value of Botswana's exports was on average P14.5 billion (US$2.5 billion) per year between 2000 to 2004. In real terms, therefore, the sale of power to South Africa is estimated to contribute at least 30% of export revenue to Botswana during operation of the power plant. This represents a significant diversification of Botswana's export earnings away from diamonds and unprocessed minerals, and hence should reduce exchange rate volatility.

Direct, indirect & induced employment during operation: The operation and maintenance of the transmission line will require a certain number of employees but is not expected to generate a significant number of job opportunities. There may also be a limited number of support industries that may have opportunities for maintenance or supply contracts.

Appreciation of the exchange rate: CIC plans to export more than 85% of the power generated to South Africa. There is an argument that this may cause appreciation of the exchange rate as a result of these increased exports. This would have the potential to make other traded export sectors less competitive. On the other hand, it would make imports more affordable at the same time, therefore those sectors relying on imports in their supply chain will likely not be impacted. It may negatively impact on export sectors that require only domestically produced inputs, and can benefit companies that produce for the domestic market using imported components.

Significance:

The increase in business skills and experience in the broader project area and Botswana will be an expected positive impact from the MEP. It is an indirect result of the procurement of goods and services by the MEP, as well as the economic development and business opportunities in the area. This will result in long term, or permanent impacts to businesses and their employees, through increased experience, capacity development and training.

The direct, indirect and induced employment created during operation is a necessary and expected aspect of the development of the MEP. It is a positive impact that will be of long-term duration, as it will last for the life of the MEP project (40 years) and beyond. It will have positive impacts in the local project area, with these also felt at a more regional and national level.

Impact	Grouping	Type	Nature	Duration	Scale	Likelihood	Ability to Adapt	Significance	Mitigation (addressing all impacts)	Responsibility
Increased business experience, training and skills	Routine	Indirect	Positive	Long term – permanent	Local – national	Medium – high	N/A	Moderate (+)	• Social and Labour Development Plan, which includes a: • Training and Localisation Plan; • Skills Development and Training Plan; • Career Progression Plan; • Mentorship Plan; and • Internship and Bursary Plan; • Social Development Plan, covering • Social Investment; • Business Development; and • Local Economic Development; • Local/ National Content Strategy • Training will include environmental, health and safety training, and would be beneficial to include training in skills that are transferable to another project or industry • The Social Development Programme will focus on addressing economic vulnerability in the area.	
Increased foreign currency earnings	Routine	Indirect	Positive	Long term	National	High	High	Major (+)		
Direct, indirect & induced employment during operation	Routine, planned	Direct, indirect & induced	Positive	Long term	Local, regional, national	Medium – high	Medium – high	Minor (+)		
Appreciation of the exchange rate	Unplanned	Induced	Negative	Short term – long term	National	Low	High	Negligible to minor (-)		

11.3 Decommissioning and Closure Phase

The life of the transmission line is likely to be longer than for the mine and power station as the lines may well remain in place as a component of the southern African regional grid. As the life of the transmission project has not yet been determined, it is difficult to accurately assess the impacts of decommissioning. Some more general potential impacts are, however, discussed below.

11.3.1 Geology

The geology is no longer disturbed during post closure and hence impact assessment and mitigation is not required.

11.3.2 Topography

There will be no further impact on topography during decommissioning.

11.3.3 Soil

Objective:

- Soil objectives for decommissioning follow closely along the lines of the objectives for the closure plan, included in this EIS.

Cause & Comment:

On decommissioning of the transmission lines, all the outstanding rehabilitation requirements need to be met. Open excavations must be closed up, bare areas must be vegetated and borrow pits rehabilitated. In addition, infrastructure should be removed or buried if too extensive to remove. This will require topsoil and should be taken into account in the closure provisions. All roads no longer required by the people still living in the area should be ripped up and rehabilitated. All of these areas could cause soil disturbance and soil loss and ultimately result in a soil erosion problem.

The soil that was stockpiled during construction will become available for final rehabilitation. Once all areas are rehabilitated, the impact on the soil is positive.

Significance:

Impacts on soil during decommissioning will initially be similar to those experienced during construction as soil is moved around to where it is required. However, once decommissioning is complete, the impact on soil is positive as rehabilitation takes place, vegetation is established and the soils is stabilised.

Impact	Grouping	Type	Nature	Duration	Scale	Likelihood	Ability to Adapt	Significance	Mitigation (addressing all impacts)	Responsibility
Loss of topsoil (erosion)	Routine	Direct	Negative	Long term	Local	Medium	Low	Minor (-)	• All heavy machinery operators and truck drivers should be instructed to stay in designated areas, such as construction sites and roads. • Accidental hydrocarbon spillages should be reported immediately, and then the affected soil should be removed, and rehabilitated or if this is not possible, disposed of at a waste sites designated to accept such waste. • Add fertilizers to soil where necessary.	
Hydrocarbon spillages	Routine & cumulative	Direct	Negative	Long term	Local	Medium	Medium	Minor (-)		
Soil compaction	Routine	Direct	Negative	Long term	Local	Medium	Medium	Minor (-)		
Replacement of soil	Routine	Direct	Positive	Long term –	Local	High	Medium	Moderate (+)		

Impact	Grouping	Type	Nature	Duration	Scale	Likelihood	Ability to Adapt	Significance	Mitigation (addressing all impacts)	Responsibility
from stockpiles				permanent						

11.3.4 Land Capability

Objective:

- To re-established pre-development land capability.
- To minimise the footprint of decommissioning activities so that impacts on land capability are minimised.

Cause & Comment:

During decommissioning and closure land capability will be restored, as far as possible, to its original condition. Tourism potential of land affected by the transmission lines will be restored to its current sense of place.

Significance:

The impact on land capability is positive once closure is complete.

Impact	Grouping	Type	Nature	Duration	Scale	Likelihood	Ability to Adapt	Significance	Mitigation (addressing all impacts)	Responsibility
Restoration of land capability.	Routine	Direct	Positive	Long term – permanent	Local	High	High	Moderate (+)	• Monitor rehabilitated areas to ensure vegetation establishes and land capability is restored.	Contractor

11.3.5 Land Use

There should not be a major change in land use from operation to decommissioning.

11.3.6 Air Quality

Cause & Comment:

As with construction there will be an increase in dust generation with the ripping of servitudes, movement of vehicles and handling of materials.

Significance:

Incremental impacts due to rehabilitation and demolition activities to be undertaken during the closure phase are of low significance. Cumulative impacts due to rehabilitation and demolition activities, taking into account background particulate concentrations are more significant. No significant aspects should occur during the closure and post-closure phases given the implementation of rehabilitation strategies during the operational phase of the power plant. This will include the covering and vegetation of the discard dump and ash dump side walls and surface areas. Once closure is completed, the potential for fugitive dust impacts will have been rendered negligible (and proven to be so) through comprehensive rehabilitation prior to closure being granted for these facilities.

Impact	Grouping	Type	Nature	Duration	Scale	Likelihood	Ability to Adapt	Significance	Mitigation (addressing all impacts)	Responsibility
Increase in fugitive dust during decommissioning	Routine	Direct & indirect	Negative	Temporary	Local	High	Low	Low (-)	• Rehabilitation and mitigation is continuous throughout the life off the project in order to result in the minimal effort to apply final rehabilitation strategies. • Dust control measures for open areas can consist of wet suppression, chemical suppressants, vegetation, wind breaks, etc. • Wet suppressants and chemical suppressants are generally applied for short storage pile durations. For long-term control measures vegetation frequently represents the most cost-effective and efficient control. • Vegetation cover retards erosion by binding the soil with a root network, by sheltering the soil surface and by trapping material already eroded. Sheltering occurs by reducing the wind velocity close to the surface, thus reducing the erosion potential and volume of material removed. • The trapping of the material already removed by wind and in suspension in the air is an important secondary effect. Vegetation is also considered the most effective control measure in terms of its ability to also control water erosion. • The long-term effectiveness of suitable vegetation selected for the site will be dependent on the nature of the cover.	Contractor

11.3.7 Noise

Objective:

- To reduce noise annoyance to the surrounding community as far as possible.

Cause & Comment:

It is expected that during the decommissioning phase, there will be an increase in noise due to the increased activity along the transmission lines. The main component of the noise emissions will be caused by diesel-powered equipment. Upon closure, the noise levels will drop significantly.

Significance:

During decommissioning noise levels are expected to increase, however the noise will be experienced predominantly during the day. Once closure is completed, noise levels will decrease and a positive moderate impact is expected.

Impact	Grouping	Type	Nature	Duration	Scale	Likelihood	Ability to Adapt	Significance	Mitigation (addressing all impacts)	Responsibility
Increase in noise levels during decommissioning	Routine	Direct	Negative	Temporary	Local	High	Low	Low (-)	• All vehicles and equipment should be monitored and maintained in good working order. • All sirens should have appropriate directional and volume settings. • Maintain a site register to record complaints and responses thereto. • Reduce the noise at the source if possible. This includes ensuring silencers on vehicles, using rubber linings, enclosing sources if possible, etc. • Place a screen between the source and the receiver. • Enclose the source of the noise if possible.	
Decrease in noise once closure is complete	Routine	Direct	Positive	Long term	Local	High	High	Moderate (+)		

11.3.8 Flora

Objective:

- To prevent further destruction of the vegetation.
- To re-establish the vegetation that was removed during the construction and operational phases.
- To improve the diversity and vigour of the vegetation that was disturbed during the construction and operational phases.
- To monitor the efficacy of rehabilitation.
- To establish and maintain ecosystem sustainability post closure.

Cause & Comment:

The decommissioning and closure phase will include removal of all unnecessary infrastructure and the reshaping, rehabilitation and re-vegetation of all disturbed areas to return the area as far as possible to its original state. Activities that will negatively, but briefly, impact on plant life in the area include:

- Potential contamination of soil with various wastes, including illegally dumped material and hydrocarbon spills, which will directly impact on vegetation and soil-dwelling animals and indirectly on other animals.
- Potential pollution or siltation of water in the area due to decommissioning phase activities.
- The continued presence of human activity and associated noise.
- The continued presence of traffic of personnel transport and coal trucks.
- Increased dust levels due to exposure and mobilisation of soils.
- Increased potential of soil erosion and loss of soil.

Activities that may impact positively on plant life in the area include:

- Re-introduction of vegetation into the area.
- Potential increase in plant biodiversity in the area which will attract animals into the area.
- Reduction of soil erosion and stabilisation of disturbed soils as area is re-vegetated.
- The possibility to return the area into its current state allowing re-introduction of Red Data species.
- Removal of alien invasive species restoring the area to a natural state.

During this phase the area will slowly be returned to its current pre-development state as far as possible. There will be initial continued negative impacts as heavy machinery will be utilised to remove infrastructure and earth moving equipment will be used to contour and rehabilitate all disturbed areas. After this the area will be re-vegetated with indigenous species to stabilise soils in the rehabilitated areas and to reduce soil erosion and improve storm water run-off drainage. This will be a positive impact. If surrounding areas are kept in their natural state as far as possible then source populations of vegetation and animals will be available to move into newly rehabilitated areas. This will speed up natural succession in the area.

Significance:

The initial impacts will be similar in nature to those of the construction phase and in the short term will be predominantly negative. Overall, after decommissioning, the impact on plant life will be positive. The duration of the impact will be of medium to long term duration and local in extent. The impact will be beneficial and possible. The significance is moderate.

Impact	Grouping	Type	Nature	Duration	Scale	Likelihood	Ability to Adapt	Significance	Mitigation (addressing all impacts)	Responsibility
Post-decommissioning impact on flora	Routine	Direct	Positive	Long term	Local	High	Low	Moderate (+)	• Machinery and vehicles used in the closure process should be restricted to demarcated areas such as roads and previously disturbed areas. • The topsoil should be replaced appropriately and the recommended seed mix applied. • The individual plants that may have been placed temporarily in the nursery should be replanted in the area from where they were removed.	

Impact	Grouping	Type	Nature	Duration	Scale	Likelihood	Ability to Adapt	Significance	Mitigation (addressing all impacts)	Responsibility
									• The areas that have been rehabilitated should be protected from further disturbances. Fences should be erected around certain areas that need extra protection. • Monitoring should be continued after closure to ensure rehabilitation efforts are effective.	

11.3.9 Fauna

Objective:

- To return the diversity to the levels it was at prior to the operation.
- To prevent further disturbance to the animal life in the area.
- To continue to prevent injury and / or death to animal life.
- To encourage the return of animal life to the area.
- To monitor the re-establishment of animals in the area.

Cause & Comment:

The decommissioning and closure phase will include removal of all unnecessary infrastructure and the reshaping, rehabilitation and re-vegetation of all disturbed areas to return the area as far as possible to its original state. Activities that will negatively, but briefly, impact on animal life in the area include:

- Potential contamination of soil with various wastes, including illegally dumped material and hydrocarbon spills, which will directly impact on vegetation and soil-dwelling animals and indirectly on other animals.
- Potential pollution or siltation of water in the area due to decommissioning phase activities.
- The continued presence of human activity and associated noise.
- The continued presence of traffic of personnel transport and coal trucks and associated noise.
- Increased noise levels due to decommissioning activities.
- Increased dust levels due to exposure and mobilisation of soils.
- Increased potential of soil erosion and loss of soil.

Activities that may impact positively on animal life in the area include:

- Potential increase in plant biodiversity in the area which will attract animals into the area.
- Decreased noise levels which will attract animals back into the area.
- Decreased human activity which will attract animals back into the area.
- The possibility to return the area into its current state allowing re-introduction of Red Data species.

During this phase the area will slowly be returned to its current pre-development state as far as possible. The introduction of vegetation will attract animals into the area, first insects and smaller herbivores followed by larger carnivores and scavengers. Depending on how well the surrounding areas are maintained will determine how fast this process happens. If surrounding areas are kept in their natural state as far as possible then source populations of vegetation and animals will be available to move into newly rehabilitated areas. This will speed up natural succession in the area. It must be borne in mind that at the time of decommissioning, it is unknown how many additional people have moved into the area or where areas have been disturbed. This should be taken into account for planning of closure.

Significance:

The initial impact on animal life will be similar to that of the construction phase and will be predominantly negative. Overall, after decommissioning, the impact will be positive. The duration of the impact will be of medium to long term duration and local in extent. The impact will be beneficial and possible. The significance is moderate.

Impact	Grouping	Type	Nature	Duration	Scale	Likelihood	Ability to Adapt	Significance	Mitigation (addressing all impacts)	Responsibility
Impacts on fauna during decommissioning	Routine	Direct & indirect	Negative	Temporary	Local	High	Low	Minor (-)	• The rehabilitation of the vegetation should allow for the natural return of animal life to the area due to the presence of suitable habitats. • Machinery and vehicles used in the closure process should be restricted to the demarcated areas such as roads and previously disturbed areas. • The stipulated speed limits should be adhered to at all times. • Employees involved in the closure process should be made aware of the importance of preserving the animal life. • Hunting by employees should be prohibited. • Monitoring should be continued after closure to ensure biodiversity attains pre-mining levels	
Impact on fauna on completion of decommissioning	Routine	Direct and indirect	Positive	Long term	Regional	High	Low	Moderate(+)		

11.3.10Sites of Archaeological and Cultural Significance

No sites of archaeological importance are expected to be impacted on during decommissioning as no new areas are expected to be affected.

11.3.11Visual Aspect

Objective:

- To remove the visual intrusion post closure.

Cause & Comment:

The following lists the activities which could result in negative impacts on the visual environment during decommissioning:

- Dust from decommissioning activities;
- Increase in machinery and equipment for demolition and earth moving.

The following are potential positive impacts post closure:

- Removal of offending infrastructure which will be broken down and removed.
- Re-establishment of vegetation to blend in with current environment.

Significance:

It is considered that the significance of the impact of the decommissioning phase is moderate and negative due to the fact that it is of a short, but intense, duration for the removal of the power plant and related infrastructure. Once closure is reached, the impact will be positive and moderate in significance.

Impact	Grouping	Type	Nature	Duration	Scale	Likelihood	Ability to Adapt	Significance	Mitigation (addressing all impacts)	Responsibility
Visual impact during decommissioning to communities and visitors to the area	Routine	Indirect	Negative	Temporary	Local	High	High	Moderate (-)	• Rehabilitate all disturbed areas to reduce visual scarring. • Blend earthworks and road access cuttings into the landscape. • Dust control methods to control dust from demolition	
Removal and rehabilitation of infrastructure	Routine	Indirect	Positive	Long term	Local	High	High	Moderate (+)		

11.3.12Traffic and Safety

Objective:

- To maintain safety to pedestrians, animals and motorists.

Cause & Comment:

Traffic and safety will be directly affected during decommissioning as heavy construction vehicles and delivery vehicles will be entering the transmission line area to remove infrastructure. This increase in traffic will impact on existing vehicle movement, safety on the roads and increase in noise and dust. The decommissioning phase is temporary, and traffic levels will decrease as closure nears completion. Roads that will not be required post closure will be rehabilitated while roads that can be used for general access will remain paved post closure.

Significance:

Although the increase in traffic will be short term, the potential resulting direct and indirect impacts are considered negatively minor to major. Local communities will have to adjust to the increase in traffic, as noise and dust levels increase. Cattle and donkeys, which roam freely, will pose a safety hazard and may give rise to compensation issues if involved in an accident. Pedestrians who walk during the evening will be at risk and any potential fatalities are considered a major negative impact. Once closure is completed, the impacts are positive as roads will be paved and available for community use and traffic levels will reduce significantly.

Impact	Grouping	Type	Nature	Duration	Scale	Likelihood	Ability to Adapt	Significance	Mitigation (addressing all impacts)	Responsibility
Increase in traffic and safety hazards	Routine	Direct	Negative	Temporary	Regional	High	Low	Moderate (-)	• Trucks are required to stay on designated roads and to adhere to speed restrictions. • The travelling public shall have the right of way on public roads and the contractor shall make use of approved methods to control the movement of his equipment and vehicles so as not constitute a hazard on the road. • Failure to maintain road signs, warning signs or flicker lights, etc, in a good condition shall constitute ample reason for the engineer to bring the works to a stop until the road signs, etc, have been repaired to his satisfaction	

11.3.13Social and IAP's

Objective:

- Address issues and impacts created through loss of income and employment.
- Adhere to open and transparent communication procedures with stakeholders at all times;
- Empower the workforce to develop skills that will equip them to obtain employment in other sectors of the economy;

- Ensure that decommissioning and retrenchments take place in a legally compliant and humane manner; and

Cause & Comment:

As there will not be a large amount of employment on the transmission lines, the impact of decommissioning is not expected to be significant.

Impact	Grouping	Type	Nature	Duration	Scale	Likelihood	Ability to Adapt	Significance	Mitigation (addressing all impacts)	Responsibility
Collapse of land management / settlement planning	Routine	Direct & indirect	Negative	Short term – long term	Local	Low	Low	Minor (-)	• Invest in training/skills development of younger employees and local community • Formulate a LED plan and Procurement Plan to assist local business development • Support local partners to diversify economy and decrease dependence on mining • A retrenchment/downscaling fund should be established to assist retrenches • Communication channels should be established and maintained between the Contractor and I&APs. • A site register should be kept with a record of all complaints, issues etc. as well as the response thereto. • Strategy for saving jobs and management of downscaling and/or retrenchment. • Facilitation of downscaling and retrenchment process by outside consultant. • Redeployment of retrenchees in other operations or assistance with alternative livelihood strategies. Money is placed into a fund for unforeseen/unplanned decommissioning or closure (alternative livelihood/redeployment strategies)	
Changes in livelihood strategies/ income generation	Routine	Direct & indirect	Negative	Short term – long term	Regional	Low	Low	Minor (-)		
Increase in social pathologies, violence and crime	Routine	Direct & indirect	Negative	Short term – long term	Regional	Low	Low	Minor (-)		
High unemployment and poverty	Routine & cumulative	Direct & indirect	Negative	Short term – long term	Regional	Low	Low	Minor (-)		

11.4 Summary of Significant Impacts

From the impact assessment described in this chapter, a summary of all the significant (major) impacts has been compiled. It is important to note that these impacts have been classified as significant prior to mitigation and management measures taking place. With the implementation of such measures, it is expected that the significance of the majority of impacts will be reduced and will become manageable. Both major and moderate impacts have been included in Table 11.2 below.

The findings of the specialist studies undertaken within this EIS provide an assessment of both the benefits and potential negative impacts anticipated as a result of the proposed project. The findings conclude that there are no environmental fatal flaws that should prevent the proposed project from proceeding, provided that the recommended mitigation and management measures are implemented. There are, however, significant impacts which need to be addressed to ensure impacts are reduced from major, negative significant impacts, to moderate or minor negative impacts and likewise to try and increase minor positive impacts to major significant positive impacts.

Table 11.2: Summary of the major and moderate impacts associated with the MEP Transmission Lines

Aspect	Significant Impacts	Nature of Impact	Impact after Mitigation
Construction Phase			
Soil	Compaction of soil may lead to reduced agricultural capability.	Moderate Negative	Minor Negative
Visual	Visual impact during construction to communities and visitors to the area results in a significant negative impact	Moderate Negative	Moderate Negative
Flora	Removal of vegetation during construction will result in habitat destruction and visual scarring. Damage of removal of red data species will result in a major impact.	Moderate Negative	Minor if rehabilitation successful
Fauna	Damage to habitat and increased activity will cause animals and birds to move out of the area.	Moderate Negative	Moderate
Traffic	Increase in traffic may disrupt local movement of people and livestock as well as pose a safety hazard.	Moderate Negative	Minor
Social	Population change and inflow and outflow of workers	Moderate Negative	Minor
	Potential for relocation of people	Major Negative	Minor
	Disruption in daily living and movement patterns	Moderate Negative	Moderate

Aspect	Significant Impacts	Nature of Impact	Impact after Mitigation
	Loss of arable land, agricultural land and communal grazing land	Moderate Negative	Minor
	Loss of natural resources	Moderate Negative	Minor
	Resettlement – loss of dwelling structures	Major Negative	Minor
	Loss of sense of place (Tuli block farmers)	Moderate Negative	Moderate
	Decreased property value in Tuli Block	Major Negative	Major
	Relocation of graves, places of worship or archaeological sites	Moderate Negative	Minor
	Decrease in safety &security	Moderate Negative	Moderate
	Opportunities for employment creation	Moderate Positive	
Economic	Indirect & induced employment during construction	Moderate Positive	
	Economic development in the project area, diversification of the economy and increased value added	Major Positive	
	Increased government revenue	Major Positive	
	Procurement of local goods and services during construction	Moderate Positive	
	Enhancement/ upgrade of skills and experience	Moderate Positive	
	Economic and/ or physical resettlement:	Major Negative	Minor
Operation Phase			
Land Use	Limit expansion of residential areas.	Moderate Negative	Minor
	Reduce tourism potential of the area	Moderate Negative	Moderate

Aspect	Significant Impacts	Nature of Impact	Impact after Mitigation
Flora	Bush encroachment resulting in loss of diversity and loss of grazing.	Moderate Negative	Minor
Fauna	Bird fatalities due to collision with lines.	Major Negative	Moderate
	Bird fatalities due to electrocution	Moderate Negative	Moderate
	Loss of habitat through servitude maintenance.	Moderate Negative	Minor
Visual	Establishment of new infrastructure which is highly visible	Moderate Negative	Moderate
Social	Decrease in land value due to aesthetic impact.	Moderate Negative	Moderate
	Loss of sense of place, individual expression and way of life	Moderate Negative	Moderate
Economic	Increased foreign currency earnings	Major Positive	
Decommissioning and Closure			
Flora	Re-establish indigenous vegetation along servitude.	Moderate Positive	
Fauna	Revegetation and a decrease in anthropogenic activity will result in increase animal movement to the area.	Moderate Positive	
	Removal of transmission lines will remove obstruction to bird movement.	Major Positive	
Visual	Post closure visual environment enhanced by removal and rehabilitation of infrastructure	Major Positive	

The recommendations and mitigation measures for the above impacts have been detailed in the previous chapter and in some cases the mitigation measures will require further investigation from the project developers.

In order to achieve appropriate environmental management standards and ensure that the findings of the environmental studies are implemented through practical measures, the recommendations from this EIS must be included within an EMP. This EMP will form part of the contract with the contractors appointed to construct and maintain the proposed transmission lines. The EMP will be used to ensure compliance with environmental specifications and management measures. The implementation of the EMP for all life cycle phases (i.e. construction, operation and de-commissioning) of the proposed project is considered to be key in achieving the appropriate environmental management standards as detailed for this project. It is also recommended that the process of communication and

consultation with the community representatives is maintained after the closure of this EIS process, and, in particular, during the construction phase associated with the proposed project.

11.5 Route Alternatives Impacts and Recommendations

11.5.1 Northern and Southern Route Alternatives

Two route alternatives were assessed between the proposed Mmamabula power plant and the Morupule power station, outside Palapye. The indication from the specialist studies is that the western alternative i.e. following the existing 220kV servitude adjacent to the A1 is the preferred alternative. Similarly for the alternative routes between the proposed Mmamabula power plant and the proposed Mosaditshweni sub-station. The justification for this recommendation is:

- The cumulative effect of the additional line will, in this case, be positive as it will provide a more obvious structure that birds are more likely to avoid, thus reducing the potential for bird fatalities.
- The addition of another transmission line along this route will have less of a visual impact where there are existing linear developments such as the 220kV lines and railways. There will thus not be a substantial altering of the sense of place as there will be should the lines traverse a more pristine area.
- This route already has a number of established access roads and servitudes and there will, therefore, be less disturbance of the environment in providing these facilities. It is also in relatively close proximity to the A1, thereby facilitating easier access.
- The vegetation along this route is more highly disturbed as a result of overgrazing and past clearing, with bush encroachment evident in many areas. There will thus be less of an impact on flora should this alternative be selected, with possibly a positive impact should rehabilitation be conducted correctly.
- The greater human and livestock activity along this route has already resulted in large disturbance to wildlife, with very little still present in the area. Although there will be a cumulative impact from construction of an additional line, this impact will be less than if disturbance is created in an area with higher numbers of wildlife i.e. the eastern route.

11.5.2 Eastern Alternatives to the Limpopo River

Four route alternatives with a fifth river crossing point have been assessed in the EIA. These routes, for obvious reasons, have to correspond with the route preferences on the South African side of the border. As Eskom, and not BPC, is responsible for the transmission lines in South Africa, they have appointed different consultants to conduct a separate EIA for these lines. This EIA process was initiated after the Botswana EIA and is therefore in an earlier stage of the study. No route preference has been identified yet in the South African study and

it is thus difficult to finalise the preferred corridor within Botswana. Once the Eskom EIA has been completed, the respective consultants will evaluate their findings for both sides of the border and make recommendations as to the preferred route. A number of factors have, however, been identified for consideration during the route evaluation:

- There is a variation in the number of farms crossed, depending on the route alternative. It will be preferable to cross as few farms as possible in order to limit the number of landowners impacted.
- Some of the farms have more tourism based income as apposed to purely livestock. The impact of transmission lines will be greater on these areas.
- Some of the landowners have large tracts of land in other areas and are not dependent only on the farms along the transmission routes for income.
- The specific river crossings have varying physical conditions, mostly relative to the size of the floodplains.
- Landowners have requested that transmission lines follow farm boundaries as far as possible to avoid dividing farms and minimise the visual impacts.
- There are a number of archaeology sites along the Limpopo River. The location and importance of these may influence the placement of towers and servitudes.
- From an ecological perspective, there is nothing to specifically differentiate the various alternatives.

11.6 Visual Impact

As the visual impact has been identified as one of the more significant impacts associated with transmission lines, the implications for the project are described in more detail below:

The generally taller vegetation zones provide a greater screening effect to the transmission towers (Figure 11-2).

If a person looks at the transmission line in areas where the trees are on average 6m tall and that person stands approximately 35m away from the trees (i.e. there is 35m of open space between the person and the trees) then that person will find that the trees between the person and the transmission line will block out the view of the transmission line only once the line is at least + 300 m away from that person. Similarly, if the space between the person and the trees is 20 m wide then the trees will block out the view of the transmission line when the line is approximately 200 m away from the person

If the trees are on average only 3 m high, as in the south, and there is approximately 35 m of open space between the person and the trees then the trees will block the view of the line at

distance of 750 m. If the open space between the person and the trees is 20 m then the trees will block the view of the line at a distance of 450 m away from the person.

Figure 11-2 only illustrates the effect of vegetation height on screening. The tower design is in this context then irrelevant. However the tower design is relevant in areas where the screening is not effective. In this case the towers that are of a lighter structure will visually less prominent.

The viewshed analysis has determined that, in theory, due to the height of the towers, the flat topography and that without any major screening components, the views of the towers can be seen, uninterrupted, from distances of over 10 km away. However, on ground truthing this exercise it was found that views are generally restricted and contained by the existing treed vegetation to approximately 750 m or less, except where the routes are elevated such as the ridge crossing south of Palapye.

The visual quality of the eastern alignment can be regarded as medium as there is a lack of visual diversity and there are no elements that create a vivid quality. The uniformity and visual monotony do, however, provide a measure of intactness and unity. The visual quality and character of the western alignment is regarded as low due to the addition visual clutter of existing infrastructure such as roads, transmission lines, railway lines, towns and villages. The visual quality and character of the alignment is medium and that the line will have a high impact on it. However the significance of this high impact is medium

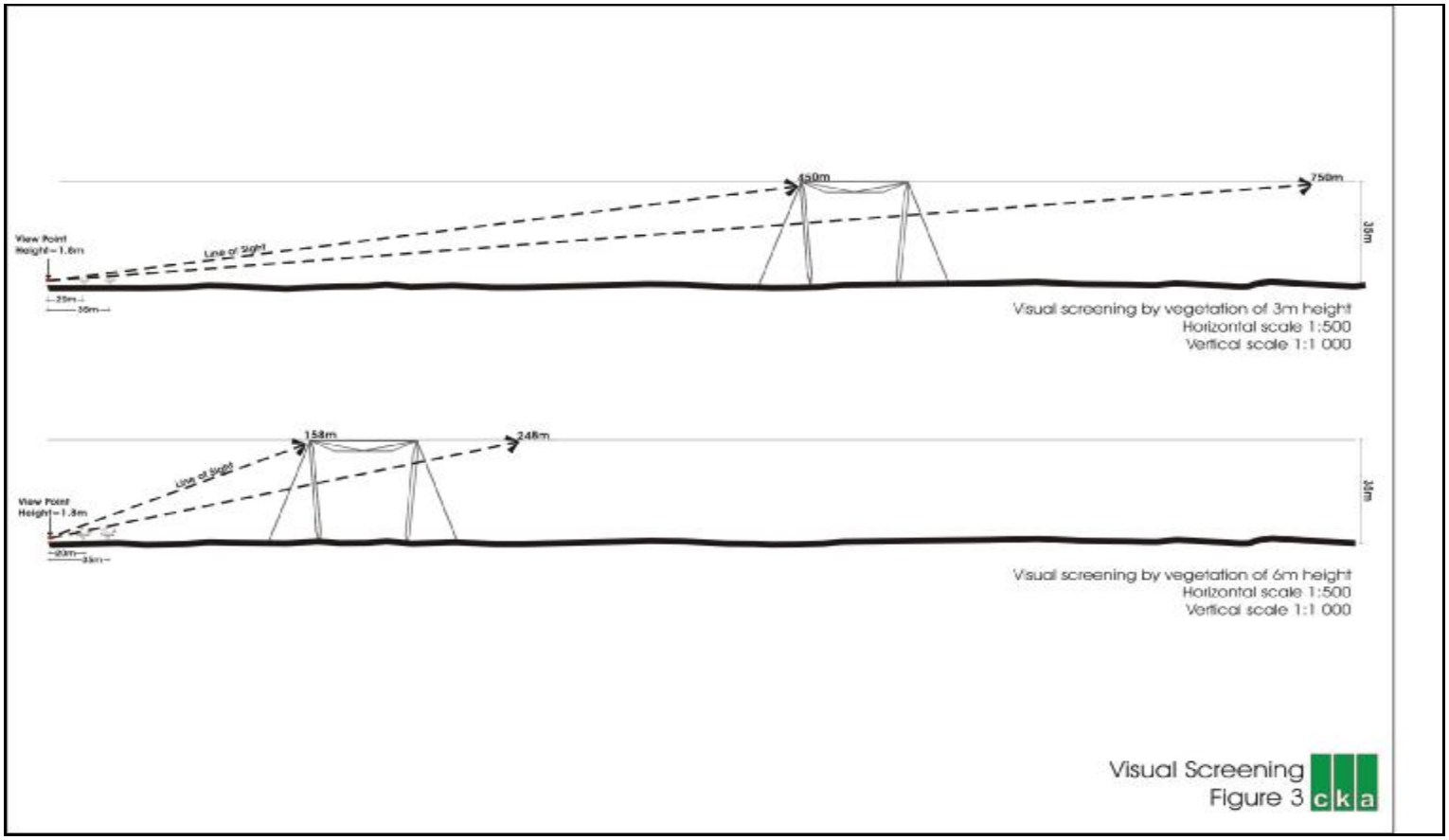

Figure 11-2: Visual screening.

12 ENVIRONMENTAL MANAGEMENT PLAN

The role of the Environmental Management Plan (EMP) is to assist the organisation in achieving their environmental objectives and fulfilling their commitment to the environment (Environmental Protection Agency, 1995). The EMP will describe methods and plans used to reduce environmental impacts, as well as identify indicators to assess the progress of the EMP. This EMP applies to the corridors assessed during the EIA and, although all the anticipated impacts are taken into account it is not specific to a defined route. Once the EIA has been approved and a preferred corridor selected, a detailed routes profile will be designed. This EMP will, then be used as a basis for compiling a profile specific EMP. Most of the impacts associated with the transmission line component of the MEP will occur during construction. The EMP therefore focuses to a large extent on this phase of the project. Recommendations for environmental management during operation are, however, also included in the EMP.

The EMP will be implemented from site preparation through to decommissioning and closure. Furthermore, there is a commitment to continuous and progressive rehabilitation as the project advances. In this regard, it is anticipated that monitoring and assessment of the potential impacts will occur on a regular basis (provisionally annually, but to be agreed upon in consultation with the Department of Mines and Department of Environmental Affairs). If required a representative of the Department may attend monitoring inspections in accordance with a pre-arranged programme (ERM, 2006).

The EMP serves as a framework for implementing the mitigation measures during each phase of the project.

12.1 Organisational Commitment and Environmental Policy

The success of an EMP is dependant upon the commitment of the organisation, at all levels, to environmental excellence (Environmental Protection Agency, 1995). Commitment to structured and effective environmental management plans will benefit both the organisations business success and the community. This commitment requires that the organisation provide the necessary resources for employee training, reference material and reporting and response procedures. By submitting this EIS and EMP, the applicant commits to the measures and plans incorporated into the EMP.

The environmental policy sets out the standards which the organisation intends to maintain for the benefit of the community and the company's own employees. The policy will be the benchmark

by which the community judges the company's fulfilment of its commitment to its environmental promises. The company should consider the following:

- What the company wants to achieve.
- Long and short-term environmental targets and objectives.
- Community consultation.
- Environmental monitoring.
- The resources the company is willing to commit to its environmental performance.
- Commitments regarding rehabilitation.

The organisation will distribute the policy widely and ensure that the workforce is reminded of its commitments, where this affects their activities, regularly.

12.2 Environmental Impact Assessment

Most projects require EIA's, or an equivalent, during the planning stage. Ideally, transmission lines should be developed, operated and eventually rehabilitated in accordance with the management plans following on the findings of the EIS. However, even in the best of circumstances, conditions vary to some extent from those anticipated and variations of the initial planning will take place. When this occurs, management will review strategic plans as required and modify company practices to achieve the environmental outcomes sought.

The environmental impacts resulting from the projects initiation will impact the physical, biological, cultural and social environments. The environmental impacts resulting from the MEP transmission lines are described in detail in Chapter 12. These impacts are described according to their duration, nature, scale, likelihood and significance. The EIS findings inform the initial objectives, targets and procedures the company must achieve or implement.

12.3 Public Participation

Public consultation during all stages of the project is essential. Constant consultation allows for community concerns and misconceptions to be addressed and dealt with. Continuous communication between the organisation and community will highlight the organisation's commitment to the community and environmental excellence and create an environment of goodwill. A community liaison officer will be appointed for both the construction and operation phases of the project. The liaison officer will be in a senior management position with authority to speak to the community through the media on the company's behalf. He or she will have a good

understanding of the operations and have had previous experience in dealing with external interest groups.

Successful consultations will facilitate the smooth running of the project through all stages of development.

The PCDP for the MEP, which includes the transmission lines, is described in this EIS. The PCDP details the methodology used for community consultations, the issues and concerns raised by community members and the recommendations for ongoing consultation.

12.4 Responsibilities and Reporting Structure

For an EMP to be affective the responsibility for its implementation should ultimately lie with the overall project manger, who will be appointed by the developer. During construction a contracts manager will oversee the site works, liaise with the project environmental manager. The environmental manager for the MEP will supervise the contractor's implementation of the EMP and adherence to the company's environmental policy. In addition this person will liaise with the public throughout construction. The contractor will also appoint a dedicated environmental officer who will report directly to the contractor's project manager and will be responsible for environmental control of site actions on a daily basis, liaison with the affected public and landowners as well as rehabilitation activities.

The responsibilities of the environmental team will include:

- Community liaison to update communities on changes to project design, potential impacts and health and safety;
- Monitoring of environmental conditions (eg. Vegetation clearing and erosion) to record historic and current conditions;
- Reporting of compliance with EMP and incident reporting;
- Liaison with Botswana authorities to ensure the project is in line with local planning and development initiatives;
- Education and training induction programmes for construction workers, permanent staff and temporary contractors;
- Development of a management system (eg. ISO14001) to ensure compliance with the EMS and document control;

- Preservation of indigenous vegetation, commencing with rehabilitation during operations and advising contractors on local conditions (Rehabilitation unit).

12.5 Environmental Compliance Audits

Environmental impact and compliance audits will assist in identifying problematic areas, as well as the project's compliance with regulations and organisation objectives. Regular reviews of each company's performance are necessary during and after operations to ensure that procedures are appropriate, to satisfy due diligence requirements and to ensure environmental outcomes are being achieved.

The role of the responsible persons will be to appoint internal personnel as well as work with external personnel to carry out the necessary audits on a regular basis. A report will be compiled annually which will provide suggestions and recommendations as to how the EMP is progressing, and any improvements that could be made. In addition to the annual audits during operation , it is recommended that at least two audits are conducted during construction, as this is when the majority of impacts are likely to occur.

The audit will take into consideration the management principals and strategies stated in the EMP, and assess whether this strategy is providing the required results. Any flaws found in the rehabilitation process will be included in the report along with the recommended mitigatory measures.

12.6 Documentation and Regulations

All environmental strategies, policies, responsibilities and procedures will be clearly documented for each contractor. The developer and the contractors will also document and retain details of the various programs and initiatives carried out as part of the EMS program. EMS documents are often compiled and stored in an Environmental Manual, which is a convenient form to collate and record the various components making up the EMP.

Documentation is a useful reference for both management and staff and is preferable in a form which may be provided to external parties, such as regulators, concerned citizens, or even company shareholders, as proof of the company's commitment to environmental management. A form which is preferable is a manual form.

The manual should contain:

- The environmental policy;
- Monthly environmental inspection checklist;

- Site environmental responsibilities and duty statements, or reference to duty statement documents;
- Reporting structure for each report or information system;
- The site's targets and objectives;
- Tabulated summary sheets for targets, objectives and regulations;
- The list of applicable regulations;
- The development process and structure of the environmental management plan;
- Monitoring program;
- Strategic, operational and emergency procedures;
- A list of all site registers and the responsibility for maintaining each one, such as the staff training register, chemical manifest, community complaints and response register.

The workforce should also be familiar with the regulations which apply to their operations. These regulations may govern phases of the project such as planning, development, operations, waste production and rehabilitation. Management will list these regulations, summarise their requirements, and ensure that relevant management and staff know them and the responsibilities they impose. If the regulations change, the list will be amended. Some specialist consultant firms provide an automatic updating service for various types of legislation.

13 EMP FOR CONSTRUCTION

As stated previously, this EMP will provide a guideline for what is required to manage the construction activities and related impacts. Once the profile design is finalised, a more customised EMP will be compiled with specific reference to aspects such as tower position, winch and tensioner stations as well as river and farm traversing.

13.1 Management of Physical Impacts

13.1.1 Physical Landscape

Objectives

- Avoid disturbance of land features.
- Minimise disturbance and loss of topsoil.
- Maintain current land use capability.
- Rehabilitate all disturbed areas along the servitude.

As described previously in this report, the current land use along the proposed transmission line routes is predominantly grazing for livestock. Apart from the servitude, this land use should capability will be re-established after construction. Stripped topsoil will be replaced and all areas not required for maintenance access should be rehabilitated with indigenous vegetation. A potential impact associated with transmission line construction is the loss of crop productivity due to the compaction of soil by construction vehicles. The ripping of compacted soil will thus be incorporated into the rehabilitation programme. Areas of black cotton soil along the Limpopo River should be avoided during the summer months as this ground becomes impassable when wet.

13.1.2 Crossing of rivers and Drainage Lines

Objectives

- Minimise damage to river and stream embankments.
- Minimise erosion of embankments and subsequent siltation of rivers, streams and dams.

- Minimise disturbance of riparian vegetation and habitats.
- Prevent impeding natural flow of water.

No new roads shall be cut through river or stream banks as this may lead to increased erosion and downstream siltation. Existing bridges and drifts may be used, although vehicles should not drive in river beds unless absolutely necessary. New bridges and drifts will only be constructed with approval of the relevant government authorities, the Environmental manager and, where relevant, with the landowner. Should this be necessary, the structures will be correctly engineered and drawings will be provided to the DEA as well as the environmental manager.

Where existing erosion gullies or dongas are crossed, suitable erosion containment mechanisms will be installed to prevent further erosion.

The larger trees along the river banks provide roosting and nesting sites for many of the raptors and shall not be disturbed, except where absolutely necessary. This riparian vegetation is also uncommon throughout the study area and should be preserved as far as possible.

13.1.3 Access Roads

Objectives

- Prevent damage to existing roads.
- Prevent unnecessary damage to the natural environment.
- Prevent erosion and loss of topsoil.

As far as possible, access should be restricted to existing roads and servitudes. Where this is not feasible new road shall be planned so as to minimise disturbance of vegetation, avoid sensitive areas such as wetlands, outcrops, and sites of cultural or archaeological significance. Where relevant, planning of access routes shall be conducted in close collaboration with the affected landowner, with all agreements documented in writing. The condition of existing roads will be documented with photographs and any damage that may occur during construction shall be repaired before the project is signed off by the developer's environmental manager.

Where roads are constructed on a slope, water diversion berms will be installed to control run-off and erosion. Where substantial water flow is anticipated, the outflow shall be stone pitched to prevent erosion originating from the water diversion. Where vegetation around these outflow areas is sparse or was disturbed during construction, introduction of suitable vegetation to control

flow will take place. Similarly all damaged areas or access roads that are not needed after construction will be rehabilitated with suitable indigenous species.

13.1.4 Solid Waste Disposal

Objectives

- Maintain clean and tidy servitude.
- Dispose solid waste in an appropriate manner.
- Minimise disturbance of landowners or land users.

All solid waste generated on site will be removed and disposed of in an appropriate land fill site. All hazardous waste such as oily rags and waste oil or diesel shall be disposed of in a registered hazardous waste site. Sufficient waste receptacles shall be provided along the transmission line route during construction to prevent littering. Waste management will be included in the environmental awareness plan and all workers will thus be educated on this issue during the induction process, before being allowed to commence with work on the site.

All unused construction material such as broken insulators, cable drums and steel off cuts will be removed from site. Surplus concrete may only be dumped in designated areas and spilled concrete shall be cleaned up immediately. Where the landowners and DEA are in agreement such concrete may be used to assist with the repair of erosion gullies or structures such as cattle grids. No concrete trucks will be washed on site, only in the designated area within the construction camp or nearby towns.

13.1.5 Gate and Fence Control

Objective

- Correctly install gates to allow access to servitude.
- Prevent damage of existing fences and gates.
- Maintain integrity of enclosures to prevent loss of livestock and game.
- Limit access to private land to construction personnel and BPC only.

Should any existing gates or fences interfere with construction and require removing altering, these will be replaced or repaired before construction is complete. Alternative or deviated fencing or gates will be provided during construction to prevent loss of livestock and allow access to

landowners and/or land users. Gates on private property shall be fitted with locks and will remain locked at all times. Gates will only be left open if specifically requested in writing by the landowner. Gates shall be positioned off centre to allow access to land during stringing operations.

13.1.6 Fire Prevention

Objectives

- Minimise risk of veld fires.
- Prevent damage to grazing.
- Prevent runaway fires.

No open fires shall be allowed on site under any circumstances, only in the designated construction camp area. Fire fighting equipment shall be available on all vehicles working on site. Particular care shall be taken during the dry winter months. All construction personnel will be educated on the risk and hazards of fire.

13.1.7 Hydrocarbon Management

Objectives

- Prevent oil or diesel spills.
- Prevent contamination of the environment, particularly soil and surface water.

Servicing of vehicles in natural areas will be strictly prohibited. All vehicles will be serviced in the contractors camp or at a recognised repair workshop within the towns and villages along the route. Should emergency repairs be necessary on site, drip trays will be used to contain oils spills. In cases where oil spills are unavoidable, bioremediation will be utilised to clean up contaminated soil. Where spills are too severe to be treated in situ, the contaminated material will be removed and disposed of off site. All oil and fuel will be stored in areas bunded to contain 110% of the total storage volume. This storage area will also be rehabilitated after construction.

13.1.8 Batching Plants

Objectives

- Prevent contamination of the environment, specifically surface water, soil and air.

- Minimise disturbance to fauna, flora and communities in close proximity to plant.

All batching plants shall be located in areas, where minimal damage to vegetation is required for the establishment of the plant. Any run off water from the area will be contained on the site in a sump for recycling. Diversion berms may be necessary to ensure this is achieved. Where possible dry cement and aggregate will be handled to minimised dust creation.

13.1.9 Stringing Operations

Objectives

- Prevent structural damage.
- Prevent disruption of services.

Where infrastructure such as smaller transmission lines, roads, telephone lines and fences are crossed, adequate protection shall be enforced to safeguard these structures. Use of “rugby post” type protection will, in most cases, be sufficient.

13.2 Management of Social Impacts

13.2.1 Sanitation

Objectives

- Ensure adequate sanitation.
- Prevent the spread of disease.

Adequate ablution facilities will be provided to staff in the construction camp. Pit latrines are not considered suitable facilities. The use of the veld will not be allowed as apart from the pollution and interference with land users, this may lead to problems with stock diseases such as measles. It can also result in toilet paper littering the area. Mobile chemical toilets shall be supplied at all other locations within the working area and will comply with the following requirements:

- Toilets shall be located within 250m from any point of work but no closer than 50m to any surface water body.
- Toilet shall be secured to the ground to prevent them toppling.
- Toilets situated close to residential areas shall be screened to the approval of the environmental manager.

- All contents will be emptied into adequate containers for removal and disposal at an approved treatment facility. Spillages will be avoided during such activities.
- Discharge of waste into the environment or burial of waste will be strictly prohibited.
- In order to prevent toilet paper from being blown around, toilets will have suitable closing mechanisms to ensure they are not left open.
- Toilets will be emptied before long weekends or builders holidays.

13.2.2 Interaction with Landowners and Land Users.

Objectives

- Maintain good relations with landowners and land users.

Only a small portion (approximately 14%) of the total length of the proposed transmission line will traverse privately owned land, however, it is critical to the successful completion of the project that good relations are maintained with these landowners. Although the remainder of the lines will not be on private land the, mainly livestock grazing, land users also need to be treated with respect to their needs during construction. It will be the responsibility of the project manager to appoint a public liaison officer who will keep farmers updated with project developments.

No interference with any livestock or crops will be allowed. All access to private land will be negotiated with the landowners before hand and adequate notice will be given to landowners before construction commences. All agreements with landowners will be recorded in writing and all claims investigated fully. No camping on private land will be allowed, should it be necessary to leave a guard on site this will be in agreement with the landowner. All contact with landowners and land users will be courteous at all times and construction personnel will be sensitised to the consideration of other land users.

13.3 Management of Biological Impacts

13.3.1 Fauna

Objectives

- Minimised disturbance of animals.
- Prevent disturbance of bird nesting sites.
- Prevent disturbance of threatened species.

- Minimise collision related fatalities.

Although most known breeding sites, such as those at Tswapong Hills, will be avoided, should any new sites be encountered or brought to the attention of the project team, these will be taken into account during the planning of the construction programme. Should it be impossible to avoid these sites, construction can possibly be planned so as to avoid activity in these areas during until fledglings have left the nest. This applies to nesting sites on adjacent transmission towers as well. As mentioned previously, disturbance to the riparian species shall be limited to sections essential for the safe operation of the lines. Bird guards and diverters shall be installed on the new line as per the recommendations of the avian specialist (see specialist report, Appendix G).

No disturbance to wildlife will be allowed along the route. No hunting or trapping will be allowed. Domestic animals will not be allowed on site, particularly domestic dogs that may hunt in the surrounding areas. Speed limits will be enforced on all roads to prevent road kills and dust creation.

13.3.2 Flora

Objectives

- Minimise disturbance of vegetation, where such vegetation does not interfere with the construction and operation of the transmission line.
- Prevent damage to red data listed plants.
- Prevent damage to areas of sensitive vegetation types.
- Ensure adequate rehabilitation after construction.
- Prevent establishment of alien invader species.
- Minimise erosion due to removal of vegetation.
- Minimise removal of vegetation on river and stream banks.

Removal of vegetation shall be restricted to areas required for the construction and safe operation of the transmission lines. All areas disturbed during construction and not required for operation shall be suitable revegetated with indigenous species. The following criteria will apply to the selection of species for rehabilitation:

- Annual and perennial plants will be chosen.

- Pioneer species will be included.
- Not all the species will be edible.
- Species will be well adapted to local conditions.
- Root systems must have a binding affect on the soil.
- The vegetation type will not cause an ecological imbalance in the area.

The clearing and cutting of vegetation shall be limited to that necessary for the safe mechanical construction and electrical operation of the transmission line. Only an 8m strip may be cleared flush with the ground to allow vehicular passage during construction. All other vegetation that may interfere with the transmission lines will be cut, not cleared. No clearing, de-stumping, scalping or uprooting will be allowed on river or stream banks. A specialist will be appointed to assist in the identification of species whose growth form and rate may interfere with the lines to enable the selective removal of these species. Although there are not many alien invasive species occurring along the proposed routes, such a specialist would also be able to identify these species for removal.

No scalping shall be allowed on any part of the servitude unless absolutely necessary. All cleared vegetation shall be cut into manageable lengths and neatly stacked. No vegetation will be pushed into heaps or left lying around. Vegetation clearing at tower sites will be kept to a minimum. Large trees with well developed root systems will be cut and removed manually as removal with a bulldozer may damage soil structure. To prevent erosion, stumps should be left in place where possible. Where new growth may interfere with the lines, stumps will be treated with an approved herbicide. Any vegetation cleared at the tower sites should be removed or flattened not pushed into an embankment around the tower.

Areas around drum stations will need to be cleared as a firebreak. These areas should not be left to rehabilitate on their own but should be actively reseeded and revegetated. If these areas are badly damaged the possibility of fencing the area until suitable vegetation cover is achieved should be considered.

Endangered or protected plants shall not be removed unless they are interfering with the structure. Where such species have to be removed, the necessary permission and permits will be obtained from the relevant authorities. The appointed specialist will also have the necessary knowledge to identify such species.

13.4 Management of Cultural Impacts.

Objectives

- Protection of archaeological sites and land considered to be of cultural value.
- Protection of known sites against vandalism, destruction and theft.
- The preservation and appropriate management of new archaeological finds should these be uncovered during construction.

Some sections of the proposed transmission line routes are relatively rich in archaeological sites, particularly in the vicinity of the Limpopo River and near to Palapye. Any known site will be marked on the final profiles but, as it is difficult to survey the entire length of the lines in the required timeframe, not all sites will have been identified before construction commences. It is therefore recommended that an archaeologist is appointed to survey the final route ahead of the construction team. Any sites will thus be identified before they are disturbed and reported to the National Museum. Appropriate measures can then be taken. These may include protection of the site, relocation of any artefacts to the museum for preservation or simply recording and documenting the find. Local communities and residents should also be consulted in order to identify areas of cultural significance and possible grave sites as many of these sites are not obviously visible. The social impact of disturbing a grave site could be severe. The removal or destruction of any artefacts or historical structure shall be prohibited. As result of limited access during the assessment, it is recommended that an archaeologist be present during the bush clearing phase to provide guidance in terms of already identified cultural sites as well as to identify any additional archaeological or cultural sites of significance. It would be recommend that, in the event of transmission line pylons being situated closer to 15m from the Lotsane River, limited excavation focusing on section recordings precede pylon construction.

14 CLOSURE & REHABILITATION PLAN

14.1 Closure Objectives

The overall closure objective is to leave the transmission line corridors in a condition that minimises adverse impacts on the human and natural environment and with a legacy that makes a positive contribution to sustainable development (ERM, 2006). Although the MEP has a projected life of 40 years, the transmission lines may well be maintained for longer as a component of the larger southern Africa regional power grid. Detailed closure plans are therefore difficult to compile at this stage and it is recommended that once the final decommissioning plan for the lines is decided, the closure and rehabilitation plans are then detailed. Some general principles and guidelines for what will be considered during decommissioning are however listed below.

14.2 Closure Principles and Standards

The following main principles and standards will be applied to closure activities in terms of environmental and social aspects (ERM, 2006).

Principles

- Protect public health and safety.
- Comply with local, provincial and national regulatory requirements.
- Minimise socio-economic impact and retain the benefits that have accrued to the communities during project life as far as possible.
- Minimise impact to employees by providing assistance with the process of transfer, retrenchment, retraining and re-employment at closure.
- Mitigate contamination, if any, of surface and ground water, soil and air to an acceptable level of environmental and social quality so that the development potential of the area can be realised.
- Maintain or restore biodiversity at levels that are sustainable in the long term.

- Follow a process of closure that is progressive and integrated into the short and long term plans and that will assess the closure impacts proactively at regular intervals throughout project life.
- Effectively balance the financial constraints of maximising the return on shareholder investment and minimising future liabilities and risks.
- Follow a comprehensive consultation and communication process with all stakeholders and interested and affected parties to gain better understanding and participation.

Standards

- Active partnerships with local communities.
- The prevention, minimisation and mitigation of negative environmental impacts from operations.
- The careful planning and implementation of closure and post-closure.
- Increased host community ownership for post-operational outcomes.

14.3 Submission of Closure Plan

With respect to decommissioning and closure, BPC will be obliged to comply with the measures outlined in this document as well as those stipulated by the Department of Mines and Department of Environmental Affairs. The Departments may, at their discretion, stipulate that regular assessment reports and/ or a closure report be submitted as part of the EMP for the proposed activities.

14.4 Rehabilitation Programme for Construction Activities

14.4.1 Contractor's Camp

At construction topsoil is to be stripped from the site, and stockpiled adjacent to or around the camp perimeter, to facilitate replacement after the camp is de-commissioned, and vegetated. As this topsoil stripping will result in the exposure of the sub-soil, and could result in the formation of (a) localized depression(s), the site chosen for the camp needs to be on a gentle slope so that rain-water drains off the site and does not pond and remain on the site.

When the contractor's camp and yard is decommissioned and infrastructure removed at closure or when no longer required, the site will be ripped on contour, before the stockpiled topsoil is replaced over the site, and vegetation established.

All solid and liquid waste needs to be removed from site and disposed of in approved facilities. Any on site wastewater treatment facilities need to be rehabilitated adequately so as to remove the potential for future health risks.

14.4.2 Access Roads and Conveyor Routes

Prior to construction of access roads, the topsoil will be stripped and stockpiled as a flattened linear windrow to the side of the road, on the upstream side of the route, and vegetated, for later replacement over the route at closure. It will be necessary to ensure that the windrow does not totally impede surface flow or run-off water from catchment areas upstream (which would cause erosion of the windrow) Localized drainage lines or gaps will be left open strategically to allow drainage through the windrows.

At closure, the routes will then be ripped on contour (even if this means ripping across the direction of the route), and the stockpiled topsoil replaced by pushing it back onto the route. This will be followed by vegetation establishment.

14.5 Rehabilitation Guidelines & Principles

The following rehabilitation guidelines apply to any disturbed areas.

14.5.1 Soil stripping and Stockpiling

There are a number of basic principles that will be observed in regard to topsoil handling (Dawson, 2006):

- Strip and place soils when dry, and not when wet. Handling of wet soils increases the loss of soil structure.
- Minimize the amount of handling, as the more handling takes place, the more the soil's structure is deteriorated (and the sandy soils in the project area have very little structure to begin with).
- Avoid compaction of the soil, in situ, during handling, during storage and during placement, as again, compaction destroys soil structure.
- Stripping by means of excavator buckets, and loading on dump trucks, is preferable to stripping and loading by means of bowl-scrapers, even in sandy soils where bowl-scrapers might be an option (again, loss of soil structure is minimized).
- Restrict the height, preferable to below 1.5m, of topsoil stockpiles. High stockpiles result in compaction (due to placement as well as due to the mass of the stockpile), and a loss of

soil structure and aeration, and loss of the biological component (soil micro-organisms including bacteria, fungi and mycorrhizae, all of which carry out essential ecological processes) in the topsoil.

- Keep the length of the stockpiling period to a minimum, to minimize losses in soil quality (there will be some degree of soil quality deterioration when soil is stockpiled. However, stockpiled topsoil, albeit with some loss of quality, is always better for rehabilitation purposes than sub-soil or absence of soil).

- Vegetate the stockpile after formation, to reduce risk of soil loss due to erosion, prevent weed growth and to reinstitute the ecological processes within the soil.

The depth of soil to stripped as "topsoil" will be determined by evaluation of the soils on a site by site basis, but in practice should not be in excess of 30cm. Sub-soils below that depth will also be conserved, but will be separately stripped and stockpiled.

In principle, topsoil stockpiles will be extensive and low, rather than high with a minimized footprint. However, circumstances and cost and availability of land for stockpiling often result in stockpiling of soil under sub-optimal conditions.

An ideal stockpiling arrangement will be to stockpile as a layer one metre in height, spread over the required area. This type of stockpile can be achieved by tipping from dump trucks on the existing surface, with minimal levelling of the heap crests using an excavator, thus keeping compaction to a minimum. This stockpile, once vegetated, can still be used as grazing land, and thus does not result in sterilization of land in the same way that a five metre high stockpile with 1:2 slope gradients will do. This would be the most appropriate form of stockpile for soil which is to be stockpiled for extensive periods of time, such as the windrows alongside the access roads.

The height and compaction considerations are not as critical for sub-soil stockpiling, as they are for the storage of topsoil, where aeration needs to be maintained for the ecological processes (which differentiate topsoil from sub-soil) to continue.

14.5.2 Vegetation Establishment

Vegetation will be actively established on all topsoil stockpiles and rehabilitated areas.

Routine vegetation establishment (grassing) will be by means of hydroseeding (which presumes the availability of water of reasonable quality for the hydroseeding operations). Fertilizer applications will be determined from analysis of soil samples taken from the topsoil stockpiles prior to placement as the rehabilitation cover, but will generally be relatively low in Phosphate (P) and Potassium (K) levels so as not to alter the nutrient status of the rehabilitated areas too

much from the baseline levels. Relatively high applications of Nitrogen will, however, be required for initial establishment, due to the sandy soils and poor nutrient retention capacity of the soils. Typical fertilizer applications would be 500 kg / ha of 3:1:1 or 3:2:1 fertilizer.

From the flora assessment, only three of the commercially available grass species appear to occur in the project area, viz. *Digitaria eriantha*, *Panicum maximum* and *Cenchrus ciliaris.* These three species are all useful and sought-after rehabilitation grasses, and will be included in the hydroseeding mixture, along with *Eragrostis tef* as a temporary (annual) nurse crop.

In addition to the "routine" grassing component of vegetation establishment, it will be necessary to introduce woody vegetation cover in areas where extensive vegetation removal occurred as this will facilitate the re-establishment of the climax community that currently occurs along most of the proposed corridors. A program will be instituted whereby seed of suitable local species occurring in the area will be harvested and propagated in a suitable local nursery. Collection of seed and propagation of these local tree species will be developed into a viable local small business opportunity for a local resident with the necessary passion, who can be taught the required expertise.

14.6 Rehabilitation Costs

The costs for topsoil placement as part of the rehabilitation programme are "engineering costs", which will be included in the demolition / site closure costing considerations.

Costs for routine vegetation establishment (hydroseeding) will on average be of the order of R20,000.00 per hectare (R2.00 per square metre), inclusive of supply of all materials (assuming water to be a free issue), labour and equipment, and the necessary preparation work (surface scarification).

Costs for the woody plant establishment on the ash and discard dumps will be of the order of R40,000.00 per hectare, inclusive of the production costs of the plants, labour and equipment, and the necessary preparation work (ripping and hole digging).

15 MONITORING PLAN

Most of the impacts expected from the MEP transmission lines will occur during construction. As this is a relatively short lived activity, it will be difficult to implement monitoring plans that will indicate trends in the monitoring parameters. In order to determine the impact of construction baseline conditions have been established and described in chapter 8 of this report. It is then recommended that a minimum of two audits are conducted, one during construction and one on completion to compare the environment with the baseline. The contractor will then not be able to sign off the project until the agreed parameters for construction are met.

Once the transmission lines are in place, their impact on most of the surrounding environment will be minimal. There are however some conditions that will be affected during operations and for these monitoring plans need to implemented before construction begins and continued throughout the life of the project. The monitoring required relative to impacts from operation are detailed below.

15.1 Soil

The transmission lines will have no impact on soil during operation. In areas where compaction may have occurred, the success of vegetation establishment can be used as an indicator of adequate soil rehabilitation. Where disturbed areas were topsoiled and revegetated soil sampling should be conducted until such stage as the vegetation is established to the point where it is self sustaining. In these cases the following will apply:

- Measurement of soil depth on a regular basis ; most practical to measure when the vegetation monitoring is done. This can be carried out using a soil auger and will establish that the placing of topsoil has been done to the correct depth.
- Soil analyses to ensure that the fertility of the soil is correct for the vegetation being grown. This is also required to calculate the fertilizer required for the next season.
- Monitor movement and stability of topsoil stockpile.
- Monitor topsoil balance annually for volumes of soil.

Vegetation cover assessments, soil depth and soil fertility testing will be carried out as a combined operation annually, during the growing season and at least one month after rain has fallen.

Erosion assessments will be carried out in the rehabilitated areas to visually check for erosion channels. This will be done twice a year, during the summer growing season, and again after rain has fallen.

Where fresh erosion channels are found, indicating that active erosion is occurring, remediation work will need to be programmed to improve the vegetation cover or divert rain water runoff, as indicated by the specific site conditions.

15.2 Flora and Fauna

Vegetation monitoring will be done by calculating a Veld Condition Index. This score is calculated using the Ecological Index Method and the Veld Condition Index (VCI). A benchmark will then be selected from all relevés (sample plots) within a specific community by considering those relevés with the highest VCI. A Veld Condition Score will then be calculated for each plant community or sampling plot, using the mean VCI of the relevés in that community expressed as a percentage of the VCI of the relevant benchmark. The condition of a community will then be described (relative to each benchmark) as very poor, poor, fair, good and excellent.

The result of this calculation will be used within the computer programme GRAZE (Bredenkamp, 1998) to calculate the grazing or carrying capacity for each relevé. The end value of the Veld Condition Score will then be compared with the results of each years end results. These results will then be used to determine if the veld has improved or not. During the vegetation cover monitoring, the presence of invasive weeds will be monitored. An active programme of weed management, to control the presence and spread of invasive weeds, will need to be instituted, so that any weeds encroaching because of the disturbed conditions are controlled

The following vegetation monitoring plan is recommended:

- Sampling technique: the results of the Step point / Wheel point techniques will be used to compile a species list for each sampling site.

- Data analysis: the computer programme Graze will be used for data analysis, as well as to calculate the grazing capacity. This programme also takes other parameters into account, such as accessibility, average annual rainfall, grass cover, tree cover (if present), herb/forb cover and ecological classes of all grass species.

- Time of year: the rainy season will be the best time to do the survey as this is when vegetation, grasses and forbs, are actively growing. The months of January, February and March are recommended.

- Photographs: photographs of each sampling point will be taken at the same time of year, within the same direction and angle (markers will be set out to ensure the margins and angles of each photograph are correct).

- Points: using a GPS, the location of each relevé will be recorded so that the same point will be monitored each year.

- Management: management guidelines and recommendations will be made after each year's vegetation monitoring.

- The basal cover of the vegetation will be measured together with a species composition assessment as well as the biomass of representative sample plots

- As fauna is more transient in nature, it is more difficult to monitor in set sample plots for comparison as with the vegetation. Most of the transmission lines will traverse land where there is no access control, which also decreases the efficacy of fauna monitoring and the use of comparative data. The presence of animals or their spoor will however be noted and recorded. Invertebrate surveys will also be conducted together with the vegetation monitoring, which will provide an indication of eco-system health and assist in a biodiversity estimation.

- One of the more severe impacts anticipated with 400kV transmission lines, is that of collision related fatalities to birds. This should therefore be monitored on a regular basis. Personnel from BPC should conduct inspections of the lines at least on a monthly basis and record any bird fatalities. The assistance of bird interest groups and private landowners could also assist with this record. If the collected data indicate any sections of the lines having an unacceptable high rate of fatalities, bird warning mechanisms on these sections should be re-evaluated and adapted or improved accordingly. Regional bird counts by research groups or government departments should also be consulted to determine if there is any fluctuation in bird numbers.

16 SOCIAL AWARENESS AND INVESTMENT PLANS

16.1 Social and Environmental Awareness Plan

The purpose of a Social & Environmental Awareness Plan (SEAP) is to outline the methodology that will be used to inform the MEP's employees of any environmental risks which may result from their work and the manner in which the risks must be dealt with in order to avoid pollution or the degradation of the environment.

16.1.1 Communication Strategies

The communication of the environmental risks for each phase of the project will take place at local training centres with personnel from both the administrative and professional worker sectors.

Methods of communication for training include:

- One Day Workshops: Each environmental and social aspect and impact will be described as well as their significance. Risks associated with each aspect will be discussed to ensure that an understanding of how each action of the project may impact on the environment. The mitigation of the environmental risk will be elaborated on. It is important that each person understands these management strategies as it ensures that the impact on the environment is kept to a minimum. Data collection regarding each aspect will also be explained to ensure that each aspect is monitored according to those protocols specified by the EMP. Along with data collection the reporting of findings will be discussed.

- Full Day (or two day) Induction Course: To ensure that each person is aware of the environmental risks associated with the project. This induction will form part of the health and safety induction. This induction course will explain and describe the relevant phases of the project as well as those environmental risks that may occur during these phases.

- Theatrical Plays and Interactive Workshops: As a method of gaining an understanding of the relevant risks, a play or industrial theatre will be performed to explain lay issues and the employees will be encouraged to rehearse and act out a play of their own. These workshops will be conducted in English as well as one of the local languages and translators will be provided where necessary. The course will take place prior to construction, thus ensuring an understanding of the impacts the project may have.

16.2 Social and Environmental Management System Strategy

In order to meet the requirements of the IFC Performance Standard 1, the MEP is committed to the establishment and maintenance of a Social and Environmental Management System (SEMS). Such a system will incorporate management responsibilities for social and environmental aspects, engagement with workers and local communities, local government and regulators and put in place procedures for long-term monitoring and reporting on the effectiveness of the implemented risk management measures identified (ERM, DWA, 2006).

The establishment of a SEMS, which is appropriate to the size and nature of the MEP, will ensure continual improvement of the company's social and environmental performance throughout the lifecycle of the project. The findings of the ESIA and the results of consultation with affected communities will be used to establish and maintain a Management Programme. The management program establishes mitigation measures and performance improvement measures and actions that address the identified social and environmental risks and impacts of the MEP.

The establishment of a SEMS may be based on existing internationally accepted standards such as ISO14001:2004, although certification is not required by Performance Standard 1.

In order to meet the requirements of Performance Standard 1, the following elements will be incorporated into the management system:

- Formulation of appropriate Environmental and Social policy statements and relevant Objectives and Targets;
- Establishment of a Management Programme to achieve the objectives;
- Organisational capacity;
- Training;
- Community Engagement;
- Monitoring of the company's performance against the policies and objectives;
- Reporting on the company's social and environmental performance results; and
- Management review of the SEMS and adapting to ensure continuous improvement.

Subsequently, the negotiated mitigation options and management measures for the proposed MEP will be developed in the EMP, EMS, SDP, LED and SIP. The bulk of this work typically commences once a positive Record of Decision on the EIS has been passed and will also form part of the final ESIA report.

16.3 Land Acquisition and Compensation Plans

Land Acquisition and Involuntary Resettlement is addressed in the IFC Performance Standard 5. Although resettlement is always seen as a last resort, this Standard recognises that involuntary resettlement occurs as a result of projects and refers to both physical and economic displacement as a result of project related land use.

The IFC Performance Standard applies to physical or economic displacement resulting from the following types of land transactions:

- Type I: Land rights for a private sector project acquired through expropriation or other compulsory procedures.
- Type II: Land rights for a private sector project acquired through negotiated settlements with property owners or those with legal rights to land, including customary or traditional rights recognised or recognised under the laws of the country, if expropriation or other compulsory process would have resulted upon the failure of negotiation.

In the case of Type II transactions involving economic but not physical displacement of people, the MEP is required to develop procedures to offer the affected persons and communities' compensation and other assistance that meets the objectives of the Performance Standard.

In order to comply to the IFC Performance Standard, the MEP is required to identify and involve all owners in a process of negotiation and planning around compensation or the provision of alternative land (near to where people are currently located otherwise resettlement will be required). To this effect, compensation structures and plans will be required. This process will be complicated by the fact that many land owners and users are not resident within the affected villages in the Prospecting Lease and will need to be traced. A Resettlement Committee has begun investigating the process of land acquisition in Botswana and this process is expected to continue for some months.

16.4 Social Investment Plan

The MEP Social Investment Plan (SIP) will involve a strategic programme and action plans aimed at providing development opportunities and benefits to the affected local communities while adding value to the MEP in terms of the management of stakeholder relationships and the establishment of collaborative business ventures. Moreover, the SIP will aim to promote and actively support the long-term sustainable development of the local communities.

Exploring the roles and responsibilities of mutually beneficial partnerships in the sustainable development of settlements affected by the MEP will represent a critical challenge for the MEP.

Pooling of resources between government, business and community will represent a cost-effective approach towards local capacity building and sustainable local economic development.

The social impact studies propose an *opportunity assessment* approach that aims to identify and assess opportunities for community development in the areas and villages surrounding the proposed MEP operations. The purpose of the opportunity assessment is to consolidate relevant information into the MEP Social Investment Plan that will effectively address the priorities of the local communities concerned.

In addition, the establishment of an Economic Development Fund will be investigated for incorporation into the Social Investment Plan. The purpose of such a fund is to contribute to economic development in the local area through partnering with Government agencies, parastatals and NGOs to assist in achieving Government's objectives of economic diversification, poverty alleviation and employment creation.

Moreover, the MEP will proactively manage retrenchment and/or downscaling and decommissioning. Local Economic Development (LED) initiatives could contribute in this regard to poverty alleviation through building local capacity, undertake economic activity and connect job seekers with the wider economy.

In accordance with the aforementioned principles, the MEP will not 'take over' the responsibilities of district and/or local government in terms of the provision and maintenance of basic municipal infrastructure or community services such as schools, hospitals, clinics, safety and security (policing). Similarly the MEP will not support preferential treatment of private interest groups or individuals. Neither will the MEP support unsustainable community development projects or activities that may increase an unhealthy dependence on the MEP by local communities.

The MEP will, however, take full responsibility for the living conditions, well-being and behaviour of their workforce in terms of housing, living conditions, meals, transport, health, safety and security. Furthermore, the MEP operations will be securely fenced and policed so as to ensure the safety of its workforce and the local population (especially children), to combat crime and discourage informal settlement or unacceptable social behaviour on its premises.

The SIP will form an integral part of the Social Development Plan that will be formulated after consultation with lead stakeholders, and taking into account the implementation agreement with the Botswana Government, to define and effectively implement the MEP's social investment policy, and its contribution to local economic development.

Accordingly, the MEP will endeavour to establish sound working relationships and collaborative effort with local government and tribal administrations in key matters that are mutually beneficial. Areas of potential collaboration include the upgrading of particular roads, housing for MEP employees, employment of suitable local labour and training/skills development of the workforce.

Responsible business practice also extends to matters such as local business development through a demand responsive procurement policy that will favour local contractors and/or suppliers which qualify in terms of industry standards and procedures.

16.4.1 Demand-Responsive Impact Management

It is apparent that the effective management of social change resulting from the MEP will not materialise without a sound understanding of the local social and political dynamics and complex relations with extra-local economic networks and linkages in the project area:

The extent and nature of poverty [in Botswana] has a rural, female and youth face which need meaningful strategies to address the root causes of unequal access to and control of resources and opportunities as well as a review of gender and rural insensitive structural and macro-economic policies (SARDC, 2003).

A key principle underlying social impact assessment is not only to minimise or mitigate the negative impacts associated with development initiatives, but to simultaneously enhance positive impacts or opportunities to ensure durable net gains incorporating economic and social well-being.

It is pertinent for the MEP to ensure that community outreach and development programmes are responsive, demand-driven and relevant to the priorities of the intended beneficiaries. This requires a management strategy based on mutual learning and shared responsibility between stakeholders.

Exploring the roles and responsibilities of mutually beneficial partnerships in the sustainable development of communities affected by the MEP, represents a critical challenge for the MEP project management, local government and the affected communities.

Pooling of resources between government and business from a wide range of economic sectors, seems a cost-effective approach to local capacity building and sustainable local economic development. The basic approach taken in this section tracks the Opportunity Assessment Framework as presented by Chown and Hoffman (2003). This approach aims to identify and assess opportunities for community development in the areas surrounding mining operations.

16.4.2 Assessment Framework

As a first step the opportunity assessment approach proposes the formulation of a negotiated framework agreement between stakeholders in order to identify the roles and responsibilities of all the participants in the envisaged Sustainable Development Plan. This framework agreement is based on the following:

Supply-chain analysis

Undertake a supply chain analysis to identify the range of services and supplies required by the MEP. Assess the inventory of goods and services required in order to link community development potential to core business activities. The required services will be made public and the MEP should identify local skills, businesses and entrepreneurs to inform them of the project requirements.

Community enterprise development

Develop a Community Enterprise Programme (or similar initiative) to promote the funding and facilitation of capacity building and institutional development, education, assistance to community-based SMMEs, technical support, business development and community projects.

Aspects to be investigated include beneficiation, infrastructure support, labour-intensive production, investment in social wages of employees, and enterprise development in the affected communities.

Human resources development and training

In order to maximise local employment and diversification, skills development, equivalent to that of technical college certification, in mechanical, secretarial and construction trades are critical. This can be complemented by scholarships for training in occupational health and safety, community health, secretarial courses, computer training, bookkeeping and building skills.

16.4.3 Identification of Opportunities

The main objective of the opportunity assessment framework is to optimise the long-term benefits to local communities. This will include the identification of opportunities for LED to balance the dependence of workers and households on the MEP, with the medium and longer-term view to develop sustainable livelihoods, especially after closure. Such opportunities are identified and developed by giving consideration to:

- Direct project opportunities arising out of various mining project phases, from exploration to construction and rehabilitation. The project could use opportunities in terms of service provision, skills development, credit, and establishment of small enterprises to develop skills amongst local residents, which may be used in other locations once the project has come to an end.

- Procurement opportunities: These are linked to direct sourcing by giving preference to local suppliers, and the project requiring suppliers to employ a percentage of people from the local communities. The company could also assist in the training and development of smaller enterprises with the goal of developing skills and services that are marketable locally.

- New products and/or services based on the natural resource base in the area concerned: excess, unused or marginal land could be used for cultivation of high-value crops that create links to other industries, where markets exist.

- Market expansion and support should be assessed. Opportunities may exist for expansion of local capability to service existing and new markets. This requires that qualified local people receive technical and financial support (access to loans, small grants, business skills development, etc).

- Capacity development and institution building: Opportunities may exist to work with local government in establishing or strengthening local business associations or other institutions and projects aimed at fostering economic development. The baseline survey will identify geographical areas/projects for collaboration and provide information on resource requirements. It is vital that the company works with local institutions during the project's life cycle to enhance the sustainability of the development projects initiated.

- Social welfare services and infrastructure: Working with local government on projects that will help develop schooling systems, health care facilities and infrastructure, roads, water, sanitation, electricity and energy provision. Assessing the long-term sustainability of such capital-intensive projects, and linking them to income generating projects, is crucial to ensure that the infrastructure/services can be maintained post closure.

Finally, the purpose of the SIA, baseline studies and opportunity assessment is to consolidate the appropriate information into an MEP Social Investment Plan that will effectively address the needs and priorities of the affected households, vulnerable social groups and receiving/host communities. An effective Social Investment Plan will include the following outcomes:

- Establishment of new forms of economic activity

- Institution strengthening and capacity development

- Empowerment of women and vulnerable social groups
- Generation of essential infrastructure services and facilities, and
- Sub-regional financial spin-offs and associated multiplier effects

16.5 Economic Resettlement Framework

16.5.1 Introduction

It is proposed that the identification of **'affected people'** is primarily based on the recognition of rights and an assessment of risks as a result of the proposed development. Adversely affected people will be recognised as the first amongst project beneficiaries. The following sections aim to provide a framework for the development of a comprehensive and negotiated Resettlement Action Plan.

16.5.2 Information Requirements

Baseline studies form the basis of all resettlement planning as they provide the framework for designing sustainable programmes. Furthermore, costs, budgets, institutional arrangements, mitigation options and entitlement policies can be drawn up once baseline surveys are completed. Detailed baseline information is further required to identify and assess appropriate compensation packages.

Baseline surveys are required so as to undertake a census of **directly affected** persons (household and land asset registers) in terms of the following, to name only the most obvious:

- Residential structures: dwelling structures; store rooms; storage huts; multi-purpose structures; cooking screens; fencing, toilets; other out-buildings.
- Crop surveys: Valuation of agricultural land according to its (a) productive value**:** Assess agricultural fields; existing (standing) crops; root damage; fruit trees and vegetable gardens at official approved replacement valuation rates (grazing, arable, irrigated, fruit trees, orchards and vegetables).
- Natural resources: thatching grass; edible plants; fuel wood; water; sand; handcraft and building material; medicinal plants; game; fishing; etc.
- Livestock: Numbers; grazing; stock watering; fencing; Cattle-post; etc.
- Potential impact of, and compensation for, mining related subsidence.

16.5.3 Guidelines and Standards

Resettlement Action Plans require that the applicant adopts a set of guidelines clearly stating their policy towards resettlement, to give all parties concerned a common ground on which to base discussions and consultations. This is also critical to ensure that the social and environmental aspects of the project are given equal status to technical, economic and financial factors.

The Department of Lands "Compensation Guidelines for Tribal Areas" (April 2006) forms the base document for compensation in the MEP project area. The following internationally accepted standards and principles are proposed to develop a relocation plan according to international best practice:

- A comprehensive analysis of project alternatives should be undertaken to identify feasible development options while minimising resettlement.
- If unavoidable, resettlement actions should be conceived and executed as sustainable development programmes aimed at improving the quality of life of affected people, in addition to restoring their long-term livelihoods.
- Project-affected populations must be engaged in the early stages of project design to assess a range of options for improving their quality of life.
- Land-based strategies should receive preference for those displaced from their land, while productive potential and locational benefits of replacement land must be equal to, or better than existing land.
- The definition of replacement costs must reflect actual cost of replacement (as against pre-project market value) and should include compensation for loss of community structures, cultural resources and support networks.
- Recognition of rights and entitlements are ensured through mutually agreed and legally protected benefit-sharing mechanisms.

16.5.4 Resettlement Implementation

Resettlement implementation typically includes the following:

- Arrange for proclamation of moratorium on development in project area
- Notify affected people in advance in writing of assessment date
- Assist with requests for " leave" for those respondents formally employed

- Prepare photographic evidence, transport and translators
- Assess affected agricultural land/crops in the presence of the legal owner(s)
- Assess affected household's fixed improvements in presence of owner
- Establish a household register, asset register and agricultural land register

16.5.5 Determining Relocation Costs

Generally, relocation costs would include, but are not limited to:

- Structures and site improvements
- Land acquisition and negotiations
- Cost of transport to new site
- Cost of graves to be relocated
- Transitional support during the relocation process;
- Cost of crops, fruit trees, vegetable gardens,
- Cost of replacement land, for compensation to previous owner, and.
- Cost of preparing and establishing new fields, stock watering dams, etc.

Non-land based compensation options such as cash payments have been shown to be ineffective. Providing land equal to, or superior to, that appropriated must be the standard, given that market-based compensation values based on pre-project estimates often do not reflect the actual resource replacement cost. It is recommended that the calculation of compensation costs include the following standards and/or minimum guidelines:

Materials that can be salvaged (e.g. corrugated iron)	Should remain the property of owner and not be deducted from final compensation amount
Standing crops destroyed	Calculate value according to (a) value of lost crops and (b) financial & non-financial inputs of the affected farmer to the crops destroyed
Fruit trees lost	Should be replaced by saplings of same or acceptable species for each tree lost plus value of lost income/products from trees
Arable land acquired temporarily by project	Returned to owner/user in the same arable condition as before its use by the Contractor

Arable land permanently lost	Should be replaced with alternative land of equal or better quality at the designated host area
Grazing land acquired temporarily by project	Should be rehabilitated after use to ensure that grazing potential is not less than it was in the pre-project period
Grazing land permanently lost	Should be replaced by the provision of new grazing areas of equal or better quality at the designated host area
Graves	Should be treated in accordance with wishes of relatives of the deceased. All expenses incurred should be borne by the project. Grave relocation costs generally include: sacrificial beast, wake fee, exhumation, digging of new grave, coffin, reed mat, shroud, blanket, transport
Vegetable gardens	Should be replaced by either (a) an area of land the same size on the resettlement stand, including the provision of appropriately determined amounts of fertilizer and seeds; (b) food plot in the proposed community garden, including provision of appropriately determined amounts of fertilizer and seeds. Households should receive a cash payment for vegetable gardens
Maize compensation/food support	Emergency food rations to meet nutritional requirements during the resettlement process
Relocation site	Land acquisition and consideration of alternatives Land must be evaluated, purchased and prepared for relocation
Immovable farming infrastructure located on land permanently or temporarily acquired by the project	Must be replaced at new sites acceptable to the affected population, or compensated at full replacement cost. (e.g. dipping tanks, fences, water pumps, irrigation channels/pipes, weirs)
Pumps	Affected individuals and farmers associations should be compensated for labour cost to remove & reinstall items
Community buildings	Must be rebuilt, or compensated for, in consultation with relevant authorities and affected communities (resettled and host) (e.g. clinics and schools)
New residential stands	Developer will provide new residential stands to affected households at no cost to these households
Process	Consulting costs for those overseeing relocation process
Pit latrines/sewerage systems	Improved latrines should be provided at all resettlement stands
House connections: water electricity	Should be supplied to those households that currently have them
Compensation for rent lost	Should be supplied to those provide rooms, etc for rent

Providing a realistic cost estimate in terms of resettlement and compensation costs requires ground-truthing and follow-up baseline studies. The costs per household and crops, however, could vary considerably depending on the kind of dwelling structures, livestock numbers and

crops grown; while the cost of land for resettlement is dependent on the area concerned, i.e. state, tribal or freehold.

In terms of the management, mitigation and/or compensation of project related impacts, it is pertinent that all measures comply with international and country-specific laws, regulations or standards, especially with reference to productive resources, pollution, health, safety and security. The following procedures with regard to resettlement and compensation are anticipated:

- The management of resettlement and compensation issues will be preceded by comprehensive and detailed planning, after proper consultation with the affected population, and in full collaboration with the relevant government departments and regulatory authorities (district and sub-district authorities, tribal office, chiefs, headmen, councillors, and land board concerned).

- Where resettlement is unavoidable, the Botswana Compensation Act and the Compensation Guidelines for Tribal Areas (2006) will be applied as a minimum standard. The Land Board concerned will appoint an assessment committee to establish eligibility of claimant, nature of compensation, as well as any technical support and assistance required for re-establishment).

- Compensation assessment will incorporate all assets, site improvements, equipment, boreholes, crops, loss of access to land and water, other natural resources, and services/facilities. The assessment will be implemented after compiling the necessary surveys, asset inventories and/or land registers in collaboration with affected parties and government departments concerned.

- Compensation for land under freehold will be at market value, in line with the Botswana Compensation Act, and will be based on the 'willing buyer-willing seller' principle. Where no agreement can be reached, the land may be expropriated in terms of the above Act.

- If required a negotiated and comprehensive ***Resettlement Action Plan*** will be formulated to define principles, policies, procedures and rights regarding resettlement. All parties directly affected by resettlement and compensation actions will have access to grievance mechanisms and legal recourse.

Any new development that takes place as part of a compensation/resettlement plan must be undertaken according to best practice - including environmentally sensitive design and construction that take the particular needs and limits of the natural areas into account (solar energy and water storage tanks). The potential risk issues listed below will be reviewed and updated on an on-going basis:

ISSUE	RISK
Resettlement cost per household	Refusal/reluctance to move. Will require incentives & a range of appropriate compensation packages
Acquisition of replacement land Buy-out of private farms (freehold)	No willing buyer-willing seller [dead-lock] Land scarcity or lower production potential; Conflict between villages; farmers & authorities
Replacement of boreholes, water points, site improvements, fencing, crops, etc	Resistance/reluctance to move may cause delays
Replacement of community services, facilities, infrastructure, such as tertiary road network	Replacement not realistic in certain cases –may have to relocate cattle-post(s)
Implementation of Resettlement Action Plan	Require negotiation forum, surveys, compensation packages & negotiated agreement
Implementation of Social Investment Plan	Require liaison and lengthy negotiations, planning and public/private agreements
Skills development and training for staff	Role/function and responsibilities of CIC, PI
Contingency	Cost escalations

16.6 Indigenous Peoples Plan

Botswana does not have a statutory definition of "indigenous peoples" and is not a party to the United Nations Indigenous and Tribal Peoples Convention, 1998. The concept of "indigenous peoples" is not acknowledged in Botswana, the argument being that every Motswana (people of Botswana) is indigenous. The culture and the language of the dominant Tswana people have however become the dominant symbols for Botswana as a nation (ERM, DWA, 2006).

In terms of Indigenous Peoples a number of individuals have been identified in the area but are mainly inward migrants living on cattle posts. Indigenous peoples therefore exist as dispersed individuals rather than in communities. The preparation of an Indigenous Peoples Development Plan is not warranted.

16.7 Community Health and Safety Action Plan

The evaluation of Community Health, Safety & Security is requirement of the IFC Performance Standard 4.

The MEP will evaluate the risks and impacts to the health and safety of the affected communities during the ESIA process and will establish preventative measures to address them in a manner

commensurate with the identified risks and impacts. The ESIA process includes a community health baseline study to establish the current health status of the potentially affected communities. Consultations with regulatory agencies local government and community representatives form an integral part of the baseline study. Once the baseline studies are complete and the impacts on the health and safety of the affected communities identified and assessed during the ESIA process, the MEP will compile a Community Health and Safety Action Plan to provide measures to mitigate unavoidable impacts.

Where project activities pose risks of adverse impacts on the health and safety of affected communities, the MEP will make available the details of an appropriate Action Plan, in an appropriate form, to affected parties and government authorities so that they can fully understand the nature and extent of the risks as well as an understanding of the actions to be taken to address these anticipated impacts.

The Action Plan will also be required to prevent or minimise transmission of communicable diseases that may be associated with the influx of temporary or permanent project labour such as the spread of sexually transmitted diseases (e.g. Chlamydia, Syphilis, HIV/AIDS and Gonorrhoea).

The MEP will therefore be required to establish an HIV/AIDS policy and implement an HIV/AIDS programme, which is focused on the reduction of the number of new HIV infections through HIV/AIDS awareness, peer education and condom distribution initiatives and the reduction of the AIDS related deaths with the promotion of HIV testing.

16.8 Occupational Health and Safety Plan

The MEP will develop and implement an Occupational Health and Safety Management System (OHSMS) to facilitate the continual improvement of its occupational health and safety management performance during the lifecycle of the project. Such an OHSMS will either be operated as a stand alone system or integrated with the overall Social and Environmental Management System (SEMS) as required in Performance Standard 1.

This OHSMS will also be applicable to contracted workers and to any other workers who provide project related services on the developer's premises or work sites. Contract specification for contractors will include provisions that meet the MEP's OHS requirements.

Occupational Health and Safety Requirements relevant to industries are found in the following titles of principle national laws and/or regulations in Botswana (DRA, 2006):

- Employment Act, 1982 [No. 29 of 1982];

- Employment (Labour Health Areas) Regulations 1984. No. 157.
- The Factories Act 1973 [No. 31 of 1973];
- Factories (Notification of Industrial Diseases) Regulations, 1974. No. 54.
- Factories (Prescribed Forms) Regulations, 1974. No. 56
- Factories (Notification of Accidents and Dangerous Occurrences) Regulations, 1974. No. 49.
- Factories (Electricity) Regulations 1974. No. 44.
- Factories (Sanitary Accommodations) Regulations 1974. No. 46.
- Factories (First-aid Equipment) Regulations 1974. No. 47.
- Factories (Building Operations and Works of Engineering Construction) (Safety and Health) Regulations 1974. No. 48.
- Mines, Quarries, Works and Machinery Act, Chapter 44:02 (as amended to 06-09-1999);
- Mines, Quarries, Works and Machinery Regulations 1978. No. 127, and
- Explosives Act, Chapter 24:02 (as amended to 06-09-1999).

The Acts, however, do not apply to all places of employment. Activities such as transport, retail, and office work are not covered under The Factories Act and the Mines, Quarries, Works and Machinery Act. The Factories Act applies only to Factories, which are defined as any premises in which persons are employed in manual labour for the purposes that are listed in the Act. The Mines, Quarries, Works and Machinery Act apply only to mines, quarries, works or machinery as defined in the Act.

All contractors will be required to comply with the provisions of this document, which will form part of the General Conditions of Contract.

Where any aspect of Safety, Health, Environment and Security is not governed by the OHSMS document and aspects of those conditions require amendment to meet the needs of the project, then revised guidelines shall be evolved in consultation between the contractors and the engineer. These revised guidelines shall comply with the standards of uniformity and consistency required by the engineer, taking cognizance of the overall circumstances on the Project.

- CIC Energy Corporation and BPC confirms that it is committed to high standards of health, safety and environmental. These standards will be implemented and maintained on the site for the protection and well being of all employees, contractors, service providers and visitors.

- Contractors, Subcontractors and Service Providers therefore agree to approach health and safety matters in strict adherence to health and safety legislation and the policies and procedures of the appointed Engineer.

- All employees employed on the Mmamabula Project shall complete a medical prior to undergoing induction, as well as at termination of employment. An Occupational Medical Practitioner approved and appointed by CIC Energy Corporation, will perform medical examinations, and the cost will be for the Contractor's account.

17 TRAINING AND COMMUNICATION PLANS

17.1 Communication Strategy and Recruitment Plan

The MEP will need to put in place, as part of its recruitment strategy, a communication plan that provides realistic information about the types of skills required and number of jobs available for the MEP.

The communication strategy and recruitment plan shall provide information on employment opportunities to people both in the local area and nationally.

This plan should be applicable to both construction and operations phases and contractors shall be required to conform to this plan.

The Recruitment Plan will be developed to ensure that:

- Employment opportunities and associated skills requirements will be well advertised locally and recruitment centres will be easily accessible to the local population. This must be done in a timely manner to allow potential recruits to receive the necessary training;
- a recruitment principle of hiring first from one of the directly affected communities, then the Central District, then Botswana, will be applied, against clear criteria;
- training priorities are identified early and pre-employment training is begun as soon as possible;
- the requirement for maximising local employment will be written into the contractors' contracts and made binding;
- a skills audit of the villages in the project area will be conducted and details kept on register for use by the project;
- a register of casual employees from the project area will be kept and referred to when casual labour is required; and
- there will be no requirement for applicants to make payments for applying for, or securing, employment on the project.

17.2 Social & Labour Development Plan

It is the official policy of the Government to encourage foreign firms to hire qualified Botswana nationals rather than expatriates. The granting of work permits to expatriates can in some instances be made contingent upon a training and localization plan that specifies activities to be undertaken to train a citizen replacement for the position. The Government has in the past recognized that the shortage of technical and managerial job skills among the general population necessitates the import of expatriate labour and generally grants work permits for positions which cannot be filled by an appropriately trained Botswana citizen or for which the company requires job-specific training. After the start-up period, however, the Government typically requires evidence that a citizen is being trained to assume some of the expatriate positions, particularly at the middle-management level, on a permanent basis (ERM, DWA, 2006).

The MEP will therefore be required to meet legislative requirements around the training and employment of locals to fill the positions of those initially filled by expatriates. This will be facilitated through the development of a Training and Localisation Plan for training locals to transfer skills and employment from expatriates to locals after a certain period of time.

The Training and Localisation Plan should maximise opportunities for employing locally and invest in skills development from as early in the project life cycle as possible. The plan should therefore start with construction workers and then move on to operational staff.

The MEP will implement a process to select and retain appropriately skilled construction employees for the operation phase of the Project. Appropriate candidates should be identified during construction and trained accordingly in sufficient time to be employed during operation.

Upon operation, the MEP will develop and implement an internal skills development and training programme for all employees. This will ensure that all employees are given the opportunity to enhance their skills, with the potential for career progression. Training must include environmental, health and safety training in order to address the specific measures and actions required in respect of the SEIA and in particular the Management Plans and Action Plans and the methods required to perform the action items in a competent and efficient manner.

The MEP will work with government departments and agencies involved in skills improvement, auditing and monitoring to achieve objectives through an integrated process and assist in capacity building.

The Social and Labour Development Plan will be developed and implemented, incorporating a nationally required Training and Localisation Plan for training of locals after start-up to transfer skills and employment from expatriates to locals after a certain length of time. The Social and Labour Development Plan will include the following components:

- Skills Development and Training Plan;
- Career Progression Plan;
- Mentorship Plan; and
- Internship and Bursary Plan;

The Social and Labour Development Plan will ensure that the company complies with the national laws of Botswana, including the Trade Unions and Employers Organisations.

17.2.1 Skills Development and Training Plan

The Skills Development Plan will be part of a broader Human Resources Programme, and will ensure that:

- Training priorities are identified as early on as possible;
- Appropriate local candidates identified during construction are trained and employed during construction;
- Training plans will be developed according to each permanent employee' work agreement and relevant to their job description;
- A certificate of employment will be offered to each employee at the conclusion of successful employment on the project;

In order to implement this strategy, CIC will develop relationships with vocational/ training institutions to develop courses and training programmes that exactly meet the project requirements. This will be done in association with the Brigades, and will include institutions such as the Brigades (present in Serowe and Mahalapye) Vocational Training Centres (VTCs), Government Colleges and Private Institutions to ensure that the correct level and type of training are provided. A particular focus will also be placed on Botswana's second university which is being established in Palapye, targeted to open in 2008 and focusing on science and technology. CIC will identify tertiary training opportunities that can be taught at this university, and provide certified training to employees at the MEP.

CIC will also invest in training and education needs in the local area as part of the Social Development Plan.

17.2.2 Business Development Programme

The Business Development Programme will be a component of the Social Development Programme focussing in particular on the development of businesses in the area, from micro enterprises focussing on the poor and vulnerable, to larger scale opportunities for enterprising individuals with existing skills in business management.

Consultation with businesses and business development institutions (governmental, quasi-governmental and private) identified a number of organisations that CIC could work with in order to encourage sustainable economic development in the area. CIC will explore ways of working with these organisations, including:

- Small Business Promotion Agency (SBPA);
- Rural Industries Promotions Company (RIPCO);
- Citizen Entrepreneurial Development Agency (CEDA);
- The Botswana Confederation of Commerce, Industry and Manpower (BOCCIM);
- Women's Finance House;
- United Nations Development Programme Botswana (UNDP);
- Action for Economic Empowerment Trust (AEET);
- Local Enterprise Authority (LEA); and
- Exporter's Association of Botswana (EAB)

CIC will support existing business development/ training centres as part of the Social Development Programme. These will include a number of business training activities, such as how to respond to an invitation to tender, writing a proposal, meeting quality requirements, business management skills, managing budgets, recruitment etc. They will also consider the provision of space for business incubators and the development or expansion of existing businesses.

The implementation of these plans and optimisation measures will improve the significance of the impacts generated by ensuring that development is sustainable and permanent, while ensuring that vulnerable groups within the communities are looked after. They will enhance the capacity of the communities to maximise opportunities made available to them through the project.

17.2.3 National/ Local Content Strategy

CIC will address the impact of upliftment of the local economy through the development and implementation of a Local/ National Content Strategy. This will ensure that procurement of goods and services from Botswana is maximised and prioritised over goods and services from other countries.

CIC will maximise opportunities for procuring locally and invest in business development from as early as possible in the project life cycle. This will include some or all of the following optimisation measures:

- Dissemination of information regarding procurement opportunities as early as possible and holding of forums/ seminars/workshops with local businesses about procurement requirements;
- Development of a supplier training programme to enhance the capacity of existing suppliers;
- Unbundling of certain contracts to allow a number of small businesses to provide goods and services rather than the supply being monopolised by one large (foreign) contractor.

17.3 Workforce Management Plan

The MEP will adopt a Human Resource Policy appropriate to its size and workforce that sets out its approach to managing employees consistent with the requirements of this Performance Standard.

The MEP will provide all employees with information regarding their rights under the Botswana national labour and employment laws, including the rights to wages and benefits. These laws include the Employment Chapter 47:01, the Employment of Non-Citizens Chapter 47:02; Factories Chapter 44:01; Trade Disputes Chapter 48:02; Workers Compensation Chapter; Trade Unions and Employers Organisations Chapter 48:01.

The MEP will document and communicate to all employees and workers directly contracted by them their working conditions and terms of employment, including their entitlement to wages and benefits. MEP will also be required to provide terms of employment to all employees of the Mmamabula Energy Project which at a minimum comply with the requirements of the Employment Act of 1982 of Botswana as amended. The Employment Act lays down minimum conditions of employment for employees, whether citizen or expatriate, employed in the private sector. Terms of employment such as working hours, shift work, overtime, rest periods, paid public holidays, paid leave, paid sick leave, maternity leave, minimum wages, employment

records, register of casual employees, probation, notice, suspension and termination, and repatriation listed below will be complied with (ERM, DWA, 2006).

All expatriate employees will be required to be in possession of a valid work permit as required in terms of Employment of Non-Citizens Act - CAP 47:02.

17.4 Procurement Progression Plan

The MEP should maximise opportunities for procuring locally and invest in business development from as early as possible in the project life cycle.

Procurement of goods and services and development of the supply chain will result in increased business experience, training and skills. However, the current capacity of local business in Botswana is currently limited and will mainly feed into the supply chain through the provision of non-technical goods and services. Tapping into and enhancing local input into the supply chain will assist in decreasing costs to the MEP. Failure to optimise local input may lead to reputation risk as expectations are not met and the basic tenets of the IFC Performance Standards in terms of enhancing beneficial impacts are not met (ERM, DWA, 2006).

The MEP will therefore develop a Procurement Progression Plan which establishes a programme for training businesses and unbundling of certain contracts, thereby increasing local procurement in the supply chain. This will be done in partnership with agencies and private sector organisations (eg Debswana).

18 WASTE & RISK MANAGEMENT PLAN

18.1 Waste Management Plan

The basic concept of the WMP will be to minimize the generation of hazardous and non-hazardous waste materials as far as practicable. Where waste generation cannot be avoided but can be minimized, wastes will be recovered and reused. Where this is not possible the wastes should be treated, destroyed or disposed in an environmentally sound manner. If the material is considered hazardous, as defined under local legislation or international conventions, commercially reasonable alternatives will be considered for its environmentally sound disposal.

A waste management plan (WMP) will be developed to address the wastes and hazardous materials aspects of the General Requirements of IFC Performance Standard 3, Pollution Prevention and Abatement. This will be done in accordance with Botswana regulatory requirements, the requirements of the World Bank Pollution Prevention and Abatement Handbook (PPAH) and IFC Guidelines for Hazardous Waste Management. A separate WMP will be required for the mine and power plant as each facility will generate and dispose of waste is different manners.

The current assumption being used for waste management is that all hazardous wastes will be transferred by road to a licensed facility in South Africa using Botswana/South African licensed carriers. This is understood to include any substance listed as a hazardous substance according to the PPAH. As the quantity of waste anticipated during construction is expected to be low, the existing facilities in towns and villages along the proposed routes should suffice.

Should transboundary or offsite disposal of wastes be considered then this will need to be done via licensed operators to approved facilities. The design and management of these facilities will need to be reviewed to ensure compliance with best international practice.

WMPs will need to be submitted by EPC contractors for approval prior to construction to ensure they meet the requirement of Equator Principles and subsequently MEP will need to prepare WMPs for the operational phase again to meet the requirements of Equator Principles. Specifically, Equator Principles require the following inputs for the construction and operation phases of the project for preparation of the WMPs:

- a listing of all chemicals and materials to be used, including manifestos and estimated quantities;

- details of transportation, storage and disposal for all wastes;
- an estimate of domestic and hazardous wastes to be generated;
- details of effluent, sewage and waste water treatment and disposal facilities;
- details of chemical tests conducted on coal and ash; and
- details of landfill designs, incinerators and stockpiles including soil data, geotechnical data and depth to water table.

18.2 Quantitative Risk Assessment, HAZOP

In order to meet the criteria set out in this Performance Standard the MEP will undertake a detailed Hazard and Operability Study (HAZOP) for the entire Mmamabula Energy Project. The aim of the HAZOP Study includes the identification of significant hazards and risks associated with the project as a whole which may arise from materials, environmental or working conditions or work processes and establishing the appropriate occupational health and safety practices to eliminate or minimise risks to workers.

Where hazards cannot be eliminated the MEP will provide appropriate personal protective equipment (PPE) at no cost to the worker.

19 PROPOSED TIMETABLE, DURATION AND SEQUENCE

19.1 Start and Duration of Transmission Period

The 66kV transmission lines will need to be in place to supply power for construction and commissioning and construction will therefore begin immediately all relative approvals are obtained. Once the power plant is commissioned, these lines will remain for local electricity distribution.

The 400kV lines will be required for exporting power when the power plant is commissioned and will therefore need to be complete at that time. Construction of these lines will therefore commence with the rest of the project. Planning at this stage indicated that these lines will remain as a component of the regional power grid after the power plant is decommissioned.

Table 19.1: MEP Implementation Phase

Project Implementation Phase	***Expected Commencement Date***	***Expected Completion Date***
Construction 66kV	Late 2007	2008
Construction 400kV	Late 2008	2009
Operation	From 2011	2050
Decommissioning	Not determined	2060

20 CONCLUSION

The transmission lines are an essential component of the MEP as they will enable the export of power from the proposed Mmamabula power plant. During the EIA process, various specialists assessed the impacts of the proposed 400kV lines running both north to Selebi Phikwe, south to the proposed Mosaditshweni sub-station as well as east to the Limpopo River and the South African border. Two route alternatives were considered for the north south route, of which the route running adjacent to the existing 220kV lines was considered preferable due to less anticipated environmental and social impacts associated with this alignment. Four route alternatives with a fifth river crossing were considered for the lines travelling east. Although certain consideration for these alternatives will have to be taken into account together with those on the South African side of the border, at this stage no preferred route has been identified.

No fatal flaws were identified by any of the specialist for the project and the recommendation from the EIA team is that the project can proceed. A number of impacts are, however, anticipated for the project, which will require mitigation to minimise the impacts. It is therefore critical that the measures described in the EMP are strictly adhered to and a profile specific EMP is compiled once the profile design is available.

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