Report Quality Verification

<table>
<thead>
<tr>
<th>Title:</th>
<th>EIA of the Morupule Colliery Expansion Project</th>
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</thead>
<tbody>
<tr>
<td>Project Number:</td>
<td>enquiry no: MOR – E51030</td>
</tr>
<tr>
<td>Date of Report:</td>
<td>October 2008</td>
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</tbody>
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Prepared By:
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Client: Debswana Diamond Company (Pty) Ltd and Morupule Colliery

Commissioned by:

<table>
<thead>
<tr>
<th>Members of the Consulting Team:</th>
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<tr>
<td>I. Kgololo</td>
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<td>D. Parry</td>
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<td>M. Muzila</td>
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<td>A. Pheiffer</td>
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<td>P. Modikwa</td>
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<td>F. van Heerden</td>
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<td>M. Konopo</td>
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<th>Contact Person:</th>
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<tr>
<td>I. Kgololo</td>
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<th>Client Contact Person:</th>
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<tr>
<td>Craig Robertson Debswana</td>
</tr>
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</tr>
</tbody>
</table>

Comments:
The EIA addressed both phase 1 and 2 i.e. 4-12 Mtpa coal abstraction with emphasis on Phase 1, the 4 Mtpa abstraction

Quality Verification:
Within the context of the above comments, this report meets the agreed scope of work and quality standard.

<table>
<thead>
<tr>
<th>Name and Capacity</th>
<th>Signature</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>D. Parry (Director)</td>
<td>![Signature]</td>
<td>30th October 2008</td>
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EXECUTIVE SUMMARY

Introduction

This Environmental Impact Statement (EIS) presents the results of the Environmental Impact Assessment (EIA) for the proposed Morupule Colliery Expansion Project at the Morupule Colliery in Palapye.

The EIS will be submitted to the Department of Environmental Affairs (DEA) the EIA authority, for review and approval. The study was initiated by Morupule Colliery Limited (MCL), the owner of the colliery, and was conducted by Ecosurv (Pty) Ltd.

The key objectives of the EIA are to:

- examine the environmental and social character of the area that is likely to be affected by the project or development;
- identify and evaluate the direct and indirect impacts resulting from the development;
- identify and describe measures that will mitigate the identified negative impacts and enhance the positive ones;
- develop an Environmental Management Plan (EMP) and monitoring and auditing requirements; and
- identify costs relating to closure of the colliery and the new infrastructure.

Project Background

MCL, a subsidiary of Debswana Diamond Company (Pty) Ltd has been operating a coal mine since 1973 and is currently producing approximately 1 million tonnes of coal per annum. The coalfield within the mining lease area is immense and contains good quality coal, with the estimated overall coal presence exceeding 5 billion tonnes.

The Botswana Power Corporation (BPC), which operates a coal-fired power station nearby, has been the main consumer of the MCL coal.

The colliery now proposes to expand its coal production from 1 million tonnes per annum to 4 million tonnes per annum in phase one and 12 Mtpa in phase two. The purpose of this expansion is to:

- cater for an increase in power generating capacity at the BPC coal-fired power station site at Morupule. The power increase is expected to be 600 megawatts (MW) for Phase 1 and 600 MW for Phase 2, together with the current 132 MW of generating capacity.
- produce beneficiated coal that has been processed through washing plants, for the local coal market and for export.
- produce unbeneficiated coal of power station grade coal for supply to existing and new customers.

The colliery has been given the authority by the BPC board to proceed with the planning and preparations aimed at ensuring adequate supply of coal to generate 600 MW for the Phase 1 expansion of the power station and the current 132 MW. Confirmation from BPC for the second phase is still pending.

Proposed Activities

Activities planned for the proposed expansion project (described in detailed in Section 3) include:
• **Phase 1**: Four million tonnes per annum (Mtpa) mining from existing shaft, replacement of the surface screening and crushing facilities at the existing location, and construction of new workshops and offices and 20 housing units at Morupule Village; and

• **Phase 2**: Twelve Mtpa mining from a new shaft some 4.5 km to the North of the existing shaft, and replacement of the coal wash plant.

The pre-feasibility study for Phase 1 has been completed, while the study for Phase 2 is ongoing. Construction of Phase 1 and Phase 2 will commence in 2011 and 2012 respectively and will each take three years. The operational life of each phase is twenty years.

Existing environmental certification and archaeological studies are:

• a situation analysis, EMP and closure plan have been prepared for the current mine shaft and its associated operations. No further EIA activity is envisaged for the existing operation. An archaeological impact assessment has been approved and salvage archaeology completed for the initial mine lease area and the first extension (to cover the surface area above the current mining area);

• separate EIAs have been carried out for the proposed pipeline connection to the North-South Carrier (NSC) and for the existing coal wash plant. These have been approved by DEA.

The colliery has applied for and received an extension to the lease area which covers the coal deposits as far as Serowe. The geographic scope of this EIA and AIA activity will be the surface area above the proposed expansion of coal abstraction activities. Within the proposed expansion area, there will be sections affected by clearing and excavation, access routes and utilities. The rest of the area will remain unchanged.

*Compensation and Resettlement*

A number of households reside within the colliery’s mining lease area. The colliery is planning to compensate and request all people who live within the 20-year mining lease area to move in the long-term. Compensation is required as the Land Board cannot give MCL the surface rights if the previous owners have not been compensated. This process is ongoing.

*Location*

The Morupule Colliery is located in the Central District of Botswana approximately 300 km north of the capital city, Gaborone, and some twelve kilometres north-west of Palapye towards Serowe.

*Approach and Methodology*

The process of assessing the impacts of the project encompasses the following: impact identification, impact prediction of their nature, magnitude, extent and duration, identification of mitigation measures that could be implemented to reduce the severity or significance of the impacts of the activity and evaluation of the significance of the impacts after mitigation measures have been implemented i.e. the significance of the residual impacts.

The main areas of impacts were identified during the scoping phase through site visits, consultations and literature review. During the EIA study the impact were further investigated through specialists’ studies.

The significance of the impact was determined as follows:

Significance = Consequence (Extent x Intensity x Duration) x Probability.

The result of the assessment of the significance of the residual impacts (Low, Medium, High) is linked to decision-making by authorities in the following manner:
• Low – will not have an influence on the decision to proceed with the proposed project, provided that recommended mitigation measures to mitigate impacts are implemented;

• Medium – should not influence the decision to proceed with the proposed project, provided that recommended measures to mitigate impacts are implemented; and

• High – would strongly influence the decision to proceed with the proposed project.

**Environmental Setting**

The project area experiences average annual temperatures between 30 °C and 14 °C. Mean annual precipitation is 371 mm with the majority of rainfall received between November and March. Potential evapotranspiration is in the order of 900 – 1,200 mm/year (WSB, 2007), which is two to three times the average annual rainfall. The dominant winds are north easterly with an average wind speed of 3 m/s.

**Air Quality**

Air quality around the colliery is affected by dust from coal screening, stockpiling and loading. The air quality is also influenced by emissions from the neighbouring Morupule Power Station in the form of ash, sulphur dioxide (SO_2) and other particles. The results of the coal dust monitoring from samples taken above surface exceed the World Bank Group limits for ambient air quality. Monitoring of methane has shown zero gas content. The output may increase as the depth of the seam increases.

**Noise**

Noise levels in Palapye Village are high and are typical of an urban complex. The existing noise climate alongside the main roads in Palapye is degraded with regard to acceptable urban residential living standards (SANS 10103 noise impact criteria). In general the daytime conditions are acceptable (SANS 10103).

The impact of the Morupule colliery on noise sensitive sites in the surrounding area is relatively minor. Noise levels from the colliery exceed 35 decibel adjusted (dBA), the maximum allowable night-time level for rural residential use, for up to a distance of about 2,600 m from the facility. Seven homesteads lie within this area of influence. The colliery village lies just outside this zone and is thus not impacted by the colliery noise.

**Topography**

The area is in general flat with the main landscape variation being that of the Tswapong hills which lie roughly 12 km south-east of the existing mining site. A number of small outcrops exist within the lease to the north. The Colliery village is situated between two of these outcrops. The Kalahari escarpment lies to the west of the lease area. The lease area is drained eastwards by the Morupule and the Lotsane rivers.

**Soils**

Soils in the area consist of an Aeolian layer of sand of between 2 and 9 m deep, averaging around 5.5 m, which overlays a band of ferrocrete/calcrete. Siltstones are found below the ferrocrete. This soil setting means that the soils are moderately to highly vulnerable to groundwater pollution.

**Geology**

The area is situated on the Karoo Supergroup and the Palapye Group. The coal seam is up to 17 m thick and at present only the lower section is mined as it is of higher quality than the rest.
of the coal seam. The coal seam dips south-east, thus mine depth will increase as mining continues unless the shallower coal is abstracted through open cast mining.

**Hydrogeology**

The main aquifer units in the area are the quartzitic members of the Tswapong Formation from which the Palapye Wellfield boreholes (east of the village) abstract water. The mine operates a small wellfield to the south of the mine on the margins of the Lotsane River. The wellfield area (the Phuduhudu Wellfield) taps the contact zone between the Tswapong and Dwyka Formations. The Tswapong Formation in the Palapye Wellfield area east of the village provides quite reasonable (albeit very variable) yields ranging from almost nothing to 30+ m$^3$/hr. However, the thickness of this unit close to the colliery is not large (a few tens of metres), is unconfined and is distant from the obvious recharge area in the Tswapong Hills.

The major coal seams are below groundwater level. The present mining takes place at a depth of 80 - 90 metres below ground level (mbgl). However, few seepage problems have been recorded by the mine. As the mine expands there would be an increase in the potential for groundwater to enter via seepages. Several private boreholes exist in and close to the expansion area. There is therefore the possibility that water levels in these boreholes may be impacted by mining below groundwater level.

**Hydrology**

There are three important ephemeral rivers that run through areas adjacent to the mine expansion area. The Morupule River, which feeds into the Lotsane River, is the closest, approximately 3 km from the site, whilst the Lotsane River is approximately 10 km south of the site. The Kamotaka River flows into the Lotsane River from the west. The Lotsane River is one of the major ephemeral rivers in the Limpopo basin. There are plans to establish a dam for domestic water supply on the Lotsane River downstream of Palapye. The mine presently passes under the Morupule River and special tunnelling procedures, as prescribed by the Department of Mines, are used below the river course.

**Vegetation**

The area comprises of two main types of vegetation; *Acacia/Burkea/Ochna* Savannah and *Acacia* Savannah. An additional vegetation type, the rocky hill outcrops, is important within the lease area. Two invasive species (*Dichrostachys cinerea* and *Argemone mexicana*) occur within the lease area. *Stapelia schinzii* var. *schinzii*, a plant listed under the red data list (under Data Deficient) was found near the proposed 12 mtpa shaft area. Riverine habitat has been greatly modified due to the practise of establishing arable agriculture in the river floodplains. At least 20% of the riverine habitat is severely degraded.

**Fauna**

Morupule Colliery has game fenced some of its lease area and is developing the wildlife population through protection, water supply and re-stocking. A game park report indicates that the colliery is aiming at a stocking rate of 1 animal unit to 12 ha.

**Current Land Use**

The area proposed for mining is located on tribal land. The area within and around the proposed expansion site has different land uses as listed below:

- The current coal mine.
- Residential areas: Palapye, which is approximately 12 km east of the mine, and Morupule village, which is located within the mine lease area.
- Commercial: businesses in Palapye.
• Industrial: the BPC power station near the Colliery.
• Agricultural: crop production and grazing of livestock currently takes place in and around the proposed expansion area. The livestock carrying capacities for the areas are on average 7 ha for every livestock unit.
• Educational: although Kgase Primary School currently lies within the power station lease area, the school is to be relocated due to the expansion activities.
• Groundwater abstraction: nine boreholes are found within the mine expansion area.

Archaeological, Cultural and Heritage Aspects

The lithic materials as well as the ceramics found in the area suggest that the area was occupied at different periods and probably by different people. Burials have also been located within the area. It should be noted that the identification of burial sites within the lease area suggests that other unknown burial sites may also be present therefore the developer should be prepared for chance discoveries.

Impact Assessment and Mitigations

High- and medium-level impacts and their mitigations are summarised in the tables below, addressed separately for construction, operation and decommissioning.
**Medium- or high-ranked impacts due to the construction of Phase 1 - 4 Mtpa and associated mitigations**

<table>
<thead>
<tr>
<th>No.</th>
<th>Activity</th>
<th>Impact</th>
<th>Nature</th>
<th>Mitigation</th>
<th>Significance (without mitigation)</th>
<th>Significance (with mitigation)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>A. Construction of; Shaft Expansion, Crusher, Ventilation shafts Screening Facilities, Coal Storage Silos, Distribution Bins &amp; Stockpiles, Conveyor System, Housing Units and Additional Facilities (no high or medium impacts)</td>
<td>E2 Clearing of area for additional staff (housing in the MCL village area for 20 house units)</td>
<td>Loss of sandveld vegetation and habitat adjacent to the rock outcrops</td>
<td>Neg.</td>
<td>Induction for house construction workers. Minimal clearing of housing sites i.e. no mechanical clearing of house sites. Maintain indigenous trees where possible (Environmental officer to mark trees for protection).</td>
<td>Medium</td>
</tr>
<tr>
<td></td>
<td></td>
<td>E3 Stripping and stockpiling of soils from lay down areas</td>
<td>Loss of soil resources through compaction, erosion and/or dilution</td>
<td>Neg.</td>
<td>Implement soil conservation procedure in all new project areas where natural vegetation exists.</td>
<td>Medium</td>
</tr>
<tr>
<td></td>
<td>B. Resource Use, Management and Waste Management at Construction Sites and Camp (no high or medium impacts)</td>
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<td></td>
<td>C. Removal of Borrow Material from Material Lay Down Areas and Crusher Facilities, Abstraction of Borrow Material (no high or medium impacts)</td>
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<td></td>
<td>D. Transportation (no high or medium impacts)</td>
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<td></td>
<td>E. Site Clearance on all Project Areas</td>
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</tr>
<tr>
<td>F1</td>
<td>Employment</td>
<td>Requirements for skilled, semi-skilled and non-skilled labour will create employment opportunities</td>
<td>Pos.</td>
<td>Non-skilled and semi-skilled job vacancies should be advertised at the Palapye Labour Office and open recruitment should be carried out in the village main kgotla with the assistance of traditional authorities. The surrounding villages should also be considered.</td>
<td>High</td>
<td>High</td>
</tr>
<tr>
<td>F2</td>
<td>Employment</td>
<td>Transitory population increase due to influx of job seekers will create social conflict, increase in sexually transmitted diseases (including HIV/AIDS) and crime</td>
<td>Neg.</td>
<td>Basic onsite facilities such as medical, accommodation and recreational should be provided to workers to ease pressure on community facilities. Sub-contractors to have a HIV/AIDS policy in place.</td>
<td>High</td>
<td>Medium</td>
</tr>
<tr>
<td>No.</td>
<td>Activity</td>
<td>Impact</td>
<td>Nature</td>
<td>Mitigation</td>
<td>Significance (without mitigation)</td>
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<tr>
<td>F3</td>
<td>Employment</td>
<td>Illegal settlement due to presence of job seekers not immediately absorbed by contractors. In addition, illegal settlement will lead to increased diseases problems, pollution, crime and other social ills.</td>
<td>Neg.</td>
<td>MCL and the Contractor should be proactive in dealing with illegal settlement through reporting people that put up temporary housing structures near the camp as early as possible. MCL could use the Public Affairs Unit. This calls for collaboration with the Palapye sub-land board and Botswana Police.</td>
<td>Medium</td>
<td>Low</td>
</tr>
<tr>
<td>F4</td>
<td>Service Provision requirement</td>
<td>Need for support services for construction will increase business opportunities</td>
<td>Pos.</td>
<td>MCL should encourage contractors to use the predetermined preferred local (Palapye-Serowe area) service providers list to procure certain goods and services in order to enhance this impact.</td>
<td>High</td>
<td>High</td>
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</table>
### Medium- or high-ranked impacts due to the operation of Phase 1 - 4 Mtpa and associated mitigations

<table>
<thead>
<tr>
<th>No.</th>
<th>Activity</th>
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<tbody>
<tr>
<td>A2</td>
<td>Coal seam removal below the piezometric water level</td>
<td>Potential damage to road and pipeline infrastructure due to surface subsidence</td>
<td>Neg.</td>
<td>Coal seam removal should follow the DoM mining guidelines/procedures for mining below roads and other infrastructure. The colliery currently adheres to these procedures. In planning, the colliery should work with DoR, DoM and CDC. The mine should also conduct studies to identify possible subsidence and prevention measures. Emergency response plans should be extended to include surface subsidence. Monitoring should be introduced to monitor the possible occurrence of subsidence.</td>
<td>High</td>
<td>Low</td>
</tr>
<tr>
<td>A3</td>
<td>Coal seam removal below the piezometric level</td>
<td>Alteration of drainage patterns on the Morupule and Lotsane Rivers due to surface subsidence</td>
<td>Neg.</td>
<td>The colliery adheres to the DoM mining procedures for below roads and rivers. Work with DWA, DoR and CDC in planning. Regular meetings between the parties required. Monitoring of surface subsidence within the Morupule and Lotsane Rivers should continue.</td>
<td>Medium</td>
<td>Low</td>
</tr>
<tr>
<td>A4</td>
<td>Coal seam removal below the piezometric level</td>
<td>Reduction of groundwater levels in areas beyond the mine due to mining below the piezometric level</td>
<td>Neg.</td>
<td>Although mining is currently below the piezometric level, no dewatering has been experienced. However, monitoring should be in place to check the occurrence of the impact. No mitigation measure identified.</td>
<td>Medium</td>
<td>Medium</td>
</tr>
<tr>
<td>A5</td>
<td>Coal seam removal below the piezometric level</td>
<td>Potential seepage into the mine</td>
<td>Neg.</td>
<td>Seepage into the mine should be monitored and if this occurs, the water should be collected for use as process water.</td>
<td>Medium</td>
<td>Low</td>
</tr>
<tr>
<td>A7</td>
<td>Coal seam removal below the piezometric level</td>
<td>Risks of accidents and fatalities due to potential subsidence</td>
<td>Neg.</td>
<td>The mine should conduct studies of possible subsidence. MCL should maintain the existing complaints register to log public complaints and consistently engage with affected parties through the stakeholder engagement plan. Areas of collapse are to be mapped.</td>
<td>Medium</td>
<td>Low</td>
</tr>
<tr>
<td>A6</td>
<td>Blasting underground</td>
<td>Damage to third party infrastructure within and around the mine lease area due to vibrations through the ground.</td>
<td>Neg.</td>
<td>Blasting should comply with the Mines and Minerals Act, Mines, Quarries, Works and Machinery Act and the Explosives Act. The colliery should notify all service providers within the area of blast programme. Blast should be designed to minimise damage to third party infrastructure. Monitoring of each blast will take place.</td>
<td>Medium</td>
<td>Low</td>
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</table>

**B. Ventilation System**
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<tr>
<th>No.</th>
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<th>Significance (with mitigation)</th>
</tr>
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<tr>
<td>B1</td>
<td>Ventilation system</td>
<td>Excess noise levels for homesteads in the surrounding area.</td>
<td>Neg.</td>
<td>The equipment should be maintained in good working order. Berms should be established around air vent shafts to deflect noise upwards. The designs of the equipment should comply with industrial requirements of SANS 10103, insulate noisy plants and equipments. Noise monitoring should be in place. Any complaints should be recorded and responded to quickly.</td>
<td>Medium</td>
<td>Low</td>
</tr>
<tr>
<td>C4</td>
<td>Coal crushing, storage and handling</td>
<td>Noise levels in excess of the minimum acceptable levels for homesteads in the surrounding area.</td>
<td>Neg.</td>
<td>The designs of the equipment should comply with industrial requirements of SANS 10103, insulate noisy plants and equipments. Any complaints should be recorded and responded to quickly.</td>
<td>Medium</td>
<td>Low</td>
</tr>
<tr>
<td>C6</td>
<td>Stockpiling coal on site</td>
<td>Release of potentially harmful pollutants into the air from spontaneous combustion</td>
<td>Neg.</td>
<td>Coal should be compacted daily to release the gases. Fire fighting equipment should be on standby and close to the stockpile area.</td>
<td>Medium</td>
<td>Low</td>
</tr>
<tr>
<td>C7</td>
<td>Stockpiling coal on site</td>
<td>Surface and groundwater contamination from acid leachate drainage</td>
<td>Neg.</td>
<td>Coal stockpiles should be stored on impervious and compacted areas. The drainage from these will need to be contained and collected for reuse as process water on the site. A borehole should be drilled down gradient of the stockpile area into the Kalahari Beds to monitor the quality of any shallow groundwater and thus provide a baseline for groundwater quality. The borehole is to be monitored and sampled on a quarterly basis, any changes in groundwater quality or levels as a result of the stockpile area can be recorded and action can be taken.</td>
<td>Medium</td>
<td>Medium</td>
</tr>
<tr>
<td>D.</td>
<td>Transportation (no high or medium impacts)</td>
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<tr>
<td>E.</td>
<td>Resource Use, Management and Waste Management (no high or medium impacts)</td>
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<tr>
<td>F.</td>
<td>Resettlement of the Inhabitants from the Lease Area</td>
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<tr>
<td>F1</td>
<td>Land appropriation</td>
<td>Loss of livelihoods due to land appropriation by the mine</td>
<td>Neg.</td>
<td>MCL should minimise displacement and disruption of livelihoods. If complete removal of affected people is not necessary, cash compensation for improvements e.g. houses and boreholes should be made and affected people allowed to continue ploughing and livestock rearing. This should be accompanied by strict control on further developments. This would be applicable only if MCL considers it safe for light land use to be permitted in the area. If displacement of affected people is inevitable for safety reasons defined by MCL, there must be a deliberate plan to restore their livelihoods and properties to pre-project levels. This could be achieved through a Resettlement Action Plan that should be drawn up before people are moved.</td>
<td>High</td>
<td>Low</td>
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### Activity and Mitigation

<table>
<thead>
<tr>
<th>No.</th>
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<tr>
<td>F2</td>
<td>Removal of inhabitants above colliery workings</td>
<td>Increase of range and habitat available to wildlife population due to resettlement of land users</td>
<td>Pos.</td>
<td>This should be enhanced by linking to Palapye tourism development, create conditions for tourism usage during mine operations.</td>
<td>Medium</td>
<td>Medium</td>
</tr>
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</table>

#### G. Employment and Service Provision Requirements

<table>
<thead>
<tr>
<th>No.</th>
<th>Employment opportunities due to need to operate new mine activities</th>
<th>Increased employment</th>
<th>Pos.</th>
<th>Non-skilled labour should be recruited through the Palapye Labour Office. Affirmative action to increase number of female workers should be adopted by the MCL. The surrounding villagers should also be considered.</th>
<th>High</th>
<th>High</th>
</tr>
</thead>
<tbody>
<tr>
<td>G3</td>
<td>Potential transmission of communicable diseases due to increased population and sexual interactions between mine workers and other people</td>
<td>MCL should maintain its internal sentinel surveys and HIV/AIDS prevention programmes. Employees are to be made aware of the risks due to high HIV/AIDS levels in Palapye.</td>
<td>Neg.</td>
<td>High</td>
<td>Medium</td>
<td></td>
</tr>
<tr>
<td>G4</td>
<td>Increased cash injection into the local economy due to increased business opportunities</td>
<td>MCL should continue procuring goods and services from local companies. By having a policy of using local services where possible (i.e. from Palapye and Serowe), the benefits within the affected area will be substantially increased.</td>
<td>Pos.</td>
<td>Medium</td>
<td>Medium</td>
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Medium- or high-ranked impacts due to the decommissioning of the 4 Mtpa infrastructure and associated mitigation measures

<table>
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<tr>
<th>No.</th>
<th>Activity</th>
<th>Impact</th>
<th>Nature</th>
<th>Mitigation</th>
<th>Significance (without mitigation)</th>
<th>Significance (with mitigation)</th>
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<tbody>
<tr>
<td>A.</td>
<td>Dismantling and Demolition of Structures (no high or medium impacts)</td>
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<td>B.</td>
<td>Sealing and Closure of Shaft, Adits and Inclines (no high or medium impacts)</td>
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<td>C.</td>
<td>Rehabilitation of Disturbed Areas (no high or medium impacts)</td>
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<td>D.</td>
<td>Storage and Removal of Waste from Site (no high or medium impacts)</td>
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<td>E.</td>
<td>Resource Use and Management at the Construction Camp (no high or medium impacts)</td>
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Conclusions

The proposed expansion of the colliery is part of the essential national program to address existing and future power requirements within Botswana. This project is one of the core components of Botswana’s power supply, along with the 600 MW Morupule B Power Station and wellfield water supply. The combined projects will allow Botswana to become self-sufficient in electrical power and provide for the diversification of the mining sector away from diamonds.

Implications for the Natural Environment

MCL has been operating for nearly thirty years and the existing direct biotic and abiotic environmental impacts have been low and the natural vegetation has been minimally affected. Recent moves to manage the wildlife population and develop the wildlife and tourism opportunities have had a positive effect on the area’s environment. The expansion, though, will create a number of additional impacts to the natural environment. Of greatest concern at the Phase 1 - 4Mtpa stage would be:

- An increase in land taken for coal storage, expansion of the crush facilities, establishment of new administrative facilities, new housing in the MCL village and new air vent shafts. These will result in an increase in overall area disturbed by the colliery from 62 ha to about 70 ha with a loss of approximately 5.5 ha of sandveld vegetation and 2.5 ha of ecotone between the rocky outcrop habitat and the surrounding sandveld.

- There will be increased use of power from the present 2.5 MW/annum to 12.1 MW/annum and increase in water use from 74 400 m$^3$/annum to 104 600 m$^3$/annum. There will be a proportional increase in solid and liquid waste. Solid waste will be managed as it is at present through local contracts for cartage and disposal in council landfills. Sewage lines will be connected to the Palapye Council mains and existing oxidation ponds rehabilitated.

- There will be an increase in noise and dust emissions from crush facilities and haulage traffic. The area affected will not increase substantially, but the volume of coal dust being deposited will increase and affect about 24 ha, of which 13 ha comprise already lightly disturbed natural vegetation. Overall noise levels will increase and will be managed under the existing Occupational Health and Safety requirements as noise impacts do not extend beyond the existing lease area.

- Methane emissions have been shown to be close to nil for the existing colliery operations. These levels will remain low for mining operations at similar depths.

- Although there is no active dewatering of the colliery, mining operations are below the aquifer and a slight draw down cone will occur. This is unlikely to affect boreholes outside the lease area, but this should be monitored. There is potential for an increase in acid drainage from coal crush and storage facilities.

- Given the Department of Mines (DoM) protocols that have been used when mining under roads and rivers, the impact on 6 km of the A14 road and 8 km of river channels is uncertain. There is, though, a slight increase in the long term potential for subsidence of surface material.

- Archaeology: There were no new sites identified within 200 m of any of the proposed developments that require salvaging. This does not preclude the chance that sites will be discovered during clearing of areas for developments.

The further expansion from 4Mtpa to 12 Mtpa will have additional impacts on the natural environment.
An increase in land taken will occur due to the establishment of a new shaft and associated crusher facilities, two new vent shafts, access track and coal conveyer to move coal to the existing crusher facility. There will also be an increase in coal wash units from one to four, and expansion of the crush and storage facilities. This will result in additional loss of approximately 50 – 120 ha of sandveld vegetation. No additional housing will be constructed at the Morupule Village.

There will be increased use of power from the present 2.5 MW/annum to approximately 36 MW/annum and increase in water use from 74 400 m$^3$/annum to 959 400 m$^3$/annum. There will be a proportional increase in solid and liquid waste.

The haulage traffic will increase substantially as all beneficiated coal will be sold to non-BPC customers. There will also be a substantial increase in road and rail traffic. The area of coal dust deposition will not increase substantially, but the volume of coal dust being deposited will increase and affect about 24 ha of which 13 ha is natural vegetation.

Further dewatering of the aquifer and additional increase in acid drainage from crush and storage facilities is anticipated.

Given the DoM protocols used when mining under roads and rivers, the impact on 9.8 km of the A14 road and 17.8 km of river channels is uncertain. There is, though, a slight increase in the long term potential for subsidence of surface along these systems.

There were no new archaeological sites identified that require salvaging within 200 m of any of the proposed developments. This does not preclude the chance that sites will be discovered during clearing of areas for developments.

**Social and Land Use Implications**

The social and land use impacts are both positive and negative. The positive impact is a direct increase in employment from the existing 254 to 600 jobs at Phase 1 - 4 Mtpa, to an estimated 1 200 jobs at Phase 2 - 12 Mtpa. This will translate into a significant cash injection into the local (Palapye) economy through enhancement of business opportunities. The ripple effects will be felt nationally.

The coal will largely be used to ensure power supply to Botswana and allow sufficient power to be generated to allow export of power to neighbouring countries. The economic multipliers would greatly increase the beneficial impacts.

The negative social impacts are both at the construction and operational phases.

- During construction the social disruption and health concerns are linked to the large number of construction crew personnel (850 for Phase 1 - 4 Mtpa and 1 200 for Phase 2 - 12 Mtpa). Health impacts will be felt well after construction is complete.

- The risk of subsidence and potential threat to human life is to be further investigated. The results of the risk assessment will guide the decisions for resettlement or not of people that presently reside within the lease area. A detailed resettlement plan will be required if it is found that people residing in and making their living from the lease area are at risk and are to be resettled.

- In the long term there are social issues linked to loss of land and associated livelihoods if people are, for health and safety reasons, moved out the lease area ahead of the mining. As many as 20 households will be moved and 194 ha of lands areas (comprised of 19 lands areas) will be lost for the current level of operation.
• An additional 3 homesteads will be moved and 91 ha of lands areas (comprised of 13 lands areas) will eventually be lost for the existing operation and Phase 1 - 4 Mtpa expansion.

• A further 34 households and 745 ha of arable lands (comprising about 71 lands areas) will be lost in the Phase 2 - 12 Mtpa expansion.

• Most of the coal beneficiated through the expanded coal wash facilities at Phase 2 - 12 Mtpa will be transported to customers other than Morupule Power Station. Roads will become more dangerous, noisier and will require higher levels of maintenance.

• If the game park is expanded to provide a safe use of the land area above the mine workings, there will be a decrease in the area of grazing available to livestock.

• Due to the resettlement of immediately adjacent homesteads, there will be no public health impacts from coal dust and noise. If resettlement is not considered then, acoustic design aspects (in terms of noise), would need to be incorporated so that noise levels do not exceed the SANS 10103 requirements. For the Phase 2, the mine should consider placing the ventilation shafts within the box cut. Dust suppression procedures will need to be followed to minimise impacts to adjacent homesteads.

Cumulative Impact Implications

There will be a number of cumulative social and environmental impacts, as follows:

• The combined noise impact of the BPC power station operations and the mining activities will create unacceptable night-time noise levels for 11 households.

• The two parallel construction activities (MCL and BPC Morupule B Power Station expansion) are likely to spur job seekers to set up illegal settlement within vicinity of the contractors’ recruitment office. BPC is already facing the problem as some temporary properties have been illegally put up within the lease area (Ecosurv and GIBB Botswana, 2007).

• The combined development of the BPC Power station and the expansion of the Colliery will create increase in water demand on both groundwater and NSC resources.

• Pressure on accommodation and other facilities such as schools and clinics will occur. The short term increase in construction personnel created by simultaneous developments such as the Colliery, BPC Power Station and university in Palapye will result in a large temporary influx of construction personnel into the area. In the long term, the Palapye population will increase more rapidly than predicted in the recent Palapye Planning Area Development Plan with the new jobs created and the annual influx of students. The Palapye Planning Area Development Plan considers the implications of population growth and infrastructure development.

Decommissioning

Decommissioning of the existing shaft is expected to occur in approximately 2028.

• Only the existing shaft, as a coal extraction conduit, will be decommissioned. The crush facilities, conveyors, coal storage areas, coal wash facilities, offices and housing will not be affected by the closure of the existing shaft. Access to the mine will be sealed with reinforced concrete and the box-cut will be backfilled and properly rehabilitated to prevent any escapes of methane. Monitoring of gases should continue after closure of the mine.
• The main decommissioning concerns lie with the impact of the old workings on the land surface (subsidence) as it may preclude human habitation and existing land use in the area above the workings. Other national infrastructure, such as the main A14 road, may also be affected.

• The colliery is considering developing the game park land use as the post mining activity so as to provide the Palapye-Serowe area with wildlife based tourism facilities.

**Environmental Impact Statement**

Given existing technology, there are few reliable alternatives within Botswana to produce the required base load electrical power essential for national security and growth. It has been found that the proposed colliery expansion to provide BPC with coal for power generation will have low environmental impacts and moderate social impacts. These impacts can be mitigated as outlined in the Environmental Management Plan. This study has found that there is no single or combination of environmental or social impacts that will preclude the proposed development.
# TABLE OF CONTENTS

1 INTRODUCTION .......................................................................................................................... 1
   1.1 PROJECT BACKGROUND ........................................................................................................... 2
   1.2 PLANNED ACTIVITIES ............................................................................................................... 2
   1.3 LOCATION .................................................................................................................................. 3
   1.4 ENVIRONMENTAL IMPACT ASSESSMENT STUDY ................................................................. 5

2 LEGAL STATUS OF PROJECT SITE APPLICANT AND CONSULTANT DETAILS ................. 6
   2.1 LEGAL STATUS OF PROJECT SITE .......................................................................................... 6
   2.2 APPLICANT’S DETAILS ............................................................................................................ 6
   2.3 CONSULTANT’S DETAILS ......................................................................................................... 6

3 DESCRIPTION OF THE PROPOSED PROJECT ....................................................................... 8
   3.1 LAYOUT OF SURFACE INFRASTRUCTURE ............................................................................. 8
   3.2 CONSTRUCTION PHASE ........................................................................................................... 11
      3.2.1 Site facilities – contractor’s camp ....................................................................................... 11
      3.2.2 Construction activities ....................................................................................................... 11
      3.2.3 Borrow pits ......................................................................................................................... 12
      3.2.4 Transport routes and mechanisms .................................................................................... 12
      3.2.5 Power supply and use ....................................................................................................... 12
      3.2.6 Water supply and use ....................................................................................................... 12
      3.2.7 Water management ........................................................................................................... 12
      3.2.8 Waste disposal and management ..................................................................................... 12
      3.2.9 Employment and housing ............................................................................................... 13
      3.2.10 Timing ............................................................................................................................. 13
   3.3 OPERATIONAL PHASE ............................................................................................................ 13
      3.3.1 Expansion of underground mining operations ................................................................. 13
      3.3.2 New crushing and screening process .............................................................................. 15
      3.3.3 Washing plant ................................................................................................................... 17
      3.3.4 Transport routes and mechanisms .................................................................................... 19
      3.3.5 Power supply ................................................................................................................... 20
      3.3.6 Water supply, use and management ............................................................................... 20
      3.3.7 Waste and residue management ...................................................................................... 21
      3.3.8 Additional support facilities ............................................................................................. 22
      3.3.9 Employment and housing ............................................................................................... 22
      3.3.10 Timing ............................................................................................................................. 23
   3.4 DECOMMISSIONING AND CLOSURE PHASE ..................................................................... 23
      3.4.1 Closure objectives ............................................................................................................. 23
      3.4.2 Decommissioning and closure activities .......................................................................... 23
      3.4.3 Financial provision .......................................................................................................... 24
   3.5 COMPENSATION AND RESETTLEMENT ................................................................................. 24

4 LEGAL AND PLANNING FRAMEWORK ................................................................................. 26
   4.1 INTERNATIONAL OBLIGATIONS AND AGREEMENTS .......................................................... 26
      4.1.1 Agreements related to air pollution ....................................................................................... 26
      4.1.2 Agreements related to noise pollution .............................................................................. 27
      4.1.3 Agreements on solid waste movement and disposal .......................................................... 27
      4.1.4 Financing arrangements ................................................................................................... 27

   4.2 NATIONAL POLICIES AND STRATEGIES .......................................................................... 28
      4.2.1 Policies related to land use and land tenure ....................................................................... 28
      4.2.2 Policies and strategies related to the environment .............................................................. 28
      4.2.3 Policies related to energy .................................................................................................. 29
      4.2.4 Policies related to socio-economic issues ......................................................................... 29
      4.2.5 Waste management strategy ........................................................................................... 29

   4.3 NATIONAL LEGISLATION ...................................................................................................... 30
      4.3.1 Laws pertaining to land use and land tenure ..................................................................... 30
4.3.2 Laws pertaining to mines and minerals ......................................................... 30
4.3.3 Laws pertaining to solid waste management ............................................. 31
4.3.4 Laws pertaining to pollution of ground and surface water......................... 31
4.3.5 Laws pertaining to the supply of water ....................................................... 31
4.3.6 Laws pertaining to the socio-economic environment .................................. 32
4.3.7 Laws pertaining to archaeology and heritage ........................................... 32
4.3.8 Laws pertaining to vegetation ................................................................. 32
4.3.9 Laws pertaining to Laws pertaining to wildlife resources......................... 33
4.4 DEVELOPMENT AND MANAGEMENT PLANS ............................................. 33
4.4.1 National and district plans ........................................................................ 33
4.4.2 Environmental plans ................................................................................ 33
4.4.3 Wastewater plans .................................................................................... 34
4.4.4 Water supply plans .................................................................................. 34
4.5 MCL ENVIRONMENTAL PROCEDURES ...................................................... 34
5 BIOPHYSICAL ENVIRONMENTAL SETTING .................................................. 37
5.1 PHYSICAL ENVIRONMENT ......................................................................... 37
5.1.1 Climate ...................................................................................................... 37
5.1.2 Air quality .................................................................................................. 39
5.1.3 Noise .......................................................................................................... 40
5.1.4 Topography ................................................................................................ 43
5.1.5 Soils ............................................................................................................ 43
5.1.6 Geology ...................................................................................................... 43
5.1.7 Hydrogeology ............................................................................................. 45
5.1.8 Hydrology .................................................................................................. 47
5.2 BIOLOGICAL ENVIRONMENT ..................................................................... 47
5.2.1 Flora ........................................................................................................... 47
5.2.2 Fauna .......................................................................................................... 50
6 SOCIO-ECONOMIC ENVIRONMENT .............................................................. 52
6.1 BACKGROUND ............................................................................................ 52
6.2 SOCIO-ECONOMIC PROFILE ................................................................. 52
6.2.1 Population .................................................................................................. 52
6.2.2 Housing ...................................................................................................... 52
6.2.3 Social amenities ......................................................................................... 52
6.2.4 Transport and communication ................................................................. 53
6.2.5 Education .................................................................................................. 53
6.2.6 Employment ............................................................................................... 53
6.2.7 Health ......................................................................................................... 53
6.3 CURRENT LAND USE .................................................................................. 54
6.3.1 Infrastructure ............................................................................................. 54
6.3.2 Boreholes .................................................................................................. 36
6.3.3 Arable agriculture ....................................................................................... 37
6.3.4 Livestock farming ....................................................................................... 39
6.4 ARCHAEOLOGY, CULTURAL AND HERITAGE ........................................ 60
7 RESULTS FROM CONSULTATIONS ............................................................... 63
7.1 PUBLIC CONSULTATIONS ........................................................................... 63
7.1.1 Kgotla Meeting .......................................................................................... 63
7.1.2 Results From Focus Groups Discussions ............................................... 63
7.2 KEY PERSONS CONSULTATIONS ............................................................ 63
8 APPROACH AND METHODOLOGY ............................................................... 65
8.1 IMPACT IDENTIFICATION ......................................................................... 65
8.2 IMPACT PREDICTION ................................................................................ 65
8.3 IMPACT ASSESSMENT AND MITIGATIONS ............................................ 67
9 IMPACT DESCRIPTION AND SENSITIVITY ANALYSIS ............................... 69
9.1 SUMMARY OF FINDINGS .......................................................................... 69
9.1.1 Socio-economic and land-use findings ................................................... 69

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9.1.2 Noise climate findings ................................................................. 70
9.1.3 Hydrology, hydrogeology and water supply findings ................. 73
9.1.4 Archaeology findings ................................................................. 74
9.1.5 Botany findings ......................................................................... 74
9.1.6 Resource use and management findings .................................... 74
9.1.7 Transportation .......................................................................... 75
9.1.8 Abstraction and removal of borrow materials ............................ 75
9.1.9 Site clearance ............................................................................ 75
9.1.10 Air quality findings ................................................................. 75
9.1.11 Other ..................................................................................... 76
9.1.12 Decommissioning ..................................................................... 76
9.2 Sensitivity Analysis ...................................................................... 76

10 IMPACT ASSESSMENT AND MITIGATION ..................................... 80

11 ASSESSMENT OF ALTERNATIVES .................................................. 92
11.1 Mining Methods for the New Mine .............................................. 92
11.2 Establishment of Housing Units .................................................... 93
11.3 Expansion of Coal Wash Plant and Use of Middlings and Cake .... 93
11.4 Material Lay Down Areas ............................................................ 93
11.5 Project - No Project Alternative .................................................... 93

12 CONCLUSIONS .............................................................................. 95
12.1 Implications for the Natural Environment .................................... 95
12.2 Social and Land Use Implications ............................................... 96
12.3 Cumulative Impact Implications .................................................. 97
12.4 Decommissioning ....................................................................... 97
12.5 Environmental Impact Statement ............................................... 98

13 REFERENCES ................................................................................ 99

14 ENVIRONMENTAL MANAGEMENT PLAN .................................... 101
14.1 Construction of Phase 1 ............................................................... 101
14.1.1 Implementation team for construction phase ............................. 101
14.1.2 Environmental specifications for construction activities .......... 104
14.1.3 Detailed EMP requirements for Phase 1 construction ............. 111
14.1.4 Monitoring requirements for Phase 1 construction ................ 117
14.2 Operation of Phase 1 ................................................................ 119
14.2.1 Implementation team for operation phase ............................... 119
14.2.2 Environmental specifications for operation activities ............... 119
14.2.3 Detailed EMP requirements for Phase 1 operation ................. 120
14.2.4 Monitoring requirements for Phase 1 operation ..................... 128

LIST OF APPENDICES

Annexure 1: Approval of Terms of Reference by DEA .......................... 132
Annexure 2: Approval of Extension of Lease ...................................... 133
Annexure 3: DNMMAG Recommendations ....................................... 134
Annexure 4: Public Consultations Results .......................................... 135
Annexure 5: MCL Energy Conservation Procedure MCL/Env/103 (2007) ........................................................................ 143
Annexure 6: MCL Vegetation Clearance Procedure MCL/Env/101 (2007) ........................................................................ 144
Annexure 7: MCL Water Conservation Procedure (MCL/Env/102) .... 145
Annexure 8: MCL Waste Oil and Diesel Handling Procedure ISO/ MCL /104 (2007) ................................................................. 146

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Annexure 10: Debswana Topsoil Management Procedure .............................................................................. 148
Annexure 11: Debswana Dust Suppression Procedure ...................................................................................... 149
Annexure 12: SHE Policy ............................................................................................................................. 150
Annexure 13: Procedure For Mining Under Rivers/Roads ............................................................................... 151
Annexure 14: Debswana HIV Policy (2001) ........................................................................................................ 152
Annexure 15: MCL Environmental Management System ................................................................................. 153
Annexure 16: Debswana Corporate Social Investment Policy (CCIPOL 001) ................................................ 154

LIST OF FIGURES

Figure 1: Location of the proposed project .......................................................................................... 4
Figure 2: Existing and proposed surface infrastructure at the colliery ............................................. 10
Figure 3: Location of proposed development for both phases ............................................................. 14
Figure 4: Conceptual process flow for 4 and 12 Mtpa ....................................................................... 16
Figure 5: Location of the areas subject to compensation and resettlement ....................................... 25
Figure 6: Temperature recordings from the BPC Station in Palapye (Source: Ecosurv and GIBB Botswana, 2008) ........................................................................................................................................... 37
Figure 7: Average monthly rainfall for the Palapye area from 1974/75 – 2007/8 (recordings from the MCL rain gauge) ................................................................................................................................. 38
Figure 8: Wind roses for Mahalapye Station (Source: Ecosurv and GIBB Botswana, 2008) .................................................................................................................................................. 38
Figure 9: Total weighted average in mg/m$^3$ of coal dust, Jan-Dec, 2007. Source: Morupule Colliery, 2008) ........................................................................................................................................... 39
Figure 10: Existing noise generated at the colliery (Source: Volume 2, Appendix 2) .................... 42
Figure 11 - Schematic of geology/hydrogeology through the proposed expansion area (Source: Volume 2, Appendix 3) ........................................................................................................................................... 47
Figure 12: Location of Dichrostachys cinerea, Argemone mexicana and Stapelia ................................ 49
Figure 13: An example of the watering points constructed by MCL and the new one under construction ........................................................................................................................................... 51
Figure 14: Population of Palapye (1981-2026: Source: Volume 2, Appendix 1) ............................ 52
Figure 15: Infrastructure within the mining lease area ......................................................................... 55
Figure 16: Existing infrastructure within the mine lease area ............................................................... 56
Figure 17: Private boreholes within the mine lease area in relation to potential resettlement ............... 57
Figure 18: Location of arable lands and other infrastructure within the MCL lease area ..................... 58
Figure 19: Location of archaeological and cultural sites identified during the archaeological survey ........................................................................................................................................... 61
Figure 20: Potential noise impact of the colliery (Phase 1 and 2) ....................................................... 72
Figure 21: Environmental sensitivity map ............................................................................................... 77
Figure 22: Social sensitivity map ............................................................................................................ 78
Figure 23: Combined social and environmental sensitivity map

LIST OF TABLES

Table 1: List of project-related infrastructure
Table 2: Changes in selected coal parameters during the washing process (Source: Morupule Laboratory feed and produce stream analyses for April 2008)
Table 3: Types of waste generated by the colliery per annum
Table 4: World Bank Group ambient air quality limits
Table 5: Botswana air quality objectives (Source: DWMPC)
Table 6: World Bank Group noise limits
Table 7: Existing ambient noise climate generated by the Morupule Colliery (Source: Volume 2, Appendix 2)
Table 8: Stratigraphy in the Palapye/Serowe area (Source: Volume 2, Appendix 3)
Table 9: Habitats of the lease area
Table 10: Lecha Lodge Dam, Palapye. A small newly constructed dam at a lodge at Palapye. The dam covers ca. 4 ha. Birds counted once, in July 2000
Table 11: Lemonwe (Limone) Pan, southwest of Palapye. An ephemeral pan, over 1 km in length and ca. 9 km from the Lotsane River. Birds counted, partially, only once, in July 2000 when it was still very full
Table 12: Unemployment by age group in Central District (Source: Volume 2, Appendix 1)
Table 14: Number of arable lands affected by the proposed development activities
Table 15: Area of arable agriculture affected by proposed development activities
Table 16: Number of properties affected by the proposed development
Table 17: Summary of archaeological findings and related rankings
Table 18: Impact prediction criteria and rating scales
Table 19: Convention for assigning a consequence rating
Table 20: Convention for assigning a significance rating
Table 21: Summary of impacts, assessment and mitigations for the construction stage of Phase 1 - 4 Mtpa
Table 22: Summary of impacts, assessment and mitigations for the operation stage of Phase 1 - 4 Mtpa
Table 23: Summary of impacts, assessment and mitigations for the decommissioning stage for Phase 1 - 4 Mtpa
Table 24: Criteria used for the mining method selection (Source: SRK, 2007)
Table 25: Management plan for the construction phase of Phase 1 - 4 Mtpa
Table 26: Monitoring requirements for the construction of Phase 1 - 4 Mtpa
Table 27: Management plan for the operation of Phase 1 - 4 Mtpa
Table 28: Monitoring requirements for the operation of the 4 Mtpa ........................................... 128
Table 29: Comments from the public .......................................................................................... 137
Table 30: Attendance register for the kgotla meeting ............................................................... 139
Table 31: Residents within the proposed expansion area .......................................................... 140
Table 32: Attendance register: key persons ................................................................................. 142

ABBREVIATIONS AND ACRONYMMS

AIA Archaeological Impact Assessment
ALD Acid leachate drainage
ARV Anti-retroviral
As Arsenic
Bgl Below ground level
BHC Botswana Housing Corporation
BID Background Information Document
BNMPWWS Botswana National Master Plan for Wastewater and Sanitation
BPC Botswana Power Corporation
BSAP Biodiversity Strategy and Action Plan
BTC Botswana Telecommunication Corporation
CDC Central District Council
CH₄ Methane
CM Continuous miner
CO Carbon Monoxide
Cr Chromium
CSO Central Statistics Office
Cu Copper
dBA decibel adjusted
DEA Department of Environmental Affairs
DHT District Health Team
DLUP District Integrated Land Use Plan
DME [South Africa’s] Department of Minerals and Energy
DMS Dense Media Separation
DNMMAG Department of National Museum, Monuments and Art Gallery
DoM Department of Mines
DoR Department of Roads
DWA Department of Water Affairs
DWMPC Department of Waste Management and Pollution Control
EIA Environmental Impact Assessment
EIS Environmental Impact Statement
EMP Environmental Management Plan
FDG Flue Gas Desulphurisation
Ga Gallium
GDP Gross Domestic Product
GIS Geographical Information Systems
GWh Gigawatts Hour
Ha Hectare
IA&Ps Interested and Affected Parties
ISO International Organisation for Standardisation
Km Kilometres
Ktpa Kilo tonnes per annum
kV Kilovolts

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<table>
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<tr>
<td>LHD</td>
<td>Load / haul driver</td>
</tr>
<tr>
<td>mamsl</td>
<td>Metre above mean sea level</td>
</tr>
<tr>
<td>MCL</td>
<td>Morupule Colliery Limited</td>
</tr>
<tr>
<td>MJ</td>
<td>Megajoules</td>
</tr>
<tr>
<td>mm</td>
<td>Millimetre</td>
</tr>
<tr>
<td>Mtpa</td>
<td>Million tonnes per annum</td>
</tr>
<tr>
<td>MW</td>
<td>Megawatts</td>
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<tr>
<td>NCSA</td>
<td>National Conservation Strategy (Coordinating) Agency</td>
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<tr>
<td>NDP</td>
<td>National Development Plan</td>
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<td>NGOs</td>
<td>Non-Governmental Organisations</td>
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<tr>
<td>ppm</td>
<td>Parts per million</td>
</tr>
<tr>
<td>PZS</td>
<td>Protection Zone Study</td>
</tr>
<tr>
<td>ROM</td>
<td>Run of Mine</td>
</tr>
<tr>
<td>Sc</td>
<td>Scandium</td>
</tr>
<tr>
<td>SHE</td>
<td>Safety, Health and Environment</td>
</tr>
<tr>
<td>SO₂</td>
<td>Sulphur Dioxide</td>
</tr>
<tr>
<td>SOER</td>
<td>State of Environment Report</td>
</tr>
<tr>
<td>SOx</td>
<td>Sulphur Oxide</td>
</tr>
<tr>
<td>ToR</td>
<td>Terms of Reference</td>
</tr>
<tr>
<td>UNFCCC</td>
<td>United Nations Framework Convention on Climate Change</td>
</tr>
<tr>
<td>Zn</td>
<td>Zinc</td>
</tr>
</tbody>
</table>
1 INTRODUCTION
This report, referred to as the Environmental Impact Statement (EIS), presents the results of the Environmental Impact Assessment (EIA) for the proposed Morupule Colliery Expansion Project at the Morupule Colliery in Palapye. An EIA is a tool that is used to identify and assess significant environmental and social concerns relating to all activities of a project or development.

The EIS will be submitted to the Department of Environmental Affairs (DEA), the EIA authority, for review and approval. The study was initiated by Morupule Colliery Limited (MCL), the owner of the colliery, and was conducted by Ecosurv (Pty) Ltd, an environmental consultancy company. The key objectives of the EIA are to:

- examine the environmental and social character of the area that is likely to be affected by the project or development;
- identify and evaluate the direct and indirect impacts resulting from the development;
- identify and describe measures that will mitigate the identified negative impacts and enhance the positive ones;
- develop an Environmental Management Plan (EMP) and monitoring and auditing requirements; and
- identify costs relating to closure of the colliery and the new infrastructure.

The EIS is structured as follows:

**Volume 1: Environmental Impact Statement**
Section 1 (this section): Introduction with a background to the proposed project and the EIA process
Section 2: Legal status of project site applicant and consultant details
Section 3: Detailed description of the project
Section 4: International, national and local planning frameworks, policies and legislations that govern environmental quality
Section 5: Description of the physical and biological environment of the study area
Section 6: Description of the socio-economic environment and land use of the study area
Section 7: Results from consultations with interested and affected parties
Section 8: Description of the methodologies used to identify, predict and assess the impacts
Section 9: Identified impacts and sensitivity analysis
Section 10: Impact assessment and mitigations
Section 11: Assessment of alternatives
Section 12: Conclusions and recommendations
Section 13: List of references used
Section 14: EMP, and monitoring and auditing requirements
Section 15 to 17: Annexes

**Volume 2: Specialists Reports**
Appendix 1: Socio-economic impact assessment
Appendix 2: Noise impact assessment
Appendix 3: Hydrological/hydrogeological impact assessment
Appendix 4: Archaeological impact assessment.
Appendix 5: Botanical impact assessment
Appendix 6: Decommissioning and closure costs

1.1 Project Background
MCL, a subsidiary of Debswana Diamond Company (Pty) Ltd, has been operating a coal mine since 1973 and is currently producing 1 million tonnes of coal per annum. The coalfield within the mining lease area is immense and contains good quality coal, with the estimated overall coal presence exceeding 5 billion tonnes. Production has increased steadily over the years from 145 000 tonnes per annum in 1973 to a total of 985 000 tonnes of coal mined and 964 000 tonnes sold in 2005.

