direction with a gradient of 1.1%. The topography is punctuated by small rocky outcrops, with highest point in the permit area being 1510 metres above mean sea level (amsl), and the lowest point being 1380m amsl.

The landscape is dominated by well established dense (in some areas seemingly untouched) Miombo woodland. In general the undulating land dominated by forest gives an impression of unspoilt wilderness. Within PE 591 itself most of the area is dominated by the Miombo forest, interspersed by the village in the centre of PE 591, artisanal workings, rock outcrops, copper clearings and linear features like roads, watercourses and riparian vegetation.

Geology

The Kalukundi deposit is located within the Copperbelt region of the Democratic Republic of Congo approximately 60km northeast of Kolwezi in the Katanga Province. The Kalukundi deposit forms part of the Lufilian Arc, which extends 700km from Luanshya (Zambia) in the southeast and through Kolwezi (DRC) in the northwest.

The Lufilian Arc comprises folded and thrust faulted sediments of the neo-Proterozoic Katanga Super Group, particularly the Upper and Lower Roan Groups (750-850 million years old) and the Kundelungu Group (500-750 million years old). The tectonic grain of the belt comprises NW-SE trending tight to isoclinal, small to large scale, upright to recumbent folds that have been cross-folded.

Geology of the Kalukundi Deposit

The Kalukundi deposit consists of a number of large individual fragments “floating” within the lithologies of the younger Kundelungu rocks. This situation is referred to as a mega breccia. In all there are 12 major fragments at within the boundaries of PE591. Four of these are the focus of this feasibility study, namely Principal and Anticline in the south-central area and Kalukundi and Kii in the NE.

The Principal fragment is the largest and has the highest grades of cobalt of the four fragments. It is 700m in length and dips steeply to the north, with the dip shallowing to about 50º N in the SE. The Anticline fragment lies adjacent to the east and is an isoclinally folded body 300m long and 80m wide. The dip is steep to the east and the fold nose plunges steeply to the NE.

The northernmost fragments both strike to the NE and dip steeply to the SW. The Kalukundi fragment is the southernmost and the larger of the two and is overturned. The northernmost Kii fragment is narrower, but is well mineralised with copper. Both fragments extend to considerable depths below the surface as indicated from deep drill holes completed by Gecamines. An intersection at a vertical depth of 490m confirms the depth continuity of the Kalukundi fragment and also indicating that it forms part of a major synclinal structure with the Kii fragment.

Of the other 8 fragments, two demonstrate good mineral potential. These are the East fragment, located 700m to the east of the Principal fragment and the Kinshasa fragment located in the NW corner of the concession.

The other 6 fragments have been superficially evaluated and warrant further evaluation, therefore every effort will be made not to construct mine infrastructure close to these units.

Land Use

The majority of land cover is relatively undisturbed woodland. There is very little agricultural activity occurring within the permit area. At the time of the first site visit (October 2004), almost all economic activity was focused on artisanal mining. The artisanal mining activities were curtailed in November 2004. There has been some artisanal activity on PE 591 on a much smaller scale, especially in the NW corner of the permit.

Kisankala Village is located at the centre of the permit area and covers an area of 0.75 km^2. This land, as well as the areas where extensive artisanal mining has been conducted forms the only degraded / built up land, equal to only 0.2% of the entire permit area.

Animal husbandry is limited to the keeping of pigs and poultry. The Tsetse fly infestation was not observed in the study area and the absence of cattle is due to other constrains.

During the initial site visit in October 2004, Kisankala village was very densely populated with over 3,000 people residing in an area of 0.75 km^2. Most of this population comprised of artisanal miners who were removed from site in November 2004, resulting in a much smaller population. A census was carried out in January 2005 and it was determined that the population of Kisankala Village was 1,064 people. The census was updated in January 2006 and it was determined that there were 2,361 people living in Kisankala Village. Most of the housing in the village is typically temporary wooden structures covered in whatever material is available (bags, plastic sheeting, etc). Kisanfu is the nearest village to Kisankala and is located 7km to the south. Kisanfu village is less densely populated with more permanent housing and infrastructure.

Land Classification

Regional land classification based on United States Department of Agriculture (USDA) standards indicates medium to low potential for sustainable development. This classification is mainly based on regional soil classification and the deeply developed, extremely weathered, iron and aluminium rich soils characteristic of the area. These soils are nutrient deficient and have poor water retention abilities, though they are easily worked.

Landsat 7 satellite data has been used to identify and outline the distribution of land cover found in the Kalukundi area. Based on satellite data interpretation and field observations, the natural land cover in the area can generally be described as predominantly woodland dissected by the Kisankala Stream and Kii River with associated riparian forest.

Agricultural land is located outside the permit area at the confluence of the Kii and Kisankala watercourses. Kisankala Village in the centre of the permit area forms the only major settlement. A land classification map has been produced from analysis and interpretation of the satellite data and from field observations.

The satellite data used was a quarter LANDSAT 7 Enhanced Thematic Mapper scene acquired in June 2002 (Landsat-7 ETM+, 174-67). The quarter scene covering 8,100 km^2 was of good quality with no cloud cover. The data has a resolution of 30 metres for 5 spectral bands and 15 metres for a panchromatic band. The classification follows common and well researched classification methods and was verified by thorough ground truthing. The higher resolution panchromatic data allowed mapping of roads and watercourses, the 5 bands in the visible and infrared spectra were used for vegetation classification and identification of agriculture land, wetlands and settlements.

Six land cover classes were selected from observations made on the ground. These are savannah / grassland; dambo/wetland; dense vegetation/forest; woodland; clearing/field; and built-up/degraded land. Land class, definition and image characteristics are described in Table 4.1. Figure 4.2 shows the distribution of land classes and proportional land cover within the mine permit area.

Table 4.1 Land Class Definition and Characteristics

Land Class	Definition	Image character	% Coverage over the Permit Area
Woodland	**Often typical Miombo woodland. Well distributed.**	**Reflectance in the near infrared spectral band with more signal from soil than in dense vegetation. Large and uniform features.**	**70 %**
Dense vegetation/ Forest	**Dense vegetation often along watercourses and sometimes on wetland.**	**Very strong signal in the near-infrared spectrum. As strips along watercourses and as "islands" in wetlands.**	**1.5%**
Built-up / degraded land	**Land used for housing and bare agricultural land. Generally rural villages (Kisankala Village).**	**High reflection in all bands. Forming patchy features.**	**0.2 %**
Clearing/Field	**Open non-forested land. Vegetated by grass or crops.**	**Strong reflectance from mineral soil and some reflectance in the near-infrared spectrum.**	**13 %**
Dambo/ Wetland	**Permanently or temporarily waterlogged area. No or few trees. Mostly sedges and grass.**	**High absorption in all bands due to wetness but some response from vegetation. Commonly forming lake or drainage patterns.**	**13.2 %**
Open Savannah	**Open Savannah Grassland. Few trees mostly grass found on plateaux or upland areas.**	**Strong reflectance from mineral soil and some reflectance in the near infrared spectrum**	**2.1 %**

Built-up or degraded land in this case is clearly seen as the area occupied by Kisankala Village.

Dense vegetation/forest occurs along watercourses where human exploitation is minimal and soil conditions favourable. This vegetation type when found away from the main drainage network is present as very dense woodland and along watercourses as riparian forest.

The clearing/field category includes agriculture land, grassland and to some extent other woodland and forest openings. Part of the existing artisanal workings fall into this category, due to the lack of vegetation on the siliceous hills where the fragments are prominent. This is due to the copper poisoning which results in the development of copper clearings.

