

Table of Contents

9. Cumulative Impact Assessment	9:1
9.1. Introduction	9:1
9.2. Kolwezi Cumulative Impacts	9:1
Biophysical impacts	9.14
9.3. Dewatering and water balance.....	9.14
9.4. Noise.....	9.16
9.5. Air quality	9.17
9.6. Tailings management.....	9.17
Social Impacts.....	9.19
9.7. Increased Pressure on Natural Resources	9.19
9.8. Increased Demand for Skilled Labour	9.19
9.9. Increased Pressure on Infrastructure	9.19
9.10. Increased demand for energy	9.20
9.11. Increased traffic	9.20
9.12. Incidence of Disease	9.21
9.13. Improved Living Conditions and Standard of Living	9.21
9.14. Increased Influx of migrant workers	9.22
9.15. Pressure on artisanal Mining.....	9.22
9.16. Displacement (resettlement) and dislocation,	9.23
9.17. Increased presence of (private) security forces	9.23
9.18. Social stratification	9.24
9.19. Pressure on institutional capacity.....	9.24
Recommendations	9.25

List of Tables

Table 9.1 : Projects which are active or which may take place in the Kolwezi area	9.3
Table 9.2: Summary of the probable future trends in KMT's impacts when the cumulative consequences of other projects are taken into account	9.8

List of Figures

Figure 9.1: Location of the various projects planned in the Kolwezi area.....	9.27
Figure 9.2: Boundaries of other mining concessions which immediately surround the KMT concession	9.28
Figure 9.3: Schematic layout of scenario of potential discharges into the Luilu and Lualaba rivers	9.29

9. Cumulative Impact Assessment

9.1. Introduction

Cumulative impacts are those that may arise due to the effects of the Kingamyambo Musonoi Tailings Project (the Project) as well as those of the existing environmental or social conditions, or the combined effects of other projects as well as the Project on the existing environmental and social conditions. Cumulative impacts include such issues as dewatering, effluent loadings in watercourses, noise, air quality, the water balance of the wider area and the effects of land-take for facilities such as tailings dams, waste rock dumps and plant sites. These will be considered further in the sections below.

The following comprise the objectives of this cumulative impact assessment:

- To assess the effect of other existing projects on the Project's significant impacts;
- To assess the cumulative impacts of the Project and other future projects in the area.

9.2. Kolwezi Cumulative Impacts

Existing facilities that may have an impact

The current state of the environment in terms of physical damage, chemical contamination and socio-economic status was described, first through the site audit undertaken in late 2002, then the Phase 2 audit, which quantified pre-existing impacts and ran alongside the baseline studies for the Project. These details have been reported extensively in Chapter 5 and Chapter 6 of this document, the environmental and social baseline descriptions.

The impacts of the Project have been considered against this baseline, namely against the cumulative effects of these conditions and the post-Project predicted levels of, for example, noise and air quality effectively present the cumulative outcome of the Project plus all other existing sources of impact.

The KMT impact assessment is itself an assessment of the overall or cumulative impacts of all the KMT infrastructure components and project activities on the surrounding environment: this represents the Project Only option. In *this* chapter, the assessment of cumulative impacts looks at the accumulating consequences of other development proposals and activities in the Kolwezi area on the KMT Project's significant impacts. The Zero Option is presented as a continuation of the *status quo*, that is, without *any* projects developing.

Combined effects of the Kolwezi project and other projects in the vicinity

FQM is aware of several other projects which are under development in the Kolwezi area. These are detailed in Table 9.1 below. Impacts on the natural environment arise as a result both of greater land take and demands on ground and surface water as a result of mining activities. In addition, greater

pressure will be placed on natural resources due to increased populations in Kolwezi and the local villages, perhaps as migrant workers arrive or through natural population growth, which is predicted to be very high in DRC.

Information about the other projects has been difficult to obtain for a number of reasons:

- Any information supplied to the Ministry of Mines (including DPEM) to support applications for exploration, exploitation and environmental approval are not in the public domain;
- SRK has been involved in the public consultation processes for several of the mines being developed. The information secured through this process is useful, but usually relatively superficial;
- Such information will, in the early stages of feasibility studies, be treated as commercially confidential by the private companies involved and little, if any, useful disclosure is made about such projects in their early planning stages.

However, FQM has a data sharing agreement with various other mining companies active in the area. These companies are DCP, KOL (now amalgamated into one company under the banner of Katanga Mining) and Anvil. This covers environmental and social baseline data only. Additional information about other potential or probable projects in the Kolwezi area and Katanga mining region that KMT has been able to obtain are listed below. The analysis of cumulative impact thus remains largely speculative, although informed assumptions can be made given SRK's knowledge of the Kolwezi area.

Table 9.1 : Projects which are active or which may take place in the Kolwezi area

Ref	Name	Company	Activities	Catchment	Air pollution	Solid wastes	Effluents	Traffic	Environmental /activity status ¹
1	Chemaf	Chemaf	Ore washing	Kakifuluwe – Musonoi	Particulate	Copper and cobalt ore	High suspended solids	Unknown	None/unknown
2	Felco ²	Gécamines/ Madmin	Cu Co electrical smelter	Luilu	Gaseous, particulate	Slag, ore and fluxes	Oils	Unknown	Old permit/unknown
3	UZK	Gécamines	Zn, Cd ingots, black copper	Musonoi	Gaseous, particulate	Residues containing Cd, As, Zn, Ag Hydrometallurgical tailings	Zn, Cd and trace metals, acid, oils	Unknown	Old permit/believed that operation of UZK has ceased
4	SAM	SAM Metal	Cu Co electrical smelter	Musonoi	Gaseous, particulate	Slag, ore and fluxes		Unknown	None/not known
5	Mutoshi	Anvil	Tailings reprocessing	Mutoshi	Dust	Tailings	Effluents	Unknown	Not known/active mining
		Katanga Mining							
6	Luilu	Gécamines/	150k tpa Cu	Luilu	Gaseous,	Concentrator	Cu, Co and	Unknown	Old permit

¹ For holders of existing, converted *exploitation* permits (that is, mining or quarry rights), an Environmental Adjustment Plan (EAP) must be submitted to the DPEM, within one year of the coming into effect of the Decree for permits/rights with in excess of five years' validity; and within six months for permits/rights with in excess of two years' validity. An EAP should set out a programme to bring the operation into compliance with the Mining Regulations.