The Botswana Power Corporation (BPC), which operates a coal-fired power station nearby, has been the main consumer of the MCL coal, consuming about 66% of the MCL annual production.

Other major industries supplied by the MCL colliery include a copper mine in Selibe Phikwe, Botswana Ash Plant in Sowa Pan, Botswana Meat Commission, Botswana Breweries, Foods Botswana, Makoro Bricks, and two retail coal distributors. In addition, the colliery also supplies graded coal to Zimbabwe, Zambia and the Democratic Republic of Congo.

The colliery now proposes to expand its coal production from 1 million tonnes per annum to 12 million tonnes per annum from two shafts. The purpose of this expansion is to:

- cater for an increase in power generating capacity at the BPC coal-fired power station site at Morupule. BPC recognised that they will not be able to meet future power demand for the country, because since 2007 South Africa’s Eskom, the main exporter of power to BPC, has begun to run out of surplus power to export. The power increase is expected to be 600 megawatts (MW) for Phase 1 and 600 MW for Phase 2, in addition to the current 132 MW of generating capacity;
- produce beneficiated coal that has been processed through washing plants, for the local coal market and for export;
- produce unbenefficiated coal of power station grade coal for supply to existing and new customers.

The colliery has been given the authority by the BPC board to proceed with the planning and preparations aimed at ensuring adequate supply of coal to generate 600 MW for the Phase 1 expansion of the power station in addition to the current 132 MW production. Confirmation from BPC for the second phase is still pending.

1.2 Planned Activities
Activities planned for the proposed expansion project (described in detail in Section 3) include:

- **Phase 1**: Four million tonnes per annum (Mtpa) mining from the existing shaft, replacement of the surface screening and crushing facilities at the existing location, and construction of new workshops and offices and 20 housing units at Morupule Village; and
- **Phase 2**: Twelve Mtpa mining from a new shaft some 4.5 km to the north of the existing shaft, and replacement of a coal wash plant.
The pre-feasibility study for Phase 1 has been completed, while the study for Phase 2 is ongoing. Construction of Phase 1 and Phase 2 will commence in 2011 and 2012 respectively and will each take three years. The operational life of each phase is twenty years.

Existing environmental certification and archaeological studies are:

- A situation analysis, EMP and closure plan have been prepared for the current mine shaft and its associated operations. No further EIA activity is envisaged for the existing operation. An archaeological impact assessment (AIA) has been approved and salvage archaeology completed for the initial mine lease area and the first extension (to cover the surface area above the current mining area);
- Separate EIAs have been carried out for the proposed pipeline to the North-South Carrier (NSC) and for the existing coal wash plant. These have been approved by DEA.

The colliery has applied for and received an extension to the lease area which covers the coal deposits as far as Serowe. An EIA and AIA will be required for areas affected by the proposed expansion activities for the colliery. The geographic scope of this EIA and AIA activity will be the surface area above the proposed expansion of coal abstraction activities. Within the proposed expansion area, there will be sections affected by clearing and excavation, and the development of access routes and utilities. The rest of the area will remain unchanged.

1.3 Location

The Morupule Colliery is located in the Central District of Botswana approximately 300 km north of the capital city, Gaborone, and some twelve kilometres northwest of Palapye towards Serowe.
Figure 1: Location of the proposed project
1.4 Environmental Impact Assessment Study

In Botswana, the EIA process involves three stages, namely: 1) application and screening; 2) scoping and preparation of Terms of References (ToR) for the EIA, and 3) the detailed EIA itself. The EIA study should begin during the project conceptualisation phase and take into consideration environmental concerns during all phases of the project development. This is to ensure that the developer is aware of the environmental and social concerns and required mitigation activities, which may affect project costs and necessitate alternative solutions.

The scoping study for the Morupule expansion project was completed in June 2008 and the ToR were approved by DEA (Annexure 1). The ToR highlighted issues relating to:

- ambient air quality;
- soil, surface and groundwater contamination;
- noise pollution;
- water resources;
- livelihoods and social impacts;
- archaeology;
- spontaneous combustion of coal stockpiles;
- acid mine drainage; and
- cumulative impacts from other projects in the area.

The potential impacts were investigated in this EIA through the following specialist studies:

- a socio-economic impact assessment (Volume 2, Appendix 1) to determine the impacts relating to changes in livelihoods, as well as the social, land use, economic and safety issues of people living around and within the colliery lease area;
- a noise impact assessment (Volume 2, Appendix 2) to determine potential noise pollution;
- a hydrological/hydrogeological impact assessment (Volume 2, Appendix 3) to determine impacts on water resources (particularly groundwater), as well as issues relating to soil and sub-soil contamination, acid leachate runoff and acid mine drainage, impacts on surface water and mining systems due to storm runoff, and cumulative impacts as the mine area increases, including possible subsidence;
- an archaeological impact assessment (Volume 2, Appendix 4) to identify archaeological, cultural and heritage resources that may be affected by the project;
- a botanical impact assessment (Volume 2, Appendix 5) to determine vegetation species that may be affected by the project, and to identify species that populate the area, particularly protected plants and species listed in the IUCN red data list.

In addition an EMP was developed and costs related to closure of the Phase 1 (4 Mtpa) of the project were identified (See Volume 2, Appendix 6).
2 LEGAL STATUS OF PROJECT SITE APPLICANT AND CONSULTANT DETAILS

2.1 Legal Status of Project Site
The Morupule Coal Mine is owned and operated by MCL, a subsidiary of Debswana Diamond Company (Pty) Ltd. The colliery holds ownership of the mineral rights in respect of the mining areas in the Serowe/Palapye Sub-District. The lease area covers an area of approximately 14 200 ha. The land is leased from Ngwato Land Board (letter appended in Annexure 2). The EIA will only be carried out on areas where the mining expansion activities will take place within the lease area (Figure 1).

2.2 Applicant’s Details
Details of the project applicant are provided hereunder.

<table>
<thead>
<tr>
<th>Project Title:</th>
<th>Morupule Colliery Expansion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project Applicant:</td>
<td>Debswana – Morupule Colliery Limited</td>
</tr>
<tr>
<td>Contact Person:</td>
<td>Craig Robertson</td>
</tr>
<tr>
<td>Postal Address:</td>
<td>P.O. Box 329, Gaborone</td>
</tr>
<tr>
<td>Telephone No:</td>
<td>(267) 364 8262</td>
</tr>
<tr>
<td>Fax No:</td>
<td>(267) 390 9430</td>
</tr>
<tr>
<td>E-mail Address:</td>
<td><a href="mailto:crobertson@debswana.bw">crobertson@debswana.bw</a></td>
</tr>
<tr>
<td>Project Location:</td>
<td>Morupule Colliery</td>
</tr>
</tbody>
</table>

2.3 Consultant’s Details
Details of the lead consultants are provided hereunder.

<table>
<thead>
<tr>
<th>EIA Consultant</th>
<th>Ecosurv</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contact Person</td>
<td>Mr. D. Parry</td>
</tr>
<tr>
<td>Postal Address</td>
<td>PO Box 201306, Gaborone</td>
</tr>
<tr>
<td>Physical Address</td>
<td>Unit B1, Kgale Siding Office Complex, Gaborone</td>
</tr>
<tr>
<td>Telephone Number</td>
<td>(267) 316 1533</td>
</tr>
<tr>
<td>Fax Number</td>
<td>(267) 316 1878</td>
</tr>
<tr>
<td>E-mail Address</td>
<td><a href="mailto:david@ecosurv.com">david@ecosurv.com</a></td>
</tr>
</tbody>
</table>
Consulting Team:

<table>
<thead>
<tr>
<th>Project Management &amp; Environmental Impact Assessment</th>
<th>I. Kgololo</th>
</tr>
</thead>
<tbody>
<tr>
<td>Team Leader, Environmental &amp; Ecological Impact Assessment</td>
<td>D. Parry</td>
</tr>
<tr>
<td>Botanical Impact Assessment</td>
<td>M. Muzila (University of Botswana)</td>
</tr>
<tr>
<td>Socio-Economic Assessment</td>
<td>T. Phuthego</td>
</tr>
<tr>
<td>Hydrology &amp; Hydrogeological Impact Assessment</td>
<td>J. Hiley (Water Surveys Botswana)</td>
</tr>
<tr>
<td>Mine Environmental Impact Assessment</td>
<td>A. Pheiffer (Metago Environmental Engineers)</td>
</tr>
<tr>
<td>Noise Impact Assessment</td>
<td>D. Cosijn (Jongens Keet Associates)</td>
</tr>
<tr>
<td>Archaeological Impact Assessment</td>
<td>P. Modikwa (Archaeological Resources Management Services)</td>
</tr>
<tr>
<td>Archaeological Survey &amp; Support</td>
<td>D. Molosiwa</td>
</tr>
<tr>
<td>Closure Plan</td>
<td>F. Van Heerden (Metago)</td>
</tr>
<tr>
<td>Geographical Information System</td>
<td>M. Konopo</td>
</tr>
<tr>
<td>Internal Review</td>
<td>L. Cassidy (Lin Cassidy Consulting (Pty) Ltd)</td>
</tr>
</tbody>
</table>
3 DESCRIPTION OF THE PROPOSED PROJECT

This section provides detailed project information for Phase 1 of the expansion project (i.e. increased production capacity from 1 Mtpa to approximately 4 Mtpa). Where available, information for the second phase of the expansion project (i.e. increased production capacity by 8 Mtpa to a total capacity of 12 Mtpa) has been included to provide a holistic overview of the colliery’s current life. However, it is expected that once more detailed information becomes available; an amendment to the EIA will be conducted for Phase 2.

3.1 Layout of Surface Infrastructure

The updated surface infrastructure layout for the colliery, as provided in Figure 2, focuses on Phase 1 of the expansion project. Existing surface infrastructure is shown in magenta/purple while proposed infrastructure for Phase 1 is shown in black.

A list of project related infrastructure that will be required for Phase 1 of the expansion is included in Table 1 below. Although detailed information for Phase 2 of the expansion project is not available at this stage of the project planning, a preliminary list of expected infrastructure is available to provide an overview of the colliery’s future.

Table 1: List of project-related infrastructure

<table>
<thead>
<tr>
<th>Existing infrastructure at the colliery (1 Mtpa)</th>
<th>Additional infrastructure for Phase 1 expansion (4 Mtpa)</th>
<th>Additional infrastructure for Phase 2 expansion (12 Mtpa)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Decline shaft with conveyor and entry road</td>
<td>Upgrading of conveyor and adding 2 ventilation shafts</td>
<td>New decline shaft with conveyor, entry road and ventilation shafts</td>
</tr>
<tr>
<td>Crushing and screening plant with conveyors</td>
<td>New crushing and screening facilities to replace existing plant with new conveyors</td>
<td>New crushing and screening facility at second decline with new conveyor to existing plant</td>
</tr>
<tr>
<td>Washing plant with conveyors</td>
<td>New conveyor</td>
<td>New wash plant with conveyors (4 x existing capacity)</td>
</tr>
<tr>
<td>Coal product stockpiles</td>
<td>New storage silos, distribution bins and stockpiles</td>
<td>Expansion of Phase 1 facilities and new stockpile</td>
</tr>
<tr>
<td>Mine access road</td>
<td>-</td>
<td>New mine access road</td>
</tr>
<tr>
<td>Railway network</td>
<td>-</td>
<td>Expansion of railway network</td>
</tr>
<tr>
<td>Conveyor to BPC</td>
<td>Additional conveyor to BPC receiving bin (BPC will have 2 new conveyors transferring coal to their new power station)</td>
<td></td>
</tr>
<tr>
<td>Power supply and distribution including sub-station</td>
<td>Additional 11 kV buried cables and 11 kV lines to ventilation shafts New 66 kV lines to site. The lines have been exempted from an EIA. An EMP will be prepared by the colliery.</td>
<td>Additional power may be required. May comprise additional 66 kV distribution lines to new shaft</td>
</tr>
<tr>
<td>Sewage treatment facilities and maturation ponds</td>
<td>Replace existing plant with pipeline to Palapye treatment works - existing plant to be decommissioned (not part of this EIA scope)</td>
<td>Addition of wastewater facilities and extension/upgrading of pipeline to Palapye treatment works</td>
</tr>
<tr>
<td>Water management facilities including boreholes, supply pipelines, raw water tanks, process water reservoirs, storm water controls, storm water sump</td>
<td>Addition of new storm water dam New connection from NSC to the colliery site (EIA already complete and approved – construction in progress)</td>
<td>Establish new facilities at second decline and connection to Phase 1 facilities</td>
</tr>
<tr>
<td>Waste management including temporary storage of general and hazardous waste, waste disposal site (not in use), salvage yard</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Workshops and washbays</td>
<td>Additional workshops</td>
<td>Establish new facilities at second decline</td>
</tr>
</tbody>
</table>

Prepared by Ecosurv (Pty) Ltd
<table>
<thead>
<tr>
<th>Existing infrastructure at the colliery (1 Mtpa)</th>
<th>Additional infrastructure for Phase 1 expansion (4 Mtpa)</th>
<th>Additional infrastructure for Phase 2 expansion (12 Mtpa)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Storage and handling of hazardous substances including fuel, lubricants, oil, process chemical, explosives</td>
<td>Quantities will increase due to increased production levels.</td>
<td>Quantities will increase due to increased production levels.</td>
</tr>
<tr>
<td>Clinic</td>
<td>Expanded clinic to cater for increased number of employees</td>
<td>Expanded clinic to cater for increased number of employees</td>
</tr>
<tr>
<td>Canteen</td>
<td>Additional dining facilities</td>
<td>Additional dining facilities</td>
</tr>
<tr>
<td>Offices (mine and administration)</td>
<td>Additional offices</td>
<td>Additional mining offices needed at second decline</td>
</tr>
<tr>
<td>Control room and lamp room</td>
<td>Additional control room and expanded lamp room</td>
<td>Additional lamp room at second decline</td>
</tr>
<tr>
<td>Change houses</td>
<td>Additional change house</td>
<td>Additional change house needed at second decline</td>
</tr>
<tr>
<td>Laboratory</td>
<td>Expanded and upgraded laboratory</td>
<td>-</td>
</tr>
<tr>
<td>Telecommunication and data lines</td>
<td>Expansion of lines</td>
<td>Additional lines needed to second decline</td>
</tr>
<tr>
<td>Security and access control</td>
<td>Upgrade of facilities required</td>
<td>Additional facilities required at second decline</td>
</tr>
<tr>
<td>-</td>
<td>Contractor’s camp/s needed for construction and commissioning phases outside lease area</td>
<td>Contractor’s camp(s) needed for construction and commissioning phases outside lease area</td>
</tr>
<tr>
<td>Borrow pit for construction material</td>
<td>Expansion of existing borrow pit</td>
<td>Possible expansion of existing borrow pit or development of new borrow pit</td>
</tr>
<tr>
<td>Morupule village comprising 26 housing units</td>
<td>Additional 20 housing units in Morupule village</td>
<td>Provision for housing in Palapye for a total of 1 200 employees</td>
</tr>
<tr>
<td>Palapye housing to accommodate 97 employees other 210 or so employees have sourced their own housing in Palapye</td>
<td>Provision for housing in Palapye for total of 600 employees, most of whom will source their own housing.</td>
<td></td>
</tr>
</tbody>
</table>

Legend: “-“ No additional infrastructure needed.
Figure 2: Existing and proposed surface infrastructure at the colliery
3.2 Construction Phase

The construction phase will focus on the upgrading and building of new infrastructure needed for the mining and mineral processing operations, upgrading of water management infrastructure, upgrading of support facilities and services and building of additional housing units.

3.2.1 Site facilities – contractor’s camp

A temporary contractor’s camp will need to be established on site during the construction of each expansion phase. This camp will be fenced and will incorporate some or all of the facilities described below:

- a workshop/maintenance area for servicing and maintaining equipment and vehicles;
- a lay-down area;
- a temporary waste collection and storage area;
- a wash bay for washing equipment and vehicles;
- a store for storing and handling fuel, lubricants, solvents, paints and construction substances;
- a parking area for cars and equipment;
- mobile site offices;
- a canteen;
- portable ablution facilities;
- a clean water reservoir;
- mobile accommodation facilities;
- change houses; and
- temporary power infrastructure.

It is estimated that the camp will cover a surface area of approximately 12 ha. The exact location of the camp is unknown at this stage but it is expected that the positioning of the camp will impact on both previously disturbed and undisturbed land.

3.2.2 Construction activities

Construction activities will depend on the nature of the site, but will include:

- selective clearing of vegetation;
- stripping and stockpiling of soil;
- digging foundations, trenches and pits;
- shaft sinking (ventilation shafts, second shaft);
- blasting to develop boxcut (depends on nature of material);
- delivery of materials;
- establishment of contractor’s camp; and
- general building activities.

As part of the construction phase, where existing infrastructure will be upgraded or replaced to cater for the project, the existing infrastructure will be demolished and either recycled, reused or disposed of at an off-site waste disposal site.
3.2.3 Borrow pits

There is an existing borrow pit within the MCL prospecting area, which can be used for providing backfill material for construction. It is expected that this borrow pit will be expanded to cater for the expansion project. In addition, overburden material from the existing boxcut will be used as fill material. An estimated 240 000 tonnes of material will be needed for Phase 1 and 480 000 tonnes of material for Phase 2. All borrow material purchased or excavated must come from legal excavation operations which hold EIA certificates and are registered with DoM.

3.2.4 Transport routes and mechanisms

Construction-related transport will make use of the A1 highway, A14 road to Serowe and mine access road to travel to and from the proposed project site. The types of materials that could be transported to and/or from site include: staff building materials, backfill material, mining and plant equipment, prefabricated offices and containers, consumables and domestic, industrial and sewage waste.

Traffic volumes for the construction period will vary depending on the activities at site. For Phase 1, approximately 14 trucks and 30 vehicles (light vehicles, buses, taxis) will travel to and from site. For Phase 2, approximately 30 trucks and 40 vehicles (light vehicles, buses, taxis) will travel to and from site. These estimates do not include haulage of backfill material.

3.2.5 Power supply and use

Approximately 0.5 MW is required for construction. Current planning is to source this power from the Lotsane substation using a 66 kilovolt (kV) line installed early as part of the bulk electrical supply to the expansion area.

3.2.6 Water supply and use

During construction, water will be required for potable use, sanitation, dust suppression, and earthworks. Per day, approximately 170 m$^3$ (0.2 m$^3$/person) of additional potable water, 400 m$^3$ of additional process water at peak periods (during earthworks stage of construction) and 50 m$^3$ during concrete work periods (mainly for cement mixing) may be required for Phase 1. This water will be sourced from the NSC via a new pipeline. MCL has been allocated a water entitlement from the NSC of 2.2 million m$^3$ per annum from 2010.

For Phase 2, approximately 240 m$^3$ (0.2 m$^3$/person) additional potable water, 800 m$^3$ additional process water at peak periods (during earthworks stages of construction) and 100 m$^3$ during concrete work periods (mainly for cement mixing) may be required per day for Phase 2. This water will also be sourced from the NSC via the new pipeline.

3.2.7 Water management

Water management infrastructure described in Section 3.3.6 will be established on site at the start of construction.

3.2.8 Waste disposal and management

The types of wastes that could be generated during the construction phase include:

- overburden from the widening of the decline shaft;
- domestic waste such as office waste, detergents, food waste;
- wastewater; and
• industrial waste such as building rubble, electrical/plastic/material off-cuts, spent oil and grease, polluted soil (from accidental spills), paints and solvents, containers and scrap.

All domestic and industrial waste generated during the construction phase of the project will be stored and managed as outlined in Section 3.3.7. Mobile enclosed portable toilets will be placed at the contractor’s camp and construction sites (where required). The enclosed chemical toilets will be cleaned and serviced twice a week by a contractor. Sufficient chemical toilets will be placed on site to cater for the number of workers.

3.2.9 Employment and housing

The number of temporary construction workers will vary depending on the construction activities at any given time. It is estimated that approximately 850 temporary construction-related jobs will be created for Phase 1. Construction employees will be housed in temporary accommodation facilities within the contractor’s camp or have their own accommodation in Palapye. For Phase 2 of the expansion project, it is estimated that an additional 1 200 construction jobs will be created.

3.2.10 Timing

Morupule would like to start construction of the housing units and Phase 1 in 2010. It is estimated that construction will take approximately three years. Construction of Phase 2 is expected to commence in 2012, provided that the required environmental authorisations have been issued to the colliery. It is estimated that construction will take approximately three years.

3.3 Operational Phase

3.3.1 Expansion of underground mining operations

Overview of current operations

Currently, MCL operates one shaft and about 1 million tonnes of coal per annum is extracted from this shaft from the Morupule Seam (about 4.2 m of the 8-10 m seam) by conventional bord/room and pillar mining methods. A room and pillar method entails mining in a chequerboard layout, leaving blocks of coal as support pillars. This operation is at about 85 m below the surface. Currently, coal is mined using a continuous miner (CM). The CM section equipment comprises:

• the CM itself (a coal shearer type of machine that mechanically breaks coal out of the coal seam);
• three shuttle cars that transport the broken coal from the CM;
• a feeder-breaker that receives coal from the shuttle cars and reduces the coal chunks to a smaller size;
• a roof bolter that reinforces the roof of the coal seam once the CM has removed coal from the seam;
• a load / haul driver (LHD) that is used to maintain good housekeeping in the section;
• power and water supply facilities;
• pumping systems to keep the workings free of stagnant water;
• a series of conveyor belts that transport the coal from the section towards the trunk conveyors that transport coal to surface; and
• staff to operate and maintain the equipment in a safe and legally compliant manner.

Mine plan and boxcuts
The colliery’s current lease area covers approximately 17,757 ha. This lease area contains sufficient coal for both Phase 1 and Phase 2 of the expansion project. Figure 3 illustrates the increase in the mine lease area for each phase of the expansion project. Permission for the total mining lease area has been obtained from Land Board (Annexure 2).

**Figure 3: Location of proposed development for both phases**

For the Phase 1 expansion project, it is planned to increase the production rate from 1 to 4 Mtpa. This will be achieved by increasing the underground mining sections from 1 to 4 CMs, employing the same methods and type of equipment that are currently in use. As a result, there will be an increase in the amount of mining equipment needed underground. Mining will take place to a maximum depth of approximately 150 m. Mining beyond this depth may entail a change in mining method, but this would only be expected to occur after 2028.

The surface layout for Phase 1 of the underground mining operations will remain relatively unchanged except for the upgrading of the trunk conveyor to surface. Two new ventilation shafts will need to be constructed approximately 3.5 km from the existing shaft to allow sufficient air to reach the working areas. No other additional infrastructure will be required for the underground mining operations.

For Phase 2, a second decline shaft is proposed approximately 3.5 km north-west of the existing one. It is assumed that the proposed decline shaft will be two times the width, but the same length and depth, and similar in operation to that of the existing decline. It is expected that mining will comprise 8 CMs and produce approximately 8-12 million tonnes/annum.

**Ventilation requirements**

Approximately 600 m$^3$/s of air will be needed for the expansion project. This will be achieved by establishing two ventilation shafts. The ventilation shafts, one upcast to expel dirty air and one downcast to suck in clean air, will be located approximately 3.5 km south-west of the
existing decline shaft. Each ventilation shaft will be approximately 6 m in diameter and 100 m deep. The ventilation requirements for Phase 2 are expected to be in order of 1 200 m$^3$/s using a similar system to that above. The exact position of the Phase 2 ventilation shafts is unknown at this stage.

**Blasting**

The mining method selected does not typically make use of explosives, however it may be necessary to use explosives, should it be necessary, for example, to break through a dyke.

**Surface subsidence**

As part of the mining operations, only about 50% of the coal seam is mined and the remaining 50% is left as support pillars in the underground mine. The aim of this is to prevent surface subsidence above the underground workings. Surface structures that could be affected by surface subsidence include the A14 road, Morupule River, Lotsane River, the NSC water supply pipeline and various private homesteads. A higher factor of safety is applied to the areas under the A14 and the rivers (i.e. wider pillars are left to support the roof, which decreases further the risk of subsidence).

**Timing**

Production from the existing shaft will be able to continue until 2028 before the resource is depleted, assuming the same mining method is maintained throughout.

### 3.3.2 New crushing and screening process

**Surface layout**

The existing dry crushing and screening plant at the colliery comprises two crushers and screens. For Phase 1 of the expansion project, this plant will be replaced to cater for the additional capacity and will include new equipment housed in new buildings. Infrastructure required includes: a concrete storage silo, a distribution bin, primary crusher and screen, secondary crusher and screen, stockpile areas, and conveyor systems linking each component. The position and layout of both the existing and proposed crushing and screening facilities is illustrated in Figure 2. Once the proposed new infrastructure has been established, the existing infrastructure will need to be demolished and recycled, re-used and/or disposed of. For Phase 2, a crushing and screening facility will need to be established at the second decline for preliminary crushing prior to transfer via overland conveyor to the Phase 1 crushing and screening facility, which will be expanded to cater for the additional production level.

**Overview of the proposed process**

This section should be read with reference to the conceptual process flow diagram included in Figure 4 below.
Figure 4: Conceptual process flow for 4 and 12 Mtpa
Run of mine (ROM) – i.e. raw – coal transported from underground via conveyors will be fed into a concrete receiving silo that will serve as a surge facility to smooth out the peaks and troughs from the normal production process. At the storage silo, a 1,700 tonne overspill stockpile will be provided to cater for emergency ore handling.

**Primary crushing and screening**

From the silo, coal will be dry crushed and screened through an open circuit primary crusher to reduce the size of coal particles from 300 mm to a diameter of < 75 mm. All crushed coal will be conveyed to a distribution bin with a capacity of 400 tonnes. From the bin, coal will be separated into different streams and will either be routed to a stockpile (with 2 days / 30 000 tonne production capacity), and then routed to the secondary dry crushing area or routed to the washing plant sizing screens.

**ROM stockpile**

Material will be fed to the stockpile when mining production is higher than plant throughput and will be reclaimed from the stockpile back to the distribution bin when mining production levels decrease. The stockpile will have an approximate capacity of 30,000 tonnes and will be placed on a compacted and impervious bed to prevent ingress of contaminated water into the groundwater system.

**Secondary crushing and screening**

The secondary crusher and screening section prepares coal for feed to the power station by crushing the ROM coal to < 32 mm in diameter. It is expected that some 2.0 million tonnes per annum will be processed through this portion of the facility. From this stage the coal is routed to the power station grade coal distribution bin for distribution to BPC Power Station A, BPC Power Station B (Phase 1), and the train trucks transporting coal to BCL and Sodaash. This crushed stream will be blended with washing plant low quality coal product and coal (< 15 mm in size) from the washing plant sizing screens. This blending material will come from the existing 5000 ton stockpile via a new conveyor belt.

**Screening for washing plant**

The washing plant sizing screens remove any < 15 mm material from the crushed ore that is to be fed to the washing plant. This is a dry screening process. It is expected that some 2.0 million tonnes per annum will be screened to produce the 1.0 million tonnes of feed to the existing washing plant. The remaining 1.0 million tonnes of finer coal (< 15 mm) will be routed to the existing 5 000 tonne stockpile, where it will be blended with the low quality coal from the washing plant, and then it will be fed to the power station grade coal distribution bin feed conveyor.

Dust suppression and containment facilities will be required for the plant. Dust will be managed in areas such as transfer points, bins and stockpiles. The type of suppression process to be used has not been finalised but a key design parameter is that moisture content of the material to be supplied to the Morupule Power Station must not exceed 8%.

3.3.3 **Washing plant**

**Surface layout and capacity**

There is an existing washing plant at the colliery comprising a single stage washing facility and product stockpiles. The position and layout of the plant is illustrated in Figure 2. This plant will be used for Phase 1 of the expansion project and will not require any upgrading. The current wash plant has a design capacity of about 1 Mtpa, although it is not operating at
design capacity at this stage. In addition, all processed material is sold and there is no generation of slimes or plant residue.

For Phase 1, it is estimated that the wash plant will process approximately 1.0 Mtpa. This will result in an increased use of water (discussed under Section 3.3.6) and increased volume of high sulphur coal being transported to BPC. For Phase 2 of the expansion project, the existing plant will continue to be used, and additional treatment capacity will be constructed. The approximate position of the new wash plant area is shown in Figure 2. The new plant will be four times the size of the current plant and will be designed to process 4.9 Mtpa. The washing process as described below is not expected to change for the new plant other than the possible use of a density cyclone to effect the separation instead of a drum or the use of both a drum and density cyclone. Any new product stockpiles will be placed on a compacted and impervious bed to prevent ingress of contaminated water into the groundwater system.

Coal washing process

The existing coal washing plant has been operational since January 2008. The environmental benefits of removing certain harmful pollutants found naturally within the coal through the washing process were identified as a key motivation for establishing the washing plant.

Washing process

The process used in washing coal is based upon the fact that good quality (high calorific value, CV) coal has a lower density than poor quality (low CV) coal. The washing plant makes use of a single stage Dense Media Separation (DMS) process to separate the high CV coal from the low CV coal.

The dense media is made by mixing water and magnetite, a mixture of iron oxides, until the desired density is obtained. The magnetite is sourced from Phalaborwa in South Africa, where it is a by-product of the copper recovery process. Magnetite losses from the system are minimized by washing the coal products with re-circulating process water and recovering the magnetite using a magnetic separator. Approximately 600 g of magnetite is required per tonne of coal fed to the washing plant.

The heart of the washing process involves feeding a mixture of coal and the dense media into a slowly rotating drum. In the drum, the low density (high CV) product floats to the surface of the media and overflows out of the drum onto a screen where the media is recovered and the coal is washed to remove residual magnetite. The high density (low CV) coal in the drum sinks in the media and is removed from the bottom of the drum. After recovery of the media and washing to remove the residual magnetite, this low CV coal product is crushed to < 32 mm and dispatched to the power station grade coal stream.

Plant operation has shown that 50% to 70% of the coal is separated as high CV product and the remainder (which is low CV coal) is fed to the power station. The high CV coal is currently stockpiled on site on compacted earth apron. Table 2 highlights changes in selected coal parameters during the washing process.

Table 2: Changes in selected coal parameters during the washing process (Source: Morupule Laboratory feed and produce stream analyses for April 2008)

<table>
<thead>
<tr>
<th></th>
<th>Moisture (%)</th>
<th>Volatiles (%)</th>
<th>Ash Content (%)</th>
<th>Phosphorous (%)</th>
<th>Sulphur (%)</th>
<th>Fixed Carbon (%)</th>
<th>Calorific Value (MJ/kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>ROM (Raw Coal)</td>
<td>5.3</td>
<td>22.6</td>
<td>22.2</td>
<td>0.015</td>
<td>1.355</td>
<td>50.0</td>
<td>22.6</td>
</tr>
<tr>
<td>High Quality</td>
<td>5.4</td>
<td>23.7</td>
<td>15.7</td>
<td>0.013</td>
<td>0.750</td>
<td>55.2</td>
<td>25.7</td>
</tr>
<tr>
<td>Product</td>
<td>4.2</td>
<td>22.5</td>
<td>35.8</td>
<td>0.015</td>
<td>3.001</td>
<td>37.5</td>
<td>18.8</td>
</tr>
</tbody>
</table>
The low quality coal stream currently constitutes some 14% of the coal fed to BPC (April 2008 figures), the remainder being raw coal from the mine. After the Phase 1 expansion, this percentage will reduce to 12.5%.

**Return water system**

All water used in the process will be captured and treated in thickeners for reuse as process water. The water that will be used is a result of increased surface moisture on the washing plant products – no slime dams will be required, and no effluent will be discharged. This will also be the case for the new wash plant.

### 3.3.4 Transport routes and mechanisms

**Roads and access points**

Staff, materials, coal product to local customers and solid waste are transported via existing roads to and from the colliery. This road network comprises the mine access road, A1 highway, and A14 road to Serowe. No new roads will be established for Phase 1 of the expansion project. For Phase 2, a new mine access road to the shaft will be required. As the position of the shaft is unknown at this stage, the route for the access road has not yet been determined.

Currently approximately 82 light vehicles, 13 heavy vehicles (excluding product) and 18 coal product trucks travel to and from site daily. For Phase 1, traffic volumes are expected to double to cater for the additional capacity. For Phase 1, some 164 light vehicles, 26 heavy vehicles (excluding product) and buses, and 36 coal product trucks are expected to travel to and from site daily. For Phase 2, this is expected to increase to approximately 330 light vehicles, 70 heavy vehicles (excluding product) and 72 coal product trucks daily.

**Railways**

There is an existing railway network at the colliery that transports coal to the main railway line. For Phase 1 of the expansion project, the existing rail network will be used. A new rail and road loading bin will be constructed. Other than this, no additional upgrades or infrastructure are required. For Phase 2, this rail network will need to be upgraded to cater for the increased capacity. The upgrade requirements are unknown at this stage, but are likely to be in the order of an additional 5 Mtpa capacity. Currently three trains leave the site per week. This may increase for Phase 1 but the increase will be insignificant. For Phase 2, it is unknown at this stage what the increase in rail traffic will be.

**Conveyor**

The mine comprises underground conveyors, a trunk conveyor (for transporting coal to surface), internal plant conveyors and product conveyors (for transporting power station grade coal to BPC). For Phase 1 of the expansion project, these conveyor systems will be upgraded as follows:

- replace the existing trunk conveyor to surface with a new conveyor to cater for the increased capacity;
- addition of new internal plant conveyors; and
- addition of new product conveyors to BPC A, BPC B Phase 1 and the rail loading facility.

Within the mining operations it is expected that any additional surface conveyors will be established within already disturbed areas. The double additional conveyor system to the BPC B Phase 1 receiving bin will run across previously undisturbed land for approximately 100 m
with a servitude of 40 m wide. These conveyors will be constructed and maintained by BPC. All MCL conveyor systems will have wind protection sides.

For Phase 2 of the project, new conveyors will be needed. This is expected to include underground conveyors, trunk conveyors to transport coal to surface, overland conveyors to transport coal between the second decline and processing plants and possibly a new product conveyor to BPC (to supply coal to a new power station: BPC B Phase 2).

3.3.5 Power supply

Electricity consumption at the colliery is expected to increase from 2.5 MW to 12.1 MW for Phase 1 and to 36 MW for Phase 2. Given the mutual interdependence of the Morupule Colliery and the Morupule Power Station, availability of the required additional electricity is not considered to be problematic.

The existing power supply to the colliery is proposed to be augmented as follows:

- addition of a single overhead 66 kV power line, approximately 2 km in length between the existing Lotsane Substation and the high voltage yard at the Morupule Power Station (Morupule Power Station – Lotsane Substation 66 kV power line). This power line is expected to have a servitude 20 m in width;
- installation of two overhead 66 kV power lines, approximately 3 km in length, which will connect the Lotsane Substation with the Morupule Colliery intake substation (Lotsane Substation – Morupule Colliery Substation 66 kV power lines). These power lines will be erected within a double servitude approximately 40 m in width;
- construction of a new outdoor 66 / 11 kV substation of approximately 2 400 m² fenced in area;
- buried 11 kV cables to a 11 kV indoor switching station of approximately 90 m², located near the existing washing plant; and
- various 11 kV on-site cables (in cable trenches) from the switching station to the distribution centres.

The first four activities listed above fall within the existing BPC and Morupule Colliery lease areas. Preliminary EIA (PEIA) studies have been conducted in these areas and have been exempted from a detailed EIA by DEA (letter dated 4th April, 2008), but an EMP will be developed and observed during the construction period.

The proposed expansion will completely do away with the existing on-site 6.6 kV network, and replace it with a new 11 kV distribution network to supply power to the new mining sections and new processing plants.

3.3.6 Water supply, use and management

Water use

Water at the colliery is used for make-up water in the washing plant, dust suppression and domestic use. The colliery currently uses approximately 55 800 to 74 400 m³ per annum. An additional 302 000 m³ per annum will be required for Phase 1 and an additional 885 000 m³ per annum for Phase 2 of the expansion project.

Water supply

Water sources available to the colliery include a borehole in the Morupule village area site (not currently in use due to a potential contamination issue), a small wellfield at the Colliery - Phuduhudu Wellfield area (owned by the Council), dewatering and surface water drainage collection from the mine area and a 'top up' facility from Paje Wellfield provided by BPC.
The colliery is planning to rehabilitate this borehole. All of these water sources are used for the current operations. Currently average monthly water supply figures are as follows:

- ~ 160 m$^3$ from on site borehole to supply the village;
- ~ 3 840 m$^3$ from the Phuduhudu Wellfield;
- ~ 620 m$^3$/h from the BPC (Paje Wellfield); and
- ~ 600 m$^3$ drainage from underground.

For both phases of the proposed expansion project, it is planned to obtain the colliery’s water from a connection to the NSC. MCL has secured an allocation of 2.2 million m$^3$ per annum from the NSC. In order to provide for the increased water demand, MCL has issued a contract for the construction of the water pipeline to allow for the transportation of raw water from the NSC. The project is at the early construction stage and its EIA study has been approved (15th February 2008). Approximately 0.8 million m$^3$/annum will be drawn from the NSC for use by MCL. The remaining unused allocation may be transferred to BPC pending an agreement with BPC on this issue.

There are no plans to expand the borehole water systems. The connection to BPC to utilise the Paje Wellfield water will be expanded such that this wellfield will also supply water to MCL. This water is only expected to be used in case of emergencies, e.g. NSC breakdown or extended drought.

**Pipelines**

There is a network of internal pipelines distributing water throughout the colliery. This network will need to be upgraded to cater for the proposed project. It is expected that pipelines will be needed for potable, process and wastewater.

**Water pollution management facilities**

The colliery has existing storm water control facilities on site comprising process water reservoirs, dirty storm water controls, and a storm water sump. These facilities will be upgraded to include an additional storm water tank with a capacity of approximately 10 000 m$^3$ (50 m x 75 m x 3 m deep). This storm water tank will capture runoff from the crusher facilities, stockpiles and wash plant, and will be lined to prevent unnecessary losses. The location of the storm water tank is shown in Figure 2.

The main aim of the storm water control system is to capture runoff for re-use in the process. This rainwater harvesting will avoid any rainwater that becomes contaminated through contact with coal particles from leaving the property, and will also reduce the need to use raw water from the various water sources to the colliery. All plant structures will be placed on a concrete surface and bunded to allow recovery of spillage water.

**3.3.7 Waste and residue management**

The only wastes generated by the colliery include domestic and industrial waste and wastewater from the ablution facilities. No other mine or plant residues are generated. All processed material is sold as product. This will be the same for the proposed expansion project.

**Domestic and industrial waste**

The types of waste that are generated by the colliery are listed in Table 3. The colliery has an existing waste management procedure in place (Annexure 8). It is expected that this procedure will be used for the expansion project.
Table 3: Types of waste generated by the colliery per annum

<table>
<thead>
<tr>
<th>Type of Waste</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scrap</td>
<td>31 894 kg</td>
</tr>
<tr>
<td>Cable</td>
<td>11 600 kg</td>
</tr>
<tr>
<td>Belts</td>
<td>1 536 kg</td>
</tr>
<tr>
<td>Empty drums</td>
<td>236 drums</td>
</tr>
<tr>
<td>Tyres (small vehicles)</td>
<td>26 tyres</td>
</tr>
<tr>
<td>Supper tyres</td>
<td>16 tyres</td>
</tr>
<tr>
<td>Oil</td>
<td>14 500 litres</td>
</tr>
</tbody>
</table>

Currently the colliery generates approximately 50 tonnes of waste per annum. It is expected that Phase 1 of the expansion project will result in an additional 100 tonnes of similar waste types being generated based on the increased capacity, facilities and workforce of the colliery. There is an existing salvage yard on site for temporary storage of recyclable materials and reusable material and equipment. About 7.5 tonnes of waste is transported weekly to the landfill in Palapye. The colliery is planning to dispose the non-recyclables to the Serowe landfill during the expansion period. The Serowe landfill is well engineered and started operating in 2005 with a design life of 20 years. The landfill has four cells and to date, only half of Cell 1 has been used. Only non-hazardous waste is accepted at the landfill. The Landfill authority (CDC) should be consulted.

Sewage treatment

There is an existing sewage treatment plant and maturation ponds at the colliery. These facilities however are not operating efficiently. Through a separate EIA process, the colliery is planning to decommission the existing facilities and replace them with a new pipeline to the Palapye treatment works. The proposed expansion project is expected to generate an additional 46 m$^3$ wastewater per day for Phase 1 and 79 m$^3$ per day for Phase 2. The Palapye Planning Area Development Plan for 2007-2031 (draft report) indicates that existing treatment spare capacity of 1 472 m$^3$/day. The Colliery should consult with the CDC’s Water and Wastewater Departments during the planning period.

3.3.8 Additional support facilities

Existing support facilities at the colliery include workshops, washbays, stores, a salvage yard, a mining scrap yard, change houses, laboratory, plant offices, a lamp room, a canteen, security access and control systems, a clinic, training facilities, parking areas, storage and handling areas for hazardous substances, telecommunication infrastructure and main administration offices. These facilities cover an area of approximately 7.2 ha.

Phase 1 of the expansion project will include the provision of new or expanded workshops, a change house, laboratory facilities for performing washability tests using heavy liquids, offices, parking areas, dining facilities, lamp room, stores, weighbridge and access control systems. It is estimated that these facilities will be accommodated within the already disturbed land of the workshop area and the plant. Potentially polluting areas will be located on impermeable substrates within bunded areas with appropriate collection facilities (drains, sumps and oil traps) in place. Storage of potentially polluting substances will be within sealed containers. Where required, old facilities will be decommissioned and the equipment and materials recycled, reused and/or disposed of at permitted off-site waste disposal sites.

3.3.9 Employment and housing

The colliery currently employs approximately 264 workers. With the expansion of the mining operations this is expected to increase to 600 for Phase 1 and 1 200 for Phase 2. The proposal
for housing operational workers is to establish an additional 20 housing units at the Morupule Village (as part of Phase 1) to accommodate senior personnel, to rent additional housing from the BHC and for employees to source their own accommodation from private individuals. It is expected that the additional housing units will be an extension of the Morupule village and will require approximately 10 ha of land. No other on-site facilities will be provided for employees during the operational phase.

3.3.10 Timing

It is expected that the new facilities will be commissioned in 2011 and 2012. The design life of colliery for the Phase 1 of the expansion project is approximately 20 years (to 2023). For Phase 2, the life of colliery could be increased by an additional 20 years.

3.4 Decommissioning and Closure Phase

The decommissioning and closure phase will focus on the removal of infrastructure and rehabilitation of areas disturbed by Phase 1 of the proposed expansion project. A preliminary closure cost estimate has been calculated by Metago. Due to limited detailed information available for Phase 2, no closure cost estimate has been determined for the second phase. In line with the colliery’s current planning, it is expected that the colliery’s current closure plan will be revised in 2010 to include the expansion project with a final closure plan drafted five years before closure.

3.4.1 Closure objectives

As sourced from MCL’s 2005 colliery closure plan, the objectives are to ensure that the colliery does not become abandoned in the future and that the site is either returned to as close as possible to its original state or such that the community can make use of the remaining mining facilities for other economically viable activities. Where it is not possible to rehabilitate the site to its original state or to develop it for other purposes, it is essential:

- to make the site safe for both humans and animals existing in the area;
- to ensure that the remaining (residual impacts) are of an acceptable nature and will not worsen over time;
- to ensure that any remaining structures are stable and sustainable; and
- to ensure that closure is achieved efficiently and at the lowest possible cost.

It is expected that these same objectives will be applied to the expansion project.

3.4.2 Decommissioning and closure activities

Decommissioning and closure activities that will be undertaken depending on the nature of the site and could include the following (based on the calculated closure cost estimate):

- dismantling of processing plant and related structures (including overland conveyors and power-lines);
- demolition of steel buildings and structures;
- demolition of reinforced concrete buildings and structures;
- rehabilitation of access roads;
- demolition of housing and facilities;
- sealing of shafts, adits (horizontal entrances) and inclines;
- rehabilitation of processing waste deposits and evaporation ponds (acidic, metal rich);
- general surface rehabilitation, including grassing of all denuded areas; and
• removal of waste from site.

3.4.3 Financial provision

A preliminary closure cost has been calculated on the basis of the standard South African Department of Minerals and Energy (DME) procedure for the determination of the quantum for financial provision for closure (DME, 2005). The calculated (DME method) closure liability is **ZAR 4,088,148.33**. The closure cost estimate report is appended (Volume 2, Appendix 6).

3.5 Compensation and Resettlement

A number of households reside within the colliery’s mining lease area. The colliery is planning to move people from this as indicated below and in Figure 5:

• **Area A:** people will be compensated and requested to move for safety reasons but light subsistence farming such as cattle grazing and light farming may continue with permission from the colliery.

• **Area B:** people will be compensated but there is no immediate need to relocate. People may request to continue with their farming activities from the colliery until such time that the colliery has made a decision to relocate. There may also be a need to rationalise the land use so as to accommodate some farmers from Area A. This will involve making a proper plan for the area.

• Compensation to all is required as Land Board cannot give MCL the surface rights if the previous owners have not been compensated. This will also mean that the colliery cannot extend beyond area C which would imply no coal to BPC for another 20 years.

• **Area C:** no resettlement is expected and people will be permitted to continue with their ploughing and cattle grazing activities.
Figure 5: Location of the areas subject to compensation and resettlement
4 LEGAL AND PLANNING FRAMEWORK

The Botswana Government requires that EIA studies be carried out for major development projects as a way of protecting the environment and natural resources. The *EIA Act of 2005* guides developmental interventions, ensures that the potential effects of planned developmental activities are assessed and that the mitigation, monitoring and evaluation measures of such environmental impacts of proposed activities are identified. Under this act, an EMP is also required to ensure that recommended mitigations are implemented and the environmental impacts are monitored and audited. Following the promulgation of this act, guidelines for preparing EIAs have been developed. However, they are still in draft format. This EIA conforms to the requirements of the EIA Act and the development will only start after the EIA Authority has approved the EIS.

Environmental policies, strategies, legislations and plans relevant to the study are highlighted and discussed below to verify that project implementation does not conflict with them. The institutions responsible for implementation of the policies and laws are mentioned with a view that in the event of any undesirable incident during the course of the project, they can be contacted for assistance and guidance.

4.1 International Obligations and Agreements

4.1.1 Agreements related to air pollution

Although the *Kyoto Protocol (1997)* does not directly apply to mining of coal, it is relevant because of the possible production of methane during mining. The falls under the United Nations Framework Convention on Climate Change (UNFCCC) and its objective is to "stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system." As of December 2006, a total of 169 countries and other governmental entities have ratified the agreement including Botswana and therefore share the common responsibility that all other countries have in reducing the emissions.

The *World Bank Group Environmental, Health and Safety Guidelines (2007)* provides the performance levels and measures normally acceptable to the International Finance Corporation (see online documentation available at the following URL: http://www.equator-principles.com/documents/EHSGuidelinesUpdated.pdf). The ambient air quality limits are summarised in Table 4. These limits should not be exceeded during construction for expansion and operation of the colliery.

<table>
<thead>
<tr>
<th>Averaging period</th>
<th>World Bank Limit (µg/m³)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>SO₂</td>
</tr>
<tr>
<td>1 hr average</td>
<td>No limit</td>
</tr>
<tr>
<td>24 hrs average</td>
<td>150</td>
</tr>
<tr>
<td>Annual average</td>
<td>80</td>
</tr>
</tbody>
</table>

In addition to the above, DWMPC has set up air quality objectives for concentration of criteria pollutants as emissions standards (Table 5). These define the maximum amount of pollutant that can be present in outdoor air without compromising the health of the public.
Table 5: Botswana air quality objectives *(Source: DWMPC)*

<table>
<thead>
<tr>
<th>Pollutant</th>
<th>Standard Value (µg/m³)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Annual average</td>
</tr>
<tr>
<td>Particulate matter (PM)</td>
<td>100</td>
</tr>
<tr>
<td></td>
<td>Monthly average</td>
</tr>
<tr>
<td></td>
<td>200</td>
</tr>
<tr>
<td>Sulphur dioxide (SO₂)</td>
<td>Annual average</td>
</tr>
<tr>
<td></td>
<td>80</td>
</tr>
<tr>
<td></td>
<td>Monthly average</td>
</tr>
<tr>
<td></td>
<td>160</td>
</tr>
<tr>
<td></td>
<td>24 hour average</td>
</tr>
<tr>
<td></td>
<td>90% of hourly observation to be less than 00</td>
</tr>
<tr>
<td>Carbon monoxide (CO)</td>
<td>8 hour average</td>
</tr>
<tr>
<td></td>
<td>10,000</td>
</tr>
<tr>
<td></td>
<td>1 hour average</td>
</tr>
<tr>
<td></td>
<td>40,000</td>
</tr>
<tr>
<td>Nitrogen dioxide (NO₂)</td>
<td>Annual average</td>
</tr>
<tr>
<td></td>
<td>100</td>
</tr>
<tr>
<td></td>
<td>Monthly average</td>
</tr>
<tr>
<td></td>
<td>200</td>
</tr>
<tr>
<td></td>
<td>1 hour average</td>
</tr>
<tr>
<td></td>
<td>400</td>
</tr>
<tr>
<td>Ozone (O₃)</td>
<td>8 hour average</td>
</tr>
<tr>
<td></td>
<td>157</td>
</tr>
<tr>
<td></td>
<td>1 hour average</td>
</tr>
<tr>
<td></td>
<td>235</td>
</tr>
</tbody>
</table>

4.1.2 Agreements related to noise pollution

Botswana in general applies the World Bank Group noise limits, which are summarised in Table 6. High noise levels are expected during the construction and operation phase and measures to reduce such noise should be put in place.

Table 6: World Bank Group noise limits

<table>
<thead>
<tr>
<th>Receptor</th>
<th>Maximum Allowable Level (dBA)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Day Time (7:00 – 22:00)</td>
</tr>
<tr>
<td>Residential, institutional, educational</td>
<td>55</td>
</tr>
<tr>
<td>Industrial, commercial</td>
<td>70</td>
</tr>
</tbody>
</table>

4.1.3 Agreements on solid waste movement and disposal

The *Basel Convention* (concluded in 1989) controls trans-boundary movement of hazardous waste and its disposal. Botswana is a party to this convention, of which the requirements are regulated by the Department of Waste Management and Pollution Control (DWMPC) through the *Waste Management Act*, 1998. Currently, Botswana does not have a disposal site for hazardous waste. Hazardous waste is transported outside Botswana through DWMPC. The colliery should be aware of this convention and should ensure that hazardous waste is separated, stored and disposed of as required by the convention.

4.1.4 Financing arrangements

The proposed colliery expansion project will be financed internationally and the prospective financier has required that the *July 2006 Equator Principles* be followed. These principles provide financial industry benchmarks for determining, assessing and managing social and environmental risks in project financing. The principles require that a social and environmental assessment be carried out for all projects with potentially significant impacts, a social and environmental assessment be carried out and that and the resultant documentation should address the following:

- assessment of the baseline social and environmental conditions;
- consideration of feasible environmentally and socially preferable alternatives;
- requirements under host country laws and regulations, applicable international treaties and agreements;
- protection of human rights and community health, safety and security (including risks, impacts and management of project’s use of security personnel);
• protection of cultural property and heritage;
• protection and conservation of biodiversity, including endangered species and sensitive ecosystems in modified, natural and critical habitats, and identification of legally protected areas;
• sustainable management and use of renewable natural resources (including sustainable resource management through appropriate independent certification systems);
• use and management of dangerous substances;
• major hazards assessment and management;
• labour issues (including the four core labour standards), and occupational health and safety;
• fire prevention and life safety;
• socio-economic impacts;
• land acquisition and involuntary resettlement;
• impacts on affected communities, and disadvantaged or vulnerable groups;
• impacts on indigenous peoples, and their unique cultural systems and values;
• cumulative impacts of existing projects, the proposed project, and anticipated future projects;
• consultation and participation of affected parties in the design, review and implementation of the project;
• efficient production, delivery and use of energy; and
• pollution prevention and waste minimisation, pollution controls (liquid effluents and air emissions) and solid and chemical waste management.

4.2 National Policies and Strategies

4.2.1 Policies related to land use and land tenure
The colliery is located to the west of Palapye village in Central District. The BPC power station is the immediate neighbour of the colliery to the east. The settlement hierarchy in the Revised National Settlement Policy (March 2004) classifies Palapye as a Primary III centre in Central District and locates it within the eastern planning region. Planning regions were established in order to harmonise the planning, provision and maintenance of infrastructure and services.

4.2.2 Policies and strategies related to the environment
Debswana’s Environmental Policy (2006) details sustainable use of natural resources and protection of the environment. The guiding principles to achieving this are to:
• continually improve the company’s environmental management performance;
• comply with all applicable laws, regulations, and commitments; and
• prevent pollution of the environment.

The National Conservation Strategy (Coordinating) Agency (NCSA) 1990 White Paper provides for the use and conservation of natural resources. It captures the ‘polluter pays’ principle and contains rather general solution packages for several environmental concerns from activities that might harm natural resources.
4.2.3 Policies related to energy

The National Energy Policy (2006) aims at providing a least-cost mix of energy supply, which reflects total life cycle costs and includes externalities, such as environmental damage. The energy policy objectives are 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; and
- in the long term sustainable energy usage needs to be implemented.