There is little evidence of any extensive logging or even charcoal burning despite the large population residing within the permit area.

Soils

Soils in the exploration area are typical of the South Katanga region. Soils occupying high ground have a deeply weathered profile, are well drained, and have low fertility. Plate 1 illustrates the depth of the soil profile within PE 591. More fertile, and sometimes hydromorphic soils, with less well-developed are generally found along watercourses and in low-lying dambos.

Upland soils are commonly deep red to yellowish grey with a very thin darker horizon with some organic matter. These soils are characterised by high iron and aluminium content and by very low content of the major nutrients such as potassium, sodium, calcium and phosphor. Lateritic horizons are common and occur as indurated laterite or disintegrated laterite material.

Plate 1 Depth of the soil profile in PE 591

Lowland soils, found along watercourses are blackish, dark brown to light reddish brown and in contrast to the upland soils, contain more organic matter incorporated in the ‘A’ horizon. These soils are less well drained than upland soils with evidence of water logging and gleying on very low and flat land adjacent to watercourses. Cultivation includes maize and a variety of green vegetables. The natural vegetation is grassland with riparian forest along stretches of stream and rivers.

Wetlands occur within the PE 591 with soils corresponding to the soil group “poorly developed, non-climatic, alluvial soils” as defined in Annex VII of the Environmental Regulations.

Dambo (dilungo) soils tend to be sandy loams exhibiting strong evidence of gleying. The upper soil horizon is frequently 5 to 15 cm thick, dark brown to black, with a fair amount of organic matter. Lower soil horizons are light to medium grey with abundant red mottles. These soils are almost permanently waterlogged with a water table at surface in the wet season and at approximately 50 cm depth in the dry season. The natural vegetation on these soils is exclusively sedges and grasses. There is no evidence of cultivation on these soils.

The dambo soils correspond to the soil group "hydromorphic soils excluding wet salic gleyic soils" as defined in Annex VII of the Environmental Regulations.

Soil Erosion

Within the permit area, accelerated soil loss is associated with artisanal workings particularly on steep slopes and hills, but erosion of soils is limited to surface wash. There are no storm water channels. There is only a small amount of agricultural activity taking place and this is mainly downstream of the confluence of the Kii River and Kisankala Stream, outside the permit area.

Soil Sampling and Analysis

M. Chifunda and N.G. Armitage conducted all soil sampling. Soil sampling was undertaken in order to classify typical soils found in the permit area as well as to evaluate the current baseline levels of pH, copper and cobalt.

A clean trowel was used to sample soil over the selected areas. Samples were obtained from the 0-30cm A horizon at all locations. Approximately 250 grams of soil was extracted and placed in labelled plastic bags. The labelling format was KDI (to indicate the Kalukundi licence area), SO (to indicate the sample is soil) followed by the sample ID number. GPS coordinates and photographs were taken at each sampling point. The samples were transported to AH Knight Laboratories, a BSI 9002 accredited laboratory in Kitwe, Zambia for analysis.

Soil sampling points were selected according to the probable location of planned surface facilities such as the waste rock dumps, tailings storage impoundment and plant area, all of which are likely to have long-term future impacts on soil quality. Baseline values of important parameters such as pH, copper and cobalt levels are therefore needed to provide a comparison with any future soil study conducted to evaluate soil contamination in the vicinity of the mine and processing facilities. A suspected copper clearing was observed during the initial site visit and a sample was taken to evaluate copper levels in the soil for this type of vegetation anomaly.

Results indicate that (as would be expected) copper and cobalt levels are generally high across all sampling points. In addition, relatively low (acidic) pH values were recorded (between 4.4 and 5.5) in almost all of the samples.

High copper and cobalt values were recorded at one of the sites designated as a future waste rock dump (north of the Kisankala stream), the plant area and at the copper clearing. Analysis results are presented in Table 4.2 below.

Table 4.2 Soil Sampling Analytical Results

Area	Sample ID	Easting	Northing	pH	% Clay	Cu µg/g	Co µg/g
Probable site for future Waste Rock Dump (North)	KDI/SO/01	382555	8824461	5.5	0.14	339	110
	KDI/SO/02	382563	8824542	5	0.32	277	100
	KDI/SO/03	382628	8824409	4.9	0.21	197	100
Possible site for future Tailings Dam (south)	KDI/SO/04	381712	8824125	4.6	0.2	133	20
	KDI/SO/05	381701	8824178	4.4	0.25	119	18
	KDI/SO/06	381761	8824165	4.4	0.16	75	10
Probable site for future Waste Rock Dump (South)	KDI/SO/07	381500	8823500	5	0.32	85	20
	KDI/SO/08	381517	8823642	4.5	0.28	140	18
	KDI/SO/09	381641	8823516	5	0.31	185	50

Area	Sample ID	Easting	Northing	pH	% Clay	Cu µg/g	Co µg/g
Probable future plant site	KDI/SO/10	383301	8823828	4.6	0.36	169	20
	KDI/SO/11	383319	8823703	4.5	0.56	284	80
	KDI/SO/12	383439	8823722	4.8	0.18	459	152
Possible site for future Tailings Dam (North)	KDI/SO/13	384326	8823134	4.8	0.69	73	10
	KDI/SO/14	384385	8823014	4.8	0.4	160	30
	KDI/SO/15	384214	8823056	4.6	0.44	82	10
Suspected Copper Clearing	KDI/SO/16	380207	8825177	5.2	0.29	318	65

Local Hazards

Local hazards are associated with thunderstorms and fires, both natural and man-made.

Thunderstorms

During the rainy season (November to March) strong winds, lightening, heavy rainfall and sometimes hailstones associated with thunderstorms, are normally experienced in the area. The strong winds accompanying rainstorms damage crops, wooden huts and houses. Lightening strikes set off bush fires and cause death in a few rare cases. Heavy rainfall results in flooding of the houses and huts due to poor drainage and the poor state of housing in Kisankala village. Hailstorms can occasionally cause crop damage.

Fire

Bush fires caused by lightening strikes and shifting cultivation (slash and burn agriculture) can cause property damage and personal injury.

Seismicity

The seismic hazard map of Africa (G. Grünthal, C. Bosse, Geoforschungs Zentrum, Potsdam, Germany) shows that there is a 10% probability of a peak ground acceleration of between 0.4 and 0.8m/s2 being exceeded every 50 years in the project area. Kalukundi is considered to be an area of low to medium seismic risk/hazard (refer to Figure 4.3 below).

Landslides

Landslides are possible due to the undulating topography, Artisanal workings and the exploration activities taking place in the area. The damage that would result from this hazard would be minor since the vegetation cover is well established. Seismicity is low and is unlikely to trigger large earth movements.

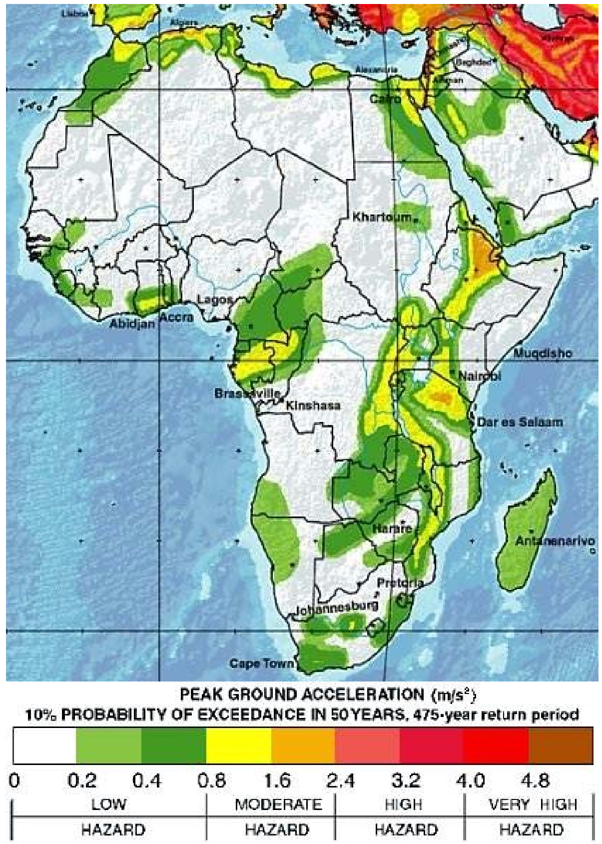


Figure 4.3 Seismic hazard map of Africa (G. Grünthal, C. Bosse, Geoforschungs Zentrum, Potsdam, Germany)

<u>Noise and Vibration</u>

There is no historical data for Kalukundi project area. Due to its remote location and the absence of active industry in the area, current noise levels are associated with drilling operations, Artisanal workings, social activities and natural elements i.e. wind, rains and thunderstorms. Daytime noise levels are basically very low compared to other areas.

Due to social activities in the evening at Kisankala village, noise levels are higher than daytime levels. Morning noise levels can also be higher during religious ceremonies.

Noise from traffic is very low as the project area is about 4 km from the main road. Vehicle noise was observed in October 2004, from trucks coming to buy ore from the Artisanal workers and also from vehicles used by contractors.

There are no significant sources of vibration in the project area apart from traffic using the mine access road and localised exploration drilling activities.

4.1 Climate and Air Quality

4.1.1 *Regional Climate*

There are four main weather stations with reliable historical meteorological data located around the Kalukundi project area. These are Lubumbashi (220km south east of the site), Kolwezi (50km west of the site), Solwezi and Mwinilunga in Zambia (situated 165km south-southeast and 175km south west of the project area, respectively).

These weather stations indicate that the typical regional weather conditions are defined by two distinct seasons of the year. These seasons are, the dry and cool season (May to September), and the rainy season (October to April).

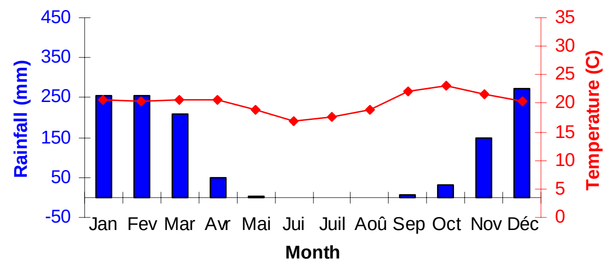
4.1.2 *Local Climate*

The climate data derived from Lubumbashi (1912-1983), Kolwezi (2001-2003), Solwezi and Mwinilunga (1981-1991) indicates that the average total rainfall of the region is between 1220 and 1320mm. Figure 4.4 below shows four graphs of precipitation and maximum temperatures for the four climate centres described above. The Kolwezi graph has a high average monthly rainfall for May because the year 2002 had a highest total rainfall in the data period of 2001-2003.

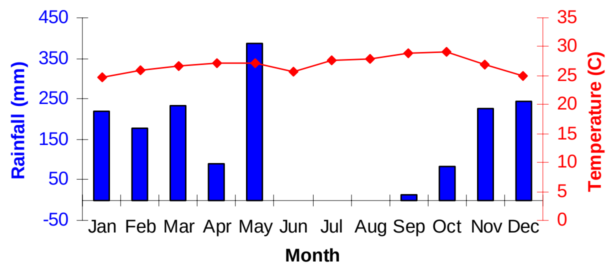
Rainfall mainly occurs in heavy thunderstorms, which can produce between 10mm and 40mm of rain during a typical precipitation event.

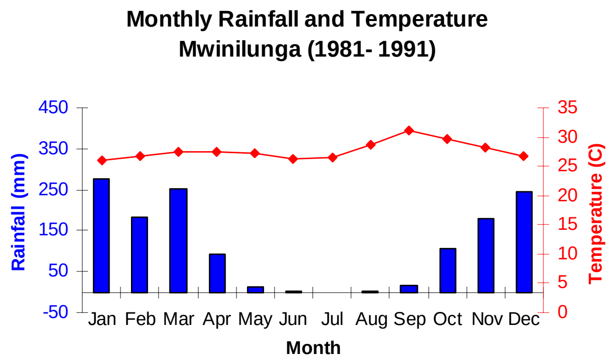
Extreme weather events such as floods, droughts and high winds do occur from time to time. The 30-year and 100-year maximum 24-hour storm event is calculated as 135 mm and 162 mm respectively. Annual rainfall of between 1,400 and 1,500 mm per annum is likely to be reached or exceeded one year out of five.

Monthly Rainfall and Temperature
Lubumbashi (1912 -1983)



Monthly Rainfall and Temperature
Kolwezi (2001- 2003)





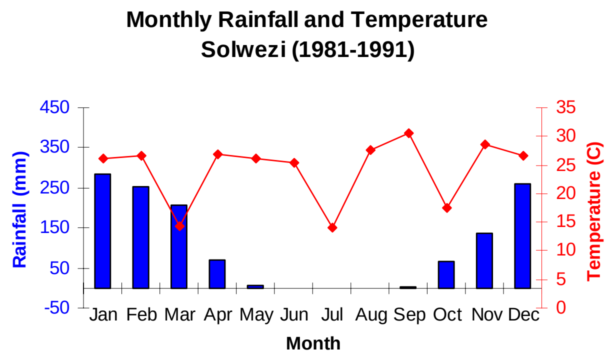


Figure 4.4 Average Monthly Temperature and Precipitation Lubumbashi (1912-1983), Kolwezi (2001-2003), Mwinilunga (1981-1991) and Solwezi (1981-1991)

Rainfall

The climate data derived from Lubumbashi (1912-1983), Kolwezi (2001-2003), Solwezi and Mwinilunga (1981-1991) indicates that the average total rainfall of the region is between 1220 and 1320mm. Figure 4.5 above shows four graphs of precipitation and maximum temperatures for the four climate centres described above. The Kolwezi graph has a high average monthly rainfall for May because the year 2002 had a highest total rainfall in the data period of 2001-2003.

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Extreme weather events such as floods, droughts and high winds do occur from time to time. The 30-year and 100-year maximum 24-hour storm event is calculated as 135 mm and 162 mm respectively. Annual rainfall of between 1,400 and 1,500 mm per annum is likely to be reached or exceeded one year out of five.

Evaporation

Evaporation generally exceeds precipitation for most of the year. Potential evaporation is highest in the driest months and during the beginning of the summer (September to November). Annual mean evaporation exceeds annual mean precipitation by ≅ 850 mm.

Humidity

Meteorological data from Kolwezi indicates that the average annual humidity for Kolwezi during 2001-2003 was 65%. Mean monthly humidity levels vary from a minimum of 51% in the cool season (June-August) and a maximum of 81% during the rainy season (November-March).

Meteorological data from Mwinilunga and Solwezi (1981-1991) indicates that average annual regional humidity is between 65% and 70%. Mean monthly humidity levels vary from a minimum of 50% in the cool season (June – August) and a maximum of 80% during the rainy season (November to March).

Temperature

Average annual temperatures in the region vary between 20ºC and 28ºC throughout the year. Minimum temperatures occur during the cold season months of June and July with temperatures varying between a minimum of 4ºC and a maximum of 25ºC. Maximum temperatures occur in the month preceding the onset of the rains (October) with minimum and maximum temperatures, during the month of 18ºC and 32ºC respectively.

Wind

Meteorological data from Mwinilunga indicates that, the predominant dry season wind direction is from the east-southeast. Mean monthly wind speeds vary from a low of 1.6 m/sec in February to a high of 3.4 m/sec in September. Maximum gusts range from about 22 m/sec in the dry winter months up to 30 m/sec in the wet summer months.

Thunderstorms during the summer are generally associated with west-north-westerly winds.

Sunshine

Mean annual sunshine in Kalukundi is estimated to be between 2,500 to 2,600 hours based on meteorological data derived from Mwinilunga and Solwezi.

Risk of Meteorological Disasters

The risk of meteorological disasters such as dust storms, hail, torrential rain, hurricanes, cyclones, floods or droughts is very low in the region and project area.

4.1.3 *Air Quality*

No air quality data is available for Kalukundi area. Field observations indicate that the general air quality in the area is good. However, seasonal variation as well as localized and temporal deterioration in air quality does occur.

Grassland and forest fires, charcoal burning and shifting cultivation practices during the dry season generate smoke and dust. This air pollution hangs over the area and forms a distinctive haze. The haze layer is visible from the air and worst during the coolest months (June and July) when temperature inversions tend to trap the smoke near ground level. The haze lasts until the arrival of the rains in November. Local air quality deterioration is also associated with village domestic fires.

4.2 Water Sources and Watercourses

4.2.1 *Surface Water Drainage*

There are two small tributaries located within the permit area. The sources of both these watercourses are located within the boundaries of the permit area. These are the Kii river located in the north-eastern corner of the permit area and the Kisankala stream located in the centre of the permit area. The Kisankala Stream flows into the Kii River 200m northwest of the permit area. The local topography slopes west-northwest, with the Kisankala Stream draining in a north-westerly direction and the Kii River draining in a westerly direction.

The Kii River flows into the Lualaba River 25km west north-west of PE 591. The Lualaba River eventually flows northwards into the Congo River system.

The watershed of Kii and Kisankala watercourses totals 3890ha and includes most of the permit area. The area of the watershed was calculated from mapped satellite images, and from a regional terrain model obtained from United States Geological Survey.

Water quality of the Kisankala stream is influenced by the large population residing within 200m of the source of the stream. The water quality is impacted by constant water abstraction, the washing of heterogenite, agricultural activities and the seepage of sewage from pit latrines in the area.

There are no dambos (flat and wet channel less valleys) or other wetland features in the permit area apart from a few small seasonally waterlogged areas along Kisankala stream. These areas are almost entirely cultivated.

Surface Water Sampling

Four representative water-monitoring sites were chosen to evaluate the baseline surface water quality. The location of the monitoring sites is shown in Table 4.3. The watershed of water sampling point SW/01 is approximately 3890ha of which 1880ha is within the mine permit.

Table 4.3 Surface Water Monitoring Sites – Co-ordinates and Description of Physical Location

Monitoring site	Site GPS UTM Co-ordinates		Physical Location
	Easting	Northing	
KDI/SW-01	380016	882545	Kii river, 20m downstream of the confluence with Kisankala stream, 50m outside the north-western corner of the permit area.
KDI/SW-02	382396	8824366	Kisankala stream, 750m downstream of the source. Point which would receive future runoff from proposed WRD and Tailings dam
KDI/SW/03	382865	8823916	Kisankala stream. 50m downstream of the source just upstream of the water abstraction point.
KDI/SW/04	3841494	8825425	Kii river. At the source of Kii river

Figure 4.5 below shows the location of the sampling points. These were sampled twice.

Rationale for monitoring site selection: -

- *Monitoring Site – KDI/SW/01*
  Point at which all runoff (and future surface water pollution) from the permit area will eventually report. The most likely point for future monitoring of compliance.

- *Monitoring Site – KDI/SW/02*
  Likely receiving point for any future runoff from the proposed WRD and Tailings Facility.

- *Monitoring Site – KDI/SW/03*
  Likely receiving point for any future runoff or discharge from the proposed plant and open pit areas. Also an indicator of groundwater quality (the source of the stream being a spring).

- *Monitoring Site – KDI/SW/04*
  Likely receiving point for discharge or runoff from the proposed C4 pit in the north-eastern corner of the permit area. Indicator of groundwater quality (the source of the river being a spring).

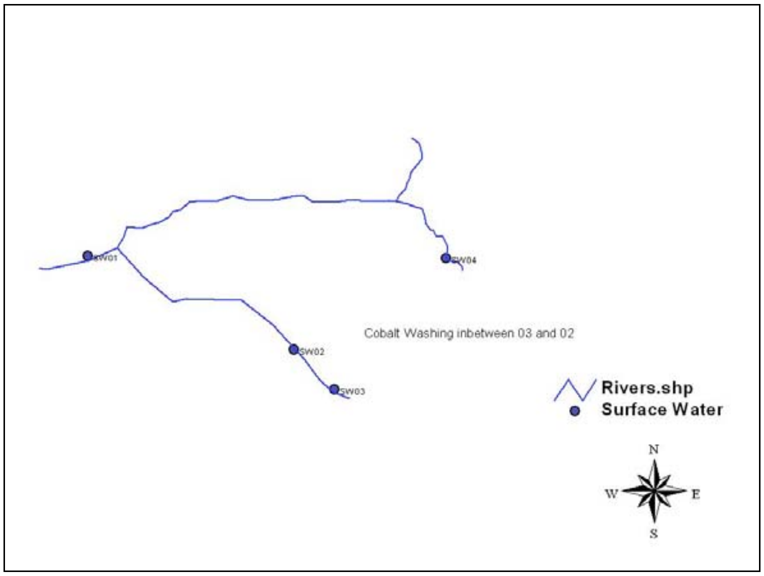

Figure 4.5 Sampling Site Locations

Sampling Frequency

A single set of samples was collected on the 26th October 2004 to investigate surface water quality. Full suite chemical, physical and bacteriological analyses were performed on samples obtained from the four surface water sampling points. A further set of samples was collected in January 2005 to evaluate the seasonal variation of selected parameters based on the initial analysis during the peak of the rainy season.

Field Water Quality Measurements

Field water quality parameters were measured at each sampling point using a Horiba U-10 water probe. The parameters measured were pH, conductivity, turbidity, temperature and salinity. The Horiba U-10 water probe was calibrated before and after sampling using standard calibration solutions. Field water quality measurements are detailed in Table 3.4.

The field sampling results, shown in Table 3.4, suggests that the water in the Kii river and Kisankala stream are generally of good quality. pH values are normal and the conductivity is low.

Analytical Parameters

Surface water sampling and subsequent analysis provides the basis on which to design the environmental monitoring programme for the mine.

During AMC's initial sampling exercise the physical, chemical and bacteriological parameters that were tested included: -

pH	Nitrates
Conductivity	Phosphates
Total Dissolved Solids (TDS)	Cyanide
Total Suspended Solids (TSS)	Colour
Sulphates	Turbidity
Fluoride	Total Coliform
Chloride	Faecal Coliform

Total and dissolved metals tested included: -

Aluminium	Lead
Arsenic	Magnesium
Boron	Manganese
Barium	Mercury
Beryllium	Molybdenum
Cadmium	Nickel
Cobalt	Selenium
Chromium	Vanadium
Copper	Zinc
Iron	

In the second sampling exercise (January 2005) the following physical, chemical and bacteriological parameters that were tested included:-

pH	Conductivity
Total Dissolved Solids (TDS)	Total Suspended Solids (TSS)
Sulphates	Turbidity
Total Coliform	Faecal Coliform

Total and dissolved metals that were tested included:-

Aluminium	Copper
Cobalt	Chromium
Lead	Manganese

Fieldwork Sampling Results

Fieldwork results were obtained using a Horiba U10 sampling probe. The parameters that were measured were pH, conductivity, turbidity, temperature and salinity. Descriptions of environmental conditions at the sampling sites were also made. The results of field sampling are shown in Table 4.4 below.

<u>*Sampling Personnel and Procedures*</u>

N.G Armitage and M.L. Chifunda (AMC) conducted all water sampling. Sampling was completed in accordance with internationally accepted procedures for the collection of surface water samples for physical, chemical and bacteriological analysis. Samples were analysed at Alfred H. Knight Laboratories, a BSI 9002 accredited laboratory in Kitwe, Zambia Analytical results of surface water analysis are detailed in Table 4.5.

The results show that the surface water in the Kii and Kisankala watercourses is generally of good quality with little discernible difference between the source waters of both rivers.

A small presence of bacterial coliforms were detected in the water sampled from the Kii river (SW-01 and SW-04) which, according to World Health Organisation (WHO) and DRC Drinking Water Quality Standards, make the water unsafe for drinking. The source of the bacterium could be a result of the use of manure on fields located at the source and along the course of the river Kii or seepage from pit latrines. No coliforms, faecal or otherwise, were sampled in water from the Kisankala stream.

The total metal concentrations (Table 4.6) are generally well within the WHO and DRC Drinking Water Quality Standards. However, the lead concentration at sampling points SW-02, SW-03 and SW-04 are equal to or exceed the WHO Drinking Water Quality Standard of 0.01mg/l.

The surface water sampled has a total aluminium concentration well above the DRC Drinking Water Quality Standard for aluminium of 0.05-0.2mg/l. Chronic long term exposure to elevated Aluminium has been associated with higher incidence of Alzheimer's disease within older population groups.

The washing of heterogenite in the Kisankala Stream was carried out between sampling points SW-02 and SW-03. This is evident at sampling point SW-02 which shows elevated cobalt concentrations of over ten times that of which is found at SW-03 upstream of the heterogenite washing area. In addition SW-02 indicates increases in turbidity, sulphate concentration, manganese (above DRC drinking water quality standards), conductivity and total dissolved solids compared to the upstream sampling point. These conditions are reflected in the stream sediment samples detailed below.

Table 4.4 Fieldwork Sampling Results for the Four Sampling Locations

Sampling Point	Date	Parameters					Comments
		pH	Cond. (mS/cm)	Turbidity (NTU)	Temp. (°C)	Salinity (%)	
KDI/SW/01	26/10/04	6.1	0.280	1	21.9	0.01	09:15hrs Water – clear water, flow rate 1200lt/sec approx Channel – 2m wide and 1m deep Sediment – gravely to sandy sediment, leaves and organic debris Vegetation – dense riparian forest Flora – no submerged or emergent plants, some fixed algae Fauna – some small tilapia
KDI/SW/02	26/10/04	6.73	0.293	13	18.5	0.01	08:30hrs Water – brown dirty colour, flow rate 300lt/s Channel – 1m wide 0.2-0.3m deep, surrounded by anthills and agricultural fields Sediment – silty sand, brown colour with organic debris Vegetation – very dense riparian forest along watercourse Flora – no submerged or emergent plants Fauna – whirly beetles
KDI/GW/SW/03	26/10/06	6.84	0.251	0	21.0	0	08:00hrs Water – clear, flow rate 250-300lts/s Channel – 2.5m wide and 1m deep pool Sediment – black silty organic material large amount of organic debris Vegetation – dense riparian vegetation Flora – no submerged or emergent plants
KDI/GW/SW/04	26/10/06	6.5	0.283	0	22.8	0.01	07:30hrs Water – clear and warm, flow rate 300lt/s Channel – 3m wide 0.2-0.3m deep Sediment – black silty, large amount of organic debris Vegetation – dense riparian just downstream of agricultural fields Flora – some rooted emergents

Table 4.5 Physical, chemical and bacteriological parameters of surface and groundwater

Site	Date of sampling	Coliform (/100ml)	Faecal Coliform (/100mls)	pH	EC (µS/cm)	TDS (mg/l)	TSS (mg/l)	SO_4^{2-} (mg/l)	F^- (mg/l)	NO_3^- (mg/l)
KDI/SW/01	26/10/04	5*^	Nil	7.4	400	218	16	14	0.3	5
	/01/05	TNTC	7	7.0	391	244	9	60	0.3	<0.08
KDI/SW/02	26/10/04	Nil	Nil	7.6	396	226	18	12	0.2	2
	/01/05	Nil	Nil	7.5	343	226	227	120	0.3	2
KDI/GW/SW/03	26/10/04	Nil	Nil	7.4	376	176	6	9	0.2	1
	/01/05	TNTC	TNTC	7.0	337	210	38	68	0.2	1
KDI/GW/SW/04	26/10/04	1*^	1*^	7.3	401	212	<3.5	26	0.2	5
	/01/05	TNTC	9	7.1	364	208	15	30	0.3	<0.08

Site	Date of sampling	Cl- (mg/l)	CN- (mg/l)	PO_4^{3-} (mg/l)	Colour (hazen)	Turbidity (NTU)
KDI/SW/01	26/10/04	9	<0.01	<0.58	<5	0.7
	/01/05	3	0.04	2	<5	1
KDI/SW/02	26/10/04	13	<0.01	<0.58	<5	27
	/01/05	5	0.04	1	30	302
KDI/GW/SW/03	26/10/04	9	<0.01	<0.58	<5	0.2
	/01/05	4	0.05	0.6	<5	16
KDI/GW/SW/04	26/10/04	9	<0.01	<0.58	<5	0.4
	/01/05	3	0.05	<0.3	<5	2

* Exceed WHO Drinking Water Quality Standards
# Equivalent to WHO Drinking Water Quality Standards
^ Exceed DRC Drinking Water Quality Standards

Table 4.6 Total Metal Analysis

Site	Date of sampling	**Al mg/l**	**Ba mg/l**	**Be mg/l**	**Ca mg/l**	**Cd mg/l**	**Co mg/l**	**Cr mg/l**	**Cu Mg/l**	**Fe mg/l**
KDI/SW/01	26/10/04	0.4^	<0.5	<0.01	30	<0.01	<0.03	0.03	0.04	0.2
	01/05	<0.03	<0.2	<0.1	14	<0.01	<0.03	<0.03	0.02	0.07
KDI/SW/02	26/10/04	3^	<0.5	<0.01	28	<0.01	0.4	0.05	0.3	1
	/01/05	8	<0.2	<0.1	14	<0.01	2	<0.03	0.2	6
KDI/GW/SW/03	26/10/04	<0.31	<0.5	<0.01	30	<0.01	0.04	0.04	0.04	0.2
	/01/05	1	<0.2	<0.1	18	<0.01	0.05	<0.03	0.1	0.6
KDI/GW/SW/04	26/10/04	7^	<0.5	<0.01	14	<0.01	0.07	<0.03	0.04	0.8
	/01/05	0.6	<0.2	<0.1	18	<0.01	<0.03	<0.03	0.03	0.1

Site	Date of sampling	**Mg mg/l**	**Mn mg/l**	**Mo mg/l**	**Ni Mg/l**	**Pb Mg/l**	**V Mg/l**	**Zn Mg/l**
KDI/SW/01	26/10/04	38	<0.03	<0.5	<0.03	<0.01	<0.5	<0.01
	/01/05	22	<0.03	<0.1	<0.03	0.05		<0.01
KDI/SW/02	26/10/04	48	0.3^	<0.5	<0.03	0.01#	<0.5	<0.01
	/01/05	30	0.4	<0.1	<0.03	0.08		<0.01
KDI/GW/SW/03	26/10/04	40	<0.03	<0.5	<0.03	0.01#	<0.5	<0.01
	/01/05	29	<0.03	<0.1	<0.03	0.06		<0.01
KDI/GW/SW/04	26/10/04	28	0.03	<0.5	<0.03	0.03*	<0.5	<0.01
	/01/05	28	<0.03	<0.1	<0.03	0.08		<0.01

* Exceed WHO Drinking Water Quality Standards
# Equivalent to WHO Drinking Water Quality Standards
^ Exceed DRC Drinking Water Quality Standards

4.2.2 *Stream Sediment Sampling and Analysis*

N.G. Armitage and M.L. Chifunda carried out all sediment sampling. Sampling was carried out in accordance with internationally accepted procedures for the collection of river sediment samples.

Stream sediment samples were submitted to A. H. Knight Analytical Services for geo-chemical analysis of sediment solids, and dissolved metal analysis on sediment pore water.

The sediment samples were collected after water samples were collected at the same sampling points as the surface water sampling program (SW-01 to SW-04) on the 26th October 2004. A further set of samples were collected in January 2005 to evaluate any seasonal variations of highlighted parameters from the initial analysis (Al, Ca, Cu, Cr, Ni, Mn, Zn and Pb) in the stream sediment. The full results of the geo-chemical (sediment solids) and dissolved metals (pore water) analysis are presented in Tables 4.7 to 4.9 below.

The sediment geo-chemical analysis shows that most of the elements are found in low concentrations except for abundant minerals such as aluminium, calcium, iron and magnesium. Metals in high concentration are chromium, cobalt, copper, nickel, manganese, zinc and lead. These concentrations are likely the result of weathering of the surrounding metal bearing ores. There is significant manganese and cobalt deposition evident at SW-02 situated downstream of the heterogenite washing area between SW-02 and SW-03.

Stream sediment pore water shows an abundance of copper, cobalt, manganese, zinc and chromium in SW-01 and SW-03. The laboratory was unable to extract pore water from the sediments samples collected from SW-02 and SW-04.

4.2.3 *Groundwater*

Groundwater quality was evaluated by analyzing the water quality of the sources of the Kii river and Kisankala Stream (GW/SW-03 and GW/SW-04), which are both fed by underground springs. Results are presented in Tables 4.6 to 4.9 indicate that groundwater quality is generally good, however aluminium and lead concentrations exceed WHO Drinking Water Quality Standards. This is most probably due to the weathering of aluminium/lead rich geology. The groundwater sampling protocol is in Appendix 2.

Table 4.7 Stream Sediment Geo-chemical Analysis

Site	Date of sampling	Al µg/g	Ba µg/g	Be µg/g	Ca µg/g	Cd µg/g	Co µg/g	Cr µg/g	Cu µg/g	Fe µg/g	Mg µg/g
KDI/SW/01	26/10/04	22000	299	<10	5000	<10	98	50	1100	22000	4800
	/01/05	2200	<10	<10	10	<5	459	32	539	8000	400
KDI/SW/02	26/10/04	16900	50	<10	<10	<10	10600	<50	996	21900	1200
	/01/05	3900	<10	<10	50	<5	6700	<1	2500	18000	1300
KDI/GW/SW/03	26/10/04	13000	140	<10	8100	<10	124	70	2000	9900	6800
	/01/05	7100	<10	<10	85	<5	2700	28	2200	12300	1600
KDI/GW/SW/04	26/20/04	19000	160	<10	1200	<10	67	50	361	33900	11400
	/01/05	1900	<10	<10	90	<5	484	84	847	14000	1800

Site	Date of sampling	Mn µg/g	Mo µg/g	Ni µg/g	Pb µg/g	V µg/g	Zn µg/g
KDI/SW/01	26/10/04	379	<10	34	75	<10	80
	/01/05	140	<10	11	10	<10	25
KDI/SW/02	26/10/04	727	<10	50	70	<10	15
	/01/05	1100	<10	66	20	<10	30
KDI/GW/SW/03	26/10/04	55	<10	44	67	<10	65
	/01/05	497	<10	11	15	<10	40
KDI/GW/SW/04	26/10/04	85	<10	34	70	<10	100
	/01/05	50	<10	22	34	<10	55

Table 4.8 Stream Sediment Pore Water, Physiological and Chemical Analysis

Site	Date of sampling	pH	EC (µS/cm)	TDS (mg/l)	SO_4^{2-} (mg/l)
KDI/SW/01	26/10/04	7.5	643	468	203
	/01/05	-	-	-	-
KDI/SW/02	26/10/04	-	-	-	-
	/01/05	-	-	-	-
KDI/GW/SW/03	26/10/04	7.9	350	250	-
	/01/05	-	-	-	-
KDI/GW/SW/04	26/10/04	-	-	-	-
	/01/05	-	-	-	-

Table 4.9 Stream Sediment Pore Water Total Metal Analysis

Site	Date of sampling	Al mg/l	Ba mg/l	Be mg/l	Ca Mg/l	Cd mg/l	Co mg/l	Cr mg/l	Cu Mg/l	Fe mg/l
KDI/SW/01	26/10/04	6	<0.5	<0.01	30	<0.01	0.3	0.04	0.6	8
	01/05	5	<0.2	<0.1	7	<0.01	0.1	<0.03	0.7	4
KDI/SW/02	26/10/04	-	-	-	-	-	-	-	-	-
	/01/05	<0.3	<0.2	<0.1	22	<0.01	3	<0.03	0.3	0.3
KDI/GW/SW/03	26/10/04	7	<0.5	<0.01	12	<0.01	0.3	0.04	2	3
	/01/05	1	<0.2	<0.1	46	<0.01	2	<0.03	0.4	0.4
KDI/GW/SW/04	26/10/04	-	-	-	-	-	-	-	-	-
	/01/05	<0.3	<0.2	<0.1	29	<0.01	0.2	<0.03	0.1	0.2

Table 4.9 Stream Sediment Pore Water Total Metal Analysis Cont.

Site	Date of sampling	**Mg mg/l**	**Mn mg/l**	**Mo mg/l**	**Ni mg/l**	**Pb Mg/l**	**V Mg/l**	**Zn Mg/l**
KDI/SW/01	26/10/04	60	1	<0.5	<0.03	0.01	<0.5	0.1
	/01/05	8	0.3	<0.1	<0.03	<0.01	<0.5	<0.01
KDI/SW/02	26/10/04	-	-	-	-	-	-	-
	/01/05	20	3	<0.1	0.13	<0.01	-	<0.01
KDI/GW/SW/03	26/10/04	24	0.1	<0.5	<0.03	<0.01	<0.5	0.1
	/01/05	40	3	<0.1	<0.03	<0.01	<0.5	<0.01
KDI/GW/SW/04	26/10/04	-	-	-	-	-	-	-
	/01/05	32	0.4	<0.1	<0.03	<0.01	-	<0.01

4.2.4 *Hydrogeology*

The Kalukundi project lies within the Katanga geological system that is divided into three super groups; the Upper Kundelungu, Lower Kundelungu and the Roan, each separated by a marker conglomerate. Within the whole Katanga system mineralised zones occur within the lower portions of the Roan. At Kalukundi, the local geology consists only of the lower portions of the Roan super group and these are mainly dolomites and sandstones that have been subjected to intense folding and faulting. The typical sequence of lithological units at Kalukundi is from bottom to top: RAT, D Strat. RSF, RSC, SDB, SDS, and CMN and these lithologies are briefly described below.

The **RAT** – Roches Argilleuses Talceuse is a silty, sandy, dolomitic rock that is normally massive but showing shearing in places. This unit is un-mineralised and forms the footwall of the ore bodies.

The **D Strat** or Stratified Dolomite is a well bedded to laminated, silty and sandy (argillaceous) dolomite.

The **RSF** is made up of thinly bedded to laminated highly silicified dolomites. The
D Strat and RSF form the Lower Ore body.

The **RSC** are silicified cellular dolomites that are massive to stromatolitic. This unit contains very little copper oxide and is considered un-mineralised.

The **SDB** are normally silty dolomites and siltstones containing locally isolated thin layers of nodules and individual nodules. The nodules are formed by coarser grains and fragments of dolomite and are normally weathered out and form small hollows. The **SDS** is composed of dolomitic siltstone and fine-grained sandstone. The SDB and SDS form the Upper Ore body.

The **CMN** is a dolomitic sequence of silty-sandy dolomites of light grey to grey in colour Massive to slightly banded and laminated types predominate. Occasionally silicified horizons are present. This unit is un-mineralised and forms the hanging wall of the ore bodies.

Surface geophysics was conducted to define the structural geology over the entire property. The magnetic method was effective in defining regional structural features (such as faults and bedding) that are likely to have a controlling influence on the hydrological system at Kalukundi. The mineralization shows no associated relationship to magnetics whatsoever. However, de-watering from these lineaments, which are possibly associated with major fractures and breccia zones, is expected to provide maximum de-watering of the ore bodies.

The seismic method indicated that the average depth to bedrock at Kalukundi is between 16 and 34m. The evaluations of the bedrock depth and velocity profile are considered to be good, within the limits of the seismic method, which usually has a 10 to 15%.

Resistivity soundings indicated an average water table of about 16 to 30 metres and a water column of between 25 to 40 metres. In general, the resistivity soundings showed distortions from the geological fold structures at depth – so the interpretations of water column depth and thickness may not be accurate because the method assumes horizontal layering.

4.3 Biological Environment

4.3.1 *Land Fauna and Birds*

The information on wildlife provided in this document is based on oral tradition rather than actual observations made in the field. This was mainly because the larger animal species once found in the area have been depleted through poaching (Table 4.10). On the other hand, birds are still common and the list provided in Table 4.11 is of some of the birds that are still found in the area.

Table 4.10 List of some animals once found in the Kalukundi area

Native Names in Kaonde	Scientific Name and Common Names
Bokwe	Pathera leo (Lion)
Chovwe	Hippopotamuss
Kabashi (Lupala)	Aepyceros melampus (Impala)
Kasha	Sylvicarpa grimmia (Common Duiker)
Katumpa	Viverra civetta (Civet)
Kolwe	Cercopithecus aethiops (Vervet Monkey)
Nkhonzhi	Alcelaphus lichtensteini (Hartebeest)
Kabuluku	Cephalophus monticolus (Blue Duiker)
Lupengo (Lumembe)	Anomalurus derbianus (flying squirrel)
Mboo	Syncerus caffer (Buffalo)
Mpenge	Phacochoerus aethiopicus Wart Hog)
Mpongo	Galago crassicaudatus (Bush Baby)
Nfumbo	Hippotragus niger (Sable Antelope)
N'gomba (Sontwa)	Tragelaphus strepsiceros (Kudu)
Ngulugu	Tragelaphus scriptus (Bushbuck)
Ngulube	Potamochoerus porcus (Bush Pig)
Nsefu	Taurotragus oryx (Eland)
Nsovu	Loxodonta africana (African Elephant)
Pupa (Nkakabuluba)	Manis temmincki (Pangolin)

Table 4.11 List of some birds found in the study area

Native Names in Kaonde	Scientific Names
Bembe	Treron australis
Chyonle (Jiole)	Lamprotormis spp.
Kamimbi	Hirundo spp.
Kamimbya	Apus apus
Kasosa	Sunbirds (Nectariniidae)
Kibegelele	Phalacrocorax spp
Lukwekwe	Bycanistes buccinator
Nduba	Tauraco livingstonii
Pwele	Pycnonotus barbatus

4.3.2 *Flora*

The baseline terrestrial flora and fauna study of the project area was undertaken by environmental consultant Mr Lishomwa Mulongwe, Principal Forestry Research Officer at the Forestry Research Department of the Ministry of Environment and Natural Resources in Kitwe, Zambia. The field component of the study was conducted in January 2005.

<u>Description of Vegetation</u>

The vegetation of the mining concession has been described as tropical dry forest (Atlas du Congo, 1998) and chiefly falls into the Zambezian Domain (White, 1965). This type of vegetation is also characteristic of lower Katanga and is dominated by leguminous trees of *Brchystegia ssp.* and *Julbernardia paniculata* (Benth Malaisse et al., 1975). It is generally derived from the Guineo – Congolian type of vegetation and is typified by remnants of tropical forest species assemblages and occasional occurrence of such species is common in areas where disturbances are few.

The vegetation is affected by settlements, artisinal mining, exploration activities, and cultivation of agricultural crops. The effect is apparent from the introduction of exotic shrub and tree species within and around settlements and the frequent use of fire in surrounding woodlands for field clearance. Vegetation suppression is also a major factor along the power – line that pass through the area. Harvesting for various forest products including poles/timber, fire – wood and herbal medicines is another activity that has contributed to the visible alteration of the woodland structure.

Regeneration in various forms and stages of growth is evident around the mining concession. Woody species commonly found regenerating in abandoned fields and around the settlement included *Diplorynchus condylocarpon, Uapaca kirkiana, Uapaca bangweolensis, Albizia adianthifolia, Pseudolacnostylis maprouneifolia, Combretum zeyherii, Monotes katangensis, Monotes angolensis, Erythrophleum afrcanum*.

Factors affecting the vegetation

The area has been inhabited for sometime now. Estimates are that the local people living in the area have there for more than 40 years. The people use the woodland and forests around the area for various purposes including fuel – wood, building materials, clearing woodland areas for agricultural fields, settlements, and collection of non wood forest products such as medicines, mushrooms, fibre, gums etc.

Although the area does not appear very disturbed, the practice of shifting cultivation for crops, such as maize and cassava, has contributed to the localised disturbances which were observed during the survey.

Vegetation Survey Methods

The concession was stratified into three strata based on vegetation composition and structure, and elevation/topography. These strata are described in Table 4.12.

The sampling was carried out randomly using circular sample plots of 40m diameter or 0.1256 of a hectare. One sample plot was placed in each stratum and as many of the woody species found in each plot were assessed for the species name (Latin name), diameter, frequency and growth habits. Common uses of recorded species were made to determine how local people used the woodland to support their everyday livelihoods.

Table 4.12 Vegetation Composition and Stratification

Stratum Number	Vegetation Composition and Structure	Height Class of Dominant Vegetation
Stratum 1	Low lying mixed grasslands with scattered woody shrubs and an abundance of suffretecies of mainly *Parinari capensis*, *Protea angloensis* and stunted forms of small tree *Phylocosmos lemaireanus*.	Dominant woody vegetation found between the height range of 15cm and 2m.
Stratum 2	A mixed woodland with a canopy layer dominated by leguminous tree species of *Brachystegia*, *Julbernardia* and *Isoberlinia* were common on plateau soils above drainage lines.	Dominant height of larger tree specimens to be between 15 to 25m.
Stratum 3	Hilly areas and rocky outcrops with large tree genera on termite mounds included *Boscia*, *Albizia*, *Allophylus*, *Combretum*, and *Zanthoxylem*. Short forms of the usually large trees such as *Parinari curatellifolia*, *P. polyandra*, *Strychnos* spp.. *Antocleista schweinfurthi* were common on rock outcrops. The locally cobalt associated plant *Vellozia equistifolia* was equally abundant on rock outcrops.	Dominant tree layer was up to 6m with a shrub layer of up to 2m.

Vegetation Structure

Stand density according to each stratum

Stand density was expressed per hectare for each stratum and was especially important for the copper clearings, where woody species were mostly suffrutex or stunted small trees. The surveyed copper clearing had the conspicuous copper flower *Becium obovatum* and *Becium homblei* was absent from the main clearing but was abundant towards the end of the clearing. Appendix 3 is a list of woody species and their density per hectare.

Diameter distribution as a measure of forest structure

Diameter distribution curves are important for determining the stage of growth of woodlands or forests. Figure 4.6 shows the diameter distribution curves for the plots that were assessed during the study (plot 1 was not shown on the graph as all the shrubs on the site were below 1m tall). In the case of the Kisankala mining concession area the vegetation appears mostly to be in the regenerative phase. Although the observed trend may also be attributed to the stunted nature of some of the tree species growing on rock ridges and other outcrops.

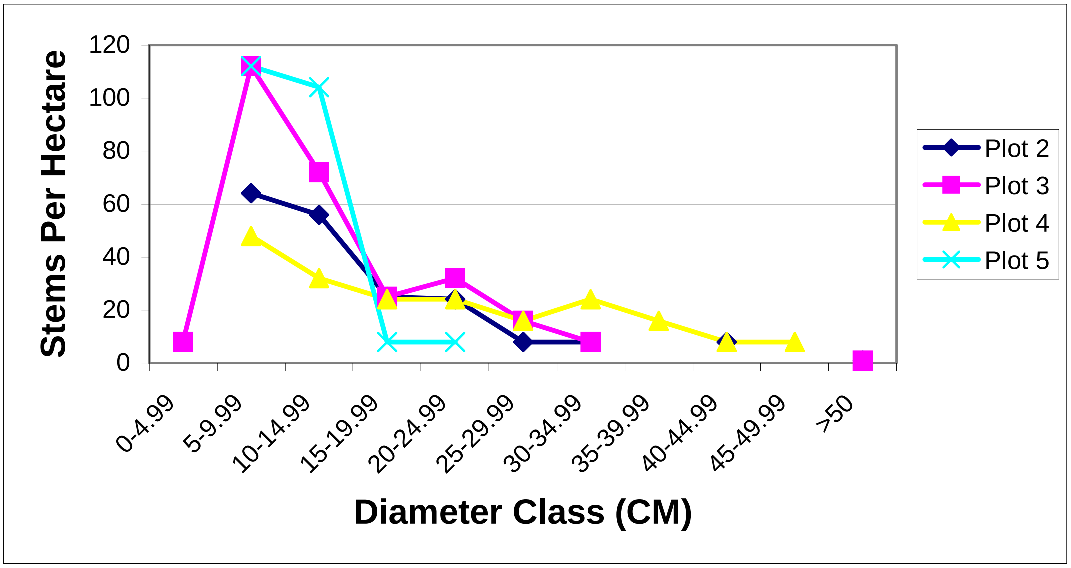

Figure 4.6 Diameter distribution curves for the surveyed area

4.6.3 *Sensitive Environments*

According to Annexe XII of the Mining Code the wetlands that are present in the project area are sensitive areas. Measures, such as improving awareness and informing the community about sensitive environments, will be undertaken by Swanmines to ensure that the impacts on these areas are reduced and mitigated wherever possible.

4.6.4 *Aquatic Flora and Fauna*

The natural water composition presents no impediment to aquatic flora and fauna. Small fish and insects were observed at several locations along of the watercourses. Interviews with the local population reveals that there is no or very small catches of fish in the Kii river or Kisankala stream and the watercourses are not considered a source for fish. Netting was not observed but does occur and would dramatically effect local fish populations.

N.G. Armitage completed a biological habitat assessment of the Kii River and Kisankala Stream at surface water sampling point SW/01 to SW/04 in October 2004. The United States Environmental Protection Agency (USEPA) Rapid Bio-assessment Protocol (RBP) was used to assess the aquatic environment at each of the surface water sampling sites. The completed field data collection sheets are included in Appendix 4. The indications of different scores in the assessment exercise are discussed in Table 4.13.

This approach provided a comprehensive description of the aquatic conditions and riverine / aquatic flora found at the sampling sites. The bio-assessment sheets provide a detailed description of the sampling sites and the surrounding riverine area, as well as a habitat assessment score that indicates the condition of the sampling point. This is based on 10 factors that influence the quality of habitat available for aquatic and surrounding riverine flora and fauna. The RBP's are useful in defining the amount of human impact on aquatic flora and fauna for a particular surface watercourse.

The Habitat Assessment Score is out of a total of 200. The score in this case indicates the level of human impact on the river. Habitat Assessment Scores are described in Table 3.10.

The results of the USEPA Rapid Bio-assessment exercise indicate that habitat quality of the watercourses within the permit area have optimal habitat scores, with little current human impact at the locations evaluated using this method.

Table 4.13 Description of Habitat Assessment Score

Habitat Assessment Score	Habitat Description (level of human impact)
0 – 50	Poor Habitat (habitat which is severely impaired by human activity)
51 – 100	Marginal Habitat (habitat which is impaired by human activity)
101 – 150	Sub Optimum Habitat (habitat not significantly impaired by human activity)
151 – 200	Optimum Habitat (habitat relatively or completely unaffected by human activity)

Table 4.14 USEPA Rapid Bio assessment of Aquatic Flora and Fauna

Aquatic Site	Location	Habitat Score (Max 200)	Aquatic Habitat Description
KDI/SW/01	Kii river, 20m downstream of the confluence with Kisankala stream, 50m outside the north-western corner of the permit area.	192	Optimal habitat for aquatic flora and fauna. (No impact from human activity).
KDI/SW/02	Kisankala stream, 750m downstream of the source. Point which would receive future runoff from proposed WRD and Tailings dam	157	Optimal – sub optimal habitat for aquatic flora and fauna. (Almost no impact from human activity).
KDI/SW/03	Kisankala stream. 50m downstream of the source just upstream of the water abstraction point.	182	Optimal habitat for aquatic flora and fauna. (No impact from human activity).
KDI/SW/04	Kii river. At the source of Kii river	180	Optimal habitat for aquatic flora and fauna. (No impact from human activity).

4.4 Archaeological and Cultural Environment

No sites of archaeological importance were identified during the site visits. Of high cultural importance is the cemetery located south of Kisankala village.