² Separate facility inside the Luilu plant

*KCC = Katanga Copper Company

Ref	Name	Company	Activities	Catchment	Air pollution	Solid wastes	Effluents	Traffic	Environmental /activity status ¹
		KCC*	Co electro winning Roaster Acid Plant		particulate	tailings, hydrometallurgical tailings	trace metals, reagents, acids, oils etc, aqueous effluent		JV carrying out ESIA/Operational, a further 250k refinery to be constructed during 2008
7	Kolwezi Concentrator	Gécamines/ DCP*	Cu, Co concentrates	Musonoi	Particulate	Concentrator tailings	Reagents, oils, aqueous effluents	None	Old permit JV carrying out ESIA/has been inactive but due to become operational April 2008
8	KOV pit	Gécamines/ DCP*	Mining	Musonoi	Particulate	Waste rock and sludge	Pumped mine water	Within mining area	Old permit JV carrying out ESIA/being dewatered, complete April/May 2008
9	Tilwezembe open pit	Gécamines/ DCP	Mining	Lualaba	Particulate	Waste rock	Unknown	Ore trucks to KZC	Old permit/has been active mining, possibly not currently active. JV carrying out ESIA
10	Kamoto	Gécamines/ KCC	Mining, Co, Cu concentrates	Luilu	Particulate	Concentrator tailings, waste rock	Pumped mine water, Tailings spillages	Within mining area	Old permit JV carrying out ESIA/active underground
11	T17	Gécamines/ KCC	Mining	Musonoi	Particulate	Waste rock	Pumped mine water	Within mining area	Old permit JV carrying out ESIA/active

* DCP = DRC Copper and Cobalt Project, formerly owned by Nikanor, now owned by Katanga Mining Limited, and to be merged with KCC

Ref	Name	Company	Activities	Catchment	Air pollution	Solid wastes	Effluents	Traffic	Environmental /activity status¹
12	Mashambe East	Gécamines/ KCC	Open Pit Mining	Luilu	Gaseous, particulate	Waste rock	Pumped mine water	Unknown	Old Permit/ will not be active for some time.
13	Dikuluwe/ Mashambe West	Gecamines/ Unknown+	Open pit mining	Luilu	Gaseous, particulate	Waste rock	Pumped mine water	Unknown	Old Permit/ inactive at present

⁺ These deposits have been transferred back to Gécamines and it is understood they will be mined by a currently unknown third-party

The location of these projects is shown schematically in Figure 9.1. The boundaries of other mining concessions are in the public domain, and the map of those which immediately surround the KMT concession is shown in Figure 9.2. It should also be noted that of the exploration permits which exist in the area, that held by Chemaf (No. 2121) and two held by Mosaka (Nos 2506, 4174) did not have the necessary Mitigation and Rehabilitation Plan (MRP) prepared in accordance with the requirements of the DRC Mining Regulations in 2006. The Regulations state that an MRP must be produced by the holder of the Exploration Licence within 6 months of the date of its award. If the Mining Code is enforced, both Mosaka and Chemaf licences would be invalidated. However, no exploration activities have been observed in the Mosaka and Chemaf areas.

It is important therefore that the analysis of cumulative impact proceeds from the assumption that the playing field for the development of all mining and mineral processing projects will be level, in terms of the DRC's new Mining Code. This means that:

- The environmental standards to which KMT is committed through FQM will be broadly followed by other projects;
- The social development goals to which KMT is committed through FQM will be agreed by other projects
- Environmental assessment procedures and mitigation measures will be applied to all projects;
- The legislation and pollution control standards will be uniformly enforced on all projects.
- Liabilities accruing from past – Belgian and Gécamines – mining activities will be excluded from the liabilities of new projects. This means that new projects will not be responsible for cleaning up existing pollution and degradation.

Clearly, those projects which might be developed in the Kolwezi area some distance from Kolwezi (principally the projects or sub projects listed as 5 and 9 above) will have no direct impact on the KMT project (or *vice versa*), their only potential interaction being the increased demand for skilled labour, the gradual expansion of the regional economy, improvement in regional infrastructure as well as traffic impacts. From the current degraded state of mines in the region, if standards are enforced, there will probably be an improvement with respect to water and air pollution in the region, although in the very long term the situation might reverse as more and more mines and mineral processing projects are developed. This may be accompanied by migration of people into the region to take up employment and economic opportunities developing there, given the paucity of economic development in contiguous regions to the north, west and east of Katanga province. An increasing population will increase pressures on the regional environment in different ways, notably water demand, water pollution and habitat and biodiversity fragmentation and loss. All these projects might also affect the KMT groundwater regime, either through impacts on water quality or aquifer draw-down due to mine dewatering.