Special emphasis will also be put on developing new and renewable sources of energy as alternatives or complementary supplies of affordable and sustainable sources of energy.

4.2.4 Policies related to socio-economic issues

The Tourism Policy of 1990 was enacted to provide support to tourism ventures in the country. The policy advances the concepts of high-value, low-impact tourism. The existing game park has taken cognisance of this policy and the colliery is planning some of the land within the lease area for tourism initiatives.

The Community Based Natural Resources Management Policy (2006) was enacted to promote conservation of natural resources and economic diversification by local communities. The policy states that “all members of a community share an interest in improving their livelihoods through sustainable management and utilisation of natural resources in their environs”.

Debswana’s HIV Policy (2001) (Annexure 14) defines the organisation’s commitment to the fight against HIV/AIDS. The policy does not only apply to the company’s employees but also to its appointed contractors. The Botswana HIV Policy (1998) outlines the national response strategy to HIV/AIDS in Botswana. This policy, together with the Debswana HIV Policy should be used by contractors to develop their HIV/AIDS and other sexually transmitted infections programmes.

The Debswana Corporate Social Investment Policy CSIPOL 001 (Annexure 16) comprise community representation (where necessary) to ensure projects are taking into account and consulting community in appropriate ways and that the views obtained are reflected in decisions.

4.2.5 Waste management strategy

The Waste Management Strategy of 1998 states that waste management will be carried out in a manner that protects human health and the environment, and that ensures prudent use of natural resources. It captures the principles of prevention, the polluter pays and the principle of cooperation. Pollution due to waste management from the proposed developments should be considered in the EIA study to prevent future pollution to surrounding environment.

The strategy has adopted an internationally acceptable Waste Management Hierarchy (i.e. Waste reduction → Waste Reuse and Recycling → Treatment → Disposal) to minimise wastes.
4.3 National Legislation

4.3.1 Laws pertaining to land use and land tenure

The State Land Act, Cap 32:01 (1955) defines the state land of Botswana and provides for its disposal and for matters incidental to, or connected with, land. The location of the mine lease is however on tribal land. MCL currently lease their land from the Bamangwato Tribal Authority. The proposed expansion of the MCL should only take place within this lease area which is on tribal land (Tribal Land Act of 1993 (as amended)).

The Town and Country Planning Act of 1977 establishes a framework for the orderly and progressive development of land in urban and rural areas. The Act is applicable in planning areas only and ensures that land is available for expansion purposes as well as other infrastructure service. The Palapye Planning Area was established in terms of this Act in April 1995 and development should be subjected to planning permission. The colliery should consult with the Serowe-Palapye Sub-district to apply for planning permission for all the structures required for expansion.

The Land Control Act of 1975 regulates transactions involving the sale and purchase of agricultural land. Since MCL is planning to relocate farmers within the lease area, any land purchases and compensation will have to conform to the regulations under this act.

The EIA Act of 2005 recognises the importance of consultations with interested and affected parties (IAPs) who may be negatively or positively affected by the project. Consultations were carried out during the scoping phase and it is recommended that further consultations be carried out by the colliery prior to the relocation of farmers within the lease area.

4.3.2 Laws pertaining to mines and minerals

The Mines and Minerals Act (No. 17 of 1999) has a provision for regulations which relate to, among others, "the protection of the environment". It specifies environmental obligations so that mining is done in a manner to minimise environmental damage and rehabilitation of the site within a reasonable time has to be undertaken. These obligations include:

- as far as possible, the preservation of the natural environment, minimisation of waste, and prevention and treatment of pollution and contamination;
- rehabilitation from time to time and ultimately reclamation in so far as is practicable in a manner acceptable to the Director of Mines;
- for any mine operations (such as excavation, waste dumps, and ponds), the undertaking of appropriate measures from time to time to maintain and the restoration of land suitability to a condition in which it was prior to the commencement of the operations;
- in the event of an emergency, which, among others, affects natural or biological resources, taking immediate actions as directed by the Director of Mines.

In addition the department should be notified in cases of mining expansion.

The Mines, Quarries, Works and Machinery Act (1995) provides for the health, safety and welfare of those involved in prospecting, mining and quarrying operations. This includes any work that is part of these operations. The colliery should be operated and managed according to this act and should develop and provided to the following:

- first aid equipment and plans;
- mine rescue plan;
- noise, ventilation and dust control systems;
• plans for surface subsidence and fencing of danger zones;
• etc.

The Explosives Act (1962) provide for the control of the manufacture, importation, sale, transport, storage, use and disposal of explosives and any related matters. The existing and new mine explosive stores should take into consideration regulations under this act.

4.3.3 Laws pertaining to solid waste management

The Waste Management Act (1998) ensures that proper waste management practises, from handling to transferring of ‘controlled waste’ (defined in this act as household, industrial, commercial, clinical or hazardous waste), are put in place. The act stipulates that waste produced by any establishment has to be classified and transported by registered and licensed waste carrier. The act also ensures registration and licensing of waste disposal sites and waste management facilities. The colliery currently produces about 50 tonnes of waste per annum and is expected to increase to 100 tonnes during Phase 1 of the project. Proper management of this waste is critical so as to prevent pollution to the environment. DWMPC should be contact for licensing of vehicles transporting waste and temporary storage facilities.

The Radiation Protection Act of 2006 provides for the safe use of atomic energy (defined as ionising radiation emitted as a result of electronic or nuclear transitions in an atom) and nuclear technology in Botswana. This act would apply to the expansion if the new laboratory is to be equipped with such technologies. Registration of importing and disposing such technologies is carried out at the Ministry of Communications, Science and Technology.

4.3.4 Laws pertaining to pollution of ground and surface water

Section 57 of the Public Health Act (1981) forbids pollution of water sources used or likely to be used for domestic purposes. It empowers health officers “to take all lawful, necessary and reasonably practicable measures to ensure the purity of any supply of water which the public has a right to use and does use for drinking or domestic purposes, and to take all necessary measures against any person so polluting any such supply or polluting any streams so as to be a nuisance or danger to health”. In this project therefore, it is essential that all activities that can pose risks to public health or are likely to pollute the groundwater resources of the area and its surroundings are to be avoided or mitigated where unavoidable. This means that all aspects of project development and storage of materials (solid and liquid) such as fuels, chemicals, construction, coal stockpiles and waste streams, etc. must be assessed according to their pollution potential.

The Mines, Quarries, Works and Machinery Act (1995) specifies that ‘no person shall pollute any place within any place with faeces, and no person shall wantonly misuse or foul any sanitary accommodation.

4.3.5 Laws pertaining to the supply of water

The Water Act (34:01) defines rights of use and ownership of water and provides for the granting of water rights and servitudes. Water in rivers, streams, lakes, pans, swamps, or beneath watercourses, or underground water, as well as in works such as canals, reservoirs and dams is public water. Such water can only be used with permission granted by the Water Apportionment Board. Section 7(1) of the Act grants a holder of any right under the Mines and Minerals Act the right to use water resources on land to which the mining right relates. However, Section 7(3) requires that a person abstracting water under the provisions of the above Section should comply with the directions of the Water Registrar regarding the disposal of unused abstracted water. The Act bars the pollution of public water through any form of
use that is likely to cause injury, either directly or indirectly, to public health, livestock, animal life, fish, crops, orchards or gardens which are irrigated by such water or to any product in the processing of which such water is used. The holder of a water right is obligated to take precautions to prevent accumulations in any river, stream or watercourse of silt, sand, gravel, stones, sawdust, refuse, sewage, waste or any other substance likely to affect injuriously the use of such water.

Any increase in water abstraction as a result of the proposed development must be assessed with regard to any existing Water Apportionment Board Abstraction Rights and whether there is need for increased water abstraction rights. Any primary strategy for water supply must be to access extra water for the increased demand without impacting the environment or other water users.

4.3.6 Laws pertaining to the socio-economic environment

The Acquisition of Property Act (1955) provides for “authorising the acquisition of property for public and other purposes, and for settling the amount of any compensation to be paid, or any matter in difference.” This act will come in effect as MCL officers have pointed out that MCL has an arrangement where they compensate the people that have property where the colliery is located so that MCL has the land rights, which then give MCL the right to control all activities (especially developments) that occur within the lease area. Reference should be made to this act during compensation and resettlement activities. The Land Board, through the Tribal Land Act has a set of compensation guidelines which are to be used in the assessment of costs relating to resettlement planning.

The Public Health Act (1981) has a bearing on the health implications and public safety aspects related to the proposed project, and MCL should have measures in place that will ensure a safe environment for the people residing near the proposed area.

The Tourism Act of 1992 follows the Tourism Policy of 1990 and its main objective is to ensure that tourist activities are carried out on an ecologically sustainable basis and to provide local communities with direct and indirect benefits from tourism activities.

4.3.7 Laws pertaining to archaeology and heritage

The Monuments and Relics Act of 1972 (as amended 2001) aims at preserving and ensuring sustainable use of historical and archaeological resources. Section 19 of this act allows for mitigation by a person of approved credentials in cases where archaeological remains occur within the proposed development area, but and only once it has been approved that the archaeological site can give way to the development. An approved archaeologist has been appointed to carry out an AIA of the expansion area and the study is on-going. The AIA report will be submitted to the Department of National Museum, Monuments and Art Gallery for clearance of the site.

4.3.8 Laws pertaining to vegetation

The purpose of the Agricultural Resources Conservation Act (1974) is to control and conserve agricultural resources in Botswana such as animals, birds, plants, waters, soils, vegetation and vegetation products, fish and insects. The expansion of the colliery will require large quantities of water during construction, operation and decommissioning. It is important that conservation measures are put in place such as rainwater harvesting, reuse of wastewater and stormwater harvesting. Topsoil will also need to be conserved for future use.
4.3.9 Laws pertaining to Laws pertaining to wildlife resources

The *Wildlife Conservation and National Conservation Act (1992, amended in 1993)* states that the owner of private land may apply for the land to be declared a private game reserve. MCL operates a game park within the colliery and village area which needs to be managed in accordance to the terms and conditions that were determined during the declaration of the game reserve.

4.4 Development and Management Plans

4.4.1 National and district plans

The plans described in this section govern and shape the economic, social and physical development of the entire country following Vision 2016. The *National Development Plan (NDP9)* prepared in 2003, is a six year national plan and is an amalgamation of all 16 development plans prepared for both the urban and rural districts of the country. NDP9 promotes both environmental responsibility and sustainability together with economic diversification and growth. NDP9 makes recommendations for the appropriate use of natural resources together with responsible development.

The proposed project will eventually provide up to 12 Mtpa of coal for the proposed new coal-fired power station by the neighbouring Botswana Power Corporation. The objective of the project is to address electricity shortages in Botswana and possibly in the SADC region, which is a significant contribution to the social and economic development to the country.

The *Draft Palapye Planning Area Development Plan (2007)* is a review of the current 1995-2015 plan that provide for a framework upon which future development of the Palapye village would be based. The plan provides a broad strategy for a 24-year planning period (2007-2031) and covers a surface area of 25 038 hectares. The Morupule Colliery is included within the Palapye Planning Area. The plan highlights major problems that need to be addressed in the 2007-2031 planning period. These include but are not limited to:

- solid and liquid waste management. The existing sewage treatment works has a capacity of 1 472 m$^3$/day. The existing facility will need to be expanded to cater for the planned Botswana International University of Science and Technology and the increasing population;
- inadequate roads infrastructure;
- pollution of surface and underground water; and
- air pollution.

The Morupule Colliery also falls within the planning area covered by the *Central District Development Plan (currently Plan 6: 2003-2009)*. The colliery is seen as a major contributor to the economy and development of the area. The plan indicates that mining activities have to be undertaken in an environmentally friendly manner. Since other mining activities in the district focus on diamonds (Orapa, Lethlakane and Damtshaa), the expansion of the colliery would be in line with diversifying the economy away from diamonds.

4.4.2 Environmental plans

The *Biodiversity Strategy and Action Plan (BSAP 2004)*, encourages sustainable and wise use of resources and provides a framework of specific activities designed to improve the way biodiversity is perceived, utilized and conserved. The goal of the BSAP is to contribute to the long-term health of Botswana’s ecosystems and related species.
The *State of Environment Report (SOER, DEA, 2002)* was aimed at informing the nation and decision-makers about the state of the nation’s natural resources. The report is thematically structured and deals with issues specifically relevant to this project, namely:

- **Society and economy:** Rural poverty is seen as a major cause of environmental degradation. This project will increase employment in the area. HIV/AIDS is considered one of the factors reducing life expectancy, and the influx of workers to the area may increase infection rates.
- **Land:** Land pollution from poor waste disposal and management, particularly from dumping of building rubble and degradation due to soil extraction practices, is an area of concern.
- **Biodiversity:** Air quality was not identified as a cause of biodiversity loss. Plant cover will be lost within the lease area especially when the new shaft and the coal wash plant are constructed.
- **Climate change:** There is potential for global warming to increase temperatures and decrease rainfall. Of particular concern at the colliery is the methane production which is largest contributor to global warming among all greenhouse gases.
- **Water:** Groundwater depletion is a major concern as recharge is limited and much water abstraction is from non-renewable sources.

### 4.4.3 Wastewater plans

The *Botswana National Master Plan for Wastewater and Sanitation (2003)* puts forward the country’s strategy for sanitation and wastewater management until 2030. Its objective is to develop planning and implementation strategies for the generation, collection and disposal of wastewater in an environmentally friendly and acceptable manner. Specifically, it aims to achieve the following management goals:

- to develop sustainable operational and management practices and services for wastewater and sanitation;
- to empower local authorities through the transfer of overall responsibility for service provision;
- to protect and improve public health;
- to prevent pollution of natural resources, water resources in particular; and
- to conserve water resources.

### 4.4.4 Water supply plans

Debswana has involved itself in the *Botswana National Water Master Plan Review 2006* and a separate volume was produced to optimise the water usage at their mines. However it is not a binding document and intends to point out good practice. One of the underpinning policies is the need to preserve water resources, conserve water and where possible use poorer quality water for processing, thus retaining better quality water for potable supply. This is an aspect of the colliery's water supply which could be investigated further. The quality of water required for processing should be assessed. Water saving alternatives on site should also be assessed. High-demand areas need to be identified and these reviewed as to how improvements can be made.

### 4.5 MCL Environmental Procedures

MCL has implemented various procedures to deal with protection of environment and natural resources. These are discussed below and will be referred to by the EIA study.
The colliery is currently using an ISO Matrix as a platform to run their *Environmental Management Systems (EMS)* (Annexure 15), which facilitates its on-going environmental management. The EMS comprises environmental aspects to be managed and actions with specified due dates and responsibilities. The EMP is structured in the same way as the EMS in the sense of environmental aspects, management actions, responsibilities and deadlines to allow the inclusion of expansion activities’ into the existing system.

*MCL Conservation Procedure MCL/ENV/103 (2007)* (Annexure 5) provides for energy conservation measures through raising awareness amongst the company’s employees. The EIA study makes recommendations on measures that would compensate this amount of power, while referring to this procedure.

The *Vegetation Clearance Procedure MCL/ENV/101 (2007)* (Annexure 6) details the method which all MCL employees and any other contractors doing work for MCL on the lease area will use when preparing the project site or when carrying out works which require site clearance.

The *Water Conservation Procedure MCL/ENV/102 (2007)* (Annexure 7) is meant to conserve water through efficient use. The procedure applies to all properties of MCL.

The *Waste Oil and Diesel Handling Procedure ISO/ENV/104 (2007)* (Annexure 8) provides a comprehensive program for the proper management of oils and related hydrocarbons through reuse and recycling and other management initiatives.

The *Waste Management Policy MCL/ENV/0031(2007)* (Annexure 9) ensures that waste disposal is managed in such a way that its impact on the environment is minimised. This is achieved through the following procedures:

- different types of wastes are disposed of appropriately in order to minimise adverse environmental impacts;
- a record of waste disposed is maintained;
- applicable legislation is complied with (e.g. Waste Management Act, 1998);
- rehabilitation and closure objectives are met; and
- quantities of wastes generated at Morupule Mine are estimated and types classified.

Presently, borehole monitoring is being carried out without a written procedure. The EIA will identify monitoring parameters and objectives.

The colliery applies the *Debswana Topsoil Management Procedure* (Annexure 10), which details procedures for removal and stockpiling of topsoil. This will apply specially during the construction phase to ensure conservation of the topsoil resource.

A *Dust Suppression Procedure* (Annexure 11) is followed at the mine to ensure that dust from mine and surface infrastructure is minimised. Dust monitoring is carried out at mechanical sections, underground services, surface plant and workshops to monitor silica for occupational reasons.

The *Safety, Health and Environment (SHE) Management and Standard Procedure* (See policy in Annexure 12) details the overall SHE monitoring that takes place at the mine and its purpose is to ensure that all significant environmental risks and aspects are monitored for compliance with relevant requirements. The procedure details monitoring requirements for:

- water consumption;
- water abstraction;
- sewerage quantity;
• groundwater quality;
• electricity consumption;
• dust and air quality;
• noise; and
• scrap.

The *Procedure for Mining under Rivers and Roads* (Annexure 13) as prescribed by the Department of Mines, requires that the colliery narrow the excavation width from 7.2 to 6.5 m and reduces the height of the ceiling from 4.2 to 3.5 m in the zone under roads and rivers. This procedure is applicable to the expansion project, since mining would take place under the A14 road and the Morupule and Lotsane Rivers. The mine however, does not have a safety emergence procedure for above ground. Recommendations are made in this EIS for the mine to develop one and procedures to notify the authorities in terms of collapse.
5 BIOPHYSICAL ENVIRONMENTAL SETTING

5.1 Physical Environment

5.1.1 Climate

Climate conditions reported here were extracted from the Morupule B Power Station EIA (Ecosurv and GIBB Botswana, 2008) and data recorded at the colliery rain gauge. The power station has a meteorological station within its premises measuring temperature.

Ambient temperature

Temperature maximums in the study area generally occur between October and March, with June and July months experiencing the lowest temperatures. Only small inter-annual variations in temperature ranges occur. The average annual maximum temperature is between 28 °C and 30 °C and the average minimum temperature is between 14 °C and 16 °C.

Rainfall

Semi-arid conditions with cool dry winters and warm, wetter summers characterise the climate of the study area. Rainfall data from 1989-2006 indicate a mean annual precipitation of 371 mm with the majority of rainfall received between November and March.

Rainfall intensity is a measure of how much rain falls over a specified time period. The more intense the rainfall the more likely it is to create surface runoff, thus potentially filling pans or depressions and thereby creating conditions conducive to groundwater recharge. The rainfall intensity/duration curves for Palapye indicate the maximum 100-year return value as being 132 mm/hr.
Figure 7: Average monthly rainfall for the Palapye area from 1974/75 – 2007/8 (recordings from the MCL rain gauge)

<table>
<thead>
<tr>
<th>Time (Months)</th>
<th>Rainfall (mm)</th>
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<tbody>
<tr>
<td>Sept</td>
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<td>Aug</td>
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Wind

Regional continental high pressure and tropical easterly systems influence the wind patterns during much of the year. The dominant winds occur from a north-easterly direction with an average wind speed of 3 m/s. Strong winds exceeding 5 m/s occur at a frequency of 41%.

Figure 8: Wind roses for Mahalapye Station (Source: Ecosurv and GIBB Botswana, 2008)

Evapotranspiration

Potential evapotranspiration is in the order of 900-1 200 mm/year (WSB, 2007), which is two to three times the average annual rainfall. Generally, monthly rainfall totals are consistently exceeded by potential evapotranspiration. This would indicate that groundwater recharge is
seldom ever really possible. However, due to extreme rainfall conditions that occur in short duration and high intensity, groundwater recharge can occur particularly through transport via preferential flow paths.

The above climate conditions indicate the following concerns:

- during moderate to high wind events coal dust will be distributed downwind affecting conditions for people and plants;
- High late dry season temperatures and wind will produce conditions for rapid evaporation off open water and dampened coal thus increasing water usage; and
- low annual average rainfall indicates considerable need to manage and conserve water resources.

5.1.2 Air quality

Coal screening, stockpiling and loading are the main sources of particulate matter (coal dust) at the colliery. Observations indicate that the quality of the air around the colliery is also influenced by emissions from the neighbouring Morupule Power Station in the form of ash and other particles (Geoflux, 2006). The station, which is located upwind of the colliery, is declared an air pollution control area under the Atmospheric Pollution (Prevention) Act of 1971. Therefore, the station is required to monitor level of emissions from their operations. Parameters monitored are SO\textsubscript{2} and PM\textsubscript{10} (Ecosurv and GIBB Botswana, 2008).

The Morupule Colliery monitors air quality for the underground operations only as part of the occupational health and safety programme (Geoflux, 2006). The parameters monitored under this programme include: methane (CH\textsubscript{4}), PM\textsubscript{10}, NO\textsubscript{x}, etc. Above ground, only silica and coal dust is monitored for occupational reasons. The results of the coal dust monitoring from samples taken above surface are shown in Figure 9. The results indicate that the World Bank Group limits for ambient air quality are exceeded.

Figure 9: Total weighted average in mg/m\textsuperscript{3} of coal dust, Jan-Dec, 2007. Source: Morupule Colliery, 2008)

Methane has been identified as one of the problems associated with coal mining. On average methane emissions are expected to be between 0.1 and 0.5 kg/tonne of coal extracted (see http://www.erc.uct.ac.za/Research/publications/07ERC-LTMSTechnical_Appendix.pdf). However, measurements of the in-seam methane content and emission rate at the colliery have shown that they are too low to measure and are lower than the average for South African mines.
Methane is also monitored underground for health reasons. The results have shown zero gas content. The output is expected to increase as the depth of the seam increases. Old workings and abandoned collieries are a significant contributor to greenhouse gas emissions in the United States (Mines contributing 74% of all Methane emissions while abandoned workings contribute 21% of these emissions – Kirchgessner 2000). Further to the south east there are methane gas abstraction concessions using the same coal seam at between 300-500 m below ground level.

5.1.3 Noise

In overview, the existing situation with respect to the noise climates in the study area was found to be as follows. The current noise profile of the existing colliery is shown in Table 7 and in Figure 10.

The main sources of noise in the area are from:
- traffic on Road A1 North, Road A1 South and Road A14;
- Morupule Power Station;
- Morupule Colliery; and
- the colliery railway line.

The main noise sensitive areas and receptors in the study area are (Volume 2, Appendix 2):
- Palapye Village;
- Morupule Colliery Village (residential);
- scattered homesteads in the study area, including the settlement Molapu Wapitsi just north of the Lotsane River;
- the contractor village adjacent to the Kgaswe Primary School; and
- Kgaswe Primary School.

Noise levels in Palapye Village are high and are typical of an urban complex. The existing noise climate alongside the main roads in Palapye exceeds acceptable levels (SANS 10103 noise impact criteria), particularly at night. Residences in some areas are negatively impacted from traffic noise (night-time standard) for up to 220 m from the main roads. In general the daytime conditions are acceptable (SANS 10103).

The areas outside Palapye and remote from the main roads and the power station/colliery are very quiet and reflect a rural character. The existing noise climate alongside Road A14 outside Palapye Village is degraded with regard to acceptable rural residential living standards (SANS 10103 noise impact criteria). Any residences within 2 000 m of the road are negatively impacted from traffic noise, particularly at night.

The impact of the Morupule colliery on noise sensitive sites in the surrounding area is relatively minor. Noise levels from the colliery exceed 35 dBA (the maximum allowable night-time level for rural residential use) up to a distance of about 2 600 m from the facility. Seven homesteads lie within this area of influence. The colliery village lies just outside this zone and is thus not impacted by the colliery noise.

Noise levels from traffic on Road A14 at the Kgaswe Primary School are slightly higher than desirable for an educational environment. The outdoor ambient noise level should not exceed 50 dBA. Noise from vehicles passing over the rumble strips on the power station access road just to the west of the school is a significant noise nuisance factor. Noise from the colliery does not have a significant impact on the activities at the Kgaswe Primary School.

The overall impact of the noise from the coal trains on noise sensitive sites in the area is not significant. The number of coal trains on the line from the Morupule Colliery to Palapye
varies and generally averages three trains per week. The noise from the passing of a freight train (drawn by a diesel locomotive) travelling at 45 km/h peaks in the vicinity of 92 dBA at a 30 metre offset from the track. There are level crossings at the colliery access road, the power station access road and Road A1 N where it is mandatory that the trains sound a warning horn. Noise from these horn soundings can be as loud as 105 dBA at 30 m and 84 dBA at 350 m from the train. This is a minor nuisance effect at the school when the train approaches the level crossing with the power station access road.

Table 7: Existing ambient noise climate generated by the Morupule Colliery (2008) (*Source: Volume 2, Appendix 2*)

<table>
<thead>
<tr>
<th>Offset Distance from Colliery (metres)</th>
<th>Sound Pressure Level (noise) (dBA)</th>
<th>Offset Distance from Colliery (metres)</th>
<th>Sound Pressure Level (noise) (dBA)</th>
<th>Offset Distance from Colliery (metres)</th>
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<tbody>
<tr>
<td>250</td>
<td>62.2</td>
<td>1200</td>
<td>45.0</td>
<td>2000</td>
<td>38.4</td>
</tr>
<tr>
<td>500</td>
<td>55.1</td>
<td>1300</td>
<td>44.0</td>
<td>2100</td>
<td>37.8</td>
</tr>
<tr>
<td>600</td>
<td>53.1</td>
<td>1400</td>
<td>43.0</td>
<td>2200</td>
<td>37.1</td>
</tr>
<tr>
<td>700</td>
<td>51.4</td>
<td>1500</td>
<td>42.1</td>
<td>2300</td>
<td>36.5</td>
</tr>
<tr>
<td>800</td>
<td>49.9</td>
<td>1600</td>
<td>41.3</td>
<td>2400</td>
<td>35.9</td>
</tr>
<tr>
<td>900</td>
<td>48.5</td>
<td>1700</td>
<td>40.6</td>
<td>2500</td>
<td>35.4</td>
</tr>
<tr>
<td>1000</td>
<td>47.2</td>
<td>1800</td>
<td>39.8</td>
<td>3000</td>
<td>32.8</td>
</tr>
<tr>
<td>1100</td>
<td>46.0</td>
<td>1900</td>
<td>39.1</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Figure 10: Existing noise generated at the colliery (Source: Volume 2, Appendix 2)
5.1.4 **Topography**

The area is in general flat with the main landscape variation being that of the Tswapong hills which lie roughly 12 km south-east of the existing mining site. A number of small outcrops exist within the lease to the north. The colliery village is situated between two of these outcrops. West of the lease area lies the Kalahari escarpment. The lease area is drained by the Morupule and the Lotsane rivers.

5.1.5 **Soils**

The study area falls within the Ferralic Arenosols (ARo35) soil unit. Arenosols are the most common soil type within the district and generally range between a sand and a loamy sand of varied texture. The sandy nature of these soils generally provides well-drained soils of low fertility and quality. The site is overlain with moderate to deep sands. The survey carried out by Schwartz Tromp and Associates (2007) indicated an Aeolian layer of sand of between 2 and 9 m deep, averaging around 5.5 m, which overlays a band of ferrocrete/calcrete. Siltstones are found below the ferrocrete.

This soil setting means that the soils are moderately to highly vulnerable. Additionally, they do not contain any significant clayey material (or organic material) likely to prevent the downward migration of contaminants, particularly biodegradable pollutants. However the depth of Kalahari Beds ~ 20-30 m acts as a reasonable protective unsaturated layer to combat pollution migration.

Other factors which play a role in the soil quality include drainage, depth, slope, and texture. In terms of erosion, both wind and water hazards have been rated as being high in the site area (Landflow/FFM, 2000).

5.1.6 **Geology**

The area is situated on the Karoo Supergroup and the Palapye group, the former being responsible for major coal seams and sandstones whilst the latter contribute the sandy shale and siltstone from the Lotsane formation. Much of these rock groups are easily weathered to a clay-rich soil, which is exposed in the Lotsane river bed (Figure 11).

The area to the north and west of the current Morupule Colliery essentially represents the eastern margin of the South East Central Kalahari Karoo Sub Basin (DGS 1984 Smith), where shales, sandstones, mudstones and siltstones of the Karoo Supergroup sediments unconformably overlie the Lotsane Mudstones of the Palapye Group. These Karoo Supergroup rocks are a succession of conglomerates, shales and sandstones occurring to around 300 m in thickness. Within these sequences lie the coal seams that are currently mined at the Colliery.

The base of the Karoo Supergroup rocks are represented by sediments of the Dwyka Group, which were deposited on an irregular basement land surface and comprise shales, tillsites, varved siltstones and mudstones of the Dukwi Formation. Their distribution is irregular by virtue of variations in the basement topography or as a result of post-depositional erosion by glacial meltwater. Few intersections are recorded in diamond-drill cored coal exploration boreholes. The Dukwi Formation comprises a basal tillite (rounded pebbles of Palapye Group quartzite and shale together with granite gneiss and dolerite set in a grey-green coloured muddy to coarse grained sandy matrix). This basal tillite can be seen as outcrop (together with elements of the Tswapong Formation - part of the Palapye Group) just along the Lotsane River to the south of the colliery close to the Phuduhudu Wellfield area, and indicates the south-eastern edge of the basin. Overlying the tillite is a sandstone unit (~ 25 m in thickness) comprising a medium- to coarse-grained sandstone becoming stratified, calcareous and fining towards the top. The
uppermost unit are varved mudstones (banded or laminated grey-green siltstones). The argillites are commonly slumped or disrupted and contain scattered dropstones.

Ecca Group sediments overlie the Dukwi Formation strata. Within the regional area four formations have been identified by Smith (1984), comprising the Makoro, Kamokata, Morupule and Serowe Formations. The basal Makoro Formation is represented by argillaceous mudstones and siltstones, fine grained sediments deposited in broad lakes which developed after the final retreat of the Dwyka icesheet. High energy deltaic sand bodies of the Kamokata Formation were laid down over the lacustrine Makoro Formation sediments. The deltas formed from rivers draining the crystalline highlands in the east. The development of temperate marshlands in adjacent low energy areas of the deltas resulted in the formation of minor coal horizons within the sandstone units. Along the basin edge the arkosic sandstones commonly oversteps onto pre-Karoo basement. Generally the sandstones show a fining up sequence from pebbly at the base grading to fines. The lower Ecca Group arenaceous sediments generally form the main aquifer horizon, although at the colliery the strata were found to be dry when intercepted.

The Morupule and Serowe Formations represent the main carbonaceous and coal-bearing strata lying above the main fluviatile-dominated deltaic sequence. The heavy dull coal seams occur within the Morupule Formation where deposition of organic and argillaceous material occurred in large low-lying tundra swamp areas. The carbonaceous shales contain channel sandstones, which were locally introduced as a result of subsidence. The overlying Serowe Formation is distinguished by its characteristic light-grey siltstone member which overlies the black carbonaceous shales. The Formation comprises siltstones and mudstones with minor sandstones and limestones. Smaller coal seams with vitrinite occur within the carbonaceous horizons.

Overlying the Ecca Group are Beaufort Group sediments represented by the Tlhabala Formation which comprise a thick suite of non-carbonaceous grey silty mudstones which were laid down following widespread inundation of the peat swamps and the formation of an open lake. Dolerite dyke and sill intrusions occur throughout the project area. The dykes are post-Karoo and form pronounced aeromagnetic and photographic features with a west-north-west trend. The dykes range from less than a metre to as much as 50 m wide, have medium to coarse grain sizes, and develop large feldspar phenocrysts in the thicker bodies. The sills appear to intrude a specific stratigraphic horizon often being at the contact between the Tlhabala and Serowe Formations. The results of core holes drilled by MCL have been assessed. Typically in the development area there is 20 to 30 m of Kalahari Sediments overlying 20 to 30 m of Shales and Siltstones containing a few thin coal seams which in turn overlie the first main Coal seam.

The Palapye Group rocks to the east of colliery lie unconformably upon gneissic Basement Complex rocks and are sub-divided into five conformable formations. For the purpose of this study only the Tswapong and Lotsane Formations are relevant and these are therefore the only rocks described in detail. The age of the Palapye Group is thought to be Middle Precambrian (i.e. +/- 2000 Ma), and the group forms a subset of the Waterberg Supergroup. The rocks are primarily clastic and are thought to originate from the weathering of the adjacent crystalline basement rocks, deposited in a shallow water environment.

The Archaean basement rocks comprise granite gneiss and amphibolites which represent a westward extension of the Southern Marginal Straightening Zone of the Limpopo Mobile Belt. The Proterozoic sediments comprise clastic sedimentary rocks with minor volcanic beds of the Palapye Group. The Lotsane Formation sediments comprise flagstones, siltstones and sandy shales. The Lotsane Formation forms the confining layer to the underlying Tswapong Formation, which forms the main aquifer in the area and provides the water in the Palapye Wellfield east of the village. The Palapye Group sediments were also intruded by dolerite sheets, representing transgressive bodies of magma which rose along faults displacing the Palapye Group. Dykes
composed of identical rock types cross-cut the sills and the host rock along north-west and east-north-east trends.

Table 8 - Stratigraphy in the Palapye/Serowe area *(Source: Volume 2, Appendix 3)*

<table>
<thead>
<tr>
<th>AGE</th>
<th>SUPERGROUP</th>
<th>GROUP</th>
<th>FORMATION</th>
<th>LITHOLOGICAL DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>CAINOZOIC</td>
<td>Kalahari</td>
<td>Kalahari</td>
<td>Kalahari Beds</td>
<td>Soil, sand, calcrite, silcrete and clay</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Tuli Dyke</td>
<td>Tuli Dyke Swarm</td>
<td>Dolerite dyke and sill intrusive event</td>
</tr>
<tr>
<td></td>
<td>Stormberg</td>
<td>Serve Pan</td>
<td>Serve Pan Lava</td>
<td>Massive amygdaloidal flood basalt extrusion</td>
</tr>
<tr>
<td></td>
<td>Lebung</td>
<td>Serae Pan</td>
<td>Ntane Sandstone</td>
<td>Aeolian sandstone. Medium to fine grain with minor mudstone intercalations becoming</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Mosolotsane</td>
<td>Fluvial to base</td>
</tr>
<tr>
<td></td>
<td>Beaufort</td>
<td>Tlhabala</td>
<td></td>
<td>Fluvial red beds. Siltstones and fine grained sandstone</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Non-carbonaceous mudstones and siltstones with minor sandstones</td>
</tr>
<tr>
<td>MESOZOIC KAROO</td>
<td>Serowe</td>
<td>Ecca</td>
<td></td>
<td>Silstones, mudstones with minor sandstones, limestones and vitrinite coal seams</td>
</tr>
<tr>
<td></td>
<td>Morupule</td>
<td></td>
<td></td>
<td>Carbonaceous shales and dull coal seams with minor sandstones</td>
</tr>
<tr>
<td></td>
<td>Kamokata</td>
<td></td>
<td></td>
<td>Coarse clastic fluvio-deltaic sediments</td>
</tr>
<tr>
<td></td>
<td>Makoro</td>
<td></td>
<td></td>
<td>Post glacial lacustrine argillaceous mudstones and siltstones</td>
</tr>
<tr>
<td></td>
<td>Dwyka</td>
<td>Dukwi</td>
<td></td>
<td>Base of Karoo sequence tillites, shales, varved siltstones and mudstones</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Dolerite dyke and sill intrusions</td>
</tr>
<tr>
<td>PROTEROZOIC WATERBERG</td>
<td>Palapye</td>
<td>Shoshong</td>
<td></td>
<td>Conglomerate and sandstone with banded ironstones, dolomite and quartzite</td>
</tr>
<tr>
<td></td>
<td>Lentsane</td>
<td>Lotsane</td>
<td></td>
<td>Variegated shales and mudstones</td>
</tr>
<tr>
<td></td>
<td>Tswapong</td>
<td>Tswapong</td>
<td></td>
<td>Massive to flaggy purple quartzites</td>
</tr>
<tr>
<td></td>
<td>Moeng</td>
<td>Moeng</td>
<td></td>
<td>Argillites pink shales and micaceous siltstones with minor limestone</td>
</tr>
<tr>
<td></td>
<td>Selika</td>
<td>Selika</td>
<td></td>
<td>Volcanic tuffs and coarse grained sandstones/quartzites</td>
</tr>
<tr>
<td>ARCHAEOAN BASEMENT</td>
<td>Limpopo</td>
<td>Mobile Belt</td>
<td></td>
<td>Granite gneiss and amphibolite</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The Morupule coalfield has an overall coal presence of over 5 billion tonnes (Geoflux, 2006). The coal field consists of four seams, namely:

- No. 4 seam - the Serowe Formation;
- No. 3 seam - the Lotsane Formation;
- No. 2 seam - The No. 2 Coal Seam Zone; and
- No. 1 seam - the Morupule Main Seam (“Morupule Seam”).

The coal seam is up to 17 m thick and at present only the lower section is mined as it is of higher quality than the rest of the coal seam. The coal seam dips south-east, thus mine depth will increase as mining continues unless the shallower coal is abstracted through open case mining.

5.1.7 Hydrogeology

The main aquifer units in the area are the quartzitic members of the Tswapong Formation from which the Palapye Wellfield boreholes east of the village abstract. Aquifer conditions are largely confined to the north of the Tswapong Hills by the thick sequence of Lotsane.
shales. The piezometric surface for the Tswapong formation is frequently only a few metres below ground level in the Lotsane shales, and in some instances flowing or artesian conditions have been recorded in some boreholes near to the river.

Unconfined aquifer conditions occur in the Tswapong Hills where the aquifer outcrops. This is the main recharge zone to the aquifer whilst the confined area in the valley bottom appears to be a groundwater discharge zone where the head in the aquifer is greater than the head in the overlying Lotsane Formation. The Lotsane Formation is a low-yielding aquifer with groundwater occurrence being restricted to fractures. A good number of old boreholes in the area have tapped this source. Today the groundwater in this aquifer around Palapye village is highly contaminated with nitrate and chloride and is unfit for public supply. Further to the north and west the Tswapong aquifer becomes deeply confined below the Lotsane Formation and Karoo Supergroup and yields reduce, probably as a result of a decrease in fractures at depth.

The area along the Lotsane River indicates the contact zone between the Tswapong and the Karoo. Although the Karoo sequence, particularly the Ntane and Ecca Sandstones, are considered the most valuable and important aquifers in Botswana, at the location of the colliery the Ntane is not present and the Ecca sequence does not contain the most productive sandstone formations available elsewhere in Botswana.

The mine's wellfield area (the Phuduhudu Wellfield) taps the contact zone between the Tswapong and Dwyka Formations. Although the Tswapong Formation in the Palapye Wellfield area (east of the village) provides quite reasonable (albeit very variable) yields ranging from almost nothing to 30+ m$^3$/hr, the thickness of this unit close to the colliery is not large (a few tens of metres), is unconfined and is away from the obvious recharge area in the Tswapong Hills.

Groundwater within the mine lease area has also historically been used for supply to the Morupule Mine village area. The hydrogeological ‘target’ at the village area appears to be the contact zone with the deeper basement rocks (Gneissic Basement Complex) as the boreholes there all penetrate to around 300 mbgl. Thus the setting of all three of the sites - the colliery, the wellfield and the ‘village’ area - cannot be considered to be located on major or particularly productive aquifers.

The major coal seams are below groundwater level (Figure 11). The present mining is reported to take place at a depth of 80-90 mbgl, and hence working is currently below the regional groundwater level. However, a few seepage problems have been recorded by the mine. As the mine expands there would appear to be an increase in potential for groundwater to enter new adits via seepages. Several private boreholes exist in and close to the expansion area (a list of these boreholes is provided in Volume 2, Appendix 3). There is therefore the possibility that water levels in these boreholes may be impacted by mining below ground level.
5.1.8 Hydrology

There are three important ephemeral rivers that run through areas adjacent to the mine expansion area. The Morupule River, which feeds into the Lotsane River, is the closest, approximately 3 km from the site, whilst the Lotsane River is approximately 10 km south of the site. The Kamotaka River flows into the Lotsane River from the west. The Lotsane River is one of the major ephemeral rivers in the Limpopo basin. The catchment of these rivers is situated to the west with Kalahari-Limpopo watershed forming the western boundary. The Lotsane flows into the Limpopo on the Botswana and South African border. There are plans to establish a dam for domestic water supply on the Lotsane River downstream of Palapye.

The mine presently passes under the Morupule River and special tunnelling procedures, as prescribed by the Department of Mines are used below the river course. These procedures require that the colliery narrows the excavation width from 7.2 to 6.5 m and reduces the height of the ceiling from 4.2 to 3.5 m in the zone under roads and rivers.

5.2 Biological Environment

5.2.1 Flora

This vegetation description and definition of plant communities is derived from the Central District Integrated Land Use (CDILUP), (Landflow/FFM, 2000). Detail has been added from the botanical field survey (Volume 2, Appendix 5) and data from the available literature. The CDILUP describes the area as comprising mainly two vegetation types: Type 6/5 (Acacia/Burkea/Ochna Savannah) and Type 10 (Acacia Savannah). These associations are associated with deep, well-drained ferralllic sandy soils. An additional vegetation type, the
rocky hill outcrops (Type 9) is important within the lease area. Type 6 is dominated by *Acacia erioloba*, *Terminalia sericea*, and *Lonchocarpus nelsii*, with the occurrence of these species being dependant on either the depth of sand or the amount of silcrete or calcrete in the soil profile. Type 6 varies between open woodland and savannah with low shrubs and sparse trees dominating extensive areas.

The botanical survey identified two invasive species (*Dichrostachys cinerea* and *Argemone mexicana*). Although the *Dichrostachys* is a common plant which encroaches due to heavy livestock grazing, the *Argemone* (Mexican Poppy) is an exotic. One rare species of *Stapelia* was identified in the proposed project area. None of the red-listed or protected species occur within the area.

Habitats: Within the lease area the habitats are dominated by sandveld and riverine habitats (Table 9). Riverine habitat has been greatly modified due to the practise of establishing arable agriculture in the river floodplains. At least 20% of the riverine habitat is severely degraded.

**Table 9: Habitats of the lease area**

<table>
<thead>
<tr>
<th>Habitat</th>
<th>Area (ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bush</td>
<td>50</td>
</tr>
<tr>
<td>Bush on old river floodplain</td>
<td>251</td>
</tr>
<tr>
<td>Disturbed</td>
<td>56</td>
</tr>
<tr>
<td>Drainages with bush</td>
<td>1,943</td>
</tr>
<tr>
<td>River floodplain</td>
<td>872</td>
</tr>
<tr>
<td>Riverine woodland</td>
<td>541</td>
</tr>
<tr>
<td>Rock outcrop</td>
<td>4.2</td>
</tr>
<tr>
<td>Sandveld</td>
<td>13,893</td>
</tr>
<tr>
<td>Sandveld with emergent Acacia</td>
<td>248</td>
</tr>
</tbody>
</table>

Floral Biodiversity

The site of the proposed expansion area has low plant species diversity, (*BSAP Stocktaking Report, Final Draft, 2003*). The Royal Botanical Gardens at Kew indicate that Botswana currently has 43 plant species on its national Red Data list. Of these, 13 are confirmed as threatened (critically endangered, endangered or vulnerable) and 22 are of uncertain status. There are an estimated 15 endemic species in Botswana, which are vulnerable due to their limited distribution. None of these species are known to occur at the site.
Figure 12: Location of *Dichrostachys cinerea*, *Argemone mexicana* and *Stapelia*
5.2.2  Fauna

Birds

Based on the maps produced by the BSAP Project, the area is known to hold between 460 and 500 bird species. In terms of importance, the Tswapong hills are host to large breeding populations of Palearctic migrants. And have as a result been identified as an Important Bird Area (IBA). However this designation does not carry any formal protection. Although the site is not situated directly on the hills, it is within ten kilometres of the western edge of them. Of the species occurring in the Tswapong hills, the Cape Vulture (Gyps coprotheres) is a species of global conservation concern (Lincoln, Fishpool, and Evans, 2001). At present an estimated 300 breeding pairs exist. Tyler (2001) published the waterbird counts for wetlands within the Palapye area. These are summarised in the tables below.

Table 10: Lecha Lodge Dam, Palapye. A small newly constructed dam at a lodge at Palapye. The dam covers ca. 4 ha. Birds counted once, in July 2000.

<table>
<thead>
<tr>
<th>No</th>
<th>Species</th>
<th>July (1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>008</td>
<td>Little Grebe</td>
<td>7</td>
</tr>
<tr>
<td>055</td>
<td>Reed Cormorant</td>
<td>3</td>
</tr>
<tr>
<td>062</td>
<td>Grey Heron</td>
<td>2</td>
</tr>
<tr>
<td>084</td>
<td>Black Stork</td>
<td>1</td>
</tr>
<tr>
<td>107</td>
<td>Hottentot Teal</td>
<td>4</td>
</tr>
<tr>
<td>108</td>
<td>Red-billed Teal</td>
<td>4</td>
</tr>
<tr>
<td>258</td>
<td>Blacksmith Plover</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>TOTAL</td>
<td>23</td>
</tr>
<tr>
<td></td>
<td>No. Species</td>
<td>7</td>
</tr>
</tbody>
</table>

Table 11: Lemonwe (Limone) Pan, southwest of Palapye. An ephemeral pan, over 1 km in length and ca. 9 km from the Lotsane River. Birds counted, partially, only once, in July 2000 when it was still very full.

<table>
<thead>
<tr>
<th>No</th>
<th>Species</th>
<th>July (1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>102</td>
<td>Egyptian Goose</td>
<td>12</td>
</tr>
<tr>
<td>108</td>
<td>Red-billed Teal</td>
<td>100+</td>
</tr>
<tr>
<td>115</td>
<td>Knob-billed Duck</td>
<td>3</td>
</tr>
<tr>
<td>116</td>
<td>Spurwinged Goose</td>
<td>15</td>
</tr>
<tr>
<td>228</td>
<td>Red-knobbed Coot</td>
<td>50+</td>
</tr>
<tr>
<td></td>
<td>TOTAL</td>
<td>180</td>
</tr>
<tr>
<td></td>
<td>No. Species</td>
<td>5</td>
</tr>
</tbody>
</table>

The presence of wetlands attracts species such as storks, herons, ducks and geese, and this will increase the likelihood of bird mortalities due to collisions with vehicles.

Faunal biodiversity

Based on the Fauna Priority Area generated for the country by the BSAP Project, the lease area is situated in an area ranked as “average”. This ranking is based on the level of protection to biodiversity in the area measured against the numbers of species and diversity of species in the area. In this case, no formal conservation measures exist, and the site is not situated in a protected area. Areas with no protection but high diversity would be ranked as being high priority areas.

Wildlife

The colliery has developed a game park in the area surrounding the mine and the village. Morupule Colliery has game fenced some of its lease area and is developing the wildlife
population through protection, water supply and re-stocking. A game park report (K. Soopu, 2006) indicates that the colliery is aiming at a ratio of 25% bulk grazers, 35% concentrate grazers, 20% mixed feeders and 20% browsers and a stocking rate of 1 animal unit to 12 ha.

The area is approximately 1,479 ha. There have been some attempts at restocking the area with wildlife from other mines. In September 2004, 8 wildebeest, 6 zebra, 4 gemsbok and 6 impala were introduced. Further introduction in 2006 included: 10 zebra, 10 hartebeest, 8 kudu, 6 wildebeest, 10 giraffe and 8 springbok. Since these introductions 5 wildebeest have escaped and there have been a number of deaths to disease (probably heartwater).

The colliery has invested in the provision of water for wildlife in the area adjacent to the MCL village. There are at present three watering holes (Figure 13) with a fourth under construction (Figure 13). Livestock licks (urea and salt) and feed (molasses and lucerne) are provided in the dry season.

**Figure 13: An example of the watering points constructed by MCL and the new one under construction.**

The game park is presently without any development or management plans. This situation may change in the future as the MCL considers game farming and tourism to be a suitable land use after decommissioning of the mine. The idea would be that the decommissioned colliery area could form the basis of a tourism area to complement Palapye development in the long term. This would link to the tourism objectives of the Central District Council (CDC)’s Palapye Planning Area Development Plan (CDC Draft November 2007). When people are moved out of the expansion area, it is probable that the game park area of fencing will extend into the depopulated area at least as far as the Morupule River.

It is noted that Phase 1 will have no serious negative impacts on the game park. The area may be expanded and additional habitats could be incorporated into the game park (Figure 18). However, Phase 2 would result in the establishment of a new conveyer between the existing crush facilities and the new shaft. The conveyer would inhibit movement between the north and south compartments of the park.
6 SOCIO-ECONOMIC ENVIRONMENT

6.1 Background

Morupule Colliery is located some 12 km west Palapye village in Botswana and it is both the administrative and service centre for the Serowe-Palapye Sub-District Council. The colliery is currently the only coal mine in the country. The settlement hierarchy classifies Palapye as a Primary III centre in the Central District and falls within the eastern planning region. Planning regions were done in order to harmonise the planning, provision and maintenance of infrastructure and services.

6.2 Socio-Economic Profile

6.2.1 Population

Population for Central District stands at 501 381 (2001 Census), and the Serowe–Palapye sub-district has the highest proportion, with 153 035 people. The sub-district has an area of 30 925 km\(^2\) and a population density of 5 people/km\(^2\). Palapye’s population was counted at 26 293 people in the 2001 Census. Population growth in Palapye has increased significantly over the years due to a number of factors, which include the designation of the village as the Serowe–Palapye sub-district headquarters, and the existence of the Morupule Coal Mine and the Power Station. Although the Palapye population has been increasing since the 1981 Census, the percentage growth for the period 1991 to 2001 shows that there was a slow down in the rate of population growth. The population for the area is projected to increase in the next +10 years. (Source: CSO, 2001). The Palapye Planning Area Development Plan has also indicated a possible growth scenario which has been used as a basis for land projections.

Figure 14: Population of Palapye (1981-2026: Source: Volume 2, Appendix 1)

6.2.2 Housing

Housing structures in Palapye, as with most villages in Central District, are predominantly modern structures with tin and tile roofing. However, there are still traditional houses made from mud and grass thatch scattered throughout the village.

6.2.3 Social amenities

Palapye is serviced by one police station although there are plans to build another, bigger one as the village is growing. There are four clinics and one primary hospital. Residential water
supply is through private connections and about 45 prepaid communal public standpipes and one feeding point. There are three cemeteries, two are in use and the other is not in use because all the areas have been covered and is in the middle of the village.

6.2.4 Transport and communication

The main mode of transport in the Palapye area is by road. The A1 trunk road (Francistown – Gaborone) links the south and north parts of the country. The A14 road, which links Central and Ngamiland Districts, also passes through the area. There is an airstrip in the village for aircrafts of limited size. Telecommunications in the area are served by Botswana Telecommunications Corporation (BTC) and cellular phone service providers. Botswana Post provides postal services.

6.2.5 Education

The literacy rate for Central District was about 62% during the 2001 census. There are nine government-owned primary schools and two privately-owned schools in Palapye. Preschools are also available throughout the village. There are three junior secondary schools and one senior secondary school in the village. There is also a vocational training centre and a non-formal education centre.

6.2.6 Employment

Employment opportunities exist through a wide range of economic activities, including agriculture (arable and pastoral), mining, industrial, commercial, manufacturing and construction. The presence of the Morupule coal mine and the BPC Power Station has boosted employment opportunities in the Palapye area. The mine currently employs 254 people.

The average unemployment rate for the Serowe-Palapye sub-district is about 14%, with unemployed women comprising 16.5% of the female population 15 years and above and unemployed men comprising 11.6% of the male population 15 years and above. About 9 000 members of the population of Palapye are unemployed, with most of these being women (approximately 5 200, CSO 2007).

Table 12: Unemployment by age group in Central District (Source: Volume 2, Appendix 1)

<table>
<thead>
<tr>
<th>Age Groups</th>
<th>12-14</th>
<th>15-19</th>
<th>20-24</th>
<th>25-29</th>
<th>30-34</th>
<th>35-39</th>
<th>40-44</th>
<th>45-49</th>
<th>50-54</th>
<th>55-60</th>
<th>60-64</th>
<th>65+</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td></td>
<td>4 997</td>
<td>7023</td>
<td>5 017</td>
<td>3 906</td>
<td>3 374</td>
<td>2 633</td>
<td>2 169</td>
<td>1 215</td>
<td>848</td>
<td>270</td>
<td>1 040</td>
</tr>
<tr>
<td>Male</td>
<td></td>
<td>1 961</td>
<td>2 865</td>
<td>1 892</td>
<td>986</td>
<td>1 314</td>
<td>809</td>
<td>120</td>
<td>634</td>
<td>116</td>
<td>134</td>
<td>481</td>
</tr>
<tr>
<td>Female</td>
<td></td>
<td>3 036</td>
<td>4 157</td>
<td>3 125</td>
<td>2 919</td>
<td>2 060</td>
<td>1 825</td>
<td>2 049</td>
<td>582</td>
<td>732</td>
<td>136</td>
<td>558</td>
</tr>
</tbody>
</table>

6.2.7 Health

Health facilities within the Serowe-Palapye sub-district include a total of 20 clinics, of which nine have maternity services. There are 24 health posts, with 13 offering anti-retrovirals (ARVs), and 24 mobile stops. The delivery of health services in Palapye is done through a primary hospital, four clinics, and four mobile stops. The primary hospital is under the administration of Ministry of Health, while clinics are coordinated by the Ministry of Local Government. There are also specialised centres such as ARV drug distribution centres. There are also private medical practitioners in the village.

HIV/AIDS, as in most major settlements in Botswana, is an issue in Palapye. In 2004 the proportion of people who tested HIV positive was about 18.2% of the tested population, a
prevalence rate slightly higher than the national one (17.1%). The infection rate for tested males was 14.4% while that for females was substantially higher at 21.2% (The Botswana HIV/AIDS Impact Survey II 2004).

6.3 Current Land Use

The area proposed for mining is located on tribal land. The area within and around the proposed expansion site has different land uses as listed below:

- The current coal mine: mining within the lease area covers an area of 2 500 ha.
- Residential areas: Palapye, which is approximately 12 km east of the mine, and Morupule village, which is located within the mine lease area.
- Commercial: businesses in Palapye.
- Industrial: the BPC power station near the colliery.
- Agricultural: crop production and grazing of livestock currently takes place in and around the proposed expansion area.
- Educational: although Kgaswe Primary School currently lies within the power station lease area, the school will be relocated due to the expansion activities.

6.3.1 Infrastructure

Transport

The two major roads in the area are the A1 and the A14 roads. The lease area is serviced by road and rail. The draft Palapye Planning Area Development Plan (2007) indicates that the existing road infrastructure cannot cope with expected increases in traffic volumes.

Water supply

At present the colliery is supplied by a borehole in the village area site (used to supply Morupule village), a small wellfield at the Phuduhudu Wellfield area, and a ‘top-up’ facility from Paje Wellfield provided by BPC. A connection pipeline is being constructed to cater for the expansion.

Power supply

Palapye village is supplied by both 33 and 66 kV lines from Morupule Power Station. Power supply for the mine is also sourced from the power station.
Figure 15: Infrastructure within the mining lease area
6.3.2 Boreholes

Nine boreholes are found within the mine expansion area which might be affected by coal mining. The colliery has some boreholes within the existing lease area.
Figure 17: Private boreholes within the mine lease area in relation to potential resettlement

6.3.3 Arable agriculture

Dryland farming is common in the area, with this practice accounting for approximately 11% of the total area within the district (Environmental Consultants, 1992). Soil fertility and water resources largely determine the distribution of these fields. The majority of the lands areas are situated in close proximity to the Morupule River. Some lands areas exist on the southern side of the road towards Palapye (Figure 18)
The main crops grown in the Palapye area are, according to the Serowe Crop Production Office, sorghum, maize, cowpeas, sweet-reed, groundnuts and melons. Average yields for these crops are low as indicated in Table 13.


<table>
<thead>
<tr>
<th>Crop</th>
<th>Yield in kg/ha &amp; estimated average yields for Palapye</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sorghum</td>
<td>Max yield sandy soils 4 000 kg/ha, maximum yield on fine medium soils 4 600 kg/ha. Average yield on sandy soils 2 060 kg/ha.</td>
</tr>
<tr>
<td>Maize</td>
<td>4 400 to 5 500 kg/ha. Average yield on sandy soils 1 550 kg/ha.</td>
</tr>
<tr>
<td>Cowpeas</td>
<td>1 000 to 1 200 kg/ha. Average yield on sandy soils 470 kg/ha.</td>
</tr>
<tr>
<td>Pearl millet</td>
<td>1 500 to 1 730 kg/ha. Average yield on sandy soils 610 kg/ha</td>
</tr>
<tr>
<td>Watermelon</td>
<td>30 000 to 40 000 kg/ha. Average yield on sandy soils 15 100 kg/ha.</td>
</tr>
</tbody>
</table>

Fields are near the upper end of national average size, being just larger than 6 ha. The total number of lands areas identified from the aerial photography analysis was 435 fields (Table 14). Distribution of the lands areas along drainages and near to Palapye can be seen in Figure 18.

The existing area being mined and falling within the old lease area is about 3 340 ha. In Area A of the proposed expansion area, people will be asked to move for safety reasons (and compensated, see Figure 5). However, light subsistence farming such as cattle grazing and some crop production will continue with strict controls from the mine. Area A is about 1 040 ha and its inclusion in the mining area will affect grazing, as well as 13 fields of about 91 ha.
The new shaft/mine will be in Area B (Figure 5). Should people need to be moved, they would be compensated. However, the need to relocate people will depend on whether Phase 2 proceeds, and what type of mining method is used. Area B covers approximately 6 635 ha and will affect 71 fields of about 745 ha (Table 14 and Table 15).

In Area C people will be compensated, but will be able to continue growing crops and grazing livestock. Area C is about 6 686 ha in extent. Should BPC continue with Phase 2, and the 8-12 Mtpa requirements are met, then people will be moved from areas A and B (approximately 7 835 ha).

### Table 14: Number of arable lands affected by the proposed development activities

<table>
<thead>
<tr>
<th>Level of Resettlement</th>
<th>Number of Arable Lands</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Active</td>
<td>Fallow</td>
<td>Recent fallow</td>
<td>Total</td>
</tr>
<tr>
<td>Area A: Compensate and move</td>
<td>7</td>
<td>5</td>
<td>1</td>
<td>13</td>
</tr>
<tr>
<td>Area B: Compensate and future</td>
<td>34</td>
<td>19</td>
<td>18</td>
<td>71</td>
</tr>
<tr>
<td>Area C: Compensate</td>
<td>43</td>
<td>14</td>
<td>15</td>
<td>72</td>
</tr>
<tr>
<td>Existing mine operation</td>
<td>18</td>
<td>1</td>
<td></td>
<td>19</td>
</tr>
<tr>
<td>Grand Total</td>
<td>102</td>
<td>39</td>
<td>34</td>
<td>175</td>
</tr>
</tbody>
</table>

### Table 15: Area of arable agriculture affected by proposed development activities

<table>
<thead>
<tr>
<th>Level of Resettlement</th>
<th>Area of Arable Agriculture (in ha)</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Active</td>
<td>Fallow</td>
<td>Recent fallow</td>
<td>Total</td>
</tr>
<tr>
<td>Area A: Compensate and move</td>
<td>47.54</td>
<td>31.77</td>
<td>11.95</td>
<td>91.26</td>
</tr>
<tr>
<td>Area B: Compensate and future</td>
<td>370.55</td>
<td>245.58</td>
<td>129.31</td>
<td>745.44</td>
</tr>
<tr>
<td>Area C: Compensate</td>
<td>323</td>
<td>179.1</td>
<td>170.37</td>
<td>672.47</td>
</tr>
<tr>
<td>Existing mine operation</td>
<td>192.06</td>
<td>2.57</td>
<td></td>
<td>194.63</td>
</tr>
<tr>
<td>Grand Total</td>
<td>933.15</td>
<td>459.02</td>
<td>311.63</td>
<td>1 703.8</td>
</tr>
</tbody>
</table>

### Table 16: Number of properties affected by the proposed development

<table>
<thead>
<tr>
<th>Mine areas</th>
<th>Dwellings</th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Homesteads</td>
<td>Abandoned homesteads</td>
<td>Kraals</td>
<td>Abandoned Kraals</td>
<td>Chicken farm</td>
</tr>
<tr>
<td>Area A</td>
<td>3</td>
<td>0</td>
<td>4</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Area B</td>
<td>34</td>
<td>1</td>
<td>7</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Area C</td>
<td>35</td>
<td>4</td>
<td>17</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Existing mine operation</td>
<td>20</td>
<td>0</td>
<td>6</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Grand Total</td>
<td>92</td>
<td>5</td>
<td>32</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

#### 6.3.4 Livestock farming

Communal livestock grazing comprises the largest form of land use in the study area as well as in the district generally, with over 65% of the district being used for communal grazing (Environmental Consultants, 1992). Cattle, goats and sheep are common in the area. In part
because of open access on communal land, there is little management of the range resources, and some overgrazing occurs.

Presently, of the 17 650 ha of the existing lease area, about 11.3% is fenced for game farming, 24.3% falls within an Artificial Insemination (AI) camp belonging to the Ministry of Agriculture (MOA) in the northern part of the lease area (Figure 18). The rest of the area (64.4%) is available for traditional livestock production (this includes arable lands). The livestock carrying capacity for the areas is on average 7 ha for every live stock unit (LSU), (Figure 18).

6.4 Archaeology, Cultural and Heritage

The archaeological investigations (Volume 2, Appendix 4) have revealed that the area has extensive archaeological resources. From the literature review it is clear that the area around Morupule Colliery is culturally and archaeologically rich, with materials dating to the Stone Age and Iron Age periods.

The archaeological foot survey showed that the area has been occupied since prehistory. The lithic materials as well as the ceramics found in the area suggest that the area was occupied at different periods and probably by different people. Burials have also been located within the area (Figure 19, Table 17). The archaeological materials within the twenty-year mine lease extension as well as those within the existing lease area may be impacted by the developments scheduled for Phase 1 and Phase 2. The materials found were ranked using the DNMMAG ranking criteria and the results are presented in Table 17. The high ranked (1, 2, and 3) sites will have to be mitigated prior to proposed mining activities (as recommended by DNMMAG, Annexure 3). In areas where archaeological sites were not reported, development may proceed but there will be a need for frequent monitoring by an archaeologist so as to salvage any artefacts that may be exposed by development activities.

It should be noted that the presence of burials within the lease area may indicate that more unknown burial sites may also be present within the area, and the developer should therefore be prepared for chance discoveries.
Figure 19: Location of archaeological and cultural sites identified during the archaeological survey
Table 17: Summary of archaeological findings and related rankings

<table>
<thead>
<tr>
<th>Site No.</th>
<th>Archaeological findings</th>
<th>Type</th>
<th>GPS location</th>
<th>Museum ranking</th>
<th>Further work required</th>
<th>Mitigation duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>MCL1</td>
<td>Undecorated ceramics</td>
<td>Iron Age</td>
<td>500116S 7509941E</td>
<td>3</td>
<td>Test excavation to determine whether further work is required</td>
<td>3 man days</td>
</tr>
<tr>
<td>MCL2</td>
<td>Undecorated pottery, few decorated pottery, house daga, burnishing stones, bones</td>
<td>Iron Age</td>
<td>500516S 7506548E</td>
<td>3</td>
<td>Test excavation to determine whether further work is required</td>
<td>3 man days</td>
</tr>
<tr>
<td>MCL3</td>
<td>Flakes</td>
<td>Middle Stone Age</td>
<td>485449S 7515092E</td>
<td>4</td>
<td>None, except monitoring if any activities are going to take place directly on site.</td>
<td>None</td>
</tr>
<tr>
<td>MCL4</td>
<td>Ceramic sherds, granary stand poles</td>
<td>Iron Age</td>
<td>500227S 7515583E</td>
<td>3</td>
<td>Test excavation to determine whether further work is required</td>
<td>3 man days</td>
</tr>
<tr>
<td>MCL5</td>
<td>Pottery and stone tools</td>
<td>Iron Age/Stone Age</td>
<td>485439S 7515533E</td>
<td>5</td>
<td>No further archaeological work required</td>
<td>None</td>
</tr>
<tr>
<td>MCL6</td>
<td>Burials</td>
<td>Historical</td>
<td>501070S 7508521E</td>
<td>1</td>
<td>Fencing, avoiding or reburial</td>
<td>3 man days</td>
</tr>
<tr>
<td></td>
<td>Infant burial</td>
<td>Historical</td>
<td>500871S 7508425E</td>
<td>1</td>
<td>Avoiding, fencing or reburial</td>
<td>2 man days</td>
</tr>
<tr>
<td>MCL 7</td>
<td>Infant burial</td>
<td>Historical</td>
<td>500907S 7508556E</td>
<td>1</td>
<td>Preserve if possible, otherwise extensive salvage work</td>
<td>2 man days</td>
</tr>
<tr>
<td>MCL 8</td>
<td>Burials</td>
<td>Historical</td>
<td>496829S 7507078E</td>
<td>1</td>
<td>Fencing, avoiding, or reburial</td>
<td>3 man days</td>
</tr>
<tr>
<td>MCL9</td>
<td>Pottery</td>
<td>Iron Age</td>
<td>486263S 7509135E</td>
<td>5</td>
<td>No further archaeological work required</td>
<td>None</td>
</tr>
</tbody>
</table>
7 RESULTS FROM CONSULTATIONS

7.1 Public Consultations

7.1.1 Kgolfa Meeting

Meeting attendees applauded Debswana for consulting with those that may be affected by the proposed project. The main issues raised at the meeting were about loss of livelihoods by those who use the land for subsistence farming. Others were concerned about subsidence as a result of the underground mining. There was also concern about the effects of the mine on property such as boreholes. There was also suggestion that MCL and BPC should work together as the impacts resulting from the expansion of the mine and that of the power station may have a larger impact when combined. Most farmers that currently carry out activities on top of the mine had no qualms about the proposal because there has always been cordial cooperation between the farmers and the mine.

7.1.2 Results From Focus Groups Discussions

People where concerned mainly about the loss of livelihoods if MCL decides to expropriate the land. This concern came about mainly because most of those who reside on the land above the mine are subsistence farmers who have ploughing fields and some livestock. Some of the people also mentioned that they have boreholes and were concerned that their water sources may be affected by the underground mining.

7.2 Key Persons Consultations

A presentation of the project and the EIA process was made to key persons during their Sub-DLUP meeting on the 18th April 2008. No major concerns or issues were raised during this meeting.
Figure 20: Areas covered during consultations

Legend

- ◊ Areas covered during consultations
- ◈ MCL lease
- ◊ MCL 25 year mine
- ◈ MCL Approx. full extension
- ◊ MCL extension
- ◈ MCL lease
- ◈ Railway
- ◈ Powerline

Prepared by: Ecosurv

Environmental Consultants
Project: MCL Expansion
8 APPROACH AND METHODOLOGY

This section presents the approach and methodology used to identify, assess and mitigate significant environmental and social impacts associated with the Morupule expansion project. Currently, there is no universally applicable methodology for assessing impacts within the EIA process. The methodology used here is based on international best practice and the draft guidelines for preparing EIAs in Botswana. All subject-area specialists involved in this EIA were required to use the same methodology in order to ensure consistency in the approach.

The process of assessing the impacts of the project encompasses the following activities:

- identification of potential impacts;
- prediction of the nature, magnitude, extent and duration of potentially significant impacts;
- assessment of impacts;
- identification of mitigation measures that could be implemented to reduce the severity or significance of the impacts of the activity; and
- evaluation of the significance of the impacts after mitigation measures have been implemented – that is, the significance of the residual impacts.

The identified impacts, their assessment and mitigations are presented in Section 10 and the resultant EMP is presented in Section 14.

8.1 Impact Identification

Impacts were initially identified through a scoping study that involved a site visit, consultations with stakeholders, and a literature review. The impacts were further distinguished through different specialist areas (see Volume 2). The detailed methods used by each specialist to identify impacts are described under the respective studies.

8.2 Impact Prediction

The identified impacts were then assessed in terms of the criteria and rating scales outlined in Table 18. In all cases, the assignment of a rating was done based on past experience and the professional judgement of the specialists as well as through desktop research.
Table 18: Impact prediction criteria and rating scales

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Rating Scales</th>
</tr>
</thead>
</table>
| **Cumulative impacts (incremental impacts of the activity and other past, present and future activities on a common resource)** | • Low (there is still significant capacity of the environmental resources within the geographic area to respond to change and withstand further stress)  
• Medium (the capacity of the environmental resources within the geographic area to respond to change and withstand further stress is reduced)  
• High (the capacity of the environmental resources within the geographic area to respond to change and withstand further stress has been or is close to being exceeded) |
| **Nature**                                                              | • Positive  
• Negative  
• Neutral                                                                 |
| **Extent (the spatial limit of the impact)**                            | • Local (site-specific and/or immediate surrounding areas)  
• Regional (e.g. Boteti)  
• National (greater than the region, may include international spatial extent) |
| **Intensity (the severity of the impact)**                              | • Low - where the impact affects the environment in such a way that natural, cultural and social functions and processes are minimally affected  
• Medium - where the affected environment is altered but natural, cultural and social functions and processes continue albeit in a modified way; and valued, important, sensitive or vulnerable systems or communities are negatively affected  
• High - where natural, cultural or social functions and processes are altered to the extent that it will temporarily or permanently cease; and valued, important, sensitive or vulnerable systems or communities are substantially affected |
| **Duration (the predicted lifetime of the impact)**                     | • Short-term (0 to 5 years)  
• Medium-term (6 to 15 years)  
• Long-term (16 to 30 years) - where the impact will cease after the operational life of the activity either because of natural processes or by human intervention |
| **Probability (the likelihood of the impact occurring)**                | • Improbable – where the possibility of the impact occurring is very low  
• Probable – where there is a good possibility (<50% chance) that the impact will occur  
• Highly probable – where it is most likely (50-90% chance) that the impact will occur  
• Definite – where the impact will occur regardless of any prevention measures (>90% chance of occurring) |
| **Non-reversibility (ability of the impacted environment to return to its pre-impacted state once the cause of the impact has been removed)** | • Low (impacted natural, cultural or social functions and processes will return to their pre-impacted state within the short-term)  
• Medium (impacted natural, cultural or social functions and processes will return to their pre-impacted state within the medium- to long-term)  
• High (impacted natural, cultural or social functions and processes will never return to their pre-impacted state) |
| **Impact on irreplaceable* resources (whether an irreplaceable resource is impacted upon)** | • Yes  
• No |
**Criteria**

<table>
<thead>
<tr>
<th>Confidence level (the specialist’s degree of confidence in the predictions and/or the information on which it is based)</th>
<th>Rating Scales</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low</td>
<td>Medium</td>
</tr>
</tbody>
</table>

- A resource for which no reasonable substitute exists, such as Red Data species and their habitat requirements

### 8.3 Impact Assessment and Mitigations

Once the impacts were assessed according to the criteria in Table 18, a consequence rating was applied, as per the convention shown in Table 19. The consequence of each potential impact is determined according to the extent, duration and intensity of that impact.

This assessment was done initially for the scenario where no mitigation measures are implemented. Mitigation measures were then identified and considered for each impact and the assessment repeated in order to determine the significance of the residual impacts (i.e. the impact remaining after the mitigation measure has been implemented).

The professional experience of the specialists determined the allocation of the pre- and post- mitigation impact consequence rating. The overall significance of the impacts was then defined based on the results of a combination of the consequence rating and the probability rating set out in Table 20. The result of the assessment of the significance of the residual impacts is then linked to decision-making by authorities in the following manner:

- Low – will not have an influence on the decision to proceed with the proposed project, provided that recommended mitigation measures to mitigate impacts are implemented;
- Medium – should not influence the decision to proceed with the proposed project, provided that recommended measures to mitigate impacts are implemented; and
- High – should strongly influence the decision to proceed with the proposed project.
Table 19: Convention for assigning a consequence rating

<table>
<thead>
<tr>
<th>Consequence Rating</th>
<th>Intensity, Extent and Duration Rating</th>
</tr>
</thead>
</table>
| HIGH Consequence    | • High intensity at a regional level and endure in the long term  
                      | • High intensity at a national level and endure in the medium term  
                      | • Medium intensity at a national level and endure in the long term  
                      | • High intensity at a regional level and endure in the medium term  
                      | • High intensity at a national level and endure in the short term  
                      | • Medium intensity at a national level and endure in the medium term  
                      | • Low intensity at a national level and endure in the long term  
                      | • High intensity at a local level and endure in the long term  
                      | • Medium intensity at a regional level and endure in the long term  |
| MEDIUM Consequence  | • High intensity at a local level and endure in the medium term  
                      | • Medium intensity at a regional level and endure in the medium term  
                      | • High intensity at a regional level and endure in the short term  
                      | • Medium intensity at a national level and endure in the short term  
                      | • Medium intensity at a local level and endure in the medium term  
                      | • Low intensity at a national level and endure in the medium term  
                      | • Low intensity at a local level and endure in the medium term  
                      | • Low intensity at a regional level and endure in the long term  |
| LOW Consequence     | • Low intensity at a regional level and endure in the medium term  
                      | • Low intensity at a national level and endure in the short term  
                      | • High intensity at a local level and endure in the short term  
                      | • Medium intensity at a regional level and endure in the short term  
                      | • Low intensity at a local level and endure in the medium term  
                      | • Low intensity at a regional level and endure in the short term  
                      | • Low intensity at a local level and endure in the medium term  
                      | • Low intensity at a regional level and endure in the short term  
                      | • Low to medium intensity at a local level and endure in the short term  |

Table 20: Convention for assigning a significance rating

<table>
<thead>
<tr>
<th>Significance Rating</th>
<th>Consequence x Probability</th>
</tr>
</thead>
</table>
| HIGH Significance    | High x Definite  
                      | High x Highly Probable  
                      | High x Probable  
                      | High x Improbable  
                      | Medium x Definite  |
| MEDIUM Significance  | Medium x Highly Probable  
                      | Medium x Probable  |
| LOW Significance      | Medium x Improbable  
                      | Low x Definite  
                      | Low x Highly Probable  
                      | Low x Probable  
                      | Low x Improbable  |
9 IMPACT DESCRIPTION AND SENSITIVITY ANALYSIS

9.1 Summary of Findings

9.1.1 Socio-economic and land-use findings

The socio-economic and land use impact study is reported under Volume 2, Appendix 1. Key issues were based on the socio-economic baseline for the area and consultations with those likely to be affected by the project. The impact assessment and the mitigations are provided in Section 10 and summarised in Section 12.

- All the business operators interviewed stated their awareness of the proposed expansion of the mine and acknowledged the positive economic impact of the mine on the local economy. It emerged during the interviews that the mine has direct business deals with most of the local suppliers. Business owners were, however, concerned about a possible increase in crime in the village due to an influx of people.

- Property owners within the Morupule lease area expressed hope that jobs would be created during the construction period.

- The project will strengthen the local economy (estimated capital expenditure for the construction and operation phase is approximately P 3 billion and P 65 million respectively) as products and services may be sourced locally.

- The construction phase and operation of the expansion will require a workforce of about 2 400 people once at Phase 2 operating levels (12 Mtpa). This implies job creation for the locals and an improvement in livelihoods.

- The sexual interaction of construction workers, jobs seekers and the local people will lead to an increase in HIV/AIDS and other STDs. Other health and safety issues include illegal settlement.

- A significant transitory population increase will be effected by both the mine and power station expansion’s workers and job seekers. This will radically alter the population structure of Palapye village.

- About 23 households reside within the lease area. Any collapse or subsidence could result in damage or loss of property and livestock, and injury or loss of life.

- A further 34 households and 745 ha of arable lands (comprising about 71 lands areas) will be lost in Phase 2 - 12 Mtpa.

- Interviews with cattlepost and field owners revealed that the area has a long history of settlement that predates the inception of the mine. They therefore have a strong sense of attachment to the area. Some of the interviewees indicated that they settled in the area before the 1950s.

- Mixed farming is the main source of their livelihoods, and some households within the area subsist solely on agricultural products. Any mining activities that will result in the displacement or relocation of the local people will affect their livelihoods. 23 households with be affected and 194 ha of lands areas (comprised of 19 lands areas) will be lost for the existing operation.

- If the game park is expanded to provide a safe use of the land area above the mine workings, there will be an increase in the area of grazing removed from livestock production from an estimated 1 200 ha to approximately 5 750 ha.
• Population influx will lead to negative impacts such as squatting, crime, pollution and diseases. The residents of Palapye will be the most affected. Other villages such as Serowe will also be affected.

• Cumulative effects: The effect is likely to be felt as a cumulative from both the Morupule Colliery and expansion of the adjacent power station which is expected to bring in 2,000 workers (Ecosurv and GIBB, 2008). The combined increase of approximately 3,200 workers will be a significant change to the Palapye population structure. Safety impacts from the construction vehicles of both the colliery and BPC expansion projects.

• Pressure on accommodation and other facilities such as schools and clinics. The short term increase in construction personnel created by simultaneous developments such as the colliery, BPC Power Station and new university in Palapye will result in a large temporary influx of construction personnel into the area. Long term the Palapye population will increase more rapidly than predicted in the recent Palapye Planning Area Development Plan with the new jobs created and the annual influx of students. The Palapye Planning Area Development Plan considers the implications of population growth and infrastructure development.

9.1.2 Noise climate findings


• The existing noise levels are summarised under Section 5.1.3.

• Noise levels near to the main roads will remain high and will continue to increase as traffic volumes increase.

• The proposed Phase 1 upgrading required at the existing Shaft 1 complex will increase the area of influence from this source area only marginally. The proposed Phase 2 upgrading required at the existing Shaft 1 complex will increase the area of influence from this source area by a radius of about 600 m.

• The additional ventilation shafts to the south-west of Shaft 1 will introduce a very loud source of noise to an area which is fairly quiet, but the impact from the traffic from Road A14 would still be significant. It should be noted that, during the nighttime, while the traffic noise is intermittent, the noise from the ventilation shafts will be continuous.

• The construction of the Shaft 2 complex will introduce a very loud noise source to an area which is currently very quiet.

• The situation in the study area is predicted to be as follows:
  o The residences on the western edge of Palapye (urban residential) lie well outside the colliery’s 45+ dBA impact zone and thus will not be negatively affected.
- The colliery village lies well outside the colliery’s 40+ dBA zone and thus will not be negatively affected.

- Some 11 homesteads (and 21 for Phase 2) (rural residential) fall within the area where the noise levels exceed 35 dBA. These noise sensitive receptors are shown in Figure 21. The noise contours in Figure 21 are the cumulative noise values from all three elements of the Phase 2 Colliery Expansion Project.

- The noise from the colliery will not significantly worsen the noise climate at the Kgaswe Primary School. The noise climate at the school is already significantly degraded from road traffic noise.

- Night-time noise levels in the Morupule village are already degraded from road traffic noise and the anticipated increase from the planned colliery expansion will be minor.

- The volume of traffic generated by the operations by the Phase 1 expansion will only marginally increase the ambient noise levels along the road corridor between the colliery and Palapye. Noise from ancillary works and equipment (such as the conveyor belts) for Phase 2 will in general be low and localised. The drive houses for the conveyor belt system, however, will be sites of high noise levels.

- Colliery trains travelling at night have the potential to have a high impact in some areas.
Figure 21: Potential noise impact of the colliery (Phase 1 and 2)
9.1.3 Hydrology, hydrogeology and water supply findings

This study (Volume 2, Appendix 3) considered impacts relating to water resources, soil and sub-soil contamination, potential acid leachate runoff and acid mine drainage, impacts on surface water and mining systems due to storm runoff, and cumulative impacts as the mine area increases, including possible subsidence. The impact assessment and the mitigations are provided in Section 10 and summarised in Section 12.

- Present mining is reported to be at a depth of 80-90 mbgl. Although few seepage problems are recorded, the mine expansion may increase potential for groundwater to enter new adits via seepages. Greater seepages into the new shaft are also expected. There are quite a few current active boreholes to the west of the mine in the area where the coal seams are mined. Therefore there is the possibility that water levels in these boreholes may be impacted by the works below ground level. This may result in the derogation of existing users’ rights of water abstraction.

- Mining below the groundwater level may also lead to potential inflows of water into the mine shaft and possible subsidence issues.

- The colliery sits on the Ecca sequence which does not contain productive sandstone formations, and the setting cannot be considered a major or particularly valuable aquifer. However, clearly groundwater is present and this requires evaluation and protection. The aquifer is considered to have only medium to low vulnerability.

- The soils in the area are of moderate to high vulnerability and do not contain any significant clayey material (or organic material) likely to prevent the downward migration of contaminants, particularly biodegradable pollutants. However, the depth of the Kalahari Beds at around 20-30 m acts as a reasonable protective unsaturated layer to combat pollution migration.

- The mine boreholes are compromised by faecal contamination. This is possibly a result of inflow from sewage works and maturation ponds. The borehole will need to be rehabilitated. Plans are to decommission the existing sewage facilities and connect to the Palapye wastewater treatment works.

- At present some areas of the site are designed to capture surface water runoff from rainfall events. However, at present little effort is made to collect or control drainage from the stockpile areas. These coal stockpiles may have some limited potential to create acid leachate drainage (ALD) as has been well documented in Europe and America. However, it is not certain whether there is sufficient rainfall in Botswana for this to occur and the leachability potential with regard to the new expansion area is not yet known. Nevertheless, increasing the size of the coal stocks as a result of the development would be likely to amplify any risks posed as a result of ALD.

- Water supply for the mine will increase as the mine expands. Expansion of the current supplies must take place to source any extra water demand. Additionally the infrastructure to deal with increased water supply (and storage) will need to be reassessed.

- Coal stockpiles have the potential to spontaneously catch on fire. Burning of coal releases large amounts of methane and carbon dioxide. The increased capacity of the mine will result in an increased number of stockpiles on site, thereby amplifying any potential impacts. Preventative measures are in place.
9.1.4  Archaeology findings

The study (Volume 2, Appendix 4) was undertaken through an intensive field survey of the proposed project area. Existing literature in and around the proposed project area was also consulted as a way of finding whether any archaeological or historical sites were recorded within the proposed project area. The impact assessment and the mitigations are provided in Section 10 and summarised in Section 12.

- The findings from the AIA are summarised in Section 6.4. Neither Phase 1 (4 Mtpa) nor Phase 2 (12 Mtpa) will directly affect any recorded sites.
- The AIA report was submitted to the DNMMAG who issued a development permit for the proposed sites since mining will be underground (see Annexure 3). Surface infrastructures likely to impact on these sites were modified accordingly.
- The result of the archaeological survey however, does not preclude the chance that sites will be discovered during clearing of areas for developments.

9.1.5  Botany findings

The proposed project area was surveyed by a Botanist using the Dallimeir (1992) (see Volume 2, Appendix 5) assessment method to determine vegetation concerns. The impact assessment and the mitigations are provided in Section 10 and summarised in Section 12.

- Two invasive species (*Dichrostachys cinerea* and *Argemone mexicana*), and one rare species of *Stapelia* (*Stapelia schinzii var schinzii*) were identified on the proposed project area. Pertaining to red data status *Stapelia* falls under (Data Deficient) DD. The plant is uncommon and it would need to be conserved (either ex-situ or in-situ). If conserved ex-situ it should be transplanted together with its original soil substrate.
- No red-listed species or protected species occur within the area.

9.1.6  Resource use and management findings

- There will be increased use of power from the present 2.5 MW/annum to 12.1 MW/annum and increase in water use from 74 400 to 104 600 m$^3$/annum for Phase 1. For Phase 2, there will be increased use of power from the present 2.5 MW/annum to 36 MW/annum and an increase in water use from 74 400 to 959 400 m$^3$/annum.
- Cumulative impacts due to water use: The combined development of the BPC Power station and the expansion of the colliery will increase water demand on both groundwater and NSC resources.
- It is expected that Phase 1 of the expansion project will result in an additional 100 tonnes of waste generated per annum in addition to the currently generated 50 tonnes per annum. The waste that would be generated by the proposed expansion project might include domestic, industrial and wastewater from the ablution facilities. No mine or plant residues will be generated as all processed materials will be sold as products.
- A new laboratory will be built increasing the need for storage and disposal of hazardous waste. The existing clinic will also be expanded. There is no hazardous landfill in Botswana and all hazardous waste are either treated and disposed of at the landfills or transported to South Africa through the Basel Convention.
- Wastewater will increase due to the colliery expansion. This will be addressed in a separate EIA as the mine is planning to connect to Palapye wastewater treatment works.
Any spills and leakages of chemicals and oils will contaminate soils, groundwater and surface water. The colliery has a procedure for storage, handling, use and disposal of such substances.

9.1.7 Transportation

Project-related vehicles will make use of existing mine and public road networks. The A1 highway, A14 road to Serowe and mine access roads will be used to travel to and from the proposed project site. The main transportation issues are:

- Traffic volume will increase due to transportation of staff and material via road during construction, though this is expected to be temporary. For Phase 1, about 50% increase is expected, thus an additional 14 trucks and 30 light vehicles per day are anticipated. During operation, traffic volumes are expected to double to 164 light vehicles and 52 heavy vehicles and trucks travelling to and from site.
- The increased traffic volume will increase the rate of deterioration of road surfaces and compromise the safety of road users.
- About 1.6 tonnes of solid waste is generated at the mine. As more activities occur within the mine, this waste will increase resulting in more frequent transportation and disposal of waste at the regional landfill. The mine is planning to take all the waste to the Serowe landfill. Consultations should be made with the CDC Environmental Health Department about the use of the landfill.

9.1.8 Abstraction and removal of borrow materials

- An estimated 240 000 tonnes of material for Phase 1, and 480 000 tonnes of material for Phase 2, will be needed for used as backfill material for construction. Overburden material from the existing boxcut will be used as fill material. A borrow pit exists within the MCL prospecting area. This can also be used for providing additional backfill material for construction. All borrow material purchased or excavated must come from legal excavation operations which hold EIA certificates and are registered with DoM.
- The removal of backfill material will create dust and noise as well as visual impacts due to the removal of natural vegetation.

9.1.9 Site clearance

- Approximately 5.5 ha of land would be cleared to cater for the additional facilities for the 4 Mtpa. A layer of topsoil will have to be stripped and stockpiled for use in future as a means of conserving the resource. Based on clearing of the top soil to about 0.5m, approximately 27,500m$^3$ will require storage.
- Incorrect stripping and stockpiling practices will result in a loss of resource due to compaction, erosion and dilution.
- These will result in an increase in overall area disturbed by the colliery from 62 ha to about 70 ha with a loss of approximately 5.5 ha of sandveld vegetation and 2.5 ha of ecotone between the rocky outcrop habitat and the surrounding sandveld.

9.1.10 Air quality findings

- During the construction phase, approximately 5.5 ha of undisturbed land will be used to establish additional facilities for the colliery. This is expected to be temporary, until the facilities have been constructed. Dispersion of dust has not been quantified, however
typically dust related impacts can be experienced within 1 to 2 km of the operations. About 23 homes will be affected by increased ambient dust.

- The release of methane gas during the mining operations is minimal. Studies carried out by MCL have shown that methane levels at the coal face are some of the lowest in southern Africa. The amount of methane gas emitted may increase with mine depth.

- The area affected is not expected to increase but the volume of coal dust deposited and the impact on vegetation will increase in the existing depositional area. Approximately 24 ha, of which 13 ha are natural sandveld vegetation, will be affected. This will lead to reduced rates of photosynthesis and a drop in soil pH.

9.1.11 Other

- Mining will take place below the A14 road and the NSC pipeline (to Serowe) at an approximate depth of 100 m. Mining also occurs below the Serowe pipeline. Support pillars are left in the underground workings and their density is increased when mining below roads, where only 50% of the seam is mined and the rest is left as support pillars. The mine follows the Department of Mines (DoM) procedure for mining under roads and rivers.

- Mining will take place below the seasonal Morupule and Lotsane Rivers. Increased support pillars are also left in the underground workings below the rivers. Ingress of water into the underground workings would amplify any potential impacts. However the mine has indicated that there is minimal seepage into the workings. Monitoring of surface subsidence within the Morupule River already takes place.

- Blasting may be necessary during operation to break through dyke structures underground. Near surface blasting (< 100 m) is usually not an issue except when blasts are poorly designed and surface structures poorly built. The location, frequency and size of blasts are unknown but they are expected to be minimal. Third party structures such as public roads and the NSC pipeline within impact zone could be affected. Although households currently occur within the potential impact zone, the mine is in the process of implementing a resettlement programme and compensating for all structures.

9.1.12 Decommissioning

- Only the shaft, as a coal extraction conduit, will be decommissioned. The crush facilities, conveyors, coal storage areas, coal wash facilities, offices and housing will not be affected by the closure of the existing shaft.

- The closure of shafts, adits and inclines may results in accumulation of methane underground. The methane production may be a health and global warming issue.

- The main decommissioning concerns lie with the impact of the old workings on the land surface (subsidence) as it will preclude habitation on the area above the workings. Other infrastructure such as the main A14 road would have to be monitored.

9.2 Sensitivity Analysis

Sensitivity analysis was used to combine information and concerns identified from consultations, existing literature and this study, and develop assessments across three areas of concern i.e. physical environment, biological environment and social issues. Information was combined using GIS, and is based on a simple ranking of issues as follows:

0 = no concerns identified for the variable;
1 = minor concerns;
2 = moderate concerns;
3 = serious concerns identified.

These concerns and issues have not been assessed in terms of expected impacts, and simply serve to identify issues and concerns and to indicate where these are spatially located.

The environmental sensitivity map (Figure 22) is based on:

- biodiversity (source - BSAP);
- soils (source - national soils mapping and CDILUP for potential and erosion);
- vegetation (source - 1:80,000 aerial photography);
- protected areas (source - national data supplied by Surveys and Mapping e.g. IBAs, game parks, sanctuaries); and
- important natural features such as rivers and hills (mapped off 1:80,000 aerial photography).

The results indicate the importance of the drainages to the natural environment.

**Figure 22: Environmental sensitivity map**
The social sensitivity map (Figure 23) was generated from:

- settlements (mapped off 1:80,000 aerial photography);
- land use (mapped off 1:80,000 aerial photography); and
- cultural and archaeological sites (AIA sites and CDILUP data).

Figure 23: Social sensitivity map
When these results were combined with the environmental sensitivity it is clear how important the river systems are for livelihoods and how these are presented as linear areas crossing the lease (Figure 24).

Figure 24: Combined social and environmental sensitivity map
10 IMPACT ASSESSMENT AND MITIGATION

For simplicity, the impacts have been classified within Table 21, Table 22 and Table 23 in terms of the phase of the development in which they are likely to occur, namely construction phase, operational phase or decommissioning phase respectively.

The significance of potential impacts and the residual (post-mitigation) impacts are marked according to the following colour code:

<table>
<thead>
<tr>
<th>Colour</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Red</td>
<td>Impact of high significance</td>
</tr>
<tr>
<td>Yellow</td>
<td>Impact of medium significance</td>
</tr>
<tr>
<td>Green</td>
<td>Impact of low significance</td>
</tr>
</tbody>
</table>
Table 21: Summary of impacts, assessment and mitigations for the construction stage of Phase 1 - 4 Mtpa

<table>
<thead>
<tr>
<th>No.</th>
<th>Activity</th>
<th>Impact</th>
<th>Nature</th>
<th>Mitigation</th>
<th>Significance (without mitigation)</th>
<th>Significance (with mitigation)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A1</td>
<td>Construction of infrastructure</td>
<td>Potential noise generation from machinery and equipment affecting</td>
<td>Neg.</td>
<td>Construction activities to mainly take place during the day between 07h00 and 1800 with no activities (or limited noise generating activities) at night</td>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td></td>
<td></td>
<td>farmers residing within the lease area</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A2</td>
<td>Burning of plant material and cooking fires at the construction area and</td>
<td>Threat to human life and loss of grazing in surrounding livestock</td>
<td>Neg.</td>
<td>Induction of construction teams. All fires controlled. Emergency procedures in place to extinguish fires (not applicable during wet season).</td>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td></td>
<td></td>
<td>and camp</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B1</td>
<td>Water use</td>
<td>Increased water abstraction due to increased usage</td>
<td>Neg.</td>
<td>Water conservation measures should be implemented where possible, through rain water harvesting, and reuse on non-potable requirements. The contractor should indicate all conservation measures that will be implemented.</td>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td>B2</td>
<td>Disposal of wastewater</td>
<td>Land contamination from spillages or leakages due to infrastructure</td>
<td>Neg.</td>
<td>Any infrastructure should be installed properly and should be approved by the mine before use. Inspection and maintenance should be carried out regularly. Wastewater disposal should meet the BOBS standards for wastewater disposal.</td>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td></td>
<td></td>
<td>damage and failure by chemical toilets or other waste water systems</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B3</td>
<td>Power use</td>
<td>Increased power usage</td>
<td>Neg.</td>
<td>Power should be used where necessary. Resource conservation measures should be implemented. The use of solar energy as well as other energy saving technologies should be maximised.</td>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td>B4</td>
<td>Storage and handling of hazardous substances including fuel, lubricants,</td>
<td>Contamination of soils, surface water &amp; groundwater by potential</td>
<td>Neg.</td>
<td>All storage areas must be bunded. Bunds must be able to contain the capacity of 110% of the bunded tank. Materials, which are capable of absorbing spillages and flows in drains, must be made easily available in case of accident. Spillages and contaminated soils must be removed immediately and disposed of at an appropriate landfill. All contaminated soils must be treated prior to disposal. Contaminated areas must be rehabilitated immediately. An incident register must be kept and should be submitted to the mine monthly. The contractor must develop a hazardous lubricants handling &amp; storage procedure that is approved by the mine.</td>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td></td>
<td></td>
<td>oil, process chemicals and explosives</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No.</td>
<td>Activity</td>
<td>Impact</td>
<td>Nature</td>
<td>Mitigation</td>
<td>Significance (without mitigation)</td>
<td>Significance (with mitigation)</td>
</tr>
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</tr>
<tr>
<td>B5</td>
<td>Storage and handling of used and unused hazardous substances</td>
<td>Potential fire outbreaks due spillages or leakages of hazardous substances</td>
<td>Neg.</td>
<td>The mitigation measure in B4 applies. Fire management measures should be put in place.</td>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td>B6</td>
<td>Disposal of used hazardous substances</td>
<td>Contamination of soils, surface water &amp; groundwater by potential spillages or leakages of used substances at the storage areas and landfill.</td>
<td>Neg.</td>
<td>The mitigation measures in B4 and B8 apply. A plan for handling, storage and disposal should be according to the Basel Convention.</td>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td>B7</td>
<td>Disposal of used hazardous substances</td>
<td>Potential fire outbreaks due spillages or leakages of used hazardous substances</td>
<td>Neg.</td>
<td>The mitigation measure for B4 applies.</td>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td>B9</td>
<td>Storage of waste</td>
<td>Visual impacts from littering and waste generation leading to reduced aesthetic value</td>
<td>Neg.</td>
<td>Temporary storage of waste should be provided. &quot;Good housekeeping&quot; practices should be implemented. Environmental awareness training should be provided. The contractor should develop a waste management plan to be approved by the mine.</td>
<td>Low</td>
<td>Low</td>
</tr>
</tbody>
</table>

C. Abstraction of Borrow Material for Material Lay Down Areas and Crusher Facilities.

| C1  | Borrow pit establishment | Visual impacts due to change in landscape by material extraction and inappropriate closure of borrow pits | Neg. | The material should be sourced from already disturbed borrows. Affected areas should be rehabilitated on an ongoing basis during material sourcing. | Low | Low |
| C2  | Removal of soil and gravel, excavation activities | Loss of biodiversity due to removal of habitat | Neg. | Use existing boxcut overburden material. If additional borrow material is required ensure borrows are licensed and have closure plans in place to guarantee rehabilitation of excavated areas. | Low | Low |
| C3  | Removal of soil and gravel, excavation activities | Generation of dust affecting farmers living downwind (within the mine lease area at a distance of <2 km) | Neg. | The dust suppression procedure should be followed during dry windy conditions. | Low | Low |
| C4  | Drilling and excavation of material | Noise pollution will affect the adjacent farmers living within the mine lease area | Neg. | Drilling should take place during the day between 07h00 and 1800 with no activities (or limited noise-generating activities) at night. | Low | Low |

D. Transportation
<table>
<thead>
<tr>
<th>No.</th>
<th>Activity</th>
<th>Impact</th>
<th>Nature</th>
<th>Mitigation</th>
<th>Significance (without mitigation)</th>
<th>Significance (with mitigation)</th>
</tr>
</thead>
<tbody>
<tr>
<td>D1</td>
<td>Transportation of staff and material via road</td>
<td>Deterioration of roads and unsafe road conditions for users of the public road network</td>
<td>Neg.</td>
<td>Monitoring of mine's use of the intersection of the A14 and mine access road through visual inspection and by obtaining accident records from police station. If more than 1 accident recorded in a month or 1 death recorded, then mine must consult a traffic specialist and implement additional mitigation measures as required in consultation with DoR and CDC Roads Department. For road maintenance, MCL will consult with the DoR and CDC Roads Department to ensure that use of public roads by the mine does not compromise the condition and integrity of the road. The mine will record and respond, appropriately and without delay, to any complaints about usage of roads by mine vehicles or their clients.</td>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td>D2</td>
<td>Transportation of waste to the Serowe landfill</td>
<td>Land contamination and risks of accidents to other road users from litter from transportation vehicles</td>
<td>Neg.</td>
<td>Trucks transporting waste should be covered. Transportation to the landfill should be carried out during low traffic periods. Vehicle speed should be limited to 60 km/hr. The landfill authorities should be notified and the expected waste amount should be given. An accident and public complaints register should be kept.</td>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td>E. Site clearance on all project areas</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>E1</td>
<td>Clearing of area for infrastructure development</td>
<td>Loss of sandveld vegetation</td>
<td>Neg.</td>
<td>Plan for minimum width roads, conveyor belts and service tracks. Follow existing water pipeline, power line and cutlines where possible. Implement the vegetation procedure (appended).</td>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td>E2</td>
<td>Clearing of area for additional staff housing in the MCL village area (20 house units)</td>
<td>Loss of sandveld vegetation and ecotone habitat adjacent to the rock outcrops</td>
<td>Neg.</td>
<td>Induction for house construction workers. Minimal clearing of housing sites i.e. no mechanical clearing of house sites. Maintain indigenous trees where possible (environmental officer to mark trees for protection).</td>
<td>Medium</td>
<td>Medium</td>
</tr>
<tr>
<td>E3</td>
<td>Stripping and stockpiling of soils</td>
<td>Loss of soil resources through compaction, erosion and/or dilution</td>
<td>Neg.</td>
<td>Implement the topsoil management procedure in all new project areas where natural vegetation exists.</td>
<td>Medium</td>
<td>Low</td>
</tr>
<tr>
<td>E4</td>
<td>Clearing of all proposed areas for infrastructure development</td>
<td>Dust nuisance to people living downwind. These include subsistence farmers</td>
<td>Neg.</td>
<td>Implement the dust suppression procedure (appended) during the clearing process. Vegetation should be removed only where necessary.</td>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td>F. Employment and Service Provision Requirements</td>
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</tbody>
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Prepared by Ecosurv (Pty) Ltd
<table>
<thead>
<tr>
<th>No.</th>
<th>Activity</th>
<th>Impact</th>
<th>Nature</th>
<th>Mitigation</th>
<th>Significance (without mitigation)</th>
<th>Significance (with mitigation)</th>
</tr>
</thead>
<tbody>
<tr>
<td>F1</td>
<td>Employment</td>
<td>Requirements for skilled, semi-skilled and non-skilled labour will create employment opportunities</td>
<td>Pos.</td>
<td>Non-skilled and semi-skilled job vacancies should be advertised at the Palapye Labour Office and open recruitment should be carried out in the village main kgotla with the assistance of traditional authorities. People from areas neighbouring Palapye should also be considered.</td>
<td>High</td>
<td>High</td>
</tr>
<tr>
<td>F2</td>
<td>Employment</td>
<td>Transitory population increase due to influx of job seekers will create social conflict, increase in sexually transmitted diseases (including HIV/AIDS) and crime.</td>
<td>Neg.</td>
<td>Basic medical, accommodation and recreational facilities should be provided onsite to workers to ease pressure on community facilities. Contractors to submit a HIV/AIDS programme that meets Debswana HIV/AIDS policy (appended) and National HIV/AIDS Strategy Framework (2003-2009) objectives.</td>
<td>High</td>
<td>Medium</td>
</tr>
<tr>
<td>F3</td>
<td>Employment</td>
<td>Illegal settlement due to presence of job seekers not immediately absorbed by contractors. Illegal settlement will also lead to increased diseases problems, pollution, crime and other social ills.</td>
<td>Neg.</td>
<td>MCL and the Contractor should be proactive in dealing with illegal settlement through reporting people that put up temporary housing structures near the camp as early as possible. MCL could use the Public Affairs Unit. This calls for collaboration with the Palapye sub-land board and Botswana Police.</td>
<td>Medium</td>
<td>Low</td>
</tr>
<tr>
<td>F4</td>
<td>Service provision requirement</td>
<td>Need for support services for construction will increase business opportunities</td>
<td>Pos.</td>
<td>MCL should encourage contractors to use the predetermined preferred local service providers list to procure certain goods and services in order to enhance this impact.</td>
<td>High</td>
<td>High</td>
</tr>
</tbody>
</table>
Table 22: Summary of impacts, assessment and mitigations for the operation stage of Phase 1 - 4 Mtpa

<table>
<thead>
<tr>
<th>No.</th>
<th>Activity</th>
<th>Impact</th>
<th>Nature</th>
<th>Mitigation</th>
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<th>Significance (with mitigation)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A1</td>
<td>Removal of coal seam underground</td>
<td>Potential increase in greenhouse gases due to release of methane gas into the atmosphere</td>
<td>Neg.</td>
<td>Although the present methane levels at the coal face are undetectable, they will increase with coal seam depth. Ensure regular monitoring of methane. Sampling should occur with an increase in seam depth of ca 10 m. The frequency of monitoring should be decided by the mine engineers and relate to international best practices. If monitoring shows unacceptable limits, additional mitigation measures must be implemented in consultation with a qualified specialist.</td>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td>A2</td>
<td>Coal seam removal underground</td>
<td>Potential damage to road and pipeline infrastructure due to surface subsidence</td>
<td>Neg.</td>
<td>Coal seam removal should follow the DoM mining guidelines/procedures for mining below roads and other infrastructure. The colliery currently adheres to these procedures. In planning, the colliery should work with DoR, DoM and CDC. The mine should also conduct studies to identify possible subsidence and prevention measures. Emergency response plans for above ground subsidence should be put in place. Monitoring should be introduced to monitor the possible occurrence of subsidence.</td>
<td>High</td>
<td>Low</td>
</tr>
<tr>
<td>A3</td>
<td>Coal seam removal underground</td>
<td>Alteration of drainage patterns of the Morupule and Lotsane Rivers due to surface subsidence</td>
<td>Neg.</td>
<td>The colliery adheres to the DoM mining procedures for below roads and rivers. Work with DWA, DoR and CDC in planning. Regular meetings between the parties required. The colliery already operates a series of subsidence measurement recorders westward from the site. No significant disturbances have been detected. Monitoring of surface subsidence along the Morupule and Lotsane Rivers should continue.</td>
<td>Medium</td>
<td>Low</td>
</tr>
<tr>
<td>A4</td>
<td>Coal seam removal below the piezometric level</td>
<td>Reduction of groundwater levels in areas beyond the mining activities due to mining below the piezometric groundwater level</td>
<td>Neg.</td>
<td>Although mining is currently below the piezometric level, no dewatering has been experienced. However, monitoring should be in place to check the occurrence of the impact. No mitigation measure identified.</td>
<td>Medium</td>
<td>Medium</td>
</tr>
<tr>
<td>A5</td>
<td>Coal seam removal below the piezometric level</td>
<td>Potential water seepage into the mine</td>
<td>Neg.</td>
<td>Seepage into the mine should be monitored and if this occurs, the water should be collected for use as process water.</td>
<td>Medium</td>
<td>Low</td>
</tr>
<tr>
<td>A6</td>
<td>Coal seam removal underground</td>
<td>Risks of accidents and fatalities due to potential subsidence</td>
<td>Neg.</td>
<td>The mine should conduct studies of possible subsidence and risks to the people residing within the mine lease area. MCL should maintain the existing complaints register to log in public complaints and consistently engage with affected parties through the stakeholder engagement plan. Areas of collapse are to be mapped.</td>
<td>Medium</td>
<td>Low</td>
</tr>
<tr>
<td>No.</td>
<td>Activity</td>
<td>Impact</td>
<td>Nature</td>
<td>Mitigation</td>
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<tr>
<td>A7</td>
<td>Blasting underground</td>
<td>Damage to third party infrastructure within and around the mine lease area due to vibrations through the ground.</td>
<td>Neg.</td>
<td>Blasting should comply with the Mines and Minerals Act, Mines, Quarries, Works and Machinery Act and the Explosives Act. The colliery should notify all service providers within the area of blast programme. Blast should be designed to minimise damage to third party infrastructure. Monitoring of each blast will take place.</td>
<td>Medium</td>
<td>Low</td>
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</tr>
<tr>
<td>B</td>
<td>Ventilation System</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>B1</td>
<td>Ventilation system</td>
<td>Excess noise levels for homesteads in the surrounding area.</td>
<td>Neg.</td>
<td>The equipment should be maintained in good working order. Berms should be established around shafts to deflect noise upwards. The design of the equipment should comply with the industrial requirements of SANS 10103 - to insulate noisy plants and equipments. Noise monitoring should be in place. Any complaints should be recorded and responded to quickly.</td>
<td>Medium</td>
<td>Low</td>
</tr>
<tr>
<td>B2</td>
<td>Ventilation of underground air</td>
<td>Air quality impacts due to dirty air from the system.</td>
<td>Neg.</td>
<td>The monitoring of air quality should continue</td>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td>C</td>
<td>Coal Processing: Crushing, Screening, Washing, Handling and Stockpiling</td>
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<td></td>
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</tr>
<tr>
<td>C1</td>
<td>Coal crushing, storage and handling</td>
<td>Potential change to existing sandveld vegetation due to the generation of coal dust.</td>
<td>Neg.</td>
<td>All coal handling facilities and processes must be designed to suppress coal dust. The existing dust suppression procedure should be followed. The impact of coal on surrounding vegetation should be monitored and, if shown to be of concern, addressed.</td>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td>C2</td>
<td>Coal crushing, storage and handling</td>
<td>Potential decrease in soil pH due to the generation of coal dust.</td>
<td>Neg.</td>
<td>Zhai <em>et al.</em> (unpublished) has found that most soil pollution in and around the mine area are not due to coal dust from the mine. Rather it is due to emissions from the adjacent power station. However, a monitoring plan should be developed to monitor this impact. The existing occupational health and safety dust management procedures should be followed.</td>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td>C3</td>
<td>Coal crushing, storage and handling</td>
<td>Possible respiratory problems to the residents within the lease area due to generation of coal dust</td>
<td>Neg.</td>
<td>The existing dust suppression procedure should be followed. Visual monitoring of activities should take place on site, minimise double handling of materials. Any complaints should be recorded and responded to quickly.</td>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td>C4</td>
<td>Coal crushing, storage and handling</td>
<td>Noise levels in excess of the minimum acceptable levels for homesteads in the surrounding area.</td>
<td>Neg.</td>
<td>The designs of the equipment should comply with requirements of SANS 10103, insulate noisy plants and equipments. Any complaints should be recorded and responded to quickly.</td>
<td>Medium</td>
<td>Low</td>
</tr>
<tr>
<td>C5</td>
<td>Use of coal crush and wash facilities</td>
<td>Establishment of exotic vegetation and weed species at the fringe of facilities.</td>
<td>Neg.</td>
<td>Rehabilitation of areas that were unnecessarily disturbed, removal of exotic species and noxious plants. Monitoring should be in place.</td>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td>No.</td>
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<tr>
<td>C6</td>
<td>Stockpiling coal on site</td>
<td>Release of potentially harmful pollutants into the air from spontaneous combustion</td>
<td>Neg.</td>
<td>Coal should be compacted daily to release gases. Fire fighting equipment should be on standby and close to the stockpile area.</td>
<td>Medium</td>
<td>Low</td>
</tr>
<tr>
<td>C7</td>
<td>Stockpiling coal on site</td>
<td>Surface and groundwater contamination from acid leachate drainage</td>
<td>Neg.</td>
<td>Coal stockpiles should be stored on impervious and compacted areas. The drainage from these will then need to be contained and collected for reuse as process water on the site. A borehole should be drilled down gradient of the stockpile area into the Kalahari Beds to monitor the quality of any shallow groundwater and thus provide a baseline for groundwater quality. The borehole is to be monitored and sampled on a quarterly basis, any changes in groundwater quality or levels as a result of the stockpile area can be recorded and action can be taken. (See monitoring plan). No uncontrolled release of drainage from stockpile areas to be allowed.</td>
<td>Medium</td>
<td>Medium</td>
</tr>
<tr>
<td>D1</td>
<td>Transportation of staff, material and product via road or rail</td>
<td>Deterioration of public roads and compromised safety of road users due to colliery and customer use of roads</td>
<td>Neg.</td>
<td>Monitoring of mine's use of the intersection of the A14 and mine access road through visual inspection and by obtaining accident records from police. If more than 1 accident recorded in a month or 1 death recorded, then mine must consult a traffic specialist and implement additional mitigation measures as required in consultation with DoR and Planning Committee. For road maintenance, MCL will consult with DoR and Planning Committee to ensure that use of public roads by the colliery does not compromise the condition and integrity of the road. The mine will record and respond, appropriately and without delay, to any complaints about usage of roads by mine vehicles and their clients.</td>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td>D2</td>
<td>Transportation of staff, materials and products</td>
<td>Noise levels in excess of the minimum acceptable levels for homesteads in the surrounding area.</td>
<td>Neg.</td>
<td>Night-time activities should be minimised. Vehicles should be maintained in a good working order.</td>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td>D3</td>
<td>Transportation of waste to the Serowe landfill</td>
<td>Land contamination and risks of accidents to other road users from litter from transportation vehicle</td>
<td>Neg.</td>
<td>Waste should be covered during transportation. Transportation to the landfill should be carried out during low traffic periods/times. Vehicle speed should be limited to 60 km/hr. The landfill authorities should be notified and the expected waste amount should be given. An accident and public complaints register should be kept and response plan should be developed for such complaints.</td>
<td>Low</td>
<td>Low</td>
</tr>
</tbody>
</table>

### E. Resource Use, Management and Waste Management

- **E1 Water use**: Increased water abstraction due to increased usage  
  - Mitigation: Water conservation measures should be implemented where possible, through rainwater harvesting, and reuse on non-potable requirements. Rainwater harvesting should be extended to new housing units.  
  - Significance (without mitigation): Low  
  - Significance (with mitigation): Low
<table>
<thead>
<tr>
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<tbody>
<tr>
<td>E2</td>
<td>Disposal of wastewater</td>
<td>Land contamination from spillages or leakages due to sewer infrastructure damage</td>
<td>Neg.</td>
<td>Any infrastructure should be installed properly and should be approved by the mine before use. Inspection and maintenance should be carried out regularly. Wastewater disposal should meet the BOBS standards for wastewater disposal.</td>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td>E3</td>
<td>Power use</td>
<td>Increased power usage</td>
<td>Neg.</td>
<td>Power should be used where necessary. Resource conservation measures should be implemented. The use of solar energy, as well as other energy saving technologies, should be maximised.</td>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td>E4</td>
<td>Expansion of the mine clinic</td>
<td>Increased need for disposal of clinical waste</td>
<td>Neg.</td>
<td>Since all clinical waste is collected by the authorities, they should be notified prior to expansion and be given expected amounts of waste that need to be disposed of.</td>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td>E5</td>
<td>Storage and use of chemicals at the laboratory</td>
<td>Potential fire outbreaks due to spillages of chemicals</td>
<td>Neg.</td>
<td>The storage, use and handling procedure should be followed.</td>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td>E6</td>
<td>Storage and use of fuels</td>
<td>Contamination of soils, surface water &amp; groundwater by potential spillages or leakages of substances</td>
<td>Neg.</td>
<td>All storage areas must be bunded. Bunds must be able to contain the capacity of 110% of the bunded tank. Materials, which are capable of absorbing spillages and flows in drains, must be made easily available in case of accident. Correct surfacing &amp; bunding should be constructed. Oil interceptors/separators should be installed on surface water. Spillages and contaminated soils must be removed immediately and disposed of at an appropriate landfill. All contaminated soils must be treated prior to disposal. Contaminated areas must be rehabilitated immediately. An incident register must be kept and incidents should be addressed as they occur. Hazardous substance storage and handling should adhere to the existing oil and diesel handling procedures (appended).</td>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td>E7</td>
<td>Storage and use of fuels</td>
<td>Potential fire outbreaks due to spillages or leakages of fuel and diesel</td>
<td>Neg.</td>
<td>The mitigation measure in B5 applies. Fire management measures should be put in place.</td>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td>E8</td>
<td>Disposal of used hazardous substances</td>
<td>Contamination of soils, surface water and groundwater by potential spillages or leakages of used substances</td>
<td>Neg.</td>
<td>The procedure for storage, use and handling of used hazardous substances should be followed.</td>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td>E9</td>
<td>Disposal of used hazardous substances</td>
<td>Potential fire outbreaks due to spillages or leakages of used hazardous substances</td>
<td>Neg.</td>
<td>The procedure for storage, use and handling of used hazardous substances should be followed. The storage, use and handling procedures based on the Waste Management Policy (appended) should be followed and should include the requirements of the Basel Convention</td>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td>E10</td>
<td>Use of materials</td>
<td>Increased need for disposal of waste due to increased volumes</td>
<td>Neg.</td>
<td>The existing waste management policy should be followed to ensure waste is minimised at source and to maximise reuse and disposal. Training on the above issues is critical.</td>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td>No.</td>
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<tr>
<td>E11</td>
<td>Primary storage of solid waste</td>
<td>Visual impacts from littering and waste generation leading to reduced aesthetic value</td>
<td>Neg.</td>
<td>Temporary storage of waste should be provided. &quot;Good housekeeping&quot; practices should be implemented. Environmental awareness training should be provided.</td>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td>F1</td>
<td>Land appropriation</td>
<td>Loss of livelihoods due to land appropriation by the mine</td>
<td>Neg.</td>
<td>MCL should minimise displacement and disruption of livelihoods. If complete removal of affected people is not necessary, cash compensation for improvements e.g. houses and boreholes and allow affected people to continue ploughing and livestock rearing. This should be accompanied by strict control on further developments. This would be applicable only if MCL considers the lease area safe for light land use to be permitted. If displacement of affected people is inevitable, for safety reasons defined by MCL, there must be a deliberate plan to restore their livelihoods and properties to pre-project levels. This could be achieved through a Resettlement Action Plan that should be drawn up before resettlement commences.</td>
<td>High</td>
<td>Low</td>
</tr>
<tr>
<td>F2</td>
<td>Removal of inhabitants above colliery workings</td>
<td>Increase of range and habitat available to wildlife population due to resettlement of land users</td>
<td>Pos.</td>
<td>This should be enhanced by linking to Palapye tourism development, and creating conditions for tourism usage of the Game Park during mine operations.</td>
<td>Medium</td>
<td>Low</td>
</tr>
<tr>
<td>G1</td>
<td>Employment</td>
<td>Increased employment opportunities due to new mine activities</td>
<td>Neg.</td>
<td>Non-skilled labour should be recruited through the Palapye Labour Office. MCL should adopt affirmative action to increase the number of female workers. The surrounding villages should also be considered.</td>
<td>High</td>
<td>High</td>
</tr>
<tr>
<td>G2</td>
<td>Employment</td>
<td>Social conflict, illegal settlement, increase in crime and strain on existing Labour Office in Palapye due to influx of job seekers</td>
<td>Neg.</td>
<td>MCL should advertise vacancies for non-skilled labour through the Palapye Labour Office.</td>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td>G3</td>
<td>Employment</td>
<td>Potential transmission of communicable diseases due to increased population and sexual interactions between mine workers and other people</td>
<td>Neg.</td>
<td>MCL should maintain its internal sentinel surveys and HIV/AIDS prevention policy (appended). Employees are to be made aware of the risks due to high HIV/AIDS levels in Palapye.</td>
<td>High</td>
<td>Medium</td>
</tr>
<tr>
<td>G4</td>
<td>Service Provision requirement</td>
<td>Increased cash injection into the local economy due to increased business opportunities</td>
<td>Neg.</td>
<td>MCL should continue procuring goods and services from local companies. By having a policy of using local services where possible (i.e. from Palapye and Serowe), the benefits within the affected area will be substantially increased.</td>
<td>Medium</td>
<td>Medium</td>
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</tbody>
</table>
Table 23: Summary of impacts, assessment and mitigations for the decommissioning stage for Phase 1 - 4 Mtpa

<table>
<thead>
<tr>
<th>No.</th>
<th>Activity</th>
<th>Impact</th>
<th>Nature</th>
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<th>Significance (with mitigation)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A1</td>
<td>Removal of infrastructure and equipment</td>
<td>Increase in disturbing noise levels from use of machinery and movement of equipment</td>
<td>Neg.</td>
<td>Activities should take place during the day and equipment should be maintained in good working order.</td>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td>A2</td>
<td>Removal of infrastructure and equipment</td>
<td>Respiratory problems due to dust generation from disturbances of soils</td>
<td>Neg.</td>
<td>The existing dust suppression procedure should be followed (appended).</td>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td>B1</td>
<td>Closure of mine</td>
<td>Risks and accidents and fatalities due to subsidence of old mining areas</td>
<td>Neg.</td>
<td>Studies should be carried out to identify areas vulnerable to subsidence. These areas should be cordoned off and rehabilitated.</td>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td>B2</td>
<td>Sealing and closure of shafts, adits and incline</td>
<td>Explosions from the shafts due to accumulation of gases</td>
<td>Neg.</td>
<td>Access to the mine will be sealed with reinforced concrete and the box-cut will be backfilled and properly rehabilitated to prevent any escapes of methane. Monitoring of gases should continue after closure of the mine</td>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td>C1</td>
<td>Topsoil replacement</td>
<td>Loss of soil resource due to incorrect placement of soils</td>
<td>Neg.</td>
<td>The topsoil management procedure should be implemented.</td>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td>D1</td>
<td>Storage of waste on site</td>
<td>Visual impacts from littering and waste generation leading to reduced aesthetic value</td>
<td>Neg.</td>
<td>Temporary storage areas of waste should be designated and should comply with statutory requirements. &quot;Good housekeeping” practices should be implemented. Environmental awareness training on waste separation and disposal should be provided. If outsourced, then the contractor involved should develop and submit a waste management plan to the mine.</td>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td>D2</td>
<td>Transportation of waste to the landfill</td>
<td>Land contamination and visual impacts due to littering</td>
<td>Neg.</td>
<td>Trucks transporting waste should be covered. Transportation to the landfill should be carried out during low traffic periods.</td>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td>No.</td>
<td>Activity</td>
<td>Impact</td>
<td>Nature</td>
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<td>Significance (without mitigation)</td>
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<tr>
<td>D3</td>
<td>Removal and Disposal of used hazardous substances</td>
<td>Contamination of soils, surface water and groundwater by potential spillages or leakages of used substances</td>
<td>Neg.</td>
<td>A plan for removal and disposal of hazardous waste should be developed and should comply with the requirements of the Basel Convention.</td>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td>D4</td>
<td>Removal and Disposal of used hazardous substances</td>
<td>Potential fire outbreaks due spillages or leakages of used hazardous substances</td>
<td>Neg.</td>
<td>A plan for removal and disposal of hazardous waste should be developed.</td>
<td>Low</td>
<td>Low</td>
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<td></td>
<td><strong>E. Resource Use and Management at the Construction Camp</strong></td>
<td></td>
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</tr>
<tr>
<td>E1</td>
<td>Water use</td>
<td>Increased water abstraction due to increased usage</td>
<td>Neg.</td>
<td>Water conservation measures should be implemented where possible, through rain water harvesting, and reuse on non-potable requirements. The contractor should indicate all conservation measures that will be implemented.</td>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td>E2</td>
<td>Disposal of wastewater</td>
<td>Land contamination from spillages/leakages due to infrastructure damage and failure of chemical toilets or other sewage management systems</td>
<td>Neg.</td>
<td>Any infrastructure should be installed properly and should be approved by the mine before use. Inspection and maintenance should be carried out regularly.</td>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td>E3</td>
<td>Power use</td>
<td>Increased power usage</td>
<td>Neg.</td>
<td>Power should be used where necessary. Resource conservation measures should be implemented. The use of solar energy, as well as other energy saving technologies, should be maximised.</td>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td>E4</td>
<td>Storage and handling of hazardous substances including fuel, lubricants, oil, process chemical, explosives</td>
<td>Contamination of soils, surface water and groundwater by potential spillages or leakages of substances</td>
<td>Neg.</td>
<td>All storage areas must be bunded. Bunds must be able to contain the capacity of 110% of the bunded tank. Materials, which are capable of absorbing spillages and flows in drains, must be made easily available in case of accident. Spillages and contaminated soils must be removed immediately and disposed of at an appropriate landfill. All contaminated soils must be treated prior to disposal. Contaminated areas must be rehabilitated immediately. An incident register must be kept and should be submitted to the mine monthly. The contractor must develop a hazardous lubricants handling and storage procedure that is approved by the mine.</td>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td>E5</td>
<td>Storage and handling of used and unused hazardous substances</td>
<td>Potential fire outbreaks due to spillages or leakages of hazardous substances</td>
<td>Neg.</td>
<td>The contractor must develop a hazardous lubricants handling and storage procedure that is approved by the mine. Fire management measures should be put in place.</td>
<td>Low</td>
<td>Low</td>
</tr>
</tbody>
</table>
11 ASSESSMENT OF ALTERNATIVES

This section discusses alternatives considered within the proposed development. The alternatives were discussed during the scoping study and take into consideration sites/location, operations/processes, designs and technologies used and these should be compared systematically in terms of their potential impacts, capital and recurrent costs. For each of the proposed project activities, an alternative is decided on and analysed in terms of environmental benefits and effects. The no project alternative is also discussed.

11.1 Mining Methods for the New Mine

The alternatives for the mining method were considered during the pre-feasibility study undertaken by the Mining Engineers (SRK, 2007). The method was determined from using a matrix approach and by considering the methods outlined below;

- Drill and blast
- CM and shuttle car
- CM and scoop
- CM - Magatar equipment
- CM - Magatar system
- CM and continuous haulage
- Short-wall
- Long-wall
- Long-wall with rear armoured face conveyor

These methods were subject to a list of criteria as shown in Table 24, ranked from 1 (unacceptable) to 5 (most acceptable), and then subject to a weighting (1 to 3) of the applicability of the criteria.

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Details</th>
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<tbody>
<tr>
<td>Production rate</td>
<td>Ability of the method to produce the desired tonnages on a sustainable basis</td>
</tr>
<tr>
<td>Flexibility</td>
<td>Ability of the method to adapt to changing conditions (geology, method, direction etc)</td>
</tr>
<tr>
<td>Extraction</td>
<td>Influence of method on extraction ratios (primary &amp; secondary)</td>
</tr>
<tr>
<td>Influence of geology</td>
<td>Influence of geological conditions (dip, faults, dykes, seam thickness) on production</td>
</tr>
<tr>
<td>Influence of floor</td>
<td>Influence of floor conditions (softness, contamination) on production</td>
</tr>
<tr>
<td>Operating costs</td>
<td>General operating cost ratings</td>
</tr>
<tr>
<td>Capital costs</td>
<td>General capital cost ratings</td>
</tr>
<tr>
<td>Safety</td>
<td>The method is inherently safe. What other factors influence safety?</td>
</tr>
<tr>
<td>Selectivity</td>
<td>How selective is the method (changing of mining horizon, variation in mining height)?</td>
</tr>
<tr>
<td>Continuity of production</td>
<td>How is production influenced by stops of any of the non-extractive equipment (e.g. not conveyors)?</td>
</tr>
<tr>
<td>Ventilation required</td>
<td>Are there any significant ventilation requirements?</td>
</tr>
<tr>
<td>Proved method</td>
<td>Has the method been proved in southern Africa?</td>
</tr>
<tr>
<td>Ancillary equipment</td>
<td>Is a significant amount of ancillary equipment required (e.g. LHDs, chock carriers, special spares, etc.)?</td>
</tr>
<tr>
<td>Development</td>
<td>Does the method need other methods to carry out development (1=Yes, 2=No)?</td>
</tr>
<tr>
<td>Skills</td>
<td>General skills of the production and planning personnel (5=Low skills, 1=High skills)</td>
</tr>
</tbody>
</table>
The analysis of alternatives by Mining Engineers concluded that the current method of mining (continuous miner and shuttle cars) is appropriate for both the existing and new shaft. With the information above, it was concluded that the EIA will concentrate on underground mining, using continuous miners and the bord and pillar mining method.

11.2 Establishment of Housing Units

Twenty housing units will be built at the MCL village for the Phase 1 expansion. The mine is also investigating ways for employees to source their own accommodation in the Palapye and Serowe areas. No alternatives are required. No additional houses are to be established for Phase 2 - 12 Mtpa.

11.3 Expansion of Coal Wash Plant and Use of Middlings and Cake

A key motivation for the expansion of the washing plant is to provide for an increasing customer requirement for the washed coal product, due to its improved quality and lower sulphur levels. No other alternatives, which serve the same general purpose and requirements of the washing plant have been identified. Various measures can be employed to improve the efficiency of the washing process and thus reduce the amount of waste material produced (either at source or by the end-users). These measures, taken from Alternatives for Future Coal Waste Disposal (http://www.nap.edu/openbook.php?record_id=10212&page=13) include the following:

- Planning mining operations so as to avoid areas of very poor quality coal if possible;
- Ensuring the use of fine coal by dewatering the fine coal product using thickeners and filters;
- Dry coal cleaning based on oscillating or fluidised bed principles removes the need for water. Dry coal cleaning is however not as efficient as wet coal cleaning and has a number of constraints with respect to particle size, transport, dust generation and related health and safety aspects.

The above indicates that there are no feasible alternatives to the proposed washing plant.

11.4 Material Lay Down Areas

Surface areas for the temporary storage of equipment and machinery will be required during the construction phase of the proposed expansion. Ideally, previously disturbed areas are preferred for this purpose. It is therefore recommended that the mine identifies these areas prior to any activities.

11.5 Project - No Project Alternative

This alternative implies that the mine would not be expanded, and that no environmental changes would occur in areas where the activities are to be established. This alternative also implies that the BPC station would not be expanded or that they would consider alternative sources of coal. It should be noted that (as discussed in section 1.1) agreements have been made for the Phase 1 (600 MW) of the power station expansion, which requires approximately 3 Mtpa of coal. A comparison of impacts for the project vs. no project alternatives is given in Section 10.

Potential losses of positive consequences include:
- insecurity of power supply for Botswana’s economic growth and slowdown in mining (e.g. cessation of the AK6 Mine development);
• loss of revenue;
• loss of jobs; and
• impacts on the local (Palapye) economy.

On the other hand, the development option will have negative physical, bio-physical and social impacts that include a possible increase in HIV/AIDS, aesthetic impacts, loss and disturbance of flora and fauna and increased water demands.

The criterion for determining the preferred alternative is the potential for mitigating the environmental effects. In the case of this project, it is reasonable to deduce that mitigation of impacts arising from the project implementation would have greater potential than mitigation of the no-project alternative. The underlying factor is that most impacts can be mitigated at lower costs. The mitigation of the impacts relating to the no-project alternative has high cost implications and depends on the stability of the mine. The proposed project development option is therefore preferable.
12 CONCLUSIONS

The proposed expansion of the colliery is part of the essential national program to meet existing and future power shortages within Botswana. This project is one of the core components of Botswana’s power supply along with the 600 MW Morupule B Power Station and wellfiled water supply. The combined projects will allow Botswana to become self sufficient in electrical power and provide for the diversification of the mining sector away from diamonds.

The first phase of expansion from one to four million tons per annum coal supply is aimed primarily at ensuring strategic coal supplies to the BPC Morupule power stations. The second phase from 4 to 12 million tons per annum is intended to provide coal for further expansion of the BPC Morupule power stations and the beneficiation of coal for other national uses and export.

12.1 Implications for the Natural Environment

MCL has been operating for nearly thirty years and the existing direct biotic and abiotic environmental impacts have been low and minimal natural vegetation has been affected. Recent moves to manage the wildlife population and develop the wildlife and tourism opportunities have had a positive affect on the area’s environment. The expansion, though, will create a number of additional impacts to the natural environment of which the following would be of greatest concern at Phase 1 - 4Mtpa:

- An increase in land take for coal storage, expansion of the crush facilities, establishment of new administrative facilities, new housing in the MCL village and new air vent shafts. These will result in an increase in overall area disturbed by the colliery from 62 ha to about 70 ha with a loss of approximately 5.5 ha of sandveld vegetation and 2.5 ha of ecotone between the rocky outcrop habitat and the surrounding sandveld.

- There will be increased use of power from the present 2.5 MW/annum to 12.1 MW/annum and increase in water use from 74 400 to 104 600 m³/annum. There will be a proportional increase in solid and liquid waste. Solid waste will be managed as it is at present through local contracts for cartage and disposal in council landfills. Sewage lines will be connected to the Palapye wastewater treatment works mains and existing oxidation ponds rehabilitated.

- There will be an increase in noise and dust emissions from crush facilities and haulage traffic. The area affected will not increase substantially, but the volume of coal dust being deposited will increase and affect about 24 ha of which 13 ha are covered by natural vegetation. Overall noise levels will increase and will be managed under the existing Occupational Health and Safety requirements as noise impacts do not extend beyond the existing lease area.

- Methane emissions have been shown to be close to nil for the existing colliery operations. These levels will remain low for mining operations at similar depths.

- Although there is no active dewatering of the colliery, mining operations are below the aquifer and a slight draw down cone will occur. This is unlikely to affect boreholes outside the lease area, but should be monitored. There is potential for an increase in acid drainage from coal crush and storage facilities.

- Given the DoM protocols that have been used when mining under roads and rivers, the impact on 6 km of the A14 road and 8 km of river channels is uncertain. There is, though, a slight increase in the long term potential for subsidence of surface material.
• Archaeology: There were no new sites identified within 200 m of any of the proposed developments that require salvaging. This does not preclude the chance that sites will be discovered during clearing of areas for developments.

The further expansion from 4Mtpa to 12 Mtpa (Phase 2) will have additional impacts on the natural environment, as follows:

• An increase in land take will occur due to the establishment of a new shaft and associated crusher facilities, two new vent shafts, an access track and a coal conveyor to move coal to the existing crusher facility. There will also be an increase in coal wash units from 1 to 4 and expansion of the crush and storage facilities. This will result in additional loss of approximately 50-120 ha of sandveld vegetation. No additional housing to be constructed at the Morupule Village.

• There will be increased use of power from the present 2.5 MW/annum to approximately 36 MW/annum and increase in water use from 74 400 to 959 400 m$^3$/annum. There will be a proportional increase in solid and liquid waste.

• The haulage traffic will increase substantially as all beneficiated coal will be sold to non-BPC customers. This will result in a substantial increase in road and rail traffic. The area of coal dust deposition will not increase substantially, but the volume of coal dust being deposited will increase and affect about 24 ha of which 13 ha is covered by natural vegetation.

• Further dewatering of the aquifer and additional increase in acid drainage from crush and storage facilities.

• Given the DoM protocols used when mining under roads and rivers, the impact on 9.8 km of the A14 road and 17.8 km of river channels is uncertain. There is, though, a slight increase in the long term potential for subsidence of surface along these systems.

• There were no new archaeological sites identified that require salvaging within 200 m of any of the proposed developments. This does not preclude the chance that sites will be discovered during clearing of areas for developments.

12.2 Social and Land Use Implications

The social and land use impacts are both positive and negative. The positive impact is a direct increase in employment from the existing 254 to 600 jobs at Phase 1, to an estimated 1 200 at Phase 2. This will translate into a significant cash injection into the local (Palapye) economy through enhancement of business opportunities. The ripple effects will be felt nationally.

The coal will largely be used to ensure power supply to Botswana and allow sufficient power to be generated for export to neighbouring countries. The economic multipliers would greatly increase the beneficial impacts.

The negative social impacts are both at the construction and operational phases.

• During construction the social disruption and health concerns are linked to the large number of construction crew personnel (850 for the Phase 1 and 1 200 for the Phase 2). Health impacts will be felt well after construction is complete.

• The risk of subsidence and potential threat to human life is to be further investigated. The results of the risk assessment will guide the decision whether or not to resettle the people who presently reside within the lease area. A detailed resettlement plan will be required if
it is found that people residing in and making their living from the lease area are at risk and need to be resettled.

- In the long term there are social issues linked to loss of land and associated livelihoods if people are, for health and safety reasons, moved out the lease area ahead of the mining. As many as 20 households will be moved and 194 ha of lands areas (comprised of 19 lands areas) will be lost for the existing (one Mtpa) operation.

- An additional 3 homesteads will be moved and 91 ha of lands areas (comprised of 13 lands areas) will eventually be lost for the existing operation combined with the Phase 1 - 4 Mtpa expansion.

- A further 34 households and 745 ha of arable lands (comprising about 71 lands areas) will be lost in the Phase 2 - 12 Mtpa expansion.

- Most of the coal beneficiated through the expanded coal wash facilities at Phase 2 will be transported to customers other than Morupule Power Station. Roads will get more dangerous, noisier and will require higher levels of maintenance.

- If the game park is expanded to provide a safe use of the land area above the mine workings, there will be a decrease in the area of grazing available to livestock.

- Due to the resettlement of immediately adjacent homesteads, there will be no public health impacts from coal dust and noise. If resettlement is not considered then, acoustic design aspects (in terms of noise), would need to be incorporated so that noise levels do not exceed the SANS 10103 requirements. For the Phase 2, the mine should consider placing the ventilation shafts within the box cut. Dust suppression procedures will need to be followed to minimise impacts to adjacent homesteads.

12.3 Cumulative Impact Implications

There will be a number of cumulative social and environmental impacts, as follows:

- The combined noise impact of the BPC power station operations and the mining activities will create unacceptable night-time noise over an area affecting 11 households.

- The two parallel construction activities (MCL and BPC Morupule B Power Station expansion) are likely to spur job seekers to set up illegal settlement within vicinity of the contractors’ recruitment office. BPC is already facing the problem as some temporary properties have been illegally put up within the lease area (Ecosurv and GIBB Botswana, 2007).

- The combined development of the BPC Power station and the expansion of the Colliery will create an increase in water demand on both groundwater and NSC resources.

- Pressure on accommodation and other facilities such as schools and clinics will occur. The short term increase in construction personnel created by simultaneous developments such as the Colliery, BPC Power Station and university in Palapye will result in a large temporary influx of construction personnel into the area. Long term the Palapye population will increase more rapidly than predicted in the recent Palapye Planning Area Development Plan with the new jobs created and the annual influx of students. The Palapye Planning Area Development Plan considers the implications of population growth and infrastructure development.

12.4 Decommissioning

Decommissioning of the existing shaft is expected to occur in approximately 2028.
• Only the existing shaft, as a coal extraction conduit, will be decommissioned, the crush facilities, conveyors, coal storage areas, coal wash facilities, offices and housing will not be affected by the closure of the existing shaft. Access to the mine will be sealed with reinforced concrete and the box-cut will be backfilled and properly rehabilitated to prevent any escapes of methane. Monitoring of gases should continue after closure of the mine.

• The main decommissioning concerns lie with the impact of the old workings on the land surface (subsidence) as it may preclude habitation and a return to existing land use in the area above the workings. Other national infrastructure such as the main A14 road may also be affected.

• The colliery is considering developing the game park land use as the post mining activity so as to provide the Palapye-Serowe area with wildlife-based tourism facilities.

12.5 Environmental Impact Statement

Given existing technology, there are few reliable alternatives within Botswana to produce the base load electrical power requirements essential for national security and growth. It has been found that the proposed colliery expansion to provide BPC with additional coal for power generation will have low environmental impacts and moderate social impacts. These impacts can be mitigated as outlined in the EMP. This study has found that there is no single or combination of environmental or social impacts that will preclude the proposed development.
### REFERENCES

<table>
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<tr>
<th>Source</th>
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<th>Description</th>
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<tbody>
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Prepared by Ecosurv (Pty) Ltd
14 ENVIRONMENTAL MANAGEMENT PLAN

This section documents the Environmental Management Plan (EMP) that will be used to facilitate the implementation of the recommended mitigations. The EIA Act (2005) defines an EMP as “a document representing the administration of efforts that will be made to manage any significant environmental impact resulting from the implementation of the activity”. The management presented here is for the construction and operation phases.

The impacts for decommissioning phase will be managed as indicated in the mine closure plan developed by Geoflux (2006).

14.1 Construction of Phase 1

14.1.1 Implementation team for construction phase

This section describes the structures required for implementation of the EMP.

**Department of Environmental Affairs**
- Review and approval of the EMP, monitoring and auditing requirements prior to construction.
- CDCl to review and approve plans on sewage connections, resettlement, etc.
- DoM to review applications for borrow pits.

**Environmental and Technical Specialists**
- Environmental Specialist where required for additional studies or monitoring;
- Liaise with DEA and the Department of National Museum, Monuments and Arts Gallery (DNMMAG).

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**Diagram:**

- **DEA** (and other technical dept)
- **MCL** (Project Manager, Env. Officer/Coordinator, SHE Officer, PR and HR Manager, MCL Community Liaison Committee)
- **Environmental Consultant** (e.g. Archaeologist, Environmentalist)
- **Consulting Engineer**
  - Project Manager
  - Resident Engineer
  - SHE Officer or Env. Officer
  - Manager
  - Appointed Environmental Officer
  - Staff

---

**Reporting**
- Induction, Timing, support
- Induction, Audit,
Morupule Colliery

Project Manager:

- Appointment of the consulting engineers and contractors and the environmental (EIA) consultant.
- Overall implementation, administration and enforcement of the EMP.
- Ensure that EMP requirements are included in construction activities’ tender documents.
- Monitor implementation of the EMP.
- Establish controls for ensuring the EMP is implemented by contractors.

Human Resources and Public Relations Manager, MCL Community Liaison Committee:

- Compensation and resettlement.
- Public interface and public meetings.
- Community, social and infrastructure planning.

Environmental Coordinator:

- Appointment of the environmental (EIA) consultant.
- Ensure that EMP requirements are included in construction activities’ tender documents.
- Ensure that the requirements of the EMP are carried out.
- Monitor implementation of the EMP.
- Environmental audits.
- Ensure integration of the EMP into the colliery’s mining EMP.
- Maintain reports and records.
- Liaise with DEA and DNMMAG.
- Recommend the issuing of fines for transgressions of site rules and penalties for contravention.

Safety, Health and Environment Officer:

- Ensure that EMP requirements are included in construction activities’ tender documents.
- Review and approval of contractor’s SHE plan.
- Ensure that the requirements of the EMP are carried out.
- Ensure training and induction activities have been carried out by the contractor’s SHE officer.
- Monitor implementation of the EMP.
- Environmental audits.
- Monitor activities on site for compliance with legislation of relevance to the environment.

Consulting Engineers

Project Manager:

- Allocate responsibilities.
• Liaise with the mine, DEA and other authorities.
• Order the removal of, or issuing spot fines for, person(s) and/or equipment not complying with the specifications.
• Issue penalties for contravention of the EMP.

Resident Engineer:
• Comply with the contents of this document as well as with the EMP specifications in the Contract Document to ensure that the requirements of the EMP are met.
• Monitor and verify that the EMP is adhered to at all times and take action if the specifications are not followed.
• Monitor and verify that environmental impacts are kept to a minimum.
• Review construction Method Statements.
• Keep records of all activities/incidents on site in the Site Diary concerning the environment.
• Inspect the site and surrounding areas regularly with regard to compliance with the EMP.

Safety, Health & Environment Officer:
• Be appointed by the Environmental/Engineering Consultant to monitor on site.
• Inspect the site regularly, to ascertain the level of compliance of works, as well as attend weekly contractor’s meetings and monthly site meetings with the project management team and report back on environmental issues.
• Maintain inspection reports on file.
• Assist the Resident Engineer in ensuring that necessary environmental authorisations and permits have been obtained.
• Monitor and verify that the EMP is adhered to at all times and take action if the specifications are not followed.
• Monitor and verify that environmental impacts are kept to a minimum.
• Review and approve construction Method Statements together with the consultant and Resident Engineer.
• Assist the contractor in finding environmentally responsible solutions to problems.
• Keep records of all activities and incidents concerning the on-site environment in the Site Diary.
• Keep a register of complaints in the Site Office and deal with any community comments or issues.
• Undertake or ensure the undertaking by the contractor of environmental awareness training for all new personnel coming onto site, or undertake environmental awareness courses themselves.
• Provide material, manuals and assistance for the environmental awareness courses.
• Advise on the removal of person(s) and/or equipment not complying with the specifications (via the consultant or Resident Engineer).
• Recommend the issuing of fines for transgressions of site rules and penalties for contravention.
• Monitor activities on site for compliance with legislation of relevance to the environment.
• Complete checklists as necessary.
• Continually, internally review the EMP and submit a report to the mine at the end of construction.

**Contractors**

*Contract Manager:*
• Allocate responsibilities.

*Staff:*
• Comply with the contents of this document as well as with the EMP specifications in the Contract Document to ensure that the requirements of the EMP are met.
• Attend induction sessions.

*Environmental/SHE Officer:*
• Be appointed by the contract manager.
• Comply with the contents of this document as well as with the EMP specifications in the Contract Document to ensure that the requirements of the EMP are met.
• Maintain incident register.
• Implement induction and awareness training.
• Environmental procedures and plans.
• Ensure that the EMP is adhered to at all times.
• Review the requirements of the EMP with the SHE officer of the consulting engineers or the resident engineer.
• Advise on the removal of person(s) and/or equipment not complying with the specifications (via the Consultant/Resident Engineer).
• Monitor activities on site for compliance with the EMP.
• Inspect the site and surrounding areas regularly with regard to compliance with the EMP.
• Keep a register of complaints and deal with any community comments or issues.

### 14.1.2 Environmental specifications for construction activities

This section presents the environmental specifications that the contractors should be aware of during the construction phase. In addition to these specifications, the MCL environmental policies and procedures as well as the mine site rules and regulations should be followed. These specifications should be appended to the contracting document.

**Environmental legislation**

The contractor shall ensure that all relevant legislation concerning the natural environment, pollution and the built environment is strictly enforced. Applicable environmental legislation that must be complied with includes the following:
• National Conservation Strategy (Coordinating) Agency (NCSA) 1990 White Paper;
• EIA Act of 2005;
• Agricultural Resources Conservation Act of 1974;
• Monument and Relics Act 1998 (Act 12 of 2001);
• Public Health Act of 1981;
• Waste Management Act of 1998;
• Basel Convention of 1989;
• Water Act of 1968 (as amended);
• Wildlife Conservation and National Parks Act of 1992;
• Mines and Minerals Act of 1999;
• Mines, Quarries, Works and Machinery Act (1995);
• World Bank Environmental, Health and Safety Guidelines;
• Legislation relating to resettlement; and
• MCL Environmental polices and procedures.

General site procedures

All works shall be undertaken in an environmentally sensitive manner. A precautionary approach shall be adopted, with any works deviating from the specification being approved by both the Mine Project Manager and the Environmental Officer/Coordinator.

Access to site and site clearance

The Consulting Engineer will review the EMP together with the contractors to ensure all aspects of the EMP are understood.

The contractor shall ensure that access to the site and associated infrastructure and equipment is off-limits to the public at all times during construction. Additional areas restricted to the public and suggested detours shall be clearly marked on the information boards to the satisfaction of the Resident Engineer and the Project Manager.

Access to the site shall be gained via routes approved by the Resident Engineer. Only demarcated roads and existing tracks shall be used.

All earthworks shall be undertaken in such a manner so as to minimise the extent of any impacts caused by such activities. Clearing operations should be kept to only that which is necessary to execute the works.

No equipment associated with the site clearance shall be allowed outside of the demarcated area unless expressly permitted by the Resident Engineer.

Contractor’s camp and materials storage area

Materials storage area, ablution facilities and chemical toilets shall be located at a position approved by the mine’s Environmental Officer. The Contractor shall provide water and/or sanitary facilities at the each construction site. Water quality must meet national standards for drinking water. The site should be kept neat and tidy and free of litter.
Demarcation of the site

It is important that activities are conducted within a limited area to facilitate control and to minimise impacts on the natural environment. Working areas should be defined, as those areas required by the contractor to construct the works.

The contractor should demarcate the boundaries of the construction site and ensure that all plant, labour and materials remain within the boundaries of the working areas. Disturbance of vegetation shall be limited to this area. Maintenance shall remain the responsibility of the contractor.

The contractor is advised that certain areas within the site property are environmentally sensitive or “no-go” areas, and personnel and equipment shall not be permitted within the following areas:

- those containing sensitive habitats or vegetation; and
- steep slopes that are sensitive to erosion.

Protection of flora, fauna and natural features

The removal or picking of any protected or unprotected indigenous plants shall not be permitted and no horticultural specimens (outside the demarcated working area) shall be removed, damaged or tampered with, unless agreed to by the mine’s Environmental Officer. In the event of this happening, the contractor shall reinstate the damaged area to the satisfaction of the Environmental Officer.

All fauna (including domestic livestock) within and around the game park shall be protected. Birds and animals shall not be caught or killed by any means, including poisoning, trapping, shooting or setting of snares. Any injured animals shall be reported to the Resident Engineer and the Environmental Officer.

Natural features shall not be defaced, painted for benchmarks or otherwise damaged unless agreed by the Environmental Officer. Any features defaced by the contractor shall be reinstated to the satisfaction of the Environmental Officer.

Protection of archaeological material

The AIA did not identify significant archaeological material on the site. However, archaeological material may be buried beneath the surface. Should any area of historical importance or archaeological sensitivity be identified it shall be demarcated and considered a “no–go” area until cleared by DNMMAG. If any palaeontological or archaeological material (e.g. fossils, bones, artefacts etc) is found during construction, the contractor shall stop work immediately and inform the Environmental Officer who should inform DNMMAG and arrange for a palaeontologist or archaeologist to inspect, and if necessary excavate, the material, subject to acquiring the requisite approval from DNMMAG. The contractor shall not recommence working in that area until he has received written permission from the Environmental Officer.

Site clearance and excavations

All earthworks shall be undertaken in such a manner so as to minimise the extent of any impacts caused by such activities. Clearing operations should be kept to only that which is necessary to execute the works.

Ablution facilities

The contractor shall provide the necessary ablution facilities for all employees at the construction sites. Chemical toilets shall be used. A minimum of one toilet per 15 people shall
be provided. Toilets shall be easily accessible and shall be transportable. The toilets shall be secured to prevent them from blowing over, and shall be provided with an external closing mechanism to prevent toilet paper from being blown out. Toilet paper shall be provided in all toilets. Toilets shall be cleaned and serviced regularly by the contractor. Toilets shall be emptied before long weekends and builders’ holidays. Toilets shall be locked after working hours.

Abluting anywhere other than in the toilets shall not be permitted. Use of other areas within the site for ablution purposes and/or spillage of chemicals and/or waste, may result in the contractor being penalised by the Environmental Officer. The contractor shall also be responsible for cleaning up any waste deposited by employees.

Refuse and waste management

Contractors should provide a refuse and waste management plan that will be approved by the mine. Refuse and waste refers to all solid waste, including construction debris (wrapping materials, timber, cans etc), waste and surplus food, food-wrappers etc. The contractor shall institute an on-site waste management system to prevent the spread of refuse within and beyond the site. The contractor shall provide sufficient bins with secure, animal-proof lids on site to store waste and these shall be emptied regularly. The contractor shall also institute a daily clean up of the site.

The contractor shall ensure that chemicals and waste from toilet-cleaning operations are not spilled on the ground at any time. Spilled chemicals or waste shall be cleaned up immediately, to the satisfaction of the Environmental Officer.

The contractor shall not dispose of any waste or construction debris by burning or burying. The contractor shall ensure that all waste is deposited in the waste bins for removal by the Contractor. Bins shall not be used for any purposes other than waste collection and shall be emptied on a regular basis. All waste shall be disposed of off site at approved landfill sites.

Water supply

The contractor shall provide for all construction and potable water requirements. Water shall be conserved wherever possible. Water envisaged for potable use should meet the standards for drinking water.

Erosion and sedimentation control

The contractor shall protect areas susceptible to erosion by installing necessary temporary and permanent drainage works as soon as possible and by taking other measures necessary to prevent the surface water from being concentrated in streams and from scouring the slopes or other areas. Any runnels or erosion channels developed during the construction period or during the vegetation establishment period shall be made good. Stabilisation of cleared areas to prevent and control erosion shall be actively managed. The method of stabilisation shall be determined in consultation with the Resident Engineer.

Traffic and movement over stabilised areas shall be restricted and controlled, and damage to stabilised areas shall be repaired and maintained to the satisfaction of the Resident Engineer.

Equipment and groundwater pollution

The contractor must ensure that all reasonable precautions are taken to prevent pollution of the ground and water resources as a result of site activities. Ground contamination may hinder or prevent the re-establishment of vegetation.

The contractor shall ensure that all mechanical equipment used in construction activities is clean, and free from leaks of oil, petrol, diesel, hydraulic fluid, etc and contaminated
compounds. The contractor shall ensure that all servicing and refuelling of vehicles and equipment takes place off-site or within the contractor’s camp. The contractor shall not change oil or lubricants anywhere on site except at designated locations, unless there is a breakdown or an emergency repair. The contractor shall keep the necessary materials and equipment on site to deal with ground spills of any of the materials used or stored on site.

The contractor shall ensure that no oil, petrol, diesel, etc. is discharged onto the ground. Pumps and other machinery requiring oil, diesel, etc. that are to remain in one position for longer than two days shall have physical controls in place to prevent all lubricants and fuels from entering the ground. Contaminated water must be disposed of off-site at a facility capable of handling such wastewater. Drip trays shall be cleaned before any possible rain events that may result in the drip trays overflowing, and before long weekends and holidays.

The Contractor shall remove all oil-, petrol-, and diesel-soaked sand immediately and shall dispose of it as hazardous waste.

Gravel and other borrow material

All borrow material purchased or excavated must come from legal excavation operations which hold EIA certificates and are registered with DoM.

Emergency procedures

General: The contractor shall ensure that emergency procedures are set up prior to commencing work. Emergency procedures shall include, but are not limited to, fire, spills, contamination of the ground or water bodies, accidents to employees, use of hazardous substances, the event of damaging services, etc. Emergency procedures, including responsible personnel, contact details of emergency services, etc. shall be made available to all the relevant personnel and shall be clearly demarcated at the relevant locations around the site.

The contractor shall also comply with National Health and Safety Standards and any amendments and any other relevant national, regional or local regulations with regard to operations on site.

The contractor shall advise the Environmental Officer of any emergencies on site, together with a record of action taken.

Fire: The contractor shall take all the necessary precautions to ensure that fires are not started as a result of his activities on site.

Open fires shall be permitted in designated areas only. Closed fires or stoves shall only be permitted at a designated safe site to be determined by the contractor in consultation with the Environmental Officer. Fires shall also not be permitted near any potential sources of combustion, such as near vehicles that are being serviced or refuelled, fuel storage area, vegetation, etc.

The contractor shall ensure that there is adequate fire-fighting equipment on the site, especially where “hot work” is to be undertaken.

The contractor shall be liable for any expenses incurred by any organisations called to assist with fighting fires, and for any costs relating to the rehabilitation of burnt areas and/or property and/or persons should the fire be caused by the contractor’s activities on the site.

Safety: The contractor shall take all reasonable measures to ensure the safety of all his staff.

The contractor shall ensure that all construction vehicles using public roads are in a roadworthy condition that they adhere to the speed limits, that their loads are secured and that any local, provincial and national regulations are adhered to. Vehicles transporting materials
such as sand, rock and pipes shall be covered to prevent their contents falling or blowing off and causing a traffic hazard.

All accidents and incidents resulting in injury or death (during construction) are to be recorded by the contractor and reported in accordance with National Health and Safety Standards. The contractor shall, in addition, inform the Environmental Officer and Resident Engineer of these incidents, together with steps taken to treat injuries and prevent repeat occurrences.

The contractor should prevent public access to the construction areas.

The contractor shall ensure compliance with all other relevant safety standards.

Environmental awareness training

An initial environmental and archaeological awareness training session is required prior to the contractor commencing work.

The contractor’s Environmental Officers and the mine’s Environmental Officer should provide the contractor with the course content for the environmental awareness-training course, and the contractor shall communicate this information to: employees on the site, any new employees coming onto site, subcontractors and suppliers. The training session shall be delivered in the languages of the site staff.

All the contractor’s employees and subcontractor’s employees and any supplier’s employees that spend more than one day a week or four days a month on site, must attend an environmental awareness training course presented by the contractor, the first of which shall be held within one week of the commencement date. Subsequent courses shall be held as and when required. The contractor is responsible for ensuring that personnel commencing work on site after the start of the contract (who therefore miss the initial training session) are also made aware of the environmental procedures before commencing work. All new employees must receive environmental awareness training.

The emphasis should be on any (potential) environmental impacts relating to the construction activities to be undertaken on site and the related environmental precautions, which need to be taken to avoid or mitigate these impacts. The contractor shall submit a Method Statement detailing the logistics of the environmental awareness-training course.

Community relations

The contractor/s appointed for the construction phase should use local facilities for services and Morupule (MCL) should ensure that this is taken on board during the tendering stage. Contractors will be responsible for addressing community issues and ensuring good community relations.

The existing MCL steering committee (comprising council, police, health, local authority, MCL and contractors) is to be engaged during the construction phase to assist with community issues, and is to meet quarterly and have representatives from PR and SHE.

Where possible, contractors should attempt to hire from local communities. At the commencement of construction a complaints procedure should be established to address concerns. These complaints and the manner in which each was addressed must be available for the mine’s Environmental Officer and for audit purposes.

The local authorities, community organizations and leaders should be informed of the project and the potential job opportunities for locals.

The employment selection process should seek to promote gender equality.
Site and construction camp rehabilitation

All construction equipment and excess aggregate, gravel, stone, concrete, bricks, temporary fencing, piping and the like shall be removed from the construction site within 2 months of completion of the work. The contractor’s camp should also be rehabilitated within 2 months of completion of the work. No discarded materials of whatsoever nature shall be buried on the site or on any other land within the site.

Retentions will only be released after site clearing and rehabilitation activities have been undertaken.

Payment for environmental specifications

The contractor’s costs incurred for compliance with this EMP shall be included in the tender price.
### 14.1.3 Detailed EMP requirements for Phase 1 construction

**Table 25: Management plan for the construction phase of Phase 1 - 4 Mtpa**

<table>
<thead>
<tr>
<th>No.</th>
<th>Activity</th>
<th>Impact</th>
<th>Objective</th>
<th>Target-Management Principle</th>
<th>Performance Indicator</th>
<th>Responsibility</th>
<th>Resources (personnel)</th>
<th>Resources (equipment &amp; materials)</th>
<th>Estimated costs</th>
<th>Timing &amp; deadline</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>A. Construction of: Shaft Expansion, Crusher, Ventilation Shafts Screening Facilities, Coal Storage Silos, Distribution Bins &amp; Stockpiles, Conveyor System, Housing Units and Additional Facilities</td>
<td></td>
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<tr>
<td>A1</td>
<td>Construction of infrastructure</td>
<td>Potential noise generation from machinery and equipment affecting farmers residing within the lease area</td>
<td>To prevent public exposure to noise</td>
<td>Construction of facilities within acceptable noise limits. All equipment in kept in good repair. Night-time activities avoided.</td>
<td>No community complaints</td>
<td>As per section 14.1.1.</td>
<td>Env officer &amp; Construction Manager</td>
<td>-</td>
<td>-</td>
<td>Beginning of construction</td>
</tr>
<tr>
<td>A2</td>
<td>Burning of plant material and cooking fires at the construction area and camp</td>
<td>Threat to human life and loss of grazing in surrounding livestock areas and game park by bush fires</td>
<td>To prevent the bush fires</td>
<td>Induction of construction teams. All fires controlled. Emergency procedures in place to extinguish fires.</td>
<td>No occurrence of fires</td>
<td>As per section 14.1.1.</td>
<td>Env officer for induction of construction crew</td>
<td>Fire control beaters at all construction sites and on all construction vehicles</td>
<td>-</td>
<td>Beginning of construction</td>
</tr>
<tr>
<td></td>
<td>B. Resource Use, Management and Waste Management at Construction Sites and Camp</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>B1</td>
<td>Water use</td>
<td>Increased water abstraction due to increased usage</td>
<td>To minimise water usage and conserve water</td>
<td>Water conservation measures</td>
<td>Use of water saving devices</td>
<td>As per section 14.1.1.</td>
<td>Env officer</td>
<td>Rainwater harvesting facilities</td>
<td>Purchase of rainwater harvesting facilities</td>
<td>Prior to construction</td>
</tr>
<tr>
<td>B2</td>
<td>Disposal of wastewater</td>
<td>Land contamination from spillages or leakages due to infrastructure damage and failure by chemical toilets used</td>
<td>To prevent pollution to due to spillages and leakages</td>
<td>Proper maintenance of wastewater disposal infrastructure. Incident record BOBS standards for wastewater disposal.</td>
<td>No spillages and leakages of wastewater recorded</td>
<td>As per section 14.1.1.</td>
<td>Planner (design) construction manager</td>
<td>Maintenance equipment</td>
<td>Maintenance of infrastructure</td>
<td>Throughout construction</td>
</tr>
<tr>
<td>B3</td>
<td>Power use</td>
<td>Increased power usage</td>
<td>To minimise power usage and conserve power</td>
<td>Provision of power saving devices. Power conservation measures</td>
<td>Use of power saving devices</td>
<td>As per section 14.1.1.</td>
<td>Env officer</td>
<td>Power saving devices</td>
<td>Purchase of power saving devices</td>
<td>Throughout construction</td>
</tr>
<tr>
<td>No.</td>
<td>Activity</td>
<td>Impact</td>
<td>Objective</td>
<td>Target-Management Principle</td>
<td>Performance Indicator</td>
<td>Responsibility</td>
<td>Resources (personnel)</td>
<td>Resources (equipment &amp; materials)</td>
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<tr>
<td>B4</td>
<td>Storage and handling of hazardous substances including fuel, lubricants, oil, process chemical, explosives</td>
<td>Contamination of soils, surface water and groundwater by potential spillages or leakages of substances</td>
<td>To prevent spillages and leakages of hazardous substances and contamination of soils, surface and groundwater</td>
<td>Procedure for storage and handling hazardous substances. Bunding of all storages. Rehabilitation of all contaminated areas. Incident register</td>
<td>No incidents of spillages recorded</td>
<td>As per section 14.1.1.</td>
<td>Env officers, SHE officers construction managers</td>
<td>Storage tanks, bunding, spill absorbers</td>
<td>Costs related to purchase of material, clean up costs</td>
<td>Throughout construction</td>
</tr>
<tr>
<td>B5</td>
<td>Storage and handling of used and unused hazardous substances</td>
<td>Potential fire outbreaks due spillages or leakages of hazardous substances</td>
<td>To prevent spillages and leakages of hazardous substances and fire outbreaks</td>
<td>See above. Fire prevention measures</td>
<td>No fire incidents recorded</td>
<td>As per section 13.1.1.</td>
<td>Env officers, SHE officers construction managers</td>
<td>Storage tanks, bunding, spill absorbers, fire extinguishers</td>
<td>Costs related to purchase of material, clean up costs</td>
<td>Throughout construction</td>
</tr>
<tr>
<td>B6</td>
<td>Disposal of used hazardous substances</td>
<td>Contamination of soils, surface water and groundwater by potential spillages or leakages of used substances</td>
<td>To prevent spillages and leakages of hazardous substances and contamination of soils, surface and groundwater</td>
<td>Storage and disposal of used hazardous substances to comply with the Basel Convention. Incident register</td>
<td>No spillages and leakages recorded</td>
<td>As per section 14.1.1.</td>
<td>Env officers, SHE officers construction managers</td>
<td>Storage tanks, bunding, spill absorbers</td>
<td>Costs related to purchase of material, clean up costs</td>
<td>Throughout construction</td>
</tr>
<tr>
<td>B7</td>
<td>Disposal of used hazardous substances</td>
<td>Potential fire outbreaks due spillages or leakages of used hazardous substances</td>
<td>To prevent spillages and leakages of hazardous substances and fire outbreaks</td>
<td>Storage and disposal of used hazardous substances to comply with the Basel Convention. Incident record. Fire prevention measures</td>
<td>No fire incidents recorded</td>
<td>As per section 14.1.1.</td>
<td>Env officers, SHE officers construction managers</td>
<td>Storage tanks, bunding, spill absorbers, fire extinguishers</td>
<td>Costs related to purchase of material, clean up costs</td>
<td>Throughout construction</td>
</tr>
<tr>
<td>B10</td>
<td>Primary storage of waste</td>
<td>Visual impacts from littering and waste generation resulting in decreased aesthetic value</td>
<td>To prevent littering</td>
<td>Provision of proper waste receptacles. Induction of environmental awareness to staff. Waste management plan</td>
<td>Waste receptacles and bunded storages</td>
<td>As per section 14.1.1.</td>
<td>Env officer Waste receptacles</td>
<td>Purchase of receptacles, professional days for training of staff</td>
<td>At the commence of and during construction</td>
<td></td>
</tr>
</tbody>
</table>

C. Removal of Borrow Material from Material Lay Down Areas and Crusher Facilities. Abstraction of Borrow Material
<table>
<thead>
<tr>
<th>No.</th>
<th>Activity</th>
<th>Impact</th>
<th>Objective</th>
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</tr>
</thead>
<tbody>
<tr>
<td>C2</td>
<td>Borrow pit establishment</td>
<td>Visual impacts due to change in landscape</td>
<td>To ensure minimum removal material from borrow pits</td>
<td>Use areas that will be disturbed and overburden material from the mine areas. Disturbed areas should be rehabilitated. Only borrow pits which are registered and have an EMP and closure plan in place should be used</td>
<td>Closure plan</td>
<td>As per section 14.1.1.</td>
<td>Env officer</td>
<td>-</td>
<td>-</td>
<td>Prior to excavation activities and the planning phase</td>
</tr>
<tr>
<td>C3</td>
<td>Removal of soil/gravel, excavation activities</td>
<td>Loss of biodiversity due to removal of habitat</td>
<td>Ensure low impact material extraction that meets the legal obligations</td>
<td>Ensure that borrow are legal properly managed and closure plan in place</td>
<td>Borrow license and closure plan</td>
<td>As per section 14.1.1.</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>Prior to excavation activities and the planning phase</td>
</tr>
<tr>
<td>C4</td>
<td>Removal of soil/gravel, excavation activities</td>
<td>Generation of dust affecting farmers living downwind (within the mine lease area at a distance of 1-2 km)</td>
<td>To minimise generation of dust and related impacts</td>
<td>No complaints regarding health impacts from mine dust. Dust suppression plan</td>
<td>No visible dust plume beyond site boundary</td>
<td>As per section 14.1.1.</td>
<td>Occupational hygienist</td>
<td>Dust suppression measures</td>
<td>Costs relating to purchase of dust suppressors</td>
<td>At start of construction</td>
</tr>
<tr>
<td>C5</td>
<td>Drilling and excavation of material</td>
<td>Noise pollution will affect farmers living within the mine lease area</td>
<td>To minimise noise during drilling and excavation of material</td>
<td>Drilling and excavation within acceptable noise limits</td>
<td>No complaints registered</td>
<td>As per section 14.1.1.</td>
<td>Occupational hygienist</td>
<td>-</td>
<td>-</td>
<td>During construction</td>
</tr>
<tr>
<td>D1</td>
<td>Transportation of staff and material via road</td>
<td>Deterioration of roads and safety of road users during use of the public road network</td>
<td>To limit mine-related disturbance to roads and safety related impacts</td>
<td>No fatal accidents or &lt; 1 accident a month due to contractors, engineers and mine use of roads</td>
<td>No accidents recorded</td>
<td>As per section 14.1.1.</td>
<td>Traffic officer</td>
<td>-</td>
<td>-</td>
<td>Planning for the routes that will be used prior to construction</td>
</tr>
<tr>
<td>No.</td>
<td>Activity</td>
<td>Impact</td>
<td>Objective</td>
<td>Target-Management Principle</td>
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<tr>
<td>D2</td>
<td>Transportation of waste to the Serowe Landfill</td>
<td>Land contamination and risks of accidents to other road users from litter from transportation vehicles</td>
<td>To prevent littering</td>
<td>Waste management plan to cover types of vehicles used and transportation periods. Complaints register</td>
<td>No records of accidents and complaints from public and road users. Approved use of vehicles from DWMPC</td>
<td>As per section 14.1.1.</td>
<td>Env officer</td>
<td>Proper vehicles</td>
<td>Costs related to purchase of vehicles or vehicle covers</td>
<td>Planning and construction phase</td>
</tr>
<tr>
<td>E1</td>
<td>Clearing of areas for infrastructure development</td>
<td>Loss of sandveld vegetation during site clearance</td>
<td>Minimise loss of woody vegetation</td>
<td>Minimise conveyor and road corridor clearing from existing (incorporate into plans). Vegetation clearance plan</td>
<td>Vegetation removal only from areas that will be constructed on. No unnecessary tracks or double width access tracks apart from high use areas.</td>
<td>As per section 14.2.1. Design to be reviewed and signed off by Env. officer</td>
<td>Review of design of new access and transport facilities by Env. officer</td>
<td>Minimal</td>
<td>Detailed design and first phase of construction for each phase of the expansion</td>
<td></td>
</tr>
<tr>
<td>E2</td>
<td>Clearing of area for additional staff (housing in the MCL village area for 20 house units)</td>
<td>Loss of sandveld vegetation and habitat adjacent to the rock outcrops</td>
<td>Minimise loss of woody vegetation</td>
<td>Single vehicle width access tracks, Tracks to follow power lines where feasible</td>
<td>No unnecessary tracks or double width access tracks</td>
<td>As per section 14.1.1.</td>
<td>Planner (design), contract manager</td>
<td>Detailed design</td>
<td>Minimal</td>
<td>Detailed design and first phase of construction</td>
</tr>
<tr>
<td>E3</td>
<td>Stripping and stockpiling of soils</td>
<td>Disturbances of topsoil</td>
<td>Topsoil stored for use during rehabilitation</td>
<td>Clear and store 0.5 m of topsoil for later rehabilitation</td>
<td>Identify area for storage, clear topsoil, document storage, monitor soil to ensure it is not used for other purposes</td>
<td>As per section 14.1.1.</td>
<td>Env officer</td>
<td>Bulldozer, back &amp; front end loader and tipper trucks</td>
<td>Assuming P200/ton, P5.4 million</td>
<td>During detailed design and construction.</td>
</tr>
<tr>
<td>No.</td>
<td>Activity</td>
<td>Impact</td>
<td>Objective</td>
<td>Target-Management Principle</td>
<td>Performance Indicator</td>
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<tr>
<td>E4</td>
<td>Clearing of all proposed area for infrastructure development</td>
<td>Dust nuisance to people living downwind. These include subsistence farmers</td>
<td>To minimise generation of dust and related impacts</td>
<td>Vegetation clearance plan. Dust suppression procedure. Complaints register</td>
<td>No complaints regarding health impacts from mine dust. Dust suppression plan</td>
<td>As per section 14.1.1.</td>
<td>Env officer</td>
<td>Dust suppression measures</td>
<td>Costs relating to purchase of dust suppressors</td>
<td>Planning and construction phase</td>
</tr>
</tbody>
</table>

**F. Employment and Service Provision Requirements**

| F1  | Employment | Requirements for skilled, semi-skilled and non-skilled labour will create employment opportunities | To ensure maximum benefit of locals on all jobs that will be created | Open recruitment through the Palapye main kgotla and Labour Office | Register of skills required to main kgotla and Labour Office | As per section 14.1.1. | HR manager | - | Advertising | Prior to construction |

| F2  | Employment | Transitory population increase due to influx of job seekers will create social conflict, increase in sexually transmitted diseases (including HIV/AIDS) and crime. | To reduce HIV and other STIs infection and reinfection chances | To provide support and education on HIV/AIDS to workers and to prevent transmission | Availability of condoms and awareness materials at strategic places at the contractors' camp and no new infections among the workers | As per section 14.1.1. | Peer educators, counsellors | Condom dispensers, HIV/AIDS information posters | P2 million | Throughout the construction period |

<p>| F3  | Employment | Illegal settlement due to presence of job seekers not immediately absorbed by contractors | To prevent illegal settlement | To collaborate with all stakeholders and work together in preventing illegal settlement | No temporary structures near the construction site and camp | As per section 14.1.1. | As per section 14.1.1. | - | Unknown | Throughout the construction period |</p>
<table>
<thead>
<tr>
<th>No.</th>
<th>Activity</th>
<th>Impact</th>
<th>Objective</th>
<th>Target-Management Principle</th>
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</tr>
</thead>
<tbody>
<tr>
<td>F4</td>
<td>Employment</td>
<td>Injection into local through need for support services for construction will increase business opportunities</td>
<td>To support existing and new service providers</td>
<td>Predetermine preferred local service providers list</td>
<td>List of service providers</td>
<td>As per section 14.1.1.</td>
<td>As per section 14.1.1.</td>
<td>-</td>
<td>-</td>
<td>Throughout the construction period</td>
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</table>
14.1.4 Monitoring requirements for Phase 1 construction

Table 26: Monitoring requirements for the construction of Phase 1 - 4 Mtpa

<table>
<thead>
<tr>
<th>No.</th>
<th>Activity</th>
<th>Environmental Aspect</th>
<th>Parameter</th>
<th>Objective</th>
<th>Responsibility</th>
<th>Location</th>
<th>Method</th>
<th>Reporting Structure</th>
<th>Thresholds</th>
<th>Recommended Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>A1</td>
<td>Construction of infrastructure</td>
<td>Noise levels</td>
<td>Third party complaints</td>
<td>Record and respond appropriately to any complaints about noise from the mining operations</td>
<td>Env. officer</td>
<td>On site</td>
<td>Complaints register</td>
<td>Incidents register</td>
<td>SANS 10103 requirements, South African noise control regulations and World Bank Group noise limits of 55dBA daytime and 45 dBA night time</td>
<td>Consult with noise specialist to determine additional measures that can be implemented</td>
</tr>
<tr>
<td>C1</td>
<td>Removal of soil/gravel, excavation activities</td>
<td>Dust levels</td>
<td>Dust plumes</td>
<td>Reduce risk of health impacts due to coal dust</td>
<td>Env. officer</td>
<td>At site boundary</td>
<td>Visual inspection, photos</td>
<td>Inspection and audits</td>
<td>World Bank Group ambient air quality limits of PM$_{10}$ not exceeding 150 µg/m$^3$ over a period of 24 hours</td>
<td>Implement additional mitigation measures such as water sprays. Consult air quality specialist</td>
</tr>
<tr>
<td>No.</td>
<td>Activity</td>
<td>Environmental Aspect</td>
<td>Parameter</td>
<td>Objective</td>
<td>Responsibility</td>
<td>Location</td>
<td>Method</td>
<td>Reporting Structure</td>
<td>Thresholds</td>
<td>Recommended Action</td>
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<tr>
<td>C2</td>
<td>Drilling and excavation of material</td>
<td>Noise levels</td>
<td>Third party complaints</td>
<td>Record and respond appropriately to any complaints about noise from the mining operations</td>
<td>Env. officer</td>
<td>On site</td>
<td>Complaints register</td>
<td>SANS 10103 requirements, South African noise control regulations and World Bank Group noise limits of 55dBA daytime and 45dBA night time</td>
<td>Consult with noise specialist to determine additional measures that can be implemented</td>
<td></td>
</tr>
<tr>
<td>D. Transportation: No environmental aspects that need monitoring</td>
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<tr>
<td>E. Site Clearance on all Project Areas</td>
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<tr>
<td>E1</td>
<td>Clearing of all proposed area for infrastructure development</td>
<td>Dust levels</td>
<td>Dust plumes</td>
<td>Reduce risk of health impacts due to coal dust</td>
<td>Env. officer</td>
<td>At site boundary</td>
<td>Visual inspection, photos</td>
<td>World Bank Group ambient air quality limits of PM$_{10}$ not exceeding 150 µg/m$^3$ over a period of 24 hours</td>
<td>Implement additional mitigation measures such as water sprays. Consult air quality specialist</td>
<td></td>
</tr>
<tr>
<td>F. Employment and Service Provision Requirements</td>
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</tr>
<tr>
<td>F1</td>
<td>Employment</td>
<td>HIV infections</td>
<td>HIV and other STIs prevalence</td>
<td>To ensure no new infections are registered and support is given to infected workers</td>
<td>MCL clinic superintendent, DHT</td>
<td>Contractors camp</td>
<td>Counselling of workers and peer education, free and regular provision of condoms</td>
<td>Camp SHE officer, MCL superintendent, DHT</td>
<td>Botswana HIV Policy Debswana HIV Policy</td>
<td>Reporting to DHT for a regional response mechanism</td>
</tr>
</tbody>
</table>
14.2 Operation of Phase 1

14.2.1 Implementation team for operation phase

Department of Environmental Affairs:
- Audit EMP implementation monitoring requirements.

MCL

Environmental Officer:
- Facilitate monitoring and auditing the requirements of the EMP.
- Liaise with DEA.

SHE Officer:
- Facilitate monitoring and auditing the requirements of the EMP.

Human Resources and Public Relations Manager, MCL Community Liaison Committee:
- Compensation and resettlement.
- Public interface and public meetings.
- Community, social and infrastructure planning.

Mine personnel:
- Carry out monitoring and reporting.
- Recommend remedial measures.

14.2.2 Environmental specifications for operation activities

Environmental Legislation
- EIA Act of 2005;
- Agricultural Resources Conservation Act of 1974;
- Public Health Act of 1981;
- Waste Management Act of 1998;
- Basel Convention of 1989;
- Water Act of 1968 (as amended);
- Mines and Minerals Act of 1999;
- Mines, Quarries, Works and Machinery Act (1995);
- World Bank Environmental, Health and Safety Guidelines
- MCL environmental policies and procedures; and
- Legislation relating to resettlement
### 14.2.3 Detailed EMP requirements for Phase 1 operation

#### Table 27: Management plan for the operation of Phase 1 - 4 Mtpa

<table>
<thead>
<tr>
<th>No.</th>
<th>Activity</th>
<th>Impact</th>
<th>Objective</th>
<th>Target-Management Principle</th>
<th>Performance Indicator</th>
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<th>Resources (personnel)</th>
<th>Resources (equipment &amp; materials)</th>
<th>Estimated costs</th>
<th>Timing &amp; deadline</th>
</tr>
</thead>
<tbody>
<tr>
<td>A1</td>
<td>Removal of coal seam underground</td>
<td>Potential increase in greenhouse gases due to release of methane gas into the atmosphere</td>
<td>To reduce contribution to greenhouse gases</td>
<td>Regular monitoring of methane and implement appropriate mitigation measures</td>
<td>Concentration of methane within allowable limits or conversion of methane to carbon dioxide</td>
<td>As per section 14.2.1.</td>
<td>Air quality specialist</td>
<td>Methane flow meter</td>
<td>Unknown</td>
<td>Prior to operation</td>
</tr>
<tr>
<td>A2</td>
<td>Coal seam removal below the piezometric level</td>
<td>Potential damage to road and pipeline infrastructure due to surface subsidence</td>
<td>Expand subsidence monitoring network</td>
<td>Studies to identify possible subsidence. DoM procedures for mining under the infrastructures and rivers.</td>
<td>Minimal subsidence impacts</td>
<td>As per section 14.2.1.</td>
<td>Geologist, mining engineer, env officer</td>
<td>Monitoring equipment</td>
<td>Mine already have a network of monitoring points. These just need to be expanded</td>
<td>Prior to operation in new areas</td>
</tr>
<tr>
<td>A3</td>
<td>Coal seam removal below the piezometric level</td>
<td>Alteration of drainage patterns on the Morupule and Lotsane Rivers due to surface subsidence</td>
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<td></td>
<td>Prior to operation</td>
</tr>
<tr>
<td>A4</td>
<td>Coal seam removal below the piezometric level</td>
<td>Reduction of groundwater levels in areas beyond the mining activities due to mining below the piezometric level</td>
<td>Reduce impacts to other groundwater users</td>
<td>Measure changes and impacts in groundwater levels</td>
<td>No changes on other boreholes of groundwater levels</td>
<td>As per section 14.2.1.</td>
<td>Hydrologist / geologist</td>
<td>Monitoring equipment</td>
<td>Purchase of equipment and professional fees if required</td>
<td>Immediately and throughout the operation phase</td>
</tr>
<tr>
<td>A5</td>
<td>Coal seam removal below the piezometric level</td>
<td>Potential seepage into the mine</td>
<td>To prevent seepage into the mine</td>
<td>Monitoring of seepage. Water collection for reuse</td>
<td>Collection of water for reuse</td>
<td>As per section 14.2.1.</td>
<td>Civil engineer</td>
<td>Monitoring equipment</td>
<td>Purchase of equipment and professional fees if required</td>
<td>Immediately and throughout the operation phase</td>
</tr>
<tr>
<td>No.</td>
<td>Activity</td>
<td>Impact</td>
<td>Objective</td>
<td>Target-Management Principle</td>
<td>Performance Indicator</td>
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<tr>
<td>A6</td>
<td>Coal seam removal below the piezometric level</td>
<td>Risks of accidents and fatalities due to potential subsidence</td>
<td>To prevent surface subsidence and related impacts</td>
<td>Conduct studies of possible subsidence. Monitoring. Maintain the existing complaints register to log in public complaints and consistently engage with affected parties through the stakeholder engagement plan. Areas of collapse are to be mapped and appropriate mitigation measures implemented.</td>
<td>No complaints from farmers residing on the mine lease area. No records of accidents and fatalities</td>
<td>As per section 14.2.1.</td>
<td>Mining engineers, geologist</td>
<td>Unknown</td>
<td>Professional costs and equipment</td>
<td>Immediate and throughout the operation phase</td>
</tr>
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</tr>
<tr>
<td>A7</td>
<td>Blasting underground</td>
<td>Damage to third party infrastructure within and around the mine lease area due to vibrations through the ground.</td>
<td>To control blasting and limit damage to third party infrastructure</td>
<td>No damage to third party infrastructure</td>
<td>Peak particle velocity from blasts is less than 12 mm/s at all vulnerable third party structures</td>
<td>As per section 14.2.1.</td>
<td>SHE officer</td>
<td>Seismograph</td>
<td>Purchase of seismograph</td>
<td>Every blast</td>
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</table>

### B. Ventilation System

<table>
<thead>
<tr>
<th>No.</th>
<th>Activity</th>
<th>Impact</th>
<th>Objective</th>
<th>Target-Management Principle</th>
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<th>Estimated costs</th>
<th>Timing &amp; deadline</th>
</tr>
</thead>
<tbody>
<tr>
<td>B1</td>
<td>Ventilation system</td>
<td>Excess noise levels at homesteads in the surrounding area.</td>
<td>To prevent noise from the ventilation system and effects on receptors</td>
<td>Establish berms around shafts to deflect noise upwards. Design to comply with requirements of SANS 10103, insulate noisy plants and equipments. Include system in noise monitoring plan. Any complaints should be recorded and responded to timeously.</td>
<td>Compliance with SANS 10103. Noise monitoring. No complaints recorded.</td>
<td>As per section 14.2.1.</td>
<td>Noise Specialist</td>
<td>Designs, insulating equipments, berms</td>
<td>Purchase of materials. Professional fees if required.</td>
<td>Design phase. Monitoring throughout the operation phase</td>
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### C. Coal Processing: Crushing, Screening, Washing, Handling and Stockpiling

<table>
<thead>
<tr>
<th>No.</th>
<th>Activity</th>
<th>Impact</th>
<th>Objective</th>
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<th>Timing &amp; deadline</th>
</tr>
</thead>
<tbody>
<tr>
<td>C1</td>
<td>Coal crushing, storage and handling</td>
<td>Potential change to existing sandveld vegetation due to the generation of coal dust</td>
<td>Reduce generation of dust</td>
<td>Reduce average particulate matter by 20 %. Dust suppression procedure. Dust monitoring</td>
<td>Low levels of dust</td>
<td>As per section 14.2.1.</td>
<td>Design engineers</td>
<td>Air quality specialist</td>
<td>Monitoring equipment. Dust suppression measures</td>
<td>Costs of dust suppression measures and equipment.</td>
</tr>
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</table>

Prepared by Ecosurv (Pty) Ltd
<table>
<thead>
<tr>
<th>No.</th>
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<th>Timing &amp; deadline</th>
</tr>
</thead>
<tbody>
<tr>
<td>C2</td>
<td>Coal crushing, storage and handling</td>
<td>Potential decrease in pH soil due to the generation of coal dust</td>
<td>Reduce generation of dust</td>
<td>Reduce average particulate matter by 20%. Dust suppression procedure. Dust and soil monitoring</td>
<td>Low levels of dust</td>
<td>As per section 14.2.1. Design engineers</td>
<td>Air quality and soil specialist</td>
<td>Monitoring equipment. Dust suppression measures.</td>
<td>Costs of dust suppression measures and equipment. Professional fees on soil monitoring (if required)</td>
<td>Prior to and during operation</td>
</tr>
<tr>
<td>C3</td>
<td>Coal crushing, storage and handling</td>
<td>Possible respiratory problems for adjacent residents within the lease area due to generation of coal dust</td>
<td>Reduce generation of dust. Prevent health problems due to dust generation</td>
<td>No complaints regarding health impacts from mine dust. Dust suppression procedure. Dust monitoring</td>
<td>No significant coal dust deposition beyond site boundary</td>
<td>SHE/Env. Officer</td>
<td>SHE officer</td>
<td>Monitoring equipment. Dust suppression measures.</td>
<td>Costs of dust suppression measures and equipment.</td>
<td>Operation phase</td>
</tr>
<tr>
<td>C4</td>
<td>Coal crushing, storage and handling</td>
<td>Noise levels in excess of the minimum acceptable levels for homesteads in the surrounding area.</td>
<td>To prevent public exposure to disturbing noise</td>
<td>Operation of facilities within acceptable noise limits. Noise monitoring</td>
<td>No community complaints</td>
<td>As per section 14.2.1.</td>
<td>SHE officer</td>
<td>Monitoring equipment</td>
<td>Costs of equipment.</td>
<td>Operation phase</td>
</tr>
<tr>
<td>C5</td>
<td>Use of coal crush and wash facilities</td>
<td>Establishment of exotic vegetation and weed species at the fringe of the facilities</td>
<td>Limit the development and spread of exotic weed species</td>
<td>MCL not responsible for hosting nor spreading exotic weed species</td>
<td>Annual removal of weed species prior to setting of seeds</td>
<td>MCL SHE Officer</td>
<td>SHE officer</td>
<td>Bush clearing tools. Part-time staff</td>
<td>100 days casual labor per annum</td>
<td>Annually during operation phase</td>
</tr>
<tr>
<td>C6</td>
<td>Stockpiling coal on site</td>
<td>Release of potentially harmful pollutants into the air from spontaneous combustion</td>
<td>To prevent combustion of coal stockpiles</td>
<td>Daily coal compaction. Fire procedures. Recording of fire incidences</td>
<td>No records of fire incidences</td>
<td>As per section 14.2.1.</td>
<td>-</td>
<td>Coal compactors. Fire fighting equipment</td>
<td>Purchase of equipment</td>
<td>Operation phase</td>
</tr>
<tr>
<td>No.</td>
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</tr>
<tr>
<td>C7</td>
<td>Stockpiling coal on site</td>
<td>Surface and groundwater contamination from acid leachate drainage</td>
<td>To prevent ALD. To prevent site drainage</td>
<td>Provide impermeable surfaces on coal storage areas. Surface and groundwater quality monitoring. Stormwater reservoirs to capture runoff</td>
<td>No change in water quality monitoring of borehole drilled down gradient from stockpile</td>
<td>As per section 14.2.1.</td>
<td>Hydrologist / geologist</td>
<td>Establishment of monitoring borehole. Sampling and analysis of water</td>
<td>Monthly samples</td>
<td>Monthly throughout operation phase</td>
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<tr>
<td>D1</td>
<td>Transport of staff, material and product via road or rail</td>
<td>Deterioration of public roads and compromised safety of road users due to colliery and customer use of roads</td>
<td>To limit mine related disturbance of public roads and rail network and safety related impacts</td>
<td>No fatal accidents or &lt; 1 accident a month due to mine use of road</td>
<td>No accidents due to mine use of roads</td>
<td>As per section 14.2.1.</td>
<td>Env. officer, traffic specialist</td>
<td>None</td>
<td>Unknown</td>
<td>Operation phase</td>
</tr>
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</tr>
<tr>
<td>D2</td>
<td>Transport of staff, materials and products</td>
<td>Noise levels in excess of the minimum acceptable levels for homesteads in the surrounding area.</td>
<td>To prevent public exposure to disturbing noise</td>
<td>Minimise night-time activities</td>
<td>No community complaints</td>
<td>As per section 14.2.1.</td>
<td>SHE officer</td>
<td>-</td>
<td>-</td>
<td>Operation phase</td>
</tr>
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<tr>
<td>D3</td>
<td>Transportation of waste to the landfill in Serowe</td>
<td>Land contamination &amp; risks of accidents to other road users from litter from transportation vehicle</td>
<td>To prevent littering</td>
<td>Waste management plan to cover vehicles used, transportation times. Complaints register</td>
<td>Records of accidents and complaints from public and road users. Approved use of vehicles from DWMPC</td>
<td>As per section 14.2.1.</td>
<td>Env. officer</td>
<td>-</td>
<td>-</td>
<td>Prior to operation</td>
</tr>
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<td></td>
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<tr>
<td>E1</td>
<td>Water use</td>
<td>Increased water abstraction due to increased usage</td>
<td>To reduce water usage</td>
<td>Water conservation procedure</td>
<td>Minimal water usage</td>
<td>As per section 14.2.1.</td>
<td>Env officer</td>
<td>Rainwater harvesting facilities</td>
<td>Purchase of rainwater harvesting facilities</td>
<td>Prior to and during operation</td>
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</tr>
<tr>
<td>E2</td>
<td>Disposal of wastewater</td>
<td>Land contamination from spillages and leakages due to infrastructure damage and failure by chemical or other toilets used</td>
<td>To prevent pollution due to spillages and leakages</td>
<td>Proper maintenance of wastewater disposal infrastructure. Incident record. BOBS standards for wastewater disposal</td>
<td>No spillages and leakages of wastewater recorded</td>
<td>As per section 14.2.1.</td>
<td>Design engineers</td>
<td>Maintenance equipment</td>
<td>Maintenance of infrastructure</td>
<td>Operation phase</td>
</tr>
<tr>
<td>E3</td>
<td>Power use</td>
<td>Increased power usage</td>
<td>To minimise power usage. To conserve power</td>
<td>Energy conservation procedure</td>
<td>Use of power saving devices</td>
<td>As per section 14.2.1.</td>
<td>Env officer</td>
<td>Power saving devices</td>
<td>Purchase of power saving devices</td>
<td>Operation phase</td>
</tr>
<tr>
<td>E4</td>
<td>Expansion of the mine clinic</td>
<td>Increased need for disposal of clinical waste</td>
<td>Incorporate clinical waste disposal into existing process</td>
<td>Waste management procedure</td>
<td>Proper separation and disposal</td>
<td>As per section 14.2.1.</td>
<td>Env officer</td>
<td>Waste receptacles</td>
<td>Purchase of equipment</td>
<td>Operation phase</td>
</tr>
<tr>
<td>E5</td>
<td>Storage and use of chemicals at the laboratory</td>
<td>Potential fire outbreaks due to spillages of chemicals</td>
<td>To prevent fire outbreaks from spillages of chemicals</td>
<td>SHE management and standard procedure</td>
<td>Compliance to procedure. No incidents of spillages and fire breaks recorded</td>
<td>As per section 14.2.1.</td>
<td>SHE officer</td>
<td>Storage facilities, bunding, spill absorbers, fire fighting equipment</td>
<td>Costs related to purchase of material, clean up costs</td>
<td>Operation phase</td>
</tr>
<tr>
<td>E6</td>
<td>Storage and use of fuels</td>
<td>Contamination of soils, surface water &amp; groundwater by potential spillages or leakages of fuels</td>
<td>To prevent spillages or leakages of fuels</td>
<td>SHE management and standard procedure</td>
<td>Compliance to procedure. No incidents of spillages recorded</td>
<td>As per section 14.2.1.</td>
<td>SHE officer</td>
<td>Storage tanks, bunding, spill absorbers</td>
<td>Costs related to purchase of material, clean up costs</td>
<td>Operation phase</td>
</tr>
<tr>
<td>E7</td>
<td>Storage and use of fuels</td>
<td>Potential fire outbreaks due to spillages or leakages of hazardous substances</td>
<td>To prevent spillages or leakages of fuels</td>
<td>SHE management and standard procedure</td>
<td>Compliance to procedure. No incidents of spillages recorded</td>
<td>As per section 14.2.1.</td>
<td>SHE officer</td>
<td>Storage tanks, bunding, spill absorbers, fire fighting equipment</td>
<td>Costs related to purchase of material, clean up costs</td>
<td>Operation phase</td>
</tr>
<tr>
<td>No.</td>
<td>Activity</td>
<td>Impact</td>
<td>Objective</td>
<td>Target-Management Principle</td>
<td>Performance Indicator</td>
<td>Responsibility</td>
<td>Resources (personnel)</td>
<td>Resources (equipment &amp; materials)</td>
<td>Estimated costs</td>
<td>Timing &amp; deadline</td>
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</tr>
<tr>
<td>E8</td>
<td>Disposal of used hazardous substances</td>
<td>Contamination of soils, surface water &amp; groundwater by potential spillages or leakages of used substances</td>
<td>To prevent spillages and leakages of hazardous substances and contamination of soils, surface and groundwater</td>
<td>Waste Management Procedure. Basel Convention. incident register</td>
<td>No spillages and leakages recorded</td>
<td>As per section 14.2.1.</td>
<td>SHE officers</td>
<td>Storage tanks, bunding, spill absorbers</td>
<td>Costs related to purchase of material, clean up costs</td>
<td>Operation phase</td>
</tr>
<tr>
<td>E9</td>
<td>Disposal of used hazardous substances</td>
<td>Potential fire outbreaks due to spillages or leakages of used hazardous substances</td>
<td>To prevent fire outbreaks from spillages of hazardous substances</td>
<td>Waste Management Procedure. Basel Convention. incident register</td>
<td>No spillages and leakages recorded. No fire outbreaks recorded.</td>
<td>As per section 14.2.1.</td>
<td>SHE officers</td>
<td>Storage tanks, bunding, spill absorbers, fire fighting equipment</td>
<td>Costs related to purchase of material, clean up costs</td>
<td>Operation phase</td>
</tr>
<tr>
<td>E10</td>
<td>Use of materials</td>
<td>Increased need for disposal of waste due to increased volumes</td>
<td>To ensure management according the waste management hierarchy.</td>
<td>Register with DWMPC. Waste Management Procedure. Provision of proper waste receptacles. Induction of environmental awareness to staff.</td>
<td>Records of waste. Licenses for storage and vehicles of waste.</td>
<td>As per section 14.2.1.</td>
<td>Env officers</td>
<td>Waste receptacles</td>
<td>Costs of purchasing equipment</td>
<td>Operation phase</td>
</tr>
</tbody>
</table>

**F. Resettlement of the Inhabitants from the Lease Area**
<table>
<thead>
<tr>
<th>No.</th>
<th>Activity</th>
<th>Impact</th>
<th>Objective</th>
<th>Target-Management Principle</th>
<th>Performance Indicator</th>
<th>Responsibility</th>
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<th>Resources (equipment &amp; materials)</th>
<th>Estimated costs</th>
<th>Timing &amp; deadline</th>
</tr>
</thead>
<tbody>
<tr>
<td>F1</td>
<td>Land appropriation</td>
<td>Loss of livelihoods due land appropriation by the mine</td>
<td>To avoid loss of livelihoods on people currently living on the mine lease area due to land appropriation by the mine.</td>
<td>Minimise displacement and disruption of livelihoods. Study to identify if relocation necessary, e.g. for safety reasons. If not necessary, compensate and allow light land use. Otherwise a Resettlement Action Plan should be drawn up.</td>
<td>Safety study and Resettlement Action Plan (if required)</td>
<td>As per section 14.2.1. Mine management</td>
<td>Sociologist or socio-economist, land use planner, mine safety specialist</td>
<td>Unknown</td>
<td>Professional costs on safety study and Resettlement Action Plan. Costs relating to equipment on of safety study</td>
<td>A safety study should commence now and a Resettlement Action Plan, if required should be drawn prior to construction after completion of the safety study</td>
</tr>
<tr>
<td>F2</td>
<td>Removal of inhabitants above colliery workings</td>
<td>Increase of range and habitat available to wildlife population due to resettlement of land users</td>
<td>Create an ecologically viable and economically sustainable game park</td>
<td>Increase game park fencing to include key habitats and manage for tourism</td>
<td>Management plan in place, tourism development identified, wildlife population increase in density and diversity</td>
<td>As per section 14.2.1.</td>
<td>Game park manager</td>
<td>Management plans, vehicle, fencing, water point establishment, purchase of animal species</td>
<td>Fence ca P10,000/km, water points 5 x P15,000. Game stocking P100,000</td>
<td>After existing farm activities cease</td>
</tr>
</tbody>
</table>

G. Employment and Service Provision Requirements

<p>| G1  | Employment | Increased employment opportunities due to need to operate new mine activities | To ensure maximum benefit of locals on all jobs that will be created | Open recruitment through the Palapye main kgotla and Labour Office | Register of skills required to main kgotla and Labour Office | As per section 14.2.1. | HR manager | Advertising | Prior to start of operation |</p>
<table>
<thead>
<tr>
<th>No.</th>
<th>Activity</th>
<th>Impact</th>
<th>Objective</th>
<th>Target-Management Principle</th>
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<th>Resources (personnel)</th>
<th>Resources (equipment &amp; materials)</th>
<th>Estimated costs</th>
<th>Timing &amp; deadline</th>
</tr>
</thead>
<tbody>
<tr>
<td>G2</td>
<td>Employment</td>
<td>Potential transmission of communicable diseases due to increased population and sexual interactions between mine workers and other people</td>
<td>To reduce HIV and other STIs infection and reinfection chances</td>
<td>To provide support and education on HIV/AIDS to workers and to prevent transmission</td>
<td>Availability of condoms and awareness materials at strategic places at the colliery and no new infections among the workers</td>
<td>As per section 14.2.1.</td>
<td>Peer educators, counsellors</td>
<td>Condom dispensers, HIV/AIDS information posters</td>
<td>Unknown</td>
<td>Prior to and throughout the operation phase</td>
</tr>
<tr>
<td>G3</td>
<td>Employment</td>
<td>Social conflict, illegal settlement, increase in crime and strain on existing Labour Office in Palapye due to influx of job seekers</td>
<td>To prevent illegal settlement</td>
<td>To collaborate with all stakeholders and work together in preventing illegal settlement</td>
<td>No temporary structures near the mine areas</td>
<td>As per section 14.2.1.</td>
<td>As per section 14.2.1.</td>
<td>-</td>
<td>Unknown</td>
<td>Prior to and throughout the operation phase</td>
</tr>
<tr>
<td>G4</td>
<td>Service Provision requirement</td>
<td>Increased cash injection into the local economy due to increased business opportunities</td>
<td>To support existing and new service providers</td>
<td>Predetermine preferred local service providers list</td>
<td>List of service providers</td>
<td>As per section 14.2.1.</td>
<td>As per section 14.2.1.</td>
<td>-</td>
<td>-</td>
<td>Prior to and throughout the operation phase</td>
</tr>
</tbody>
</table>
### 14.2.4 Monitoring requirements for Phase 1 operation

**Table 28: Monitoring requirements for the operation of the 4 Mtpa**

<table>
<thead>
<tr>
<th>No.</th>
<th>Activity</th>
<th>Environmental Aspect</th>
<th>Parameter</th>
<th>Objective</th>
<th>Responsibility</th>
<th>Location</th>
<th>Method</th>
<th>Reporting Structure</th>
<th>Thresholds</th>
<th>Recommended Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>A1</td>
<td>Coal seam removal below ground</td>
<td>Potential surface subsidence</td>
<td>Amount of subsidence if any</td>
<td>Identify possible subsidence and potential damage to roads, rivers and other infrastructure and risks of accidents and fatalities</td>
<td>As per section 14.2.1.</td>
<td>Use existing mine subsidence measuring network (to be expanded when the mining area expands)</td>
<td>Already installed</td>
<td>Report to DoM, DWA and local authorities</td>
<td>Regulations under Mines, Quarries, Works and Machinery Act and Procedure for under roads, rivers (DoM)</td>
<td>Mark all areas affected. Put up emergence evacuation on affected areas. Rehabilitate all areas affected</td>
</tr>
<tr>
<td>A2</td>
<td>Coal seam removal below the piezometric level</td>
<td>Mining below the piezometric level</td>
<td>Groundwater level</td>
<td>Measure lease and adjacent areas for groundwater changes</td>
<td>As per section 14.2.1.</td>
<td>Boreholes which are to be drilled in the new future</td>
<td>Dipper monthly</td>
<td>DWA, I&amp;APs and local authorities</td>
<td>DWA/DGS groundwater (quantity) standards</td>
<td>Compensation to affected parties</td>
</tr>
<tr>
<td>A3</td>
<td>Coal seam removal below the piezometric level</td>
<td>Potential seepage into the mine</td>
<td>Amount of water pumped</td>
<td>Will only come into action if seepage into mine causes a problem to working conditions. Then water can be pumped which can be measured.</td>
<td>As per section 14.2.1.</td>
<td>Within the shaft</td>
<td>On line inflow pipeline meter on pipeline</td>
<td>Mine management</td>
<td>DWA/DGS groundwater (quantity) standards</td>
<td>Cease mining and pump the water for reuse</td>
</tr>
<tr>
<td>A4</td>
<td>Blasting underground</td>
<td>Damage to third party infrastructure within and around the mine lease area due to vibrations through the ground.</td>
<td>Vibrations: peak particle velocity</td>
<td>To control blasting and limit damage to third party infrastructure</td>
<td>As per section 14.2.1.</td>
<td>Ground within and around the mine lease area</td>
<td>Seismograph</td>
<td>Mine management</td>
<td>Mines and Minerals Act, Mines, Quarries, Works and Machinery Act and Explosives Act: Blasting regulations</td>
<td>Compensation to affected parties</td>
</tr>
</tbody>
</table>

**B. Ventilation System**
<table>
<thead>
<tr>
<th>No.</th>
<th>Activity</th>
<th>Environmental Aspect</th>
<th>Parameter</th>
<th>Objective</th>
<th>Responsibility</th>
<th>Location</th>
<th>Method</th>
<th>Reporting Structure</th>
<th>Thresholds</th>
<th>Recommended Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>B1</td>
<td>Ventilation system</td>
<td>Noise levels</td>
<td>Noise</td>
<td>To identify if there has been any noise impacts</td>
<td>As per section 14.2.1.</td>
<td>Homesteads surrounding the mine</td>
<td>Measurement in accordance with SANS ISO 8297:194 and SANS 10103</td>
<td>Annual report by Env Officer to Mine Management - DoM</td>
<td>SANS 10103 requirements, South African noise control regulations and World Bank Group noise limits of 55dBA daytime and 45 dBA night time</td>
<td>Consider insulating the system</td>
</tr>
<tr>
<td>C1</td>
<td>Coal crushing, storage and handling</td>
<td>Dust generation</td>
<td>Use existing dust monitoring plan. Vegetation and soil monitoring can be included. Expand monitoring into the homestead areas.</td>
<td>To identify if there has been impacts on soil pH, vegetation and health impacts</td>
<td>As per section 14.2.1.</td>
<td>Homesteads downwind of the crushing, storage and handling facilities</td>
<td>As per existing monitoring plan</td>
<td>World Bank Group ambient air quality limits of PM$_{10}$ not exceeding 150 µg/m$^3$ over a period of 24hours</td>
<td>Inspect to identify the malfunctioning of dust suppression systems</td>
<td></td>
</tr>
<tr>
<td>C2</td>
<td>Coal crushing, storage and handling</td>
<td>Noise levels</td>
<td>Noise</td>
<td>To identify if there has been any noise impacts</td>
<td>As per section 14.2.1.</td>
<td>Homesteads surrounding the mine</td>
<td>Measurement in accordance with SANS ISO 8297:194 and SANS 10103</td>
<td>Annual report by Env Officer to Mine Management - DoM</td>
<td>SANS 10103 requirements, South African noise control regulations and World Bank Group noise limits of 55dBA daytime and 45 dBA night time</td>
<td>Install noise deflectors</td>
</tr>
<tr>
<td>No.</td>
<td>Activity</td>
<td>Environmental Aspect</td>
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<td>Objective</td>
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</tr>
<tr>
<td>C3</td>
<td>Stockpiling coal on site</td>
<td>Surface and groundwater</td>
<td>Major Ions quarterly And Water Level Major ions are Na, Ca, Mg, K, Cl, NO3, SO4, HCO3, CO3, Fe.</td>
<td>Identify if there has been any changes in water quality due to ALD</td>
<td>As per section 14.2.1.</td>
<td>Down gradient of expanded coal storage area when established</td>
<td>Dipper and bailed water sample. Sampling method is provided in BOS ISO 5667-1. Analytical test methods are provided in 93:2004</td>
<td>Report annually to DGS &amp;DWA</td>
<td>BOBS Standards for wastewater disposal into the environment, BOS 93:2004</td>
<td>Rehabilitate contaminated water/areas Remove stockpiles and inspect the material where the coal stockpiles are and reconstruct damaged areas</td>
</tr>
</tbody>
</table>

**D. Transportation:** No aspects that require monitoring

**E. Resource Use, Management and Waste Management**

<table>
<thead>
<tr>
<th>E1</th>
<th>Water use</th>
<th>Water use</th>
<th>Water</th>
<th>Measure amount of water used</th>
<th>As per section 14.2.1.</th>
<th>Sectional metre and borehole Water balances units</th>
<th>Metre readings Measures of reused/recycled water</th>
<th>Monthly reports by Env Officer to Accounts and Utilities department to Mine Management</th>
<th>Amounts of water allocated to the project</th>
<th>Rainwater harvesting during the wet season Install more water saving devices</th>
</tr>
</thead>
</table>

| E2  | Storage, use and disposal of chemicals at the laboratory and fuels | Spillages | Oil spillages | To identify occurrence of oil spillages | As per section 14.2.1. | Chemical and fuel storage areas | Observations Incident register by Env Officer to Mine management and DWMPC | Waste Management Act, Basel Convention and MCL Waste oil and diesel handling procedure | Identify and turn off source of spillage; use the absorbent material to clean up spillage; clean up contaminated areas; Treat contaminant materials and dispose off at the landfill. |

**F. Resettlement of the Inhabitants from the Lease Area**
<table>
<thead>
<tr>
<th>No.</th>
<th>Activity</th>
<th>Environmental Aspect</th>
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<th>Reporting Structure</th>
<th>Thresholds</th>
<th>Recommended Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>F1</td>
<td>Land appropriation</td>
<td>Loss of livelihoods due land appropriation by the mine</td>
<td>Changes in livelihoods</td>
<td>To identify if there has been any impacts due to land appropriation</td>
<td>As per section 14.2.1.</td>
<td>To be identified by the mine</td>
<td>To be identified during the drawing up of the resettlement plan</td>
<td>To be identified during the drawing up of the resettlement plan</td>
<td>To be identified during the drawing up of the resettlement plan</td>
<td></td>
</tr>
</tbody>
</table>

G. Employment and Service Provision Requirements

| G1  | Employment | HIV infections and other STIs infections | HIV and other STIs infections | To ensure that no new infections are registered and give support to infected workers | As per section 14.2.1. | The mine, mine village and Palapye | Counselling and checking of condom use | Botswana HIV Policy, Debswana HIV Policy | Reporting to DHT for a regional response mechanism |
ANNEXURE 1: APPROVAL OF TERMS OF REFERENCE BY DEA

Ref: NCS/ BOD 7/9 XXX IV (6) 23rd July 2008

Director
Ecosurv
P. O. Box 201306
Gaborone

Dear Sir,

RE: SCOPING REPORT AND TERMS OF REFERENCE FOR ENVIRONMENTAL IMPACT ASSESSMENT STUDY FOR MORUPULE COLLIERY EXPANSION PROJECT:

1. Reference is made to the scoping report and terms of reference for the above project which you submitted to the Department of Environmental Affairs (DEA) for review.

2. We have reviewed the terms of reference and consider it to be adequate as it addresses the relevant issues.

3. You can proceed with undertaking the detailed environmental assessment studies. Before printing the draft EIA report, please consult the DEA with regard to the number of copies that will be required for distribution to other stakeholders and the public for review. The attached structure should be used for the Environmental Management Plan (EMP) and monitoring tables.

Thank you

Yours faithfully

David Aniku
For Director
MORUPULE COLLIER EXPANSION PROJECT

APPROVED TERMS OF REFERENCE

Submitted April, Revised June 2008

Prepared by
# TABLE OF CONTENTS

1 INTRODUCTION ............................................................................................................. 1
   1.1 Project Background .............................................................................................. 1
   1.2 Proposed Development ...................................................................................... 1
   1.3 Study Area ......................................................................................................... 2

2 KEY ISSUES IDENTIFIED FROM SCOPING .............................................................. 2

3 PURPOSE AND OBJECTIVES OF THE EIA STUDY .............................................. 2

4 SCOPE OF WORK FOR THE EIA ............................................................................. 3
   4.1 Stages ............................................................................................................. 3
   4.2 Activities ......................................................................................................... 3
      4.2.1 Description of the Project ......................................................................... 3
      4.2.2 Planning Framework ............................................................................... 4
      4.2.3 Environmental and Social Setting ......................................................... 4
      4.2.4 Consultations ......................................................................................... 4
      4.2.5 Assessment of Environmental and Social Impacts and Interventions ........ 4
      4.2.6 Archaeological Impacts Assessment ....................................................... 6
      4.2.7 Mitigation Measures and Interventions ............................................... 6
      4.2.8 Environmental Management Plan ....................................................... 6
      4.2.9 Decommissioning and Closure Plan ..................................................... 7

5 PROPOSED EIA TEAM ............................................................................................... 7

6 AVAILABILITY OF DATA .......................................................................................... 8

7 REPORTING AND TIMING ...................................................................................... 8

8 STRUCTURE OF REPORT ........................................................................................ 8

9 CONCLUSIONS ......................................................................................................... 9

## LIST OF ABBREVIATIONS AND ACRONYMYS

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AIA</td>
<td>Archaeological Impact Assessment</td>
</tr>
<tr>
<td>BPC</td>
<td>Botswana Power Corporation</td>
</tr>
<tr>
<td>DEA</td>
<td>Department of Environmental Affairs</td>
</tr>
<tr>
<td>DNMMAG</td>
<td>Department of National Museum, Monuments and Art Gallery</td>
</tr>
<tr>
<td>EIA</td>
<td>Environmental Impact Assessment</td>
</tr>
<tr>
<td>EIS</td>
<td>Environmental Impact Statement</td>
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<tr>
<td>EMP</td>
<td>Environmental Management Plan</td>
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<tr>
<td>Ha</td>
<td>Hectare</td>
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<tr>
<td>IA&amp;Ps</td>
<td>Interested and Affected Parties</td>
</tr>
<tr>
<td>Abbreviation</td>
<td>Description</td>
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<td>--------------</td>
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</tr>
<tr>
<td>Km</td>
<td>Kilometres</td>
</tr>
<tr>
<td>kV</td>
<td>Kilovolts</td>
</tr>
<tr>
<td>MCL</td>
<td>Morupule Colliery Limited</td>
</tr>
<tr>
<td>Mtpa</td>
<td>Million tonnes per annum</td>
</tr>
<tr>
<td>MW</td>
<td>Megawatts</td>
</tr>
</tbody>
</table>
1 INTRODUCTION

This section presents the Terms of Reference that needs to be covered in the detailed EIA for the Morupule Colliery expansion to a three shaft, underground continuous miner operation with an upper maximum abstraction of 12 Million tpa coal.

1.1 Project Background

The colliery proposes to increase its production of coal from 1 Mtpa to 12 Mtpa to cater for the increase in power generating capacity at the Botswana Power Corporation’s (BPC) coal-fired power plant in Morupule. The power increase that will meet the increased power demands in the country is expected to be 600 MW during phase 1, and then 600 MW for phase 2, together with the current 132 MW of generating capacity.

1.2 Proposed Development

To allow for production of 12 Mtpa the following will be required and are subject to a detailed EIA. The EIA will only cover areas where the development will be implemented.

- **Mining:** Coal will be mined using the underground mining (bord and pillar) methods from two shafts, i.e. the existing shaft and shaft 2 located 4.5 km to the North of the existing shaft.

- **Screening and Crushing Facilities:** The existing facilities will be replaced and expanded.

- **Coal Wash Plant:** An additional coal wash plant will be constructed which will be 4 times the existing one (in terms of capacity). This will be located near the existing plant.

- **Housing:** A number of houses (at least 20) will be constructed at the village to accommodate senior personnel involved in the operation of the proposed mine.

- **Other Support Infrastructure:** Other necessary infrastructure include:
  - New workshops and offices within the plant. The plant area covers an area of 34 ha;
  - Administration office block to be erected in the vicinity of the existing administration offices;
  - Various 11 kV distribution power lines to distribute power from the substation to plant areas where power is required;
  - Internal water pipelines;
  - Storm water capture systems;
  - New access roads;
  - Expansion of the existing railway link to allow increased levels of coal transport from the mine to the main railway line; and
o Fully equipped laboratory to perform tests on the products of the washing plants.

Construction of the housing units and the mining infrastructure is likely to commence in 2008 and 2009 respectively, and will employ about 100 and 2000 people respectively. Backfill construction material will be sourced from a local borrow pit. During operation, the number of employees will increase from 264 to approximately 2000.

1.3 Study Area

The proposed project will be located within the colliery, new lease area, about twelve km north west of Palapye towards Serowe.

2 KEY ISSUES IDENTIFIED FROM SCOPLING

Key issues identified from scoping include

- Soil contamination;
- Impacts of air quality (ambient dust during construction);
- Noise pollution;
- Impacts on water resources;
- Impacts on livelihoods and social impacts;
- Archaeological impacts;
- Spontaneous combustion of coal stockpiles;
- Acid mine drainage; and
- Cumulative impacts.

3 PURPOSE AND OBJECTIVES OF THE EIA STUDY

The main objectives of the EIA study are to:

- Assess options for the location of material lay down areas and shafts;
- Identify and evaluate the ecological, environmental and hydrological impacts, which will be caused by the project.
- Identify and describe procedures and measure that will mitigate the predicted adverse impacts of the development proposals and measures that enhance the beneficial effects of the proposed activities.
- Liaise with key interested and affected parties and relevant government departments on issues relating to the proposed development to ensure compliance to existing policies, guidelines, regulations (bye-laws).
• Undertake consultations with I&APs.
• Develop an environmental management plan and a closure/decommissioning plan;
• Ensure that the proposed mitigation measures are implemented during the construction/development stage through environmental audit;
• Assess impacts apart from occupational, health and safety.

The consultant shall propose methodologies in order to achieve the above objectives.

4 SCOPE OF WORK FOR THE EIA

4.1 Stages

The EIA study will be carried out in three stages;

1. Assessment of alternatives for material lay down areas: The consultant will assess the project alternatives identified during scoping. Alternatives are discussed in section 7 of the scoping report.
2. Detailed EIA on the proposed activities including the selected alternative above.
3. Submission of the EIA to DEA for review

4.2 Activities

4.2.1 Description of the Project

The client will provide the following information during the EIA:

• Detailed description of the proposed screening and crushing process envisaged;
• Confirmation on the dimensions, location and number of screening, crushing and washing plants required for the proposed 12 Mtpa expansion;
• Discussion and assessment of impacts identified according to the EIA methodology required.

The EIA consultant is expected to give a description of the concept and the proposed project and its associated developments such as relocation of existing infrastructure to make way for new developments. This includes for example; the roads, pipelines and sewage. The description must include but not limited to the following:

• Description of the existing and adjacent land use.
• Description of farming activities and annual farming process.
• Description of the processes and stages of the project.
4.2.2 Planning Framework

The EIA should assess the implications of the proposed project on existing international obligations and agreements, national policies and the legal framework.

4.2.3 Environmental and Social Setting

The consultant should also give description of the projects’ environmental setting. The description should cover all environmental components, including but not limited to, existing infrastructure, geology, topography, soils, climate, surface and ground water, hydrology, and water quality, flora, fauna, rare or endangered species, archaeological and historical interest.

4.2.4 Consultations

Further consultations should be carried with those who were not consulted during the environmental scoping. A close liaison should be made with leaders of Morupule and Mmatshadidi. These consultations should be advertised in the local newspapers. All relevant government departments (including Department of Roads) and parastatal institutions (including Botswana Railways) are to be consulted to enable the study to take cognisance of revised policies, guidelines, regulations (bye-laws) that have a bearing on the proposed development.

4.2.5 Assessment of Environmental and Social Impacts and Interventions

The EIA consultant shall identify and assess both positive and negative effects of the proposed development activity. The consultant shall provide a description of the impacts, which shall include the evaluation of the potential impacts of each project stage for all aspects of the project and supporting infrastructure. These need to be assessed in terms of the magnitude, extent, likelihood of occurrence, cumulative, duration, and local, regional, national and international significance of the impacts, and the potential for mitigation.

In addition, the Consultant shall investigate possible impacts on the physical, biological and socio-economic environment with respect to, (but not limited to) the identified impacts in order to make recommendations on all mitigating measures to be taken. In particular the following will be carried out by the consultant;

Soils
- Inventory of potential contaminants
- Material requirements and source of materials
- Soils storage and stockpiling requirements
- Evaluation of construction and operation activities
- Mitigations, soil rehabilitation plan and monitoring

Air Quality
- Identification of sources of dust
- Identification of recipients during construction and operation
• Monitoring of impacts

Noise
• Identification of sources of noise
• Identification of recipients of noise during construction and operation and potential impacts
• Noise baseline and mitigation requirements
• Monitoring of impacts

Hydrology
• Inventory of pollution sources
• Description of the drainage system
• Factors needed to avoid pollution from the site being transported to the Morupule and Lotsane Rivers.
• Consideration for existing private borehole impacts and the potential use of these boreholes for monitoring.

Hydrogeology
• Impact on water supply and water quality including wastewater management
• Documentation of existing private boreholes and wells

Water Supply
• Increased water use as a result of the expansion of the washing plant
• The need for a sustainable, reliable and at times independent supply resource. EIA implications for water supply systems outside the immediate mine area are not considered here.
• The need for water conservation measures
• Inventory of other users of water as a direct result of mine expansion.

Vegetation
• Vegetation sampling to describe the vegetation types and distribution within the proposed areas for clearing.

Animal Life
• Description of the existing wildlife management system and implications of the development on the operation of such system.
• Documentation of existing livestock practises within the lease area

Socio-Economic and Livelihoods Impacts
• Socio-economic profile should be drawn. It should show key socio-economic activities that define the local people’s livelihoods (within the Morupule mining expansion area)

• The impacts on livelihoods should be identified and investigated. This is particularly imperative if the mine’s idea on land appropriation is still active. The main concern is that the compensation money might be abused by the recipients and possibly leads then into abject poverty. It is therefore important that a resettlement plan be prepared if resettlement is required.

• Health impacts such as HIV/AIDS, dust and noise as well as public safety impacts must be assessed by the EIA

• Potential impact to infrastructure existing within the mine lease area such as the Main road to Serowe – EIA to consider the Mine emergency response plans.

• The number of incoming population will be evaluated against available resources

• Evaluation of proposed development on the economy of the area.

• Any other issues of land take

Other Impacts due to Coal Mining and Processing

• Evaluate potential for spontaneous combustion of coal stockpiles and acid mine drainage and identify mitigations.

• Solid and liquid waste management issues

• Evaluate cumulative impacts

4.2.6 Archaeological Impacts Assessment

An Archaeologist has been engaged to undertake the AIA and prepare the report which shall be approved by the Department of National Museum, Monuments and Art Gallery (DNMMAG) shall approve an Archaeological Impact Assessment and the methods used by the Archaeologist. The report will be submitted as a sub-component of the EIA report for the proposed project. A site clearance certificate will be obtained from DNMMAG.

4.2.7 Mitigation Measures and Interventions

The Consultant shall describe both the measures required to mitigate adverse environmental and archaeological effects of every proposed development as identified and other measures that would enhance the environmental quality and integrity of the development area during planning, construction and operation phases. Where the approach to mitigation is not feasible, potential redesign options will be considered and proposed. For each impact assessed, the consultants must indicate their confidence in their predictions and whether the impact is irreversible or not. The cumulative, antagonistic and synergistic effects of the project with other developments in the region must also be addressed.

4.2.8 Environmental Management Plan

The Environmental Management Plan (EMP) will serve as the framework for implementing the mitigation measures during construction and operation of the proposed
development. If a decommissioning stage is envisaged it should also be included in the EMP. The EMP report will provide an institutional mechanism for monitoring and recommend steps for its implementation.

4.2.8.1 Auditing and Monitoring Requirements

From the EMP, monitoring and auditing requirements will be developed to ensure compliance to the EMP and establishment of a monitoring programme. The EIA consultant will undertake auditing during the construction phase and by the client at the end of construction and during operation. All the aspects covered in the EIA/EMP must be evaluated within the context of the government's planning policies, administrative planning guidelines and legislative framework as well as institutional responsibilities.

4.2.9 Decommissioning and Closure Plan

There is need to prepare a decommissioning and closure plans for the new mine and its activities. The consultant will also identify and estimate costs related to rehabilitation and mine closure.

5 PROPOSED EIA TEAM

Core Team

- **Project Manager** to manage the project and team and liaise with the project proponent.
- **Team Leader** an EIA specialist to lead the team and coordinate the teams input.
- **Specialist in Mine EIA** to assess impacts relating to coal mining and processing. This person could double as both team leader and mine EIA Specialist.
- **Wildlife Specialist** and/or **Ecologist** to look at impacts on animal life.
- **Botanist** to identify vegetation distribution and species of importance and assess related impacts.
- **Socio-Economist** to assess socio-economic and livelihoods impacts. The specialist will also undertake consultations.
- **Hydrologist** to assess impacts of mining on the Morupule River and Make recommendations.
- **Hydrogeologist** to assess impacts on groundwater resources and pollution impacts. This person could cover the hydrology and water supply issues.
- **Water Supply Specialist** to assess impacts due to water supply and recommend alternatives.
- **Environmental Engineer** to assess impacts from waste contamination and waste management.
- **Noise Specialist**.
The following will provide Specialist reports, which will be appended to the main report:

- Wildlife and Ecology.
- Botany and Biodiversity
- Socio-Economic and Livelihoods.
- Hydrology, Hydrogeology and Water Supply.
- Noise.
- Closure Plan.

In addition, the AIA report will be appended.

6 AVAILABILITY OF DATA

The following shall be made available to the consultant:

- Reports
  - Project Pre-feasibility studies
  - Mine Environmental Situation Analysis, EMP and Closure Plan
  - EIA for the Design and Build of the North-South Carrier Water Pipeline
  - EIA for the existing Coal Wash Plant
  - MCL Environmental Protection Procedures

- Maps and figures of the project
- Coordinates of the location of project components

7 REPORTING AND TIMING

<table>
<thead>
<tr>
<th>Title of the report</th>
<th>Comments/Timing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inception Report</td>
<td>To be prepared and submitted to client within 2 weeks of signing</td>
</tr>
<tr>
<td>Progress Note</td>
<td>To be prepared and submitted to client within 5 weeks of the Inception report</td>
</tr>
<tr>
<td>Draft Environmental and Impact Assessment, Environmental Mitigation Report and Closure Plan</td>
<td>Client to review report 2 weeks before submission to DEA. Submission to client will be made 3 months from start date</td>
</tr>
<tr>
<td>Final Environmental Impact Assessment, Environmental Mitigation Report and Closure Plan</td>
<td>Submission to DEA. Timing here is unknown and will depend on DEAs review period.</td>
</tr>
</tbody>
</table>

8 STRUCTURE OF REPORT

The main elements of presenting the findings of the EIA into the EIS shall include:

- Executive Summary
9 CONCLUSIONS

The detailed EIA will consider the above impacts and any impacts identified further. The impacts will be assessed considering their magnitude, extent, likelihood of occurrence, duration, and local, regional, national and international significance of the impacts, and the potential mitigation will be provided. A comprehensive Environmental Management Plan will need to be formulated to manage the residual impacts for each project stage. The EMP should include objectives, management criteria, rehabilitation plans, etc.
ANNEXURE 2: APPROVAL OF EXTENSION OF LEASE

NGWATO LAND BOARD

TELEPHONE: (267) 4630 487/280
FACSIMILE: (267) 4631 483
TELEGRAPH: LEFATSHE

PRIVATE BAG 12
SEROWE
REPUBLIC OF BOTSWANA

All Correspondence to be addressed to
The Land Board Secretary

Ref: L/E/1/3(130) 12th August 08

The Manager
Morupule Quaillier
Palapye

RE: Application for extension of mining lease

Ngwato Land Board in its 15-23 June 08 sitting considered your extension and approved it. The issue was handed over to Assessment Committee and you will be notified when date for consultations are finalised.

Yours faithfully,

[Signature]

T. Mochanang for
BOARD SECRETARY
ANNEXURE 3: DNMMAG RECOMMENDATIONS

17 November 2008

A.R.M.S (Pry) Ltd
P.O Box 601271
Gaborone

RE: DEVELOPMENT PERMIT: MORUPULE COLLIERY EXPANSION PROJECT

A development permit is given for the above proposed development at Morupule Coal Mine. This permit applies only to the archaeologically assessed and surveyed area within the boundaries of the proposed area.

After receiving a report for the Morupule Colliery Expansion Project, our office went on a fact-finding mission and inspection of the proposed development area. It was established, after the inspection that indeed the proposed development would not affect the burials and the archaeological sites. The decision to give this permit is given on the understanding that most development takes place under the ground and does not pose any threat to materials on the surface.

However, should your client consider an open pit type of mining in future, some mitigation measures should be done for the sites within the lease area. In case of chance discoveries please inform the Department of National Museum and the consulting Archaeologist immediately.

Thank you

Yours Faithfully

O. Ntebang
For /Director.
ANNEXURE 4: PUBLIC CONSULTATIONS RESULTS

Public meeting advert - second advert

### Meeting Agenda

**Date of Meeting / Letsatsi:** 27th March 2008  
**Venue / Lefelo:** Palapye Main Kgotla  
**Time / Nako:** 0800hrs

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
<th>Responsibility</th>
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<tbody>
<tr>
<td>1.</td>
<td>PRAYER</td>
<td>Village resident</td>
</tr>
<tr>
<td></td>
<td>THAPELO</td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>WELCOME REMARKS AND INTRODUCTIONS</td>
<td>Senior tribal Authority</td>
</tr>
<tr>
<td></td>
<td>KAMOGELO LE KITSISO YA BATSENA PHUTHEGO</td>
<td>Kgosi Ntebele</td>
</tr>
<tr>
<td>3.</td>
<td>PURPOSE OF THE MEETING</td>
<td>M. Konopo</td>
</tr>
<tr>
<td></td>
<td>MAIKAELELO A PHUTHEGO</td>
<td>Debswana Mining Company</td>
</tr>
<tr>
<td>4.</td>
<td>EIA BACKGROUND AND RATIONALE</td>
<td>Debswana Mining Company</td>
</tr>
<tr>
<td></td>
<td>MAIKAELELO A DITSHEKATSHEKO</td>
<td></td>
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<tr>
<td></td>
<td>- Over view of Morupule Colliery expansion programme</td>
<td></td>
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<td></td>
<td>- Tshoboko ya kato loso ya moepo wa Morupule</td>
<td></td>
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<tr>
<td></td>
<td>- Purpose of the EIA Scoping</td>
<td></td>
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<tr>
<td></td>
<td>- Maikaelelo a ditshekatsheko tse</td>
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**Final EIS Volume 1: Morupule Colliery Expansion Project**  
Prepared by Ecosurv (Pty) Ltd  
December 2008

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Minutes of Meeting

The meeting started around 0900hrs and was chaired by Mr. L. Ngwako. An opening prayer was said by J. Ditirwa.

Opening Remarks

Kgosi R. Ntebele welcomed the guests and everyone to the Kgotla. He said that he understood that the objective of the meeting was the intension of expansion activities by MCL. He said the activities may bring about both good and bad impacts to the people and the environment. Therefore, MCL has engaged consultants to look further into these impacts and advise on mitigations.

Objectives of the Meeting

M. Konopo outlined the objectives and also gave a brief summary of what had motivated the study. She said that the objective of the meeting was to formerly announce the proposal by MCL of expanding the mine and other infrastructure.

Role of the client representatives

The role of the client representative was to outline the proposed project as well as motivation for the proposal. M. Menyatso from MCL gave the rationale and background to the project. He pointed out that MCL had a number of customers including BPC, and BCL. He said that the current coal production by the mine was 1 million tones per annum and that the objective is to expand to 12 million tonnes per annum. He said that the mining expansion is likely to continue the current trend of underground mining. However, he pointed out that engineers were still conducting studies to check if there will be a requirement for an open cast operation. He also pointed out that there is a difference between open cast and open pit mining. In open cast, the pit is covered up with soil after the coal is extracted, whilst in open pit the pit is left behind as in the case of diamonds. He also gave a brief overview of the current mining process with the use of a poster. He mentioned that the mine currently has one machine, but are in the process of acquiring another one, which they should have by July 2008. The raw coal from underground is transported to the surface using a conveyor belt.

In addition, currently, the coal is transported to the nearby Morupule power station by a conveyor belt. The supply to the rest of the customers is done through railroad and through trucks. However, he pointed out that the expansion may increase the number of trucks on the road, but there is also an option of using the railroad more to avoid the trucks. He mentioned that Botswana Railways may consider constructing a road to the new Mmamabula power station.
EIA Process

T. Phuthego gave a presentation of the EIA process in Botswana and then pointed out how the proposed project fits into the process. The major phases of the process are:

1. The completion of Preliminary Environmental Impact Assessment (PEIA) form

This is then submitted to the Department of Environmental Affairs (DEA), the EIA authority in the country. DEA will then assess the information and make recommendations as necessary. There may be three outcomes from the DEA after review of the PEIA. These are:

   a. The first is that DEA may rule that the proposed project does pose danger to the environment. Therefore, the project may proceed to the next phase.

   b. The second outcome maybe that the proposed project may have adverse impacts on the environment, therefore DEA may rule that a full EIA be carried out.

   c. The third outcome may be that the information contained in the PEIA form about the proposed project is insufficient, and the DEA may send it back to the project proponent for more information.

2. The Environmental scoping and terms of reference follows the PEIA.

If the decision of the DEA after review of the PEIA is that a full EIA be undertaken, then this stage follows. During this phase, issues and concerns that will be addressed in the detailed EIA phase are identified through a number of activities which include literature review, consultations with identified stakeholders, and visit to the site to gain better understanding of the proposed project area. The scoping report, together with the terms of reference, is then submitted to DEA for acceptance and approval.

3. The detailed EIA phase

When the terms of reference are accepted and approved by DEA, this will then mark the beginning of this phase. During this stage, impacts are assessed and mitigations are proposed. An environmental management plan is prepared after the assessments are complete. More consultations with stakeholders are conducted if they are required.

Table 29: Comments from the public

<table>
<thead>
<tr>
<th>Name</th>
<th>Questions/Comments Raised</th>
<th>Response/Recommendation for Resolution</th>
</tr>
</thead>
<tbody>
<tr>
<td>C.R. Ntebele</td>
<td>Applauded MCL for consulting with community so that the people could be informed of such development and be able to voice out their concerns where possible. He said this was a good progress as in the olden days there were no consultations carried out. He was concerned about the possibility of land collapse because of the digging going on underground.</td>
<td>MCL representatives explained that the mining process being used by MCL is such that there are some pillars left standing to support the ground above</td>
</tr>
<tr>
<td>T.R.R. Ntebele</td>
<td>Asked if it will still be possible to continue using the land on top of the mine. He also wanted to know what would happen to the expansion activities since there is a rumour of airport that has to be built in the area.</td>
<td>Representatives of the mine explained that the mining method being used currently allows for the land above the mine to be used for certain activities such as subsistence farming. The mine has a procedure where they acquire land rights from current occupiers, and this gives MCL the right to control activities/projects that are carried out on the land above the mine. The airport idea could not materialise as activities occurring could have put stress on the land</td>
</tr>
<tr>
<td>Name</td>
<td>Questions/Comments Raised</td>
<td>Response/Recommendation for Resolution</td>
</tr>
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<tr>
<td>M. Olebile</td>
<td>Concerned by the use of machinery in the mining activities as these were possibilities in replacing human labour. He said that when the first machine was ordered a considerable number of MCL employees lost their jobs.</td>
<td>MCL representatives pointed out that even though the MCL purchased a second coal digging machine, the expansion of the mine will create approximately 2000 permanent job positions, and those that had lost their jobs may be taken back into full time employment.</td>
</tr>
<tr>
<td>R. Kebatsholetse</td>
<td>Concerned with the low turn out of attendance at this type of meetings as absentees may be given wrong information about the developments. He gave an example of people being told that they would have to evacuate the land, whilst in truth, nothing to that effect having been mentioned.</td>
<td>Consultants pointed out that they will continue consultations with affected parties within the proposed mine expansion area.</td>
</tr>
<tr>
<td>P. Nkau</td>
<td>Concerned about the underground digging as this may affect some of the property on land such as boreholes in some ploughing fields within the proposed project area. He suggested that maybe MCL should consider carrying out a drilling programme which will help farmers in locating boreholes on areas that will not interfere with the mining activities. He also wanted to understand the procedure proposed by MCL where they own all the rights on the land, but allows people to continue using the land for subsistence purposes. He also asked if residents will be given enough time to find land elsewhere if there is need for them to evacuate from the lease area.</td>
<td>MCL representative explained that the mine encourages people to consult with them before carrying out any activities, so that the mine can approve of such before they are carried out.</td>
</tr>
<tr>
<td>M. Mhatshie</td>
<td>Suggested that that people should be given enough time to apply for land elsewhere if there is need for evacuation from the current lease area</td>
<td>MCL representatives pointed if there is need for people to relocate due to the proposed activities, then the affected parties will be notified and will be given enough time to evacuate.</td>
</tr>
<tr>
<td>K. Tumedde</td>
<td>Asked how an ordinary Motswana would know that Ecosurv was the best company to carry out the job and would also not be manipulated by Debswana to give a product that suite Debswana but not necessarily conforming to the legal requirements. He also asked if the time allocated to carry out the EIA activities will be enough to allow the consultants to fully study the ecology of the area as ecology changes over time.</td>
<td>The consultants explained that the EIA authority in the country (DEA) reviews all the work and gives approval. As for the ecology of the area and other impacts, the consultant pointed out that the EIA has to be completed and approved by DEA before MCL can commence with the proposed activities.</td>
</tr>
</tbody>
</table>
H.M. Masundire  
Commended Debswana on conforming to the EIA process in the country. He asked the about the number of people and where they will be housed that will be coming in during and after construction activities. He also mentioned that with the project of this size, a considerable amount of waste is likely to be generated and asked what would be done with the waste. He went on to point out that the combined effects of the expansion activities of the mine and that of the of the power station may have a larger significance than when considered as standalone project and suggested that maybe it would be worthwhile if the impacts are looked into together by both parties.

MCL representatives said that there will be about 2000 permanent jobs created when the expansion activities are complete. As for housing, majority of the colliery staff resides in Palapye and not at Morupule village. In addition, the mine has applied for more than 70 additional plots in the village. Waste that will be generated will be disposed of at waste facilities in Palapye. The representatives also pointed out the Palapye sewerage network is currently being upgraded to cater for a growing population. They also pointed out that some MCL staff were part of the reference group for the current review of the existing Palapye Planning Area Development Plan, therefore MCL was well informed of the developments in the village. In addition, MCL and BPC have established a for a where information regarding the activities will be discussed

M. Lebalang  
Asked if the expansion will affect the current Serowe – Palapye road. He also mentioned that the suggested open cast mining may introduce stress over vegetation in the area, some of which may be endemic, which may therefore have a bearing on the ecology of the area.

Currently the road is located on top of the mine. The EIA will assess all the impacts that may arise due to the proposed activities, and propose mitigations.

O. Ramalebana  
Asked if there has been a study on impacts that happened earlier such as emissions of green house gases. He also asked how MCL was going to mitigate emissions of the gases during the operation of the new mine. He went on to ask about the source of soil for rehabilitation of the affected areas if an open cast form of mining was undertaken.

There has been a retrospective EIA study (carried out by Geoflux) on the activities of the mine that occurred before the EIA Act was enacted. On the issue of rehabilitation, MCL representatives explained that mining is done to a depth of 13 metres, and the rehabilitation is done with the top soil that is usually put aside.

M. Letshwenyo  
Asked for the clarification on the size of the area that will be affected by the expansion activities to help people to get an appreciation of the land to be taken up by the mine.

MCL explained that the lease area of the mine is about 142 hectares.

Closing remarks

Closing remarks were offered by K. Motshidisi who also applauded MCL on their efforts of consulting with the interested and affected parties. He also pointed out the importance of attending Kgotla meetings as people will be better informed on the developments occurring in their area.

Table 30: Attendance register for the Kgotla meeting

<table>
<thead>
<tr>
<th>Initial</th>
<th>Surname</th>
<th>Initial</th>
<th>Surname</th>
</tr>
</thead>
<tbody>
<tr>
<td>T</td>
<td>Phuthego</td>
<td>M.</td>
<td>Letshwenyo</td>
</tr>
<tr>
<td>M.</td>
<td>Konopo</td>
<td>M.</td>
<td>Gomotsegang</td>
</tr>
<tr>
<td>C</td>
<td>Robertson (MCL)</td>
<td>M.</td>
<td>Nthobatsang</td>
</tr>
<tr>
<td>A</td>
<td>Mutiti (MCL)</td>
<td>M.</td>
<td>Kobe</td>
</tr>
<tr>
<td>M</td>
<td>Majaha (MCL)</td>
<td>K.</td>
<td>Ditshego</td>
</tr>
<tr>
<td>T. R. R</td>
<td>Ntebele</td>
<td>A. K.</td>
<td>Tumedi</td>
</tr>
<tr>
<td>L. R</td>
<td>Nwako</td>
<td>L. M</td>
<td>Motsheo</td>
</tr>
</tbody>
</table>

Prepared by Ecosur (Pty) Ltd
### Table 31: Residents within the proposed expansion area

<table>
<thead>
<tr>
<th>Initial</th>
<th>Surname</th>
<th>Contact details</th>
<th>Concerns</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>N.</td>
<td>Ngwako</td>
<td>71306189</td>
<td>• Compensation will be welcome if there is need for relocation</td>
<td>Subsistence farmer Consulted over the phone on 31/03/08</td>
</tr>
<tr>
<td>A</td>
<td>Malete</td>
<td>Not supplied</td>
<td>• MCL has to keep residents informed of the changes</td>
<td>Subsistence farmer</td>
</tr>
<tr>
<td>P.</td>
<td>Kethamile</td>
<td>71683848;</td>
<td>• Prepared to relocate if there is compensation or if new plot is provided</td>
<td>Subsistence farmer</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4633764</td>
<td>• Asked if MCL can avail some of their boreholes for use by the community within the</td>
<td></td>
</tr>
<tr>
<td>Initial</td>
<td>Surname</td>
<td>Contact details</td>
<td>Concerns</td>
<td>Notes</td>
</tr>
<tr>
<td>---------</td>
<td>---------------------</td>
<td>-----------------</td>
<td>------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
<td>------------------------</td>
</tr>
</tbody>
</table>
|         |                     |                 | lease area as this will reduce compensation cost to those who may wish to drill boreholes  
• Asked why Land Board is continuing to allocate land ownership within the lease area, but not telling people about the land  
• MCL has to consult and compensate if it takes land away from the farms  
• Attended the meeting where MCL explained about land rights  
• If people have to relocate, MCL should compensate for developments  
• Will not refuse to relocate as the development is for the nation  
• It will be good if there is compensation  
• Has drilled a borehole after consulting with MCL  
• No major concerns as he is constantly consulting with MCL  
• Aware of lease area since commencement of the mine in 1970s  
• Would like further consultations, possibly by MCL organised through the area councillor  
• Owner not in at time of consultation, but talked to caretaker  
• Concerned about subsidence  
• Will relocate if MCL provides alternative land or take compensation. Will prefer both as it difficult to find land these days. Compensation will be for developments  
• Problem with relocating is having to start afresh at a new place  
• MCL will have to consult in advance if there is need for relocation  
• Will relocate if there is compensation  
• No concerns.  
| E.    | Ntshwabi Sibina    | Not supplied    |                                                                                                                                                                                                                                                                                                                                        | Subsistence farmer     |
| D.    | Gareitsane         | 4634984         | No concerns                                                                                                                                                                                                                                                                                                                         | Consulted with owner’s son (Onalethata) |
| T.    | Sesinyi            | Not supplied    |                                                                                                                                                                                                                                                                                                                                        | Subsistence farmer     |
| M.    | Matshambani        | 71565554, 4632615 | Not in at time of consultation                                                                                                                                                                                                                                                                                                       | Found herd boys at the site |
|       | Monyena            | 72941694        | Not in at time of consultation                                                                                                                                                                                                                                                                                                       | Farmer, has borehole on site (found herd boys) |
| D.    | Phokoje            | Not supplied    |                                                                                                                                                                                                                                                                                                                                        | Subsistence farmer     |
| L.    | Ramokununu         | Not supplied    |                                                                                                                                                                                                                                                                                                                                        | Subsistence farmer     |
| G.    | Sechele            | 71878674        |                                                                                                                                                                                                                                                                                                                                        | Subsistence farmer     |
| J.    | Kgano              | Not supplied    |                                                                                                                                                                                                                                                                                                                                        | Subsistence farmer     |
| M.    | Thoriso            | Not supplied    | No concerns                                                                                                                                                                                                                                                                                                                          | Subsistence farmer     |
| E.    | Small              | Not supplied    |                                                                                                                                                                                                                                                                                                                                        | Subsistence farmer     |
| S.    | Moepe              | Not supplied    | No concerns.                                                                                                                                                                                                                                                                                                                          | Subsistence farmer, with water tanks |
| P.    | Olatotse           | Not supplied    |                                                                                                                                                                                                                                                                                                                                        | Subsistence farmer     |
| N.    | Maguri             | Not supplied    |                                                                                                                                                                                                                                                                                                                                        | Subsistence farmer     |
| B.    | Sebetela           | 71816430        | Not in at time of consultation                                                                                                                                                                                                                                                                                                       | Consulted with farm manager |

Prepared by Ecosurv (Pty) Ltd
**Key Persons Consulted**

**Table 32: Attendance register: key persons**

<table>
<thead>
<tr>
<th>Name</th>
<th>Department</th>
<th>Position</th>
<th>Telephone</th>
</tr>
</thead>
<tbody>
<tr>
<td>D. L. Nkgwana</td>
<td>Maunatlana Sub land Board</td>
<td>Board Clerk</td>
<td>4958221</td>
</tr>
<tr>
<td>G.B. Kenosi</td>
<td>Dept. of Lands – S/Palapye</td>
<td>DOL</td>
<td>4920128</td>
</tr>
<tr>
<td>K. M. Butale</td>
<td>Palapye Sub Land Board</td>
<td>Board Clerk</td>
<td>4924212</td>
</tr>
<tr>
<td>B. Sivia</td>
<td>Physical Planning CDC</td>
<td>PPI</td>
<td>4637227</td>
</tr>
<tr>
<td>D. Omphile</td>
<td>RADP</td>
<td>CDO II</td>
<td>4924855</td>
</tr>
<tr>
<td>CPK Otoo</td>
<td>Health</td>
<td>C.E.F.</td>
<td>4923057</td>
</tr>
<tr>
<td>B.H. Kgakole</td>
<td>Physical Planning</td>
<td>SPP</td>
<td>4923862</td>
</tr>
<tr>
<td>B.M. Mbwe</td>
<td>RADP</td>
<td>SRADO</td>
<td>4924855</td>
</tr>
<tr>
<td>M. Koorate</td>
<td>Maunatlala</td>
<td>TO (L)</td>
<td>4958221</td>
</tr>
<tr>
<td>M. Rankalape</td>
<td>Animal Production</td>
<td>P.T.A.</td>
<td>4924741</td>
</tr>
<tr>
<td>M. Legwaile</td>
<td>Animal Production</td>
<td>Dairy Officer</td>
<td>4924741</td>
</tr>
<tr>
<td>B. Baliki</td>
<td>Animal Production</td>
<td>PTO</td>
<td>4630344</td>
</tr>
<tr>
<td>S.T. Pebe</td>
<td>Animal Production</td>
<td>CTO</td>
<td>4630344</td>
</tr>
<tr>
<td>B. Botumile</td>
<td>DWNP</td>
<td>CCO</td>
<td>4630443</td>
</tr>
<tr>
<td>T. Tshekiso</td>
<td>DWNP</td>
<td>Project Officer</td>
<td>4630443</td>
</tr>
<tr>
<td>K. Wasekgwa</td>
<td>DWNP</td>
<td>ACLO</td>
<td>4630443</td>
</tr>
</tbody>
</table>

**Concerns and Issues**

No concerns and issues were raised during the key persons consultations.
ANNEXURE 5: MCL ENERGY CONSERVATION PROCEDURE MCL/ENV/103 (2007)
INTRODUCTION

The conservation of energy must always be a carefully managed part of MCL planning, operation, and construction activities. Operation, maintenance, and facility improvement elements and conservation efforts must be complementary and should be achieved in a planned program.

PURPOSE

The purpose of this procedure is to make Morupule Colliery an energy efficient company and also to create energy conservation awareness amongst MCL workforce.

SCOPE

This procedure is applicable to all MCL properties including the places of residences and it shall affect all employees and contractors doing work for the Morupule Colliery within the lease area.
RESPONSIBILITIES

Colliery Engineer

The Colliery Engineer is responsible for making sure that all MCL equipment and buildings including places of residences are fitted with energy saving electrical equipment (energy saving bulbs, geysers, stoves, motors) and that the building is energy efficient.

Environmental Officer

The Environmental Officer is responsible for availing new green technologies to the Colliery Engineer.

Control room operator

The Control room operator shall be responsible for informing the plant foreman when there is a more than 3hr breakdown underground for him/her to shut down the plant.

Materials Controller

Materials Controller is responsible for making sure that equipment bought such as bulbs are energy efficient and for including that as requirement in the tender documents.

All MCL employees

All MCL employees are responsible for purchasing and using energy saving appliances in their offices and places of work.

PROCEDURE

BUILDINGS - All new projects shall be made in such a that they are energy efficient. This include fitting them with energy efficient bulbs/ geysers and stoves

EXISTING BUILDINGS - the conventional equipment such as bulbs shall be replaced with the new energy saving bulbs through maintenance program.

NATURAL LIGHT - All new buildings shall be made in such a way that they are energy efficient and they maximize the natural light.

AIR CONDITIONER – all employees must switch off their air conditioners when they leave their offices.
LIGHTS - all employees must switch off their air conditioners when they leave their offices.

PLANT OPERATIONS

Operational Guidelines

1. Plan system operation and maintenance on the basis of "least total cost," considering both labor and energy costs.
2. Reduce running time of energy-consuming equipment through:
   o Equipment shutdown when not required (no continuous operation or idling when there is no demand).
   o Programs for selective load shedding of power in event of excessive peak usage.
3. Adjust lighting levels to no more than illumination required.
4. Optimize heating, ventilating, and air conditioning (HVAC) systems (through modification by way of Capital Improvement Projects where necessary).
   
   o Modify or adjust HVAC systems to avoid simultaneous use of heating and cooling energy use in the same zone or space wherever possible, or minimize such simultaneous energy use within system limitations by resetting the system operating limits.
   o Minimize the rate of air circulation within constraints of applicable laws, regulations, codes, or other necessary limitations.
5. Suggest that personnel minimize individual automobile use through car pooling when doing mine chaos

OTHER CONSERVATION STANDARDS AND GUIDELINES

The following standards and guidelines support MCL’s policy on energy conservation and management in facilities operation. Detailed standards are included on operational limits for example, thermostat settings as well as on more general subjects such as the operation and planning of MCL energy programs.

Application of the standards and guidelines shall not involve any measure that will violate applicable laws, be hazardous to health or safety, cause significant impairment of the instructional effort, or result in an unreasonable minimum standard of comfort.
PLANNING AND DESIGN GUIDELINES

Maintain an inventory of major buildings and systems to:

1. Assess current performance of earlier-instituted operation and maintenance conservation practices, or begin such efforts where opportunities exist.
2. Assess possibilities for modifications to existing systems to reduce energy and water use.
3. Develop a priority list for capital improvements to achieve modification and conversion possibilities and to integrate the possible projects into the Capital Improvement Program for the Facility.
5. Plan new buildings and systems to utilize water-conserving fixtures and features; for example, prohibit "once-through" water cooling systems and continuous-flow operations for intermittent demand.
6. Avoid landscape design or plant replacement that requires excessive water use.

_____________________________________________________
C. M TANGANE      DATE
MINE MANAGER

RELATED DOCUMENTS:

MCL SHE POLICY
1. PURPOSE

This procedure details the method by which all MCL employees and any other Contractor doing work for MCL on the lease area shall follow when preparing site for project or carrying out works which require site clearance.

2. SCOPE

This procedure shall be applicable to MCL employees and contractors preparing to undertake land clearance works or site preparation for any project on the Morupule Colliery Limited lease area. This Vegetation Clearance procedure is applicable to all activities that require vegetation clearance within MCL lease area and or MCL controlled areas. All personnel involved in activities associated with vegetation clearance are required to adhere to this procedure.

Land clearance may be supervised by MCL employees and or undertaken by MCL employees and contractors as part of their operations on the Leases area.

3. DEFINITIONS

Land clearance - is defined as any removal of native and exotic vegetation or disturbance of natural ground.

Permit to Clear form - is the standard form associated with SOP 7 Permit to Clear vegetation.
**Fire Break** – Track which has been constructed to clear vegetation to prevent or control wild fires from progressing into virgin lands.

4. **PROCEDURE**

- The Permit to clear vegetation form must be completed by the applicant, and must include the sketch plan showing how vegetation will be affected by the proposed development.
- The Permit to Clear vegetation form must be signed off by a representative from Environmental section who is to make sure that the methods for clearing allows for selective vegetation clearance in the proposed clearance area.
- The Permit to Clear vegetation form must be signed off by the representative from Environmental section to ascertain that there are no areas of environmental significance or monitoring equipment liable to be damaged.
- The Permit to Clear form must be signed off by the Survey Section Representative who will ascertain that there are no control points or other survey markers that may be damaged by the clearing works.

5. **CONTROL MEASURES**

Morupule Colliery Limited SHE policies must be observed at all times.

6. **MATERIALS AND EQUIPMENTS**

Completed Permit to Clear Vegetation Form  
List of Equipment required for completing clearance activities.  
Site plan

7. **RESPONSIBILITIES**

Everybody who engages in a project or an activity that requires site clearance will feel a Permit to Clear vegetation form.

Environment officer shall maintain original records of each Permit to Clear vegetation application and will be responsible for identifying trees which are supposed to be spared and the prescription of rehabilitation works to the affected area.

All personnel involved in the process of vegetation removal for any development works are to adhere to this procedure without fail.

Environment officer
When on site, conduct daily inspections of the area being cleared.
Assist in the treatment and relocation of fauna.
Ensure supervisor of clearing activities is aware of the location of trees to be excluded from clearing.
Recommend a method to be used for clearing to the project officer
Conduct inspections of the area being cleared.
Identify and Mark out all trees to be left out during clearing.
Notify supervisor of clearing activities and of the location of trees so identified and marked for exclusion from clearing.

Clearing Supervisor/ Project officer

Advise Environment personnel when clearing of vegetation is to occur to allow an inspection to be conducted prior to and post clearing.
Contact Environment personnel if fauna requires relocation.
Ensure clearing is conducted within the specified project area.
Ensure vegetation outside the designated clearing area is not disturbed
Make sure that the site plan reflects trees on the site.
Consult all the relevant business units

C.M TANGANE  DATE
MINE MANAGER
Appendix A

PERMIT TO CLEAR VEGETATION: FLOW CHART

1. Complete all sections of a copy of the “Permit to Clear Vegetation Form” and approach all indicated personnel for their signatures.
2. Land clearance operations carried out
3. Pass original to the Environment section
4. Keep a copy of the original form with sign off completed.
5. Any MCL employees and earthworks contractors working on the job must be given a copy of the permit to clear form.
6. Environmental Section representative to personally check all areas cleared to ascertain any immediate rehabilitation requirements.
7. Environmental Section to be notified upon completion of proposed works.
8. Any extra area needs separate approval via Permit to Clear vegetation procedures.
Appendix B

PERMIT TO CLEAR VEGETATION FORM

MCL/ENV/001: Application and Authorization for Proposed Land Clearance at MCL

Applying Dept:_____________________________________________________
Name:_______________________________________________________________
Section:______________________________________________________________
Signature:____________________________________________________________
Time:_______________________________________________________________
Date:_______________________________________________________________

1. Survey Department Representative
Name:_______________________________________________________________
Signature:____________________________________________________________
Time:_______________________________________________________________
Date:_______________________________________________________________

2. Environmental Section Representative
Name:_______________________________________________________________
Signature:____________________________________________________________
Time:_______________________________________________________________
Date:_______________________________________________________________

As the applicant, I___________________________________ have consulted the above parties and have received the signature of each of the parties above, and have informed the following parties of the area, extent, and period of the proposed land clearance:

Signature ________________     Date: ________________________________

To be completed by MCL Environment Section:
Environmental Section Representative
Date of inspection: __________________________________________________________________

Immediate rehabilitation works required: ________________________________________________
RELATED DOCUMENTS

MCL SHE POLICY OF 2006
ANNEXURE 7: MCL WATER CONSERVATION PROCEDURE (MCL/ENV/102)
MORUPULE COLLIERY LIMITED
(A DEBSWANA COAL MINING OPERATION)

STANDARD PROCEDURE NUMBER : MCL/ENV/102
PROCEDURE : WATER CONSERVATION
ORIGINATED BY : ENVIRONMENTAL COORDINATOR
APPROVED BY : MINE MANAGER
ISSUE NUMBER : 1
EFFECTIVE DATE : 15 OCTOBER 2007
REVISION NUMBER : 0
LAST REVISION DATE : N/A

PURPOSE
This policy is meant to conserve water through efficient use.

SCOPE
This policy shall apply to all properties of Morupule Colliery Limited.

RESPONSIBILITIES
The Utilities foreman is responsible for making sure that all mine houses and offices are efficient in their use of water.

All employees are responsible for conserving water within their offices, place of work and residence.

PROCEDURE
Plumbing
Plumbing in all buildings, including new houses and offices shall be installed with flow control plumbing fixtures to save water.
In all existing buildings the replacement of existing plumbing equipment with equipment that uses less water shall be done through maintenance.

**Low-Flush Toilets** – all new buildings shall be fitted with dual low flush toilets.

**Low-Flow Showerheads** - All new houses and change houses shall be installed with water saving showers heads.

**Faucet Aerators** – all new houses shall be installed with Faucet aerators as a water conservation measure.

**Gray Water Use** – for the new houses and offices, a gray water plumbing system may be integrated into the normal plumbing system for landscaping purposes.

**Landscaping** - Outdoor irrigation shall only take place before 8:30 am or after 4:30 p.m all year except in winter. This rule applies to everyone irrespective of whether the water comes from a mine borehole or other utility. Use of reclaimed water is excluded from this rule.

**Rain water harvesting** - All new buildings shall be fitted with rain water harvesting reservoir commonly known as jojo.

For existing building, budgeting shall be made to install the houses with rain water harvesting reservoirs.

**Water rationing** - As part of our water saving measures each household shall be allowed to use \( X \) litres of water every month beyond, which the household must pay the difference. This is not meant to punish anyone but to encourage people to use this important resource carefully and with environmental sustainability at the back of their minds.

________________________________________________

C.M TANAGANE      DATE

MINE MANAGER
ANNEXURE 8: MCL WASTE OIL AND DIESEL HANDLING PROCEDURE
ISO/ENV/104 (2007)
1. INTRODUCTION
Inappropriate storage and handling of fuels and oils can result in contamination of ground, ground water and surface water as such can harm the environment.

2. PURPOSE
The intent of these regulations is therefore to establish a comprehensive program for the proper management oil and related hydrocarbons through reuse and recycling and other management initiatives.

3. SCOPE
The purpose of this document is to assist the whole of MCL operations with this regulatory compliance. Every section in the Mine is subject to this procedure. Unannounced inspections by environmental section or anybody authorized to do so by Mine Manager will be carried out.

This procedure covers:

- Bulk storage of fuels and oils, including waste oil
- Filling of bulk storage tanks
- Storage and handling of drums
- Refuelling operations
- Procedure for emptying bunded areas
- Fuel and oil spills
Determination of a "waste" as a material that has no intended use or reuse.
Proper labelling of the waste.
Proper accumulation and disposal of the waste.

The following are waste streams that are commonly generated at MCL maintenance workshops:

4. DEFINITIONS

The term "Used Oil" is a broad category and it includes motor oil, vacuum pump oil, synthetic oils, transmission and brake fluids, lubricating greases, etc.

- Used oil does not include products derived from vegetable or animal fat.
- Used oil is prohibited from going to the landfill.
- Environmental Section must perform a hazardous waste determination on each oil waste stream to find out if it should be classified as hazardous. If the used oil stream is determined to be hazardous, then the oil must be handled as a hazardous waste and Environmental Section must coordinate its disposal by the polluter. The main reason for an oil stream to be classified as hazardous is through its contact with solvents (such as brake cleaners and paints) or heavy metals.
- If the used oil is determined not to be hazardous, it may be sent to a recycling centre or reused.

"Oily wastes" are also covered under these regulations. Oily wastes are defined as "those materials, which are mixed with used oil and have become separated from that used oil." This includes oil that has been mixed with "kitty litter," absorbent clay and organic absorbent material. These materials may be taken to the landfill provided that:

- The amount generated is a small amount.
- It is the result of minor leaks or spills from a normal process operation.
- All free-flowing oil has been removed to the practical extent possible.

Large quantities of oily wastes, generated as a result of a major spill or in lieu of proper maintenance of the processing equipment, must have a hazardous waste determination performed prior to disposal. Contact Environmental and Safety section at 279/257/294 to have a hazardous waste determination performed. Environmental Section strongly
recommends that this type of waste be minimized through good housekeeping practices.

Oily rags must be properly disposed of or sent to a rag cleaning service.

5. BULK STORAGE OF FUELS AND OILS, INCLUDING WASTE OIL

1. All fuels and oils in bulk shall be kept in bunded storage, the location of which shall be identified on a site plan.
2. The walls and floor of storage bunds must be impervious to oil.
3. Tank filling points shall be inside the bunded area.
4. Delivery nozzles shall be stored inside the bund and locked when not in use.
5. Bund drain valves, where fitted, shall be designed so that they can only be removed by key or hand held tool, except when emptying the bund under controlled conditions.
6. All bulk storage tanks shall be appropriately labelled with contents and capacity.
7. Spill kits shall be provided close to hand at all workshops.
8. Bunded areas shall be checked monthly for build up of oil residues, rainwater or debris by environmental representative.
9. The inside of the bund shall have a line painted to identify when 10% of the capacity has been filled by rainwater etc.

6. FILLING OF BULK STORAGE TANKS

1. A member of site staff must supervise all tank filling operations.
2. Storage tank levels must be checked to gauge spare capacity before starting filling operations.
3. Check delivery hoses and hose connections for leaks.
4. Report spillages and leaks and clean them up promptly, disposing of waste correctly according to the requirements of prevailing regulation(s).

7. STORAGE AND HANDLING OF DRUMS

1. All drums and containers used for the storage of fuels and oils, including waste oil, shall be appropriately labelled and kept in designated areas. This will include temporary storage areas.
2. All drums or containers will be kept in bunded storage or on bund trays. This will include temporary storage.
3. Where drum taps are fitted these should be secure. The tap should be positioned over a bund tray to collect drips and spillage.
4. No drum shall be stored in the open without a drum cap fitted.
5. Drums shall be secured when moving them about the site.
6. Report spillages and leaks and clean them up promptly.
7. Spill kits shall be provided.
8. Any leak or spill must be contained and cleaned up, and the tank repaired or replaced.
9. Drum storage areas shall be checked monthly for evidence of poor practice.

8. REFUELLING OPERATIONS

1. The person refuelling the vehicle must be present throughout the entire refuelling operation.
2. Check vehicle fuel tank level before starting refuelling operations to gauge how much fuel is required.
3. Check delivery hose from the pump / tank to the nozzle for leaks.
4. All delivery nozzles shall be fitted with an automatic cut-out to prevent over-filling.
5. Ensure delivery nozzle is held upright when moving between storage tank and vehicle.
6. Operatives should be prepared to react to any gas oil splashing out whilst re-fuelling.
7. Fuel delivery nozzles shall be locked or similarly disabled when not in use.
8. Report spillages and leaks and clean them up promptly.

9. PROCEDURE FOR EMPTYING BUNDED AREAS AND UNDERGROUND TANKS

1. Authority of site management is required before emptying a bund.
2. Details of bund emptying shall be recorded and maintained on site.
3. If the contents of the bund include floating oil then the water underneath this oil should be carefully pumped out. The remaining oil coated water should be cleaned with spill sorb.

10. FUEL AND OIL SPILLS

1. Any spillage that cannot be cleaned up promptly with a rag or use of a shovel-full of absorbent material must be reported to the environmental or safety officers who will co-ordinate the response and investigate the cause.
2. Spills to ground shall be absorbed and prevented from spreading by using absorbent materials such as sand, fines, absorbent mats, paper or cloth.
3. Halt the movement of fuel or oil towards a watercourse by creating a barrier in front of it by sand bagging, deployment of absorbent boom or finer dust.
4. If oil enters a watercourse, prevent it spreading by deploying an absorbent boom.
5. If spilt oil or fuel leaves the site the environmental coordinator must inform the Department of waste management and Department of Environmental Affairs.
6. Contaminated materials from clean-up should be put in an appropriately cleaned or disposed of through a licensed Council landfill in line with regulatory requirements.

11. STORAGE OF USED OIL
   1 Generators must store used oil in appropriate containers such as approved drums or tanks that are dedicated solely for the storage of used oil.
   2 Each container must be labelled with the words "Used Oil"/ Waste oil and all containers must be maintained in good condition.
   3 The storage containers must be protected from weather and stored on an impermeable surface.
   4 Waste oil shall be stored in a tank clearly labelled waste oil
   5 The waste oil tank shall be emptied only in the presence of the stores personnel or any other person so nominated.

12. USED OIL-FILTERS
Commercially generated used oil-filters must be cleaned with absorbent before they can be incinerated. Used oil-filters must be stored in above ground containers, which are in good condition and are clearly labeled "Used Oil-Filters".
   - The storage containers must be protected from weather, have a lid and stored on an oil impermeable surface.

13. AEROSOL CANS
Only empty aerosol cans shall be placed in the trash.
   - Aerosol cans that are empty must be accumulated in a container or drum and be disposed of correctly.
   - The container or drum must have a Hazardous Waste Label on it.
14. ACCUMULATION REQUIREMENTS

- Do not accumulate waste oil which is more than 3/4 the capacity of your secondary container.
- Keep all containers closed.
- Keep containment area clean and protected from the weather.
- Do not allow any accumulation of water or liquid on the top of the container.
- All waste containers must have a label identifying the contents.
- No un-approved waste in sink or trash.
- Keep liquid and solid waste streams separate.
- Keep a spill kit within easy access for all section/ workshop personnel.

15. SAFETY PRECAUTIONS

Do not mix incompatibles (ex. Acids/bases, flammables/oxidizers, reactives)

- Always wear personal protective equipment.

16. WASTE MINIMIZATION

Waste minimization is any action that reduces the amount and/or toxicity of wastes that must be transported off-site for disposal. There are three methods of waste minimization.

A. Source Reduction:

The most desirable method of waste minimization is source reduction. This is any activity that reduces or eliminates the generation of waste at the source. This can be accomplished by good materials management, substitution of less hazardous materials and good shop operating procedures. The following are some examples:

- Implement a waste minimization policy and train all employees.
- Make a commitment to reducing waste in all areas of the shop.
- Evaluate the wastes being generated and identify areas where changes can be made.
- Encourage employee’s participation through education, training and incentives.
o Evaluate procedures to see if a less hazardous or non-hazardous materials could be substituted.

o Centralize purchasing of material through one person in the department.

o Minimize inventory and use a first-in, first-out system.

o Keep Material Safety Data Sheet (MSDS’s) for chemicals on file.

o Inventory materials and identify their location at least once a year.

o Update inventory when materials are purchased or used up.

o Purchase chemicals in the smallest quantities needed.

o Label all containers to prevent the generation of unknowns.

o Avoid the use of materials containing arsenic, barium, cadmium, chromium, lead, mercury, selenium, and silver when it is feasible.

o Substitute red liquid (spirit-filled), digital, or thermocouple thermometers for mercury thermometers when it is feasible.

o Consider using detergent and hot water for cleaning parts instead of solvents.

o Use latex-based paints because typically they are non-hazardous.

o Find a vendor that will recycle used antifreeze. Some vendors will recycle the antifreeze on site so the antifreeze never leaves the site.

o Use multi-purpose solvents to reduce the types of hazardous waste that needs to be managed.

B. Recycling:

The second most desirable approach is recycling. When a waste material is used for another purpose, treated and reused in the same process, or reclaimed for another process, this is called recycling. Following are examples:

o When solvent is used for cleaning purposes, use contaminated solvent for initial cleaning and fresh solvent for final cleaning.

o Purchase compressed gas cylinders (including lecture bottles) only from manufacturers who will accept empty cylinders.
Do not contaminate used oil with solvents because this prevents the oil from being recycled.

Recycle solvents.

C. Treatment:
The least preferable technique is treatment. The most common treatment is elementary neutralization.

17. CONTRACTORS AND SUPPLIERS
- No repairs shall be allowed to take place at areas which have not officially been designated repair areas.
- No refueling or refueling of trucks, Lorries or any other vehicle shall be allowed to take place at areas which have not been designated fueling point.
- MCL shall clean the spillage and pass the cost of cleaning to the polluter
- Persistent polluter shall be banned from working with Morupule Colliery Limited

18. FAILURE TO ADHERE TO PROCEDURE
Loss of incentives
Exclusion from participating in SHEQ draws

19. OIL AND CHEMICAL EMERGENCY PROCEDURE
These include the minor, major and serious spill of oil and chemicals within the mining lease that causes or may result in unintended harm to the environment.

The Observer:
- Turn off the source of spillage
- Use adequate absorbent equipment
- Collect the spillage in one site
- Prevent run off by using sand or absorbent
- Dispose the contaminated materials into the appropriate area.
- Report to the Environmental Officer/Safety officer on ext.279/257/223
Environmental Officer:

- Notify the Safety Officer/ Mining Engineer Planning/ and GES
- Liaise with Section Foreman for treatment of spillage
- Arrange for the necessary equipment to clean the spillage.
- Log the incident and report into Environmental Coordinator

Environmental Coordinator

- Liaise with the Environmental Officer for investigation purpose
- Notify the Group Environmental Manager at Debswana Head Office
- Notify the District Environmental Health Officer
- Notify the Mine Engineer (Planning) and Section Manager

Mining Engineer Planning:

- Notify the head of Departments
- Notify the Mine Manager
- Liaise with the Colliery Engineer for provision of transport and equipment
- Report to Exco for information
1. PURPOSE

The protection of the environment is a strategic issue and adherence to this policy will assist Morupule Colliery in achieving environmental objectives.

2. OBJECTIVES

The objective of this policy is to ensure that waste disposal is managed in such a way that its impact on the environment is minimised; This shall be achieved by doing the following

2.1 Different types of wastes are disposed of appropriately in order to minimize adverse environmental impacts.

2.2 A record of waste disposed is obtained.

2.3 Applicable legislation is complied with (Waste Management Act, 1998).

2.4 Rehabilitation and closure objectives are met.

2.5 To estimate quantity and classify types of wastes generated at Morupule Mine.

3. SCOPE
3.1 This policy will apply to all Morupule employees and contractors and spatially it is applicable to all MCL properties.

4. DEFINITIONS

4.1 Inert waste is the term used for waste which contains less than 5% of biodegradable organic components and which are neither wet nor hazardous. If the waste supports combustion it is not considered inert. Examples of inert waste include builders’ rubble, excavation soil, and material from de-silting of drains.

4.2 General waste is a generic term applied to all controlled waste that is not inert, wet or hazardous. It may comprise of garden, domestic, commercial and dry industrial waste. This waste may also contain small amounts of hazardous substances e.g. single cell batteries, weed killer, insecticides etc.

4.3 Hazardous waste is waste that has the potential even in low concentrations to have significant adverse effects on human health and/or the environment. This would be because of its inherent chemical and physical characteristics such as toxicity, ignitable, carcinogenic and other properties e.g. acids, lead fluorescent tubes, poisons such as weed-killer, insecticides, paint and redundant chemicals or medicines.

4. RESPONSIBILITIES

4.1 The Utilities Foreman must ensure that there is a schedule in place for the removal of telecom bins to the designated landfill/dump site.

4.2 The Serowe –Palapye Sub district Council is responsible waste management (waste collection and disposal) at Palapye residential estate. The Utilities is responsible for liaison with relevant Council officials for the smooth and regular collection of waste at all Morupule residential estate in Palapye village.

4.3 Wastes generated by Mine Clinic that could be harmful or hazardous if disposed of in the mine dump site must be incinerated at the mine incinerator. In case that the mine clinic incinerator is not working arrangement must be made with the council to collect and dispose off the clinical waste.

4.4 The clinic nurse is responsible for ensuring that a clinical waste is incinerated.

4.5 The Materials Controller will be responsible for making the necessary arrangements with different foremen and the environmental officer to sell off the mine sellable waste at the earliest possible time.
CONTRACTORS

4.6 **Small works contractors** - will utilize general waste bins or provided with one in areas where they are working. And they may be required to pay for collection of their general waste. This collection does not cover other wastes such as rubble and hazardous waste, which shall remain the responsibility of the contractor.

4.7 **Larger contracts** - will be provided with bins for their general waste. Other waste other general waste will remain the responsibility of the contractor. The contractor may be required to pay for collection of their general waste. The department for which the contractor is working will make sure that the bins are provided.

PLANT

4.8 All plants shall have a cleaning schedule drawn up by the respective foremen

4.9 The wash plant foreman will ensure that the discard dumps are disposed off in an environmental friendly manner. S/He must take all the necessary action to prevent soil and underground water pollution.

4.10 The wash plant foreman shall be responsible for providing barrier around hazardous wastes

WORKSHOPS

4.11 All workshops shall be operated in accordance with applicable legislation.

4.12 The workshop foreman will ensure that all the engineering workshops are kept clean at all time.

4.13 It shall be the responsibility of the General Engineering Supervisor to ensure good housekeeping for all the workshops.

4.14 Cleaning shall be done everyday before any work could resumes
4.15 The workshop foreman shall draw up a schedule for everyday cleaning of his/her workshop.

4.16 The General Engineering Supervisor in consultation with the workshop foreman shall draw up a schedule for monthly **general cleaning** of the all the workshops which shall be done on the last working Saturday of every month.

4.17 The environmental section will facilitate for the landfill site to be internally audited on a bi-annual basis in accordance with Table 2.

4.18 The landfill site assistant will ensure the following

- All waste is inspected before disposal at the landfill site
- Any other waste that is not to be disposed at the landfill site is returned to the originator for sorting.

4.19 Each Environmental Appointee will ensure that waste is managed in accordance with this policy within the area of his responsibility.

5.0 RESIDENTIAL

5.1 General Waste
Waste emanating from places of residences shall be treated as general waste and must be deposited in bins painted in green. Hazardous waste bin may be provided only when the amount of clinical waste generated by a household exceed the expected normal amounts for a normal household.

6.0 PROCEDURE

6.1 General Waste
General Waste will be deposited in 210L drum painted green. Scrap will be deposited in yellow telecon bin. General waste will be deposited at the waste disposal sites

Hazardous Waste
Hazardous waste will not be deposited at the waste disposal site. The disposal methods are as detailed in Table 5.

6.2 Recycled Waste

6.2.1 Aluminum Cans
6.2.2 Aluminum Cans shall be disposed of in white metal boxes with a green stripe. The contents must be transferred to a recycling bag and sent for recycling.

6.2.3 **Glass bottles**
All glass bottles must be returned to the source for recycling. Other glass other than glass bottles must be treated as general waste and deposited in green belted 210L drums.

Note:
Only glass bottles are recyclable. Any other glass for example vehicle glass, broken panes will be landfilled. These are to be deposited in General waste telecon bin.

6.2.4 Used oil will also be sent for recycling and this will be governed by MCL procedure on waste oil and chemicals. Each workshop foreman shall be responsible for ensuring that oil is disposed of to the appropriate place. Care should be taken not to include water.

6.2.5 **Used printer cartridges**
Used printer cartridges will be deposited in a card board box (in the IT section) for recycling as part of recyclable wastes.

6.3 **Salvageable Items**
The area Environmental appointee will identify salvageable items. The Salvage yard Foreman will receive the items for storage at the Blue and Green area salvage Yards. It is the responsibility of the Environmental appointee to deliver the identified salvageable items to the Salvage Yard. Examples of salvageable materials include empty drums, plastic containers, electrical elements etc.

6.4 **Garden refuse**

6.4.1 Garden waste shall be deposited in communal telecoms bins marked garden waste

6.4.2 The Mine shall provide telecom bin at the appropriate location specifically for garden refuse

6.4.3 Each household is responsible for removing the garden refuse from its yard to the appropriate communal telecom bin.

6.4.4 The garden refuse must be disposed off in the appropriate communal telecom bin after they have been cut into sizes appropriate to the telecom bin
6.4.5 Composting – the mine shall make provision for composting of garden refuse by households by providing equipment for shredding of garden refuse by tenants.

6.4.6 The mine landscape assistant/Gardener is responsible for proper disposal of garden waste from the mine gardens.

6.4.7 Tenants in mine house are responsible for shredding garden waste from their houses.

6.4.8 The result of shredded garden waste shall be used as garden compost/organic manure and shall be availed to anyone wanting to use it as organic manure.

6.5 Notice and Signs

6.5.1 The following notices and signs will be displayed at each telecon bin site;
- Site Number, e.g. Security – Telecon Bin Site No. 1
- Symbolic signs indicating – refuse disposal, no smoking, naked flames and the personal protective equipment required by employees or collecting waste.

6.6 Waste Separation

It shall be the responsibility of everyone in the area to ensure that waste separation is done at source. The Environmental appointee shall be accountable to the exercise.

6.7 Waste Removal
- The control of the telecon bin on surface Area shall be the responsibility of the Utility Foreman.
- The Materials Manager will be responsible for making the necessary arrangements with responsible foreman and the environmental officer to sell off the mine sellable waste at the earliest possible time.
MORUPULE COLLIERY

TELECON BIN SITE STANDARD

In order to effectively manage the collection and disposal of solid waste and scrap generated on the mine, the following standard concerning telecon bin sites shall apply.

1. SITES

   1.1 All sites shall have a concrete base that is of sufficient strength to carry the weight of the vehicle used to collect the bins.
   1.2 Telecon bin sites shall be so selected and constructed that they will not be flooded.
   1.3 The base shall be ramped at one end to allow easy access to the site for collection vehicles.

2. TELECON BINS

   2.1 Telecon bins used for garden refuse will be green striped.
   2.2 Telecon bins used for scrap metals will be painted yellow (non recycled nor salvageable).
<table>
<thead>
<tr>
<th>Fleet number</th>
<th>Drivers name</th>
<th>Sec. number</th>
<th>Arrival time</th>
<th>Depart time</th>
<th>Waste type</th>
<th>Origin</th>
<th>Weight or volume</th>
</tr>
</thead>
<tbody>
<tr>
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</tbody>
</table>
### Table 2- Waste disposed at the Landfill sites

<table>
<thead>
<tr>
<th>Waste Description</th>
<th>Disposal Method</th>
<th>Applicable procedures / documents/ Legislation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scrap Metal</td>
<td>Recycle</td>
<td>• Waste Management Act&lt;br&gt;• Salvage yard procedure</td>
</tr>
<tr>
<td>General Waste</td>
<td>Waste disposal site</td>
<td>• Waste Management Act</td>
</tr>
<tr>
<td>Aerosols cans</td>
<td>Waste disposal site</td>
<td>• Waste Management Act</td>
</tr>
<tr>
<td>Any other Glass except bottles</td>
<td>Waste disposal site</td>
<td>Waste Management Act&lt;br&gt;• SHE Policy</td>
</tr>
<tr>
<td>Hydraulic hoses</td>
<td>Flush with water &amp; biodegradable detergent and Waste disposal site</td>
<td></td>
</tr>
<tr>
<td>Paint residues</td>
<td>Waste disposal site</td>
<td></td>
</tr>
</tbody>
</table>


## Table 3 - Recyclable wastes

<table>
<thead>
<tr>
<th>Waste Description</th>
<th>Collection Method</th>
<th>Applicable Procedures/Documents/Legislation</th>
</tr>
</thead>
</table>
| Used Oil          | Used oil tanks are located near stores. | • Standard Contract with the Rose foundation.  
|                   |                   | • SHE Policy                               
<p>|                   |                   | • MCL for handling oil                     |
| Glass Bottles     | Collected in 210 drums painted green. The drums are located in the telecon bin sites | SHE Policy                                 |
| Used printer cartridges | Returned to IT exchange and refill and recycling. | SHE Policy                                 |
| Aluminum Cans     | Collected in painted cages and marked cans only. | SHE Policy                                 |
| Scrap metal       | Collected in yellow telecons | SHE Policy                                 |</p>
<table>
<thead>
<tr>
<th>Waste Description</th>
<th>Disposal Method</th>
<th>Applicable /procedures/Legislation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fluorescent Tubes</td>
<td>- Crush and mix with concrete &amp; landfill</td>
<td>• Environmental Engineering Procedures</td>
</tr>
<tr>
<td>Oily rags</td>
<td>- Incinerate</td>
<td>Incinerator Operational Procedure</td>
</tr>
<tr>
<td>Lead Acid batteries</td>
<td>- Salvage yards &amp; returned to the Supplier</td>
<td>- Procedure Engineering Environmental Procedures - SHE Policy</td>
</tr>
<tr>
<td>Oil Filters</td>
<td>- Incinerate</td>
<td>- Incinerator Operational Procedure</td>
</tr>
<tr>
<td>Used Grease</td>
<td>- Stockpiled at designated areas. Disposal method under investigation.</td>
<td>- Under investigation</td>
</tr>
<tr>
<td>Used tyres</td>
<td>- Return to supplier – make this a standard procurement specification</td>
<td>- Standard contract - SHE Policy</td>
</tr>
<tr>
<td></td>
<td>- Tyres will be returned to the Supplier include that in tender documents</td>
<td></td>
</tr>
<tr>
<td>Medical waste</td>
<td>- Incinerate</td>
<td>- Incinerate – clinics and utilities</td>
</tr>
</tbody>
</table>
ANNEXURE 10: DEBSWANA TOPSOIL MANAGEMENT PROCEDURE
1. **SCOPE**

   This procedure is applicable to all production foremen and supervisors and relevant officials involved in the ore and waste functions.

2. **OBJECTIVE**

   To minimize the amount of top soil and vegetation covered by dumps.

3. **REFERENCES**

   Mines, Quarries, Works and Machinery regulations Part Xvii, Reg.231

4. **METHOD OF CONTROL**

   The mining Engineer (MC&E), Senior mine foreman (dumps and crushers), mine foreman and supervisors shall be responsible for the implementation of and the adherence to this procedure.
PROCEDURE

4.1 Dumping limits

i) For every dump, a plan must be submitted to the Inspector of Mines. On such a plan a limit boundary is to be shown. This limit may not be over tipped at any time unless permission is obtained from the Inspector of Mines.

ii) The limit shall be staked out in the field by the Survey department. The Mine Foreman (Production) shall then employ a tyre dozer to cut a line along these stakes to ensure that it is visible (tipping for 1 year at a time).

iii) All tipping must remain within the demarcated area. The duty Mine Foreman (Production) is to keep a close check to ensure that tipping does not exceed the limit at any time.

5 Removal of top soil prior to Dumping of ore and Waste

i. A dozer shall be used to remove all the top soil from all areas identified for dumps i.e. within the staked area.

ii. The dozer shall cut the depth of 1 meter of soil and vegetation and heap it up.

iii. The top soil shall then be loaded and stockpiled in a designated area for rehabilitation purposes or to be loaded and tipped to rehabilitate the final sides of the dumps or pit.

iv. All areas of top soil shall be surveyed and the area documented accordingly and made available for environmental audit by mines or related audit.
ANNEXURE 11: DEBSWANA DUST SUPPRESSION PROCEDURE
DEBSWANA DIAMOND COMPANY (PTY) LTD  
MINING BU - ENVIRONMENTAL PROCEDURE

<table>
<thead>
<tr>
<th>ENVIRONMENTAL PROCEDURE NUMBER: M1/EP/008</th>
<th>REVISION: 01</th>
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**PROCEDURE:** DUST SUPPRESSION IN THE MINING BUSINESS UNIT

<table>
<thead>
<tr>
<th>ORIGINATED BY:</th>
<th>DATE ISSUED: 19.06.2000</th>
</tr>
</thead>
<tbody>
<tr>
<td>G. MABOTE</td>
<td>EFFECTIVE DATE: 01.07.2000</td>
</tr>
<tr>
<td>SECTIONAL LOSS CONTROL OFFICER</td>
<td>LAST REVISION: 27.03.2003</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>RECOMMENDED BY:</th>
<th>APPROVED BY:</th>
</tr>
</thead>
<tbody>
<tr>
<td>SECTIONAL LOSS CONTROL OFFICER - MINING</td>
<td>MINING MANAGER</td>
</tr>
<tr>
<td>SECT. MINING SUPERINTENDENT PRODUCTION</td>
<td></td>
</tr>
<tr>
<td>DIVISIONAL ENGINEER MINING</td>
<td></td>
</tr>
</tbody>
</table>

**DISTRIBUTION:** MINING BU

---

**1 SCOPE**

This procedure is applicable to all employees in the Mining Business Unit.

**2 PURPOSE**

To define the responsibilities, frequencies and methods of dust suppression in the Mining BU area of responsibility to ensure the safety and health of employees and the environment.

**3 REFERENCES**

- Mines, Quarries, Works and Machinery Act Part 12
- Atmospheric Pollution (Prevention) Act Chapter 65:03 and section 2
- Blasting Procedure – MIN/B/001
- Workplace Air Quality, Ventilation and Temperature Extremes Procedure – M1/EP/005
4 DEFINITIONS

Dust: Dust is defined as any solid matter in a fine or disintegrated form which is capable of being dispersed or suspended in the atmosphere.

5 RESPONSIBILITIES AND AUTHORITIES

The mining production foreman on shift, drill and blast foreman and crushers maintenance foreman will be responsible for the implementation and ensuring the maintenance of the various methods of dust suppression as well as enforcing adherence to the procedure. Scheduled audits by the mining SLCO and line management will check for compliance.

6 PROCEDURE

6.1 Haul Roads, Loading, Dumping And Tipping Area Surfaces

The above mentioned surfaces are to be wetted down by water bowsers on an ongoing basis at all areas of activity that generate dust. Recycled water from the braith-waite tanks, water from the pit goosenecks and maturation ponds are to be used for this purpose. In windy conditions the mining production foreman on shift and dispatch foreman must evaluate the situation and if problem areas are identified they must ensure that the water bowsers wet these areas more often to suppress any dust generated by the activities. They must immediately report any delay or lack of water supply or water bowsers to the relevant maintenance section to be rectified.

6.2 Drilling Operations

The drill and blast foreman must ensure that the drills are regularly filled up with recycled water from the water bowsers and that drill operators utilise the water to suppress any dust from the drilling process. The foreman must also ensure that all the dust covers are in a good working condition and that the cabin seals effectively to keep any possible dust out. The foreman must immediately report any deviations that delays or prevents the dust suppression system to the relevant maintenance section to be rectified.

6.3 Blasting Operations

There is no effective way of suppressing dust generated by blasts. The relevant areas that can possibly be affected by the dust and blasting fumes are evacuated according to the Blasting Procedure – MIN/B/001. To measure the amount of dust carried off during extremely windy conditions a number of fall-out dust monitoring tests will be carried out by the Jwaneng Mine environmental officer according to environmental procedure ISO/ENV/005. The monitoring locations identified will be the Green Area, Jwana Game Park and Jwaneng Township. The results of these tests will be reflected in the Jwaneng Mine environmental reports.

6.4 Crushers And Conveyor Systems

The dust generated by the crushing and conveying process is suppressed by means of water sprays at the crusher and a number of dust extracting plants along the conveyor system. The malfunctioning of any of these dust suppression systems must immediately be reported by the mining production foreman on shift to the relevant maintenance section to be rectified.
ANNEXURE 12: SHE POLICY
Morupule Colliery Limited

Morupule Colliery Ltd is committed to mine its coal reserves in a sustainable and responsible manner and will strive to minimize its impact on the environment and ensure the safety and health of its employees.

The guiding principles will be to:

- Continually improve the company’s safety, occupational health and environmental performance.
- Comply with all applicable laws, regulations, conventions and other commitments.
- Prevent pollution of the environment.
- Conserve natural and other resources.
- Treat the protection of safety, occupational health and the environment as the responsibility of everyone working at Morupule Colliery.

Management will accomplish these principles by:

- Integrating safety, occupational health and environmental considerations into all aspects of the business management process.
- Implementing formal safety, occupational health programs i.e. (OHSAS 18001).
- Implementing formal environmental management systems i.e. (ISO 14001).
- Complying with applicable environmental, safety and health legislation and company standards.
- Providing appropriate awareness and training to all employees and contractors.
- Prevent pollution by managing waste, emissions, noise and dust and where applicable apply the principle of 3 R’S: Reduce, Re-Use and Recycle
- Providing adequate resources and facilities to implement the requirements of this policy.
- Promote sound environmental practices to employees, contractors, suppliers and the local community.
- Conserve natural resources under the mine with emphasis on Water, Energy and Land.
- Proactively engaging with the government, communities and other stake holders on matters related to safety, occupational health and the environment.
- Making public, the company’s safety, occupational health and environmental Policy and performance.
- The policy shall be reviewed annually by MCL management during their Management Review meeting.
ANNEXURE 13: PROCEDURE FOR MINING UNDER RIVERS/ROADS
REMARKS: Regular floor probing must be done to make sure that we are more or less 1.0m from seam floor so that we remain in the low phosphorus part of the seam. Please note that mining widths and heights within the river restrictions must be restricted to 6.5m and 3.5m respectively.
DEBSWANA DIAMOND COMPANY (PTY) LIMITED

HIV/AIDS IMPACT MANAGEMENT

ENGAGING STAKEHOLDERS IN THE FIGHT AGAINST HIV/AIDS

In order to protect the health and safety of employees, Debswana has in place policies and programmes on HIV/AIDS Management as well as Safety and Loss Control and Occupational Health. These policies seek to create a safer working environment, reduce the number of injuries on duty, improve the health of employees and their families and reduce the incidence of HIV/AIDS as well as to address the treatment and support of people who are living with the virus.

Contract work by its nature is migratory because it uproots employees from their normal social and family life and could place them in circumstances of increased risk of HIV transmission. These circumstances may range from single sex hostels, or camps, overcrowded accommodation, poor access to health care services, lack of recreation facilities and lack of access to accurate information. A partnership between Debswana and the companies supplying Debswana with goods or services in the fight against HIV transmission is therefore imperative.

Companies wishing to conduct business with Debswana will be required to actively support Debswana’s policies and efforts in the promotion of health and safety and specifically in the fight against the spread of HIV/AIDS. Debswana offers in return, its excellent health care services, recreation and HIV/AIDS support services.

Companies must demonstrate that they are responsible employers committed to addressing HIV/AIDS within their workforce. This is not only because HIV/AIDS is an issue of concern to employees, their families and the community, but because on the job health and safety are concerns of all. Employers are responsible for providing a safe working environment both physically and mentally through empowering their employees with the knowledge to avoid risks and protect themselves from contracting HIV in the communities related to Debswana’s and other workplaces, and in their personal lives.

Companies will be required to show that they have a workplace policy and programme on HIV and AIDS both at the home base Company and on site at the Debswana premises which includes the major elements noted below.

1. **Work Place Policy on HIV/AIDS**

   An HIV/AIDS policy is the foundation of a Company’s entire programme and is the standard for communication about HIV/AIDS. It establishes consistency within the Company and sets standards of behavior expected of all employees. It instructs supervisors on how to address HIV and AIDS in the workplace and lets employees know where to go for assistance.

   The policy must have a statement on the following areas:

   1.1 Non-Discrimination based on HIV status
1.2 Confidentiality and privacy
1.3 Acceptable performance standard
1.4 Testing of HIV/AIDS
1.5 Ability to work and criteria for ill-health retirement
1.6 Employee benefits

2. Work Place Education / Training Programme

The workplace education/training programme must adequately cover the basic medical facts about HIV and AIDS. It must be designed to give employees current and accurate information not only about HIV issues in the workplace but also about potential risk on HIV infection in their personal lives. Furthermore the programme must assume that some employees are already infected with HIV and may therefore need information on support services within and outside the Company without requiring such employees to disclose their identity.

2.1 Basic Medical Facts

The programme must cover the following minimum medical facts:

2.1.1 Different methods of transmission
2.1.2 Methods of preventing the HIV transmission including universal workplace precautions and safer sex practices
2.1.3 The difference between HIV infection and AIDS
2.1.4 Reduction of myths and fears about transmission

2.2 Workplace Issues

The programme must cover the following issues:

2.2.1 First Aid Programmes must:
- Emphasise the fact that Human blood is a hazardous medium for transmission of the virus
- Establish universal or standard precautions to be used whenever blood is present

2.2.2 Why a co-worker who is infected with the HIV does not pose a risk to others
2.2.3 How to respond to a co-worker who is infected with the HIV virus
2.2.4 How to deal with co-workers who are concerned about working with someone who is infected
2.2.5 How to respond to an employee who wishes to disclose his/her HIV status
2.2.6 Company benefits available to employees (sick leave etc)
2.2.7 Where to go for information, counseling and assistance on HIV/AIDS issues inside the Company
2.2.8 Where else to go for additional information, counseling and assistance outside the Company

3. Facilities and Enabling Structures

3.1 Facilities or opportunities must be provided for attending induction and AIDS education training during working hours

3.2 Facilities or opportunities should be provided for employees to visit the clinic or hospital during working hours

3.3 There must be ablutions/toilet facilities at the workplace for basic hygiene control

3.4 The male condom must be distributed free of charge at both the workplace and the accommodation where the employer provides this.

3.5 A peer education programme must be established which includes peer counseling.

4. Participation in Debswana HIV Structures

4.1 Representation on workplace and multi-sectoral committees

4.2 Representation on peer education and peer counseling structures

4.3 Participation in evaluation activities such as KAP studies undertaken by Debswana.

5. General

Debswana reserves the right to conduct audits in order to establish compliance with this policy.

L.G. NCHINDO
MANAGING DIRECTOR

Bd/HIV/05/2001
ANNEXURE 15: MCL ENVIRONMENTAL MANAGEMENT SYSTEM
MORUPULE COLLIERY LIMITED

ENVIRONMENTAL MANAGEMENT SYSTEM DOCUMENTATION

ISO –EMS – 015

EMS THE ROAD MAP
### TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>SECTION</th>
<th>TITLE</th>
<th>PAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>SECTION A</td>
<td>TABLE OF CONTENTS</td>
<td>2</td>
</tr>
<tr>
<td>SECTION B</td>
<td>INTRODUCTION</td>
<td>3</td>
</tr>
<tr>
<td>SECTION C</td>
<td>ISO 14001 REQUIREMENT</td>
<td>3</td>
</tr>
</tbody>
</table>

#### 4.2 4.2
**ENVIRONMENTAL POLICY**

4.2.2

#### 4.3 4.3
**PLANNING**

4.3.1

- Environmental Aspects                           6

4.3.2

- Legal and Other Requirements                    7

4.3.3

- Objectives and Targets                          7

4.3.4

- Environmental Management Programs                7

#### 4.4 4.4
**IMPLEMENTATION & OPERATION**

4.4.1

- Structure and Responsibility                     8

4.4.2

- Training, Awareness and Competence                8

4.4.3

- Communication                                     9

4.4.4

- Environmental Management System Documentation    9

4.4.5

- Document Control                                  9

4.4.6

- Operational Control                               10

4.4.7

- Emergency Preparedness and Response               11

#### 4.5 4.5
**CHECKING AND CORRECTIVE ACTION**

4.5.1

- Monitoring and Measurement                        11

4.5.2

- Non-conformance and Corrective Action             11

4.5.3

- Records Management                                12

4.5.4

- Environmental Management System Audits            12

#### 4.6 4.6
**MANAGEMENT REVIEW**

4.6.1

- Monitoring and Measurement                        11

4.6.2

- Non-conformance and Corrective Action             11

4.6.3

- Records Management                                12

4.6.4

- Environmental Management System Audits            12
SECTION B

1. INTRODUCTION

In order to improve management of environmental issues related to activities and products of Morupule Colliery, the Mine has implemented an ISO 14001 environmental management system. The Morupule Colliery Limited Environmental Management System (EMS) shall be divided into five levels as follows:

- **LEVEL 1:** EMS Manual
- **LEVEL 2:** EMS Procedures
- **LEVEL 3:** Standard Operating Procedures/Work Instructions
- **LEVEL 4:** Forms/Records
- **LEVEL 5:** Other environmental documents

**LEVEL 1 - THE EMS MANUAL:** shall present the environmental policy, structure of the management system, and related documents. The EMS is designed according to the requirements set forth by the ISO-14001 Standard. Sections 4.2-4.6 parallel the ISO-14001 Standard number scheme. Each of these sections provide specific information or instructions necessary for complying with the requirements in the ISO-14001 Standard.

**LEVEL 2 - THE EMS PROCEDURE:** present all the fundamental procedure that are required by the ISO14001 standard. It will cover area such as the procedures themselves, their DISTRIBUTION, REVISION, AND CONTROL.

The controlled version of the procedures can be accessed on the computer system and it is located in the EMS server. There will be a “Master Copy” in hard copy form maintained by the EMS Coordinator. This copy shall have the signature of the general Manager and the date of approval. Any part of the manual in hard copy form, other than the master copy and controlled copies issued per the distribution list, shall be considered “UNCONTROLLED” and will have “THIS IS AN UNCONTROLLED COPY OF A CONTROLLED DOCUMENT PRINTED” automatically inserted at the bottom of each page when printed.

**LEVEL 3 - STANDARD OPERATING PROCEDURES:** Present all the Environmental standard operating procedures (SOPs) that the mine uses, guide its employees in the execution of activities that may significantly have an impact.
of the environment. This is so that the mine continually improve is environmental performance or limits it environmental foot print.

**LEVEL 4 – FORMS AND RECORD:** Present all the a record of all the forms and records needed by the ISO 14001 Standard.

LEVEL 5 – OTHER ENVIRONMENTAL DOCUMENTS: present all other environmental documents that do not fall into the other four levels. This may include internet downloads on best practices etc.

The five levels shall form MCL Environmental Management System which is essentially a tool for implementing an on-going, systematic and co-ordinated process to assist the Mine in continual improvement of its Environmental performance. The Environmental Management System is an integral part of business and forms part of an overall management approach which includes setting up structures, planning activities, responsibilities, practices, processes and resources for developing, implementing and achieving the MCL SHE policy requirements with its goal of continual improvement. This document therefore provides an overview of the core elements of the Environmental Management System, illustrates their interaction with other business core elements and line functions, and refers to related Environmental Management System documentation.

2. **Scope**

This EMS has been developed specifically to review the work processes and activities that Morupule Colliery and it’s contractors and suppliers perform. This EMS will Identify opportunities for improvement in how work processes and activities are performed; set goals and establish programs aimed at minimizing the wastes generated; reduce the quantity and toxicity of emissions and discharges to the environment; and identify opportunities for improving energy efficiency in conducting day to day operations. This EMS is designed to integrate environmental protection, environmental compliance, pollution prevention, and continual improvement into work planning and execution throughout all work areas. The term EMS will be used throughout this document to represent the an Environmental Management System. This EMS program is founded in the five core elements of the International Organization for Standardization (ISO) 14001 Environmental Management Systems Requirements for Guidance and Use: policy, planning, implementation and operation, checking and corrective action, and management review.
The scope of the Morupule Colliery Limited EMS covers all activities undertaken in our facilities located within the lease area:

- **Underground mining activities (the mine & associated activities)**
- **Surface workshops (all workshops on the surface and associated offices)**
- **Utilities (all surface utilities including boreholes and roads sewage ponds)**
- **Infrastructure/plant (crusher and wash plant)**
- **Special projects (any other projects the mine may undertake)**
- **landfill**
- **Administration (all surface offices)**
  - **Admin block**
  - **Stores**
  - **Security**
  - **Clinics**

The scope excludes facilities such as the game park, place of residence, both at the village and in Palapye.
3. Objectives

The MCL Environmental Management System Roadmap aims to achieve the following objectives:

- To describe the basic elements of the Environmental Management System, how these elements work together and to refer to related documents.

- To provide a description of the Environmental Management System programme as implemented at Morupule Colliery

- To provide a description as to how MCL has organized it’s Environmental programme and how responsibility for Environmental management is delegated.

- To give an indication as to what is required by MCL in order to maintain its Environmental Management System according to the requirements of the ISO 14001:2004 International Standards.
4. CORE Environmental Management System PROCESSES

The core elements of the Environmental Management System process are shown in Figure 1 below. The way in which each of these core elements are implemented and managed at MCL, is described under Section C in this Roadmap document. The numbering of each of the Environmental Management System core elements is further described. This numbering system is followed to synergise the process and for ease of reference to this document.

4.1 FIGURE 1
SECTION C

SECTION 4.2 - ENVIRONMENTAL POLICY

Management Commitment
Morupule Colliery limited its contractor(s) are committed to systematically integrating environmental protection, into management and work practices at all levels so that the mission is accomplished in a manner that protects the environment. Morupule Colliery Limited top management has defined its Environmental policy as below.
MORUPULE COLLIERY ENVIRONMENTAL HEALTH AND SAFETY POLICY OF 2006

Morupule Colliery Ltd is committed to mine its coal reserves in a sustainable and responsible manner and will strive to minimize its impact on the environment and ensure the safety and health of its employees.

The guiding principles will be to:

- Continually improve the company’s safety, occupational health and environmental performance.
- Comply with all applicable laws, regulations, conventions and other commitments.
- Prevent pollution of the environment.
- Conserve natural and other resources.
- Treat the protection of safety, occupational health and the environment as the responsibility of everyone working at Morupule Colliery.

Management will accomplish these principles by:

- Integrating safety, occupational health and environmental considerations into all aspects of the business management process.
- Implementing formal safety, occupational health programs i.e. (OHSAS 18001).
- Implementing formal environmental management systems i.e. (ISO 14001).
- Complying with applicable environmental, safety and health legislation and company standards.
- Providing appropriate awareness and training to all employees and contractors.
- Prevent pollution by managing waste, emissions, noise and dust and where applicable apply the principle of 3 R’S: Reduce, Re-Use and Recycle.
- Providing adequate resources and facilities to implement the requirements of this policy.
- Promote sound environmental practices to employees, contractors, suppliers and the local community.
- Conserve natural resources under the mine with emphasis on Water, Energy and Land.
- Proactively engaging with the government, communities and other stakeholders on matters related to safety, occupational health and the environment.
- Making public, the company’s safety, occupational health and environmental Policy and performance.
- The policy shall be reviewed annually by MCL management during their Management Review meeting.
The EMS team will review the policy annually and any revisions will be presented to management for adoption. The EMS Coordinator will make the EMS Policy available to the public upon request. The policy will be communicated to all MCL employees through training and briefing events.

SECTION 4.3 – PLANNING

Definitions to be used during planning stages.

- **Audit**… systematic examination to determine whether activities and related results conform to planned arrangements and whether these arrangements are implemented effectively and are suitable for achieving the organization’s policy and objectives.
- **Continual improvement**… process of enhancing the Environmental management system, to achieve improvements in overall occupational health, safety and environmental performance.
- **Aspect identification**… process of recognizing that an aspect exists and defining its input and outputs to gauge its impact.
- **Incident**… event that gave rise to an accident or had the potential to lead to an impact.  
  **Note:** An incident where no environmental damage, or other loss occurs is also referred to as a “near-miss”. The term “incident” includes “near-misses”.
- **Interested parties**… individual or group concerned with or affected by the Environmental performance of an organization.
- **Impact (Environmental)**… is defined as any change to people, property and the environment, whether adverse or beneficial, which can result wholly or partially from an organization’s activities, products or services.
- **Non-conformance**… Any deviation from work standards, practices, procedures, regulations, management system performance etc. that could either directly or indirectly lead to injury or illness, property damage, damage to the workplace environment, or a combination of these.
- **Objectives**… goals, in terms of Environmental performance, that an organization sets itself to achieve.  
  **Note:** Objectives should be quantified wherever practicable.
- **Occupational health and safety**… conditions and factors that effect the well-being of employees, temporary workers, contractor personnel, visitors and any other person in the workplace.
- Environmental **management system**… part of the overall management system that facilitates the management of the Environmental risks associated with the business of the organization. This includes the organizational structure, planning activities, responsibilities, practices,
procedures, processes and resources for developing, implementing, achieving, reviewing and maintaining the organizations SHE policy.

- **Organization**... company, operation, firm, enterprise, institution or association, or part thereof, whether incorporated or not, public or private, that has its own functions and administration.
  
  Note: For organizations with more than one operating unit, a single operating unit may be defined as an organization.

- **Performance**... measurable results of the Environmental management system, related to the organization's control of environmental impacts, based on its SHE policy and objectives.

- **significance**... combination of the likelihood, extent and consequence(s) of a specified impact on the environment.

- **Significance rating**... overall process of estimating the magnitude of impact and deciding whether or not the impact is tolerable.

4.3.1 Environmental Aspects

**MCL** has identified all known environmental aspects and related impacts of our activities and products that we can control and have influence over in order to determine which can have a significant impact on the environment. The list of environmental aspects and related impacts will be reviewed at least once annually by the SHE Team and respective section/head of departments to identify the significant aspects. New aspects and impacts may need to be identified and ranked more frequently if modified or new activities occur during the year.

The EMS Team will use the aspect procedure and related documents to carry out the identification and significance ranking of aspects and associated impacts.

Environmental Aspect and Impact Analysis and Ranking Procedure

1) Identify the environmental aspects and impacts of its activities, products, or services that it can control and over which it can be expected to have influence and record those on Environmental Aspect and Impact.

2) When identifying aspects and impacts the EMS Team should consider environmental aspects related to air emissions, discharge of liquid waste, disposal of solid waste, land and water contamination, use of raw material and natural resources, as well as local and community issues. These issues should be considered for normal as well as abnormal operating conditions.

3) After identifying the aspects and associated impacts the EMS Team should rank the associated aspects and impacts for severity of occurrence, frequency of occurrence and quantity. The ranking in **ISOMETRIX** should be used to establish a rank.
4) Aspects that are ranked high in the overall by ISOMETRIX will receive priority in terms of mitigation measures.

4.3.2 Legal and Other Requirements

**MCL** is required to comply with a variety of legal and other requirements that are applicable to the environmental aspects of its activities, products or services. The EMS Coordinator is responsible for keeping up to date on legal and other requirements and communicating information to affected parties. The EMS Coordinator is responsible for handling issues related to permitting, reporting, and auditing requirements.

4.3.3 Objectives and Targets

*Related documents:*  
Environmental aspects Identification (ISOEMS/003)  
Environmental objectives and targets (ISOEMS/005)  
Management Review (ISOEMS/018).

- **An objective** is defined as a practical expression of the commitments made in an SHE policy.  
- **Targets** on the other hand are quantitative and should be achieved within a given period of time. Targets also contain elements of personal responsibility and a number of targets may be set in order to achieve a certain objective.

Based on the above definitions MCL has established and maintained documented environmental objectives and targets. The EMS Coordinator will maintain a listing of documented environmental objectives and targets. The EMS Team will establish environmental objectives and targets annually and they shall depend on the aspects identified. The EMS Team will consider at least the following information when developing new objectives and targets: legal and other requirements, significant environmental aspects and impacts, prevention of pollution, technological options, financial, operational, and business requirements, MCL environmental policy, and views of interested parties. Below is a list of high level objectives:

<table>
<thead>
<tr>
<th>Objectives</th>
<th>Targets</th>
<th>Actions</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Reduce the amount of lubricants (oil and grease) used by machines</td>
<td>Reduce the amount of lubricants by fleet by 10% of baseline FY 2007</td>
<td>Re-use the oil by cleaning it first. Educate employee about the effect of having too much waste oil on the ecosystem and on company profits</td>
</tr>
<tr>
<td>2. Reduce</td>
<td>Reduce by 20% the amount of</td>
<td>Water conservation measures</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td><strong>Water Use in the whole of the mine</strong></td>
<td>Water used by the mine</td>
<td>Educate employee about the effect of wasting water on the ecosystem and on company profits</td>
</tr>
<tr>
<td><strong>3. Reduce gasoline use and air emissions</strong></td>
<td>Improve average MPG of Fleet by: 1 MPG from baseline by FY 2008</td>
<td>1.2) Reduce gasoline use by fleet by: 5% from baseline by FY 2006</td>
</tr>
<tr>
<td><strong>4. Reduce energy (Electricity) consumption by the mine</strong></td>
<td>Reduce electricity used by MCL by 5% of baseline by FY 2006 10% of baseline by FY 2007 15% of baseline by FY 2008</td>
<td>Get energy saving incentives and initiatives for all the sections Install energy saving technologies</td>
</tr>
<tr>
<td><strong>5. Reduce the indiscriminate cutting of trees</strong></td>
<td>Reduce to zero the number of trees cut without permission</td>
<td>Reinforce on awareness and procedure Educate employee about the importance of trees to the ecosystem</td>
</tr>
<tr>
<td><strong>6. Reduce coal dust from the plant</strong></td>
<td>Reduce drastically amount of dust from the plant starting next year by Install a dust suppression system in FY2008</td>
<td>Install a dust suppression system Educate employee about the use of PPEs</td>
</tr>
<tr>
<td><strong>7. Reduce the use of material unfriendly to environment</strong></td>
<td>Start green purchasing next year (stores)</td>
<td>Include in tender documents the green purchasing principles</td>
</tr>
<tr>
<td><strong>8.</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>9. Reduce Paper Use</strong></td>
<td>Reduce paper use to: 10% of baseline by FY 2006 25% of baseline by FY 2007 30% of baseline by FY 2008</td>
<td>Have a check list for printing/photocopying starting next year</td>
</tr>
<tr>
<td><strong>10. Reduce Waste</strong></td>
<td>Increase reuse rate in our building to: 10% by FY 2007 20% by FY 2008</td>
<td>Ensure re-use or recycling of printing and photocopying paper.</td>
</tr>
<tr>
<td><strong>11. Increase the Purchase of Green Products</strong></td>
<td>Include the purchase of green products in any new tender or purchase order by FY 2008</td>
<td>Use re-refined or recycled oil in: 25% of fleet vehicles by FY 2007 30% of fleet vehicles by FY</td>
</tr>
</tbody>
</table>

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<table>
<thead>
<tr>
<th>12. Reduce effect of noise on our people</th>
<th>Reduce the effect of Noise on people’s health starting 2008</th>
<th>Purchase new and effective ear protective equipment (ear clippers)</th>
</tr>
</thead>
<tbody>
<tr>
<td>13. Reduce effect of dust on our people</td>
<td>Reduce the effect of dust on people’s health by reducing the number who get boarded</td>
<td>Purchase new and effective respiration protective equipment (gas mask instead of respirators)</td>
</tr>
</tbody>
</table>

### 4.3.4 Environmental Management Programs

After rating of impacts, MCL shall develop environmental management program for selected environmental impacts depending on their rating and management priority. This EMP shall have **objectives** and **targets** and includes the designation of responsibility for achieving the objectives and targets at each relevant function and level of organization. The EMPs are established to ensure that the organization is able to reach is high level objectives. EMPs that relate to new developments and new or modified activities, products or services, shall be amended where relevant to ensure that environmental management programmes applies to such projects. EIAs reports shall also be used as a source of EMPs. The EMS Team in consultation with the head of department concerned will designate responsibilities, means, and time frames for individual objectives and targets.

**Top Management** will review the progress on objectives and targets annually and approve new objectives and targets in December.

### SECTION 4.4 - IMPLEMENTATION & OPERATION

#### 4.4.1 Structure and Responsibility

**MCL** has defined, documented and communicated the roles, responsibility and authority of personnel in order to facilitate effective environmental management. These roles and responsibilities are identified in a procedure: Resources, roles, responsibility and authority: refer to Resources, roles, responsibility and authority procedure for details.

#### 4.4.2 Training, Awareness and Competence

**MCL** has identified training needs of all employees in relation to its environmental management system. (Refer to training matrix)
The SHE Team is responsible for training all existing and new employees on the environmental policy.

The SHE Team is responsible for making all existing and new employees whose work activities may create a significant impact upon the environment aware of:

- The importance of conformance with the environmental policy and procedures and with the requirements of the Environmental Management System;
- The significant environmental impacts, actual or potential of their work activities and the environmental benefits of improved personal performance;
- Their roles and responsibilities in achieving conformance with the environmental policy and procedures and with the requirements of the Environmental Management System, including emergency preparedness and response requirements;
- The potential consequences of departure from specified operating procedures.

The EMS Team is responsible for evaluating the competence of personnel performing the tasks, which can cause a significant environmental impact on the environment, on the basis of appropriate education, training, and/or experience. Competence will be evaluated by training section and head of section. The EMS Coordinator will maintain all training records in ISOMETRIX. The EMS Coordinator will assure all training requirements identified for contract personnel will be established under the terms of contract or handled directly. Follow-up will be done annually to evaluate conformance with the contract.

### 4.4.3 Communication

**MCL** has developed procedures for handling internal communications between the various levels and functions of the organization and external communications with interested parties. It is the Policy of **MCL** to provide a list of aspects and impacts to any requesting interested parties. The EMS Coordinator is responsible for communicating information relative to the EMS to affected employees. All external request related to environmental issues will be referred to the EMS Coordinator.

### 4.4.4 Environmental Management System Documentation

**MCL** has developed an EMS documentation system that is organized in a four-tier structure:

- **LEVEL 1:** EMS Manual
- **LEVEL 2:** EMS Procedures
- **LEVEL 3:** Standard Operating Procedures/Work Instructions
- **LEVEL 4:** Forms/Records
- **LEVEL 5:** Other environmental documents
Each of these levels will provide direction to relative documents in other levels.

4.4.5 Document Control

MCL has established a Document Control System that controls all documents and data that relate to satisfying the elements of the ISO 14001 standard and ensures: they can be located; they are periodically reviewed, revised as necessary; the current versions of relevant documents are available at all locations where operations could significantly impact the environment; obsolete documents are assured against accidental use and those retained for legal or knowledge preservation suitably identified; and they are legible, dated, readily identifiable and properly stored.

The EMS Coordinator will control the development or modification of any EMS documents. EMS documents shall include: title, document #, origination date, revision #, and names and numbers for any related forms and/or procedures. All EMS procedures must also include the previous items as well as the following: effective date, corresponding ISO Standard and EMS Manual requirements, and person responsible for preparation and an approval signature.

The origination date represents the date the first documented procedure went into effect under the EMS system. The revision date is the date the document was revised. The effective date the date when the newly approved document becomes effective (training should be complete). Revision #s begin with 0, which is the first documented version of this document under the EMS system and are updated subsequently as revisions are made.

The EMS Coordinator will assure all records will be uniquely identifiable by the form number and date completed. Records will be maintained according to requirements of their corresponding procedures and listed in the document control matrixes.

The EMS Coordinator, or designee, will be responsible for moving obsolete electronic versions of a document to the obsolete file and placing new documents on the EMS server once the document has been submitted as approved.

The EMS Coordinator, or designee, will replace existing hard copies of any controlled documents, which have been revised. Controlled procedures will have a statement in the footer that states “****Controlled copies of this document are on the computer network”.

The EMS Coordinator will assure all documents made obsolete by revised or new documents will be stamped “Obsolete” or will be discarded. Hard copies of obsolete procedures will be maintained in the EMS Coordinators obsolete files. Locations and retention times for obsolete documents will be maintained on the document control/training matrixes listed above in the reference material section.

The EMS Coordinator will assure that all new or revised external documents that are referred to in procedures, if appropriate, will be listed in the document control matrixes listed above on the reference section. The document control matrix will include at a minimum the name of the reference material and location.
4.4.6 Operational Control

MCL has identified operations and activities associated with the identified significant environmental aspects. All operating procedures are identified in the document control / training matrix. The EMS Team shall plan these activities, including maintenance, in order to ensure they are carried out under specified conditions by: establishing and maintaining documented standard procedures to cover situations where their absence could lead to deviations from the environmental policy, objectives and targets; stipulating operating criteria in the procedures; establishing and maintaining procedures related to supplies and services used by the plant and communicating relevant procedures and requirements to suppliers and contractors.

4.4.7 Emergency Preparedness and Response

MCL has developed an emergency response plan. The plan identifies the potential for accidents and emergency situations and the corresponding response. The plan also considers the prevention and mitigation of any environmental impacts associated with accidents or emergency situations. These plans shall be reviewed at least every three years or after the occurrence of an emergency.

SECTION 4.5 CHECKING AND CORRECTIVE ACTION

4.5.1 Monitoring and Measurement

MCL has established and maintains a system for measuring and monitoring the key characteristics of our operations that can have a significant impact on the environment. This system includes recording information to track performance, relevant operational controls and conformance with the established objectives and targets. The EMS Team will monitor the following environmental performance indicators:

- Water quality
- Water consumption
- Energy consumption
- Dust/Air quality
- Water abstraction
- Fluorescence tube disposal
- Waste quantities
- Paper consumption
- Scrap quantity
The responsible persons will assure that monitoring equipment are calibrated and maintained and records kept. The EMS Team will periodically evaluate compliance with relevant environmental legislation and regulation using the following procedure.

4.5.2 Non-Conformance and Corrective Action

MCL has established and maintains a procedure to determine the need for and implementing corrective and preventative actions. All employees are empowered to report any nonconformities relating to environmental impacts. Corrective and preventative actions are taken to eliminate the causes of actual or potential nonconformities and are appropriate to the magnitude of problems and commensurate with the environmental impact. Changes to documented procedures resulting from corrective or preventative actions are recorded.

4.5.3 Records Management

MCL has established procedures for identification, maintenance, and disposition of all environmental records. These records are kept to demonstrate conformance to MCL EMS, the ISO 14001 standard and applicable regulations. Environmental records are legible, identifiable, and traceable to the corresponding activity or product involved. Environmental records are stored in a way that they are retrievable and protected against damage, deterioration or loss. The retention times for all environmental records are established and recorded. The EMS Coordinator will maintain a list of environmental records.

4.5.4 Environmental Management System Audits

MCL has established and maintains procedures to carry out periodic audits of the environmental management system. The EMS audit procedure will determine the scope, frequency, methodology, and responsibility for the audits. The purpose of audits is to determine if the EMS has been properly implemented and maintained. Results of the EMS audits are reviewed with the Top Management.

SECTION 4.6 MANAGEMENT REVIEW

The Top Management reviews the EMS annually to ensure continuing suitability, adequacy, and effectiveness of the EMS. This review is documented. The Top Management addresses the possible need for changes to the policy, objectives, and other elements of the EMS. Observations, conclusions and recommendations are document for necessary action and changes.
5. Revision history

<table>
<thead>
<tr>
<th>Issue No</th>
<th>Date issued</th>
<th>Revision No</th>
<th>Date last revised</th>
<th>Amendment details</th>
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<td>1</td>
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<td>None – new procedure</td>
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ANNEXURE 16: DEBSWANA CORPORATE SOCIAL INVESTMENT POLICY
(CSIPOL 001)
CSI POLICY

<table>
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<tr>
<th>Discipline Head</th>
<th>Public and Corporate Affairs Manager</th>
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<tr>
<td>Policy Reference</td>
<td>CSIPOL 001</td>
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<tr>
<td>Applies to</td>
<td>Head Office and Operations</td>
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<tr>
<td>Effective Date</td>
<td>01 June 2006</td>
</tr>
<tr>
<td>Relevant Procedure(s)</td>
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</tbody>
</table>

OBJECTIVE

To put in place a policy that will support and underlie the implementation of social investment projects in Debswana.

POLICY

1. Policy Statement

Debswana to seek to maintain a profitable business environment while at the same time enhancing its reputation and the well being of the communities in which it operates, as well as the country in general. In essence this will mean the following:

1.1 Optimal and inclusive governance structures

Decision-making structures that govern Debswana’s Corporate Social Investment (CSI) programme will, as far as practicable, provide a link for accountability from the organisation to the company’s Board of directors through a Sub Committee of the Board. In addition, it will comprise community representation (where necessary), to ensure projects are taken into account and consulting the community in appropriate ways and that the views obtained are reflected in decisions. Government representation will also be included to ensure alignment with government’s strategies and with the aim of facilitating partnerships between government and Debswana. Debswana’s representation will comprise an executive with sufficient decision-making powers, for example, the MD. As a business representative, the MD will be responsible for cross-functional integration, i.e. involving core areas of the business-including Human Resources, Finance and Communications-to ensure that opportunities and risks are appropriately dealt with. In addition, the MD will report to the company’s Board of Directors on CSI activities. Committee membership will also include the Group CSI Manager, who deals with day-to-day activities of the CSI programme.

1.2 Alignment to Botswana’s economic development strategy

Given Debswana’s central role in the national economy, Debswana will ensure that its regional CSI activities are aligned with development planning at the local, regional and national levels. To this end, Debswana will identify opportunities to work with local economic development programmes such as small and micro enterprise development.
Debswana will also ensure close liaison with regional economic planning agencies, non-governmental organisations and government to assist the process of alignment.

1.3 Alignment with Debswana's business strategy
Social investments will be treated as an integral component of Debswana’s business activities, be aligned with and complement other business processes and strategies concerned with minimising the negative and maximising the positive socio-economic impacts associated with its operations. Debswana will ensure that social investments are not seen as a substitute for adopting and applying best environmental and social practice in relation to core business activities.

Debswana will focus its funding through a strong emphasis on local, site-specific community development, with select national flagship projects that aim to profile Debswana, build its reputation, and allow it to partner with key stakeholders such as government. To this end, Debswana undertakes to split its funding and involvement between those communities that are directly involved with the group’s local operations and funding made at a Corporate level.

The ratio of investment will be as follows: 15% of CSI funding at each mine, while 70% of funding will support the Group’s national/flagship activities.

1.4 Partnerships
Since Debswana aims to collaborate closely and shares common goals and values with the projects that it sponsors, these organisations can be viewed as its partners. To this end, Debswana aims to partner with reputable organisations at a local and/or regional level.

1.5 Stakeholder engagement
Debswana recognises that the CSI function is important as a means of acquiring and acting on high-quality information about stakeholder interests that are likely in the future to translate into market signals, how to build new competencies in and around the business, and how to understand and respond to new forms of risk. Notably social investments should aim to enhance all consultation and stakeholder engagement programs. CSI practitioners will therefore be experienced in stakeholder engagement and community participation.

1.6 Allocation of suitable human resources and budget
Debswana aims to be as professional in managing its impact on society and community relations as it is in all its commercial activities. It also aims to take into account the wider context in which the business operates in its decisions. The implementation of
sustainable social investments requires the allocation of suitable organisational and financial resources. Individuals with appropriate skills and expertise, as well as adequate financial resources will be dedicated to CSI.

1.7 Avoiding dependency while planning for closure
Debswana takes into account the risk of long-term dependency of projects on Debswana's funding. It is important that social investments are designed not to create unrealistic expectations, and include a strategy to ensure long-term financial sustainability. However, Debswana will bear in mind that community development projects may require multi-year funding to achieve meaningful results. The development by Debswana of an appropriate exit strategy will therefore form part of all project planning. The eventual establishment of a Trust, the aim of which will be the mitigation of the effects of mine closure, forms part of Debswana's overall CSI strategy.

1.8 Measurement
Debswana will implement a monitoring and evaluation plan, which will aid us to systematically check that programmes are going according to plan and that money invested in them has been well spent. Given that CSI funds are shareholders' funds, measurement will be an important element of Debswana's CSI programme. Without monitoring of progress, the danger exists that community priorities could be sidelined or that token community involvement could take the place of real participation by local communities. Throughout the monitoring and evaluation process, full account will be taken of the community's views.

CSI measurement will take into account both quantifiable outputs, e.g. new community facilities; voluntary organisations supported; community enterprise start-ups; capacity building initiatives carried out, as well as qualitative outputs, e.g. attainment of results against objectives, whether the project has the desired impact on the project recipients.

1.9 Focus Areas
In order to ensure the maximum effectiveness of its funding at a local level, Debswana operating sites adhere to a set of guidelines, criteria in funding decision-making and controls tools.

At a national level, where Debswana will select flagship projects, a careful distinction will be made between funding of developmental activities (e.g. sports development, school sports programmes), and marketing initiatives (e.g. sponsoring the national football team). Debswana recognises that partnerships provide the opportunity for greater impact. In addition, recognising the scarcity of resources and the need to create sustainability when funding individual projects, joint ventures with other agencies, including the community, are more likely to endure. Debswana therefore subscribes to the Partnering Guidelines, (attached as Appendix 1) which describe the ground rules for
entering into a partnership, whether with government or a non-profit organisation (NGO).

The areas of focus will be at a national level:
- Entrepreneurship and Small Business Development
- Sport development
- Cultural development
- Education
- Environment
- Welfare and Poverty Alleviation
- Exit Strategies
- Employee Involvement (volunteer work in any of the above focus areas)
- Music and Art
- HIV/AIDS

At a Mine operation level:
- Environment
- Community Development
- Education
- Employee Involvement (volunteer work in any of the above focus areas)
- Music and Art
- HIV/AIDS

2. Responsibility

The Corporate Social Investment Manager has overall responsibility for the CSI issues covered under this policy.

3. Scope

This policy covers the operations and Head Office.

4. Budget

The budget for the CSI and CSR programmes shall be in line with international standards for similar extractive industries and the CSI budget shall be agreed annually by the Board.
5. Responsibilities

This policy and its update shall be the responsibility of the Group Public and Corporate Affairs Manager.

Signed:

[Signature]

Chairman of the Board

Date: 15-03-2007

[Signature]

Chairman of the CSI Committee

Date: 15-02-2007