Table 9.2 below presents a summary of our understanding of the probable future trends in KMT's impacts when the cumulative consequences of other projects are taken into account. This is contrasted against the Zero Option. Positive and negative impacts are indicated, and increasing and decreasing trends are represented by up and down arrows, respectively. Where it is felt that there is significant uncertainty in predicting the direction of the trend, a diagonal up/down arrow is inserted. Where a KMT specific impact is not relevant to cumulative effects, N/A (Not Applicable) is entered in the cell.

The areas of impact are also discussed in broad terms, based on knowledge of the region and of other mining projects, in subsequent sections.

Table 9.2: Summary of the probable future trends in KMT's impacts when the cumulative consequences of other projects are taken into account

Environmental Components and Impacts	CUMULATIVE IMPACT		ZERO OPTION	
	Direction of trend	Discussion	Direction of trend	Discussion
SOCIO-ECONOMIC				
Secure jobs, incomes and social security	+↑	The realisation of several projects in the Kolwezi area in addition to KMT's will significantly augment the positive socio-economic consequences of KMT's project, and accelerate the reversal of the economic decline of the last 30 years. As the local economy grows in size, infrastructure and services will improve, the tax base will grow, the financial viability of state/ local authority services will improve leading to further infrastructure upgrading, the capacity of local and Congolese professionals and skilled workers will develop and the economy will become more sophisticated. This will reduce reliance on imports of materials, equipment and people. The potentially socially divisive need to bring in expatriates should thus decline, and leakage of monies from the local economy should reduce in the long term (although this may be countered by global economic trends towards free flow of profits and capital). The only potentially negative consequence is related to the increased demand for housing and infrastructure: while this is a positive impact, because more tax will flow into local authority coffers, there is likely to be a point at which demand outstrips supply, and it will take some time for the effect to return to the positive side of the base line. This is especially true with respect to transport, given the poor state of regional transport spines at present. However, over the medium term, one of the major benefits of these projects will be the restoration of regional transport networks.	-↓	Presently the mining industry at Kolwezi is emerging from a period of near standstill. Should no new projects proceed to full implementation, socio-economic conditions in the area may continue. With none of the predicted positive outcomes of KMT and other developments realised, it will be extremely difficult for local government to generate sufficient revenues to invest in infrastructure and services. As regards social divisiveness, while the anticipated causes (employment of expatriates; limited jobs for locals) would not apply, further deterioration in the economic status of local residents might in any event be the stimulus to social division and conflict. This is unprecedented in the DRC.
Increased disposable income among employees and local multipliers.	+↑		-↓	
Local business opportunities arising from procurement of goods and services.	+↑		-↓	
Use of external suppliers due to depressed local economy, leading to export of funds	-↓		-↓	
Increase in business confidence and attraction of investors.	+↑		-↓	
Increased involvement of and cooperation with traditional authorities and local government	+↑		-↓	
Demand for housing, with impacts on markets (construction, resale, and rental).	+↑		-↓	
Increased demand for privately and publicly provided social services	-↑		-↓	
Payment for services by income earners, improving viability of providers.	+↑		-↓	
Local improvements to road, power and other infrastructure	+↑		-↓	

Environmental Components and Impacts	CUMULATIVE IMPACT		ZERO OPTION	
	Direction of trend	Discussion	Direction of trend	Discussion
Income to government through payment of taxes	+ ↑		- ↓	
Community capacity building through social programmes	+ ↑		- ↓	
Assistance to vulnerable groups through social programmes	+ ↑		- ↓	
Increased access to social and health facilities	+ ↑		- ↓	
Increased role for NGOs and CBOs	+ ↑		- ↓	
Dissatisfaction with the employment and presence of expatriate managers	- ↘		0	
Social division over limited jobs and perceived preferential access	- ↓		- ↗	
Environmental Components and Impacts	CUMULATIVE IMPACT		ZERO OPTION	
	Direction of trend	Discussion	Direction of trend	Discussion
Loss of crops and associated livelihoods due to land take in project footprint areas and to changing dambo and river water levels	- ↗	Compensation to be paid to affected farmers	0	No project development = no impact, no change baseline.
Nuisance and danger to proximate villages	- ↑	Mitigation measures to be employed by all operators	0	No project development = no impact, no change baseline.

Environmental Components and Impacts	CUMULATIVE IMPACT		ZERO OPTION	
	Direction of trend	Discussion	Direction of trend	Discussion
Increased risk of HIV / AIDS with influx of workers and opportunity seekers	-↗	Levels of HIV/AIDS prevalence are relatively low in Kolwezi at present. Increasing economic activity will draw migrants to the area, creating a more culturally and socially dynamic situation, which tends to result in high HIV/AIDS prevalence. On the other hand, Kolwezi presently displays, and has historically been characterised by, a great diversity of cultural groups and considerable cultural volatility, so definitive conclusions may be hard to draw.	+↗	It is difficult to predict the course of HIV/AIDS prevalence in the area with no further development. Continental trends in the pandemic are upwards. In non-developing Kolwezi will see ongoing decline in public services, it can be deduced that the likely trend would be an increase in the local prevalence of disease, but with a high degree of uncertainty.
Disruption of artisanal mining and associated activities	+↗/-↘	It is impossible to predict whether the development of formal mining projects will be to the greater individual good of artisanal miners, or not. While the development of formal mining and processing will re-establish many formal sector jobs (Gecamines used to employ 30000 people in the region, of which some 20000 were in Kolwezi. Now, in Kolwezi, it nominally has some 6000 on its books, although their salaries are, more often than not, not paid), it is not possible to say whether the projects will support more or less households than does artisanal mining at present (in which thousands of individuals are involved). The prevalence of artisanal mining is variable, closely linked to metal prices.	+↗/-↘	Again, it is difficult to predict whether the course of artisanal mining will be up or down, or a positive or negative impact, if no new projects come about. If projects are realised, artisanal mining is certain to increase, assuming a stable or increasing cobalt price with positive economic outcomes, given the absence of formal sector jobs. On the other hand, if the cobalt price drops again, artisanal mining might go into decline. If no formal sector projects developing, there will be no options available to local people other than subsistence trading and food production, which do not yield equivalent returns to formal sector jobs.
Environmental Components and Impacts	CUMULATIVE IMPACT		ZERO OPTION	
	Direction of trend	Discussion	Direction of trend	Discussion

Environmental Components and Impacts	CUMULATIVE IMPACT		ZERO OPTION	
	Direction of trend	Discussion	Direction of trend	Discussion
NOISE				
Noise disturbances to local communities	-↑	Increased mining and industrial activity will cause a pronounced increase in ambient noise levels in the vicinity of the mining area, probably reaching unacceptable levels at discrete sites, such as the UZK mining village. However, there appears to be a relatively high tolerance for noise and this also represents a return to levels of noise experienced when activities were at their height.		Baseline prevails
GEOLOGY				
Exposure of receptors to radioactivity	-↑	This is likely to be an accumulating impact.		The impact continues to accumulate
SOILS				
Loss of productivity of soils due to sterilisation	-↑	Despite improved control of impacts on soils initially, in the long term the trend will be an increase in local soil degradation, with associated impacts on livelihoods.	-↗	While project impacts will not occur, increasing subsistence pressure on the land is likely to result in deterioration of soil fertility and stability conditions.
Degradation of soils due to salinisation	-↑		-↗	
Loss of livelihood for subsistence farmers	-↑		-↗	
AIR QUALITY				
Increases in nuisance and health risks to Samukonga residents due to increase in ambient dust concentrations (PM10 and TSP)	N/A	Impacts specific to Samukonga will not be affected by other projects	N/A	
Health risk to local villages over the long term due to increases in ambient gas concentrations. (SO ₂ , NO _x and Volatile Organic Compounds)	-↑	Despite some initial improvement due to the enforcement on new projects of air quality standards for dust and gases, in the long term,		No such health risks will develop

Environmental Components and Impacts	CUMULATIVE IMPACT		ZERO OPTION	
	Direction of trend	Discussion	Direction of trend	Discussion
Ambient dust concentrations	-↑	With increasing heavy industrial activity in the area, air quality is likely to deteriorate, due to the increasing absolute volume/ mass of pollutants being released into the atmosphere	-↗	Presently poor control of dust from tailings dam result in increasing levels of dust fallout.
GROUND WATER				
Pollution of ground water resources	-↑	This is likely to be an accumulating impact depending on water management measures employed by other operations.		Baseline prevails
Lowering of ground water table resulting in reduction in ground water resources for local communities	-↑	The commencement of additional mining operations will result in a greater demand on ground water resources; further reducing the resources available for local community use		Ground water levels may recover in the area of pit and generally in the KMT Concession area if further mining activities take place in Kolwezi.
Variable inflows to the KOV high walls	-↑	Drawdown will be increased resulting in reduced inflows to the KOV highwalls		Baseline prevails
Return to natural hydro geological regime	-↓	This is likely to be an accumulating negative impact		Status quo remains
SURFACE WATER				

Environmental Components and Impacts	CUMULATIVE IMPACT		ZERO OPTION	
	Direction of trend	Discussion	Direction of trend	Discussion
Pollution of downstream water courses	-↑	Five projects which might be developed in the Kolwezi area might impact the KMT project. The three of them which will be located in the vicinity of Luilu will have lesser impacts on KMT, because the drainage there is into the Luilu River, not into the Musonoi. Discharge of effluents into the Musonoi will counteract KMT's plans in the long term to restore the riverine ecosystem. Cumulative impacts of effluent discharge into the Luilu could confine increasing degradation to that catchment, but will reduce the potential to restore that river to an acceptable state in the long term. Future discharges from other industry into the Luilu will have a cumulative impact on the Lualaba.	+↗/-↘	Due to continuing absence of control, pollution of Musonoi will probably increase for some time, should later decline. A catchment management plan for the Luilu catchment and specifically for the more sensitive Lualaba catchment should be pursued as a collaborative effort amongst all the stakeholders affecting that river.
FLORA AND FAUNA; ECOSYSTEMS				
Destruction, degradation and fragmentation of natural habitats	-↑	An expanding mining and related industrial sector may cause, in the short term, some relief in pressure on local ecosystems as people move from subsistence survival strategies to employment. In the long term, however, it will result in accelerating habitat destruction, ecological degradation and loss of biodiversity, as more space is consumed for mining wastes and people migrate into the region. All components of the local natural environment will probably suffer, with consequent reduction in natural productivity and availability of resources, such as fish, to local subsistence communities. In the long term, the removal of tailings from the Musonoi valley and its reinstatement as a water body will increase wetland habitat and may also prove to be a useful fishery if managed appropriately.	-↘	Increasing subsistence production pressure on the environment will result in continuing degradation of habitats and associated biodiversity. Deterioration of soil conditions, leading to increased erosion into the Musonoi, will cause degradation of wetland and aquatic habitats too.
Loss of plant and animal biodiversity	-↑		-↘	
Degradation of terrestrial and wetland/ riverine ecosystems (due to runoff and stream pollution)	-↑		-↘	
Loss of wetland/ riverine habitats	+↑			Baseline prevails
Loss of fish resource to local communities	+↑			Baseline prevails
Re-establishment of natural habitat	+↑			No such opportunity will arise; the Musonoi will be filled with tailings

Biophysical impacts

9.3. Dewatering and water balance

While the KMT project will not be dewatering large areas, except in Kasobantu Dam and the immediate surrounds of the Kananga wellfield which will be installed for water supply, other projects will be increasing the amount of dewatering in order to enable them to recommence mining. Primarily these are the dewatering of the KOV pit by GEC and the dewatering of the New Forrest concession pits (Dikuluwe, Mashamba West and Mashamba Nord), both south of the Kingamyambo Musonoi Tailings Project, possible exploitation of the Manga ore body, and the continued and possible increase in dewatering of the underground Kamoto operation. The possible effects of this on the regional groundwater has not been determined as yet, however the impact of dewatering on the Luilu River will add to the dilution of effluent and stormwater discharged into the Luilu from the various mines.

The water pumped from around the KOV pit is currently discharged to the Musonoi River. It is expected that KMT may request the discharge point to be relocated to the Luilu River to protect its mining operations in the Musonoi from excess water flows. Once the KOV pit is emptied the dewatering boreholes will continue to discharge into the Luilu River, adding dilution to the Luilu. The pumped groundwater is likely to be of reasonably good quality, given the current quality which is generally acceptable for most purposes. Water from the base of the KOV pit in particular may be higher in suspended solids and of poorer quality, and if the lower levels of Kamoto are in sulfide ore, this water may be acidic in nature. The proposed management of these water streams is however not known.

Increased population pressure on water courses as sources of drinking, washing and irrigation water, and the general faecal contamination of such water courses near towns, as is currently seen from Kolwezi, may also increase. Increased agricultural use of the land, which involves clearance and cultivation, is likely to result in greater soil erosion, and should fertilisers be used widely, there may be leaching of these to water courses resulting in potential eutrophication in water bodies such as Nzilo Lake. However, it is assumed that as much of the subsistence agriculture being carried out at present is a direct result of the current lack of formal employment, this situation will possibly reverse once production begins. If more mines open and employ more of the locally available workforce, this combined effect will be positive. In general, these sources of impacts on water courses are likely to be diffuse, resulting from the general increase in population and activity rather than point sources from industrial sites, which can be effectively controlled using state-of the-art technologies.

This will be addressed by FQM via the groundwater monitoring plan outlined in the ESMP and by various aspects of the Community Development Plan (Annex D of the ESMP). Raw data will continue to be made available to other operators through the data sharing agreement.

Effluent loading in water courses

Associated with dewatering, additional impacts to water courses may also increase, as a result of other effluents from the other mining projects. It is assumed that both Kamoto and KOV projects will ultimately be sulfide, hard rock mines which will require mills and flotation plants as well as tailings dams. The main effluent will be wet weather spillages from the tailings dams and may be of a different chemistry due to the flotation process. However, due to the carbonate host rocks, no evidence of acid rock drainage (ARD) has been detected, despite many years of mining, so it may be assumed that in the longer term these effluents would be neutral rather than acidic. Many of the mining operations will aspire to producing cobalt metal as well as copper. No definitive metallurgical flowsheets are currently available for assessment, but cobalt production in other areas has produced high salinity effluents that are difficult and costly to manage effectively. Information on the flowsheets and mass balances for cobalt production has been requested from various operators in Kolwezi, and the implications will be evaluated when this information becomes available.

The development of mining in the Kolwezi area will mean that more than one mine will go ahead and it is likely that each of the mining operations will discharge water into the Luilu River. It will be important to understand the cumulative impact of the proposed mines, assuming each of the mines discharge their effluents into the Luilu, and the resulting impact of the discharges on the presently almost pristine Lualaba River. SRK Consulting has sketched a scenario of potential discharges into the Luilu and their associated TDS for the discharges and then determined the resultant TDS and flows in the Lualaba. A schematic layout of the scenario is presented in Figure 9.3 and the assumptions and results are presented below.

The natural runoff into the Luilu averages about 29 Ml per day and a conservative TDS value in the river of 1000mg/l was used in calculations, although wet weather TDS values may be as low as 50 mg/l.

The discharges from the New Forrest pits based on historical data are about 150 Ml/d with a conservative TDS of 700 mg/l. Some of the old data indicated cleaner water than 700mg/l, but for this exercise a relatively higher value was used. Due to the uncertainty of the quality of the historical data this has not been included in the baseline description. It also covers areas outside the Project Affected Area.

The discharges from the KOV pits based on historical data are about 80 Ml/d with a conservative TDS of 700 mg/l. Some of the old data indicated 120Ml/d of dewatering but this should be less if all other pits in the area are also dewatering.

Wet weather discharges from the KMT and KML tailings storage facilities have been estimated at 8 ML/d each carrying TDS of 6,000 mg/l. The Luilu Plant discharge has been estimated at 5 ML/d carrying 10,000 mg/lD

The results of the dilution calculation are indicated in Figure 9.3, and the following is concluded. The expected flow in the Luilu will be about 350 ML/d with a TDS of about 1170 mg/l. This compares reasonably well with typical drinking water guideline values of about 1000 mg/l TDS, but periodically elevated levels of copper and cobalt are found in the Luilu River that makes the water unsuitable for human or animal consumption. The water in the Lualaba River upstream of the confluence with the Luilu River has a TDS of less than 300 mg/l and a dry season flow of 7430 ML/d. The flow data was abstracted from releases through the hydro-electric scheme and the TDS values were estimates based on water quality samples collected from site.

The resultant water quality in the Lualaba River after the confluence with the Luilu River is a TDS of 340 mg/l, an increment of about 40 mg/l typically made up of Ca 5 mg/l, Mg 10 mg/l and Sulfate of 25 mg/l. The KMT contribution to this increment is assessed at about 9 mg/l as TDS. Revisions to the process flow sheet by KMT since acquiring the project from Adastra has resulted in an 80 percent decrease in the total dissolved solids load it will discharge to the Luilu River each year. This is considered a minor incremental impact in relation to the vast economic benefit to the country that mining will provide.

As a note of caution, none of the mines in the Kolwezi area have yet developed their metallurgical flowsheets for cobalt metal production. Brief discussions with other mining companies in the region indicate that management of effluents from cobalt metal production may be problematic depending on the metallurgical processes used. These considerations are not included in the calculations used in Figure 9.3.

Raw data will continue to be made available to other operators through the data sharing agreement.

9.4. Noise

Noise levels are discussed briefly in table 9.2. It is inevitable that if more projects should start in the Kolwezi area, the levels of noise will increase. However, it is not possible to say, without carrying out a modelling exercise, which areas will be most effected. The modelling for this project shows that the noise contours do not extend far from the facilities; in general, a tailings reclamation project and SX-EW plant are not significant sources of noise when compared to hard rock operations involving blasting, crushing, milling and the disposal of waste rock. The sites are however reasonable distances apart (except for the proximity of the KOV pit to KMT's Kingamyambo tailings deposit) so the background noise levels may show little increase.

Noise levels will be monitored regularly as described in the Monitoring Plan of the ESMP. Raw data will continue to be made available to other operators through the data sharing agreement.

9.5. Air quality

Increased impacts to air quality may arise from a number of sources, such as blasting from open pits, waste rock disposal and fresh waste rock dumps, increased diesel use, other mines using sulphur burning acid plants and generating particulate matter, more dust generation from vehicle movement, and the possibility of roasting technology being used with little pollution control at other mines. However, new operators of such large mining ventures are likely to employ efficient control technology as this is required by the DRC Mining Regulations. In general, the sources are likely to be diffuse, and will result in generally higher ambient levels of particulate pollutants, such as nuisance dust, PM10 and gaseous pollutants, notably, oxides of nitrogen (NO_x) and oxides of sulfur (SO_x).

Air quality will be monitored through a network of deposit gauges, which will be reinstated due to the cessation of monitoring following FQM's acquisition of the project. Gaseous monitoring will also be carried out as described in the Monitoring Plan of the ESMP. Raw data will continue to be made available to other operators through the data sharing agreement.

9.6. Tailings management

Increased mining activity in the Kolwezi area has highlighted the inadequacy of current tailings disposal methods – for the Kolwezi Concentrator (KZC) this is the Musonoi River, as the tailings in the valley are the legacy of many years of operations at KZC. The current operators, DCP, now part of Katanga Mining, are exploring alternative tailings storage areas and currently use an abandoned open pit, JH Pit, close to the Musonoi River. However, using this pit may present technical and environmental difficulties, so the search for an alternative site has been widened. The extent of the infrastructure and waste rock dumps, derelict land etc associated with the past century of mining activity means that suitable alternative tailings sites are increasingly distant from the town of Kolwezi, with escalating costs. While tailings dams represent the largest demand for land in terms of area, the requirements for other mining facilities, such as new plant sites or expansions, are also considerable and finding suitable sites is becoming increasingly difficult. As existing sites expand, there is also the need for the resettlement of communities which are becoming encroached on, and this too, along with the expansion of the town of Kowezi, puts increased pressure on land resources. Without a coordinated, strategic approach, there is the risk that villages are resettled into areas that other companies have earmarked for infrastructure or tailings dams, possibly leading to repeat resettlement. It must also be borne in mind that some villages on the KMT concession have already been moved, many decades ago, from what are now the main mining areas.

The development of new tailings dams and the continued management of the existing tailings deposits (not many would be recognised as engineered structures) will have a cumulative effect on the effluent discharges and seepages to some rivers. At the moment the key catchments affected are the Musonoi and the Luilu, and the various discharges are summarised in Section 9.3. Without some catchment management planning, unacceptable negative cumulative impacts on both land and water courses will occur.

Social Impacts

9.7. Increased Pressure on Natural Resources

Throughout the area there will be an increased demand for natural resources which sustain human life, such as water, fuel wood, secondary minerals such as sand for construction and lime as a reagent, mud for adobe houses and aggregate for larger buildings and roads. Increasing populations and land use will increase land take and reduce biodiversity. There will also be a greater demand for food. Food may be produced locally to each mine, as will be encouraged by KMT's Community Development Plan, or may be imported from elsewhere. The positive benefit of this is to provide commercial opportunities for farmers to sell their crops, but the increased pressure on land resources, without the further development of more sustainable farming techniques, may result in the rapid increase of slash and burn agriculture, extensive fires in the dry season, and the degradation of natural habitats further from Kolwezi. The effect of the demand for fuel wood and charcoal from centres of population density such as Kolwezi and Lubumbashi can be seen clearly, where closer to Lubumbashi the trees have been completely removed to make charcoal and grow crops. Further from towns the tree cover is less degraded, although frequently charcoal is available for sale in these areas, from where it is taken to the towns and sold. The KMT Community Development Plan will encourage the planting of fuel wood plantations and the use of simple stoves which require less fuel to boil water and cook food. Increased prosperity is likely to result in more people living longer, extending the demand for food and other natural resources.

9.8. Increased Demand for Skilled Labour

This would result from several mines coming into production at the same time. This is likely to encourage the migration of skilled workers from other areas, but the existence of more than one mine in the area means that re-employment at an alternative location becomes a possibility when one closes. While a pool of skilled workers remains from the days of greater copper production in the area, it is also likely to have a positive effect on education, as the need for new skills and enhanced job opportunities is recognised and the community responds, with support from mining companies like KMT.

9.9. Increased Pressure on Infrastructure

In addition to the increased demand on natural resources as a result of this and other developments, the infrastructure will also be put under greater strain. There will be greater demand for rail transport for both passenger and freight loads, roads will be used more as more vehicles become available and are required to move goods, materials and staff to and from the mining areas. The increased population will result in a greater demand for housing, schools and medical facilities. As far as the

KMT project is concerned, the community policies aim to provide health care, assistance for agricultural producers and will encourage the development of schools and training centres. KMT may support initiatives that involve upgrading the rail facilities and it will increase the impetus to maintain and upgrade the main Lubumbashi - Kolwezi road. This may not necessarily be the case for other, smaller developments, which may attempt to rely on the facilities set up by KMT, or increase pressure on existing facilities.

9.10. Increased demand for energy

The development of new mines will greatly increase demand for energy in and around Kolwezi. This will be a result of greater industrial demand, partly to serve the re-activated former Gécamines plants, and later the new plants planned by Katanga Mining and KMT. Industrial demand will be compounded by domestic and commercial demand, as population increases, living standards improve and commercial activities multiply. The commissioning of new energy generation requires long lead times. It is not clear whether energy planning in the DRC has accounted for the cumulative demand growth related to mining-led economic recovery, but any generation shortfall could have serious consequences for industrial development and investor confidence.

9.11. Increased traffic

The increased activity around Kolwezi, and the poor state of the railway and scarcity of rolling stock, means that companies such as First Quantum, DCP and Katanga Mining are all using the existing road network, which is also in poor repair and not maintained. Stretches of the road between Lubumbashi and Kolwezi, which runs through Likasi, are being upgraded, or there are plans to upgrade, but the roads in and around the town are being heavily used and this will only increase with more mining activity. The location of much of the mining activity means that the lorries have to pass through the town and this has been noted by the inhabitants as causing greater damage to the roads and to nearby properties. The increase in lorry traffic will be particularly pronounced during the construction, refurbishment and expansion programmes of the various projects. No detailed information is available on this, but for DCP and KCC is anticipated to take place within the next five years, adding to the volumes of construction traffic generated by FQM. While the railway remains in a poor state, lorries will remain the preferred option for transporting reagents and supplies to the area, and copper and cobalt products away from site to market.

Lorries are also the only means of getting goods and materials to the town to supply the increased demand in the shops from expatriate workers or from residents who are experiencing an increased standard of living and are therefore able to afford imported food and goods.

Air traffic is also likely to increase as more mining companies organise flights to get key personnel to and from site, including over weekends.

9.12. Incidence of Disease

The general increase in prosperity in the area as a result of new mining operations is likely to attract migrant workers from other parts of the country and even from neighbouring countries. High levels of migrancy, coupled with the breakdown of socio-cultural norms, are frequently correlated with high incidences of sexually transmitted diseases, particularly HIV/AIDS, which has tended to spread along main roads and transport routes. Also, crowded shanty towns which will grow up around the mining centres may lead to an increased incidence of diseases such as cholera and dysentery, which can affect the old and the young, as a result of lack of sanitation and waste disposal. However, medical facilities and health education are likely to improve, as indicated above, and care is likely to be more available as a result. Mining companies have already launched a joint malaria management initiative that includes the handing out of mosquito nets to communities as well as measures to reduce the breeding environment and habitats that harbour mosquitoes. Collective efforts are also underway to improve hospital facilities.

9.13. Improved Living Conditions and Standard of Living

The availability of healthcare, education, housing and the improvement of basic infrastructure such as water supply and sewage treatment, roads, railway services and communications will contribute to an overall increased standard of living for the population of the region. As the regional and local administration will be in receipt of very considerable sums of money accruing from royalty payments and corporate tax payments, infrastructure and services should improve dramatically, assuming the money is managed and spent correctly. If it is assumed that just 3 of the possible 8 projects previously identified are fully developed, and those three projects together roughly equate to the KMT project, the annual sum available for infrastructure development will double to USD 34 million per year for the duration of these projects. In fact, annual infrastructure investment could well exceed this amount.

A rapid increase in the cost of living and associated general inflation should be mentioned as a negative side effect of the augmented economic activities in and around Kolwezi. Rents of local houses are reported to have doubled over the course of 2007, and local entrepreneurs complain about the rise in salaries of local contract workers and service providers because of the influx of mining companies.

Another possibility which cannot be ignored is the potential for corruption, as more resources become available in the region. The UN report on corruption in the mining sector in the DRC must be noted (UN Security Council, Nov 2001), as must the current review of mining contracts. The review was prompted in part by allegations that some contracts were corruptly negotiated. FQM subscribes to a strong Ethics and Conflict of Interest Policy and a Corrupt Practices Policy, and KMT is a member of a fledgling group of companies committed to doing business in a transparent

manner in the DRC, as well as agreeing to comply with the requirements of EITI, the Extractive Industries Transparency Initiative (see Chapter 2).

There will also obviously be many more opportunities for employment and commerce, both in the mines and in support industries such as equipment suppliers, food producers, retailers etc., and in training and education across the region.

In summary, the development of mining projects in Kolwezi is seen as crucial to the re-development of the region, if not the nation. Many other developments and benefits will result which will strengthen the infrastructure and economy of the country and encourage the development of other economic sectors to provide sustained development.

9.14. Increased Influx of migrant workers

A common impact of major mining and infrastructural projects in developing countries is the influx of opportunity seekers. The influx may be motivated by expectations around the project itself, or it might be the result of a more general perception of opportunity in a town or a region. Influx is not negative by definition, but its impacts can be damaging where the migrants are not readily assimilated, placing stress on services, disrupting existing communities, and in some cases living in unhealthy and crowded conditions.

The revival of mining in Kolwezi, Democratic Republic of Congo (DRC) is taking place against the background of a depressed local and regional economy and high unemployment. The Kingamyambo Musonoi Tailings Project (KMT) is one of several new mining ventures in Kolwezi, and is thus an element of the mining revival. It is inevitable that the possibility of jobs and other economic opportunities will stimulate in-migration, and there is already evidence that this is taking place.

Influx can only be managed by collective action of the mining companies' activities in and around Kolwezi, and by government taking a proactive role. Harmonised information-gathering and approaches to regional movements of artisanal miners are required. Changes in the circumstances of artisanal miners elsewhere in the district could precipitate influx onto one or several of the concessions.

9.15. Pressure on artisanal Mining

The growing number of mining companies undertaking industrial-scale mining in large concessions directly affects artisanal (informal, itinerant) and small scale mining. Artisanal mining remains one of the most important economic activities in and around Kolwezi. In terms of numbers it is still the most prevalent mining activity in the area. It is estimated that around 30 000 artisanal miners operate illegally in the Kolwezi area, including several thousand women and 4000 children. Artisanal mining activity has grown following the decline of Gécamines. It has proceeded with government approval as a "social calming" strategy to deal with the effects of the near cessation of formal mining. The sector is largely unregulated.

The struggle for mining resources has already created tension between artisanal miners and formal mining companies in the area, and this has the potential to increase as the formal miners begin mining in earnest. All formal miners face a dilemma. It is legally and reputationally risky to get involved with artisanal miners. But it is a reputational and humanitarian risk to remove them using

overly coercive methods, and without some negotiated solution. Removal also raises the possibility of reprisal.

Close collaboration amongst companies as well as with the relevant governmental authorities is essential for dealing with the artisanal mining issue.

9.16. Displacement (resettlement) and dislocation,

Cumulatively, the formal mining companies active in Kolwezi will require significant areas of land for industrial infrastructure, tailings storage facilities, transport infrastructure and housing. The cumulative land take is difficult to quantify, but it is likely to exceed 2000 ha. Against this background there will be significant displacement, with associated impacts. To date most of the displacement has been economic (loss of access to land and loss of crops), but some physical displacement has also occurred. Significant physical displacement is possible in future, for example as the expansion of the KOV pit impinges on nearby settlements. As more areas are occupied by mining infrastructure, the remaining areas of land, on which local communities may still grow crops, become increasingly dislocated from the villages. The obstacles to accessing the land, such as fences, pipelines, roads etc frequently mean that longer distances have to be travelled to reach the fields. This will translate into a reduction in communities' ability to produce enough food and to transport it.

Most of the formal miners have undertaken to manage resettlement in accordance with international standards, and to compensate project impacted people accordingly. If this collective responsibility is carried through as promised, most of the impacts of resettlement should be mitigated, and in many cases living conditions should improve. Challenges will include the availability of suitable replacement land, and the management of opportunity seekers wanting to gain access to compensation. The latter has proved to be difficult in other mining settings in the DRC.

9.17. Increased presence of (private) security forces

The increase in mining ventures in the area has led to a growing number of security personnel, operating in and around the various concessions. Most companies choose to organise their own security instead of relying on the 'police des mines' and other government security bodies. The privatisation of security is leading to a reduced role and power of public security agencies in the mining areas. Combined with the fact that a significant part of the newly employed security personnel comes from outside the communities, this presence has the potential to create tension, both between the private security guards and communities as well as government security forces and companies.

Most of the formal mining companies have developed strict policies to guide their security arrangements, and alignment with the Voluntary Principles for Security and Human Rights is common among these enterprises. PACT Congo is active in the area providing and developing training material for security guards on the Voluntary Principles.

Fencing and boomed access control on a large scale could disrupt movement of people and goods across the concessions. This may be positive where illegal activities such as the smuggling of ore have been taking place, but it might also hinder community access to their own and other villages or to agricultural plots. Enforced access control could precipitate the movement of artisanal miners from one concession to another.

Close communication among formal mining companies and between the mines, local authorities and communities is essential to prevent community disadvantage and social unrest, and to maintain security while respecting human rights.

9.18. Social stratification

As Kolwezi residents gain access to jobs and other economic opportunities associated with the new mines, it is likely that a social stratification reminiscent of social organisation under Gecamines will re-emerge. In general, greater wealth should benefit the local economy, with benefits for many. However, the differential access to direct and indirect opportunities could magnify existing divisions (such as the gap between urban and rural communities), and introduce new contrasts (for example between expatriates and locals).

The mining companies should be in a position to moderate some of the stratification, through transparent and fair recruitment and procurement policies, and via community development programmes.

9.19. Pressure on institutional capacity

The growth of mining in Kolwezi will both challenge and promote institutional capacity. In the short term, a growth in demand for services such as electricity, water, education and health could place stretched and underfunded institutions under pressure. In the longer term, however, the expansion of a market able to pay for such services, together with improved local revenue from tax and other revenue sources should see services improving. Unequal access is a risk, with potential for social stratification, as discussed above.

Recommendations

(See ESMP Action Plan for detailed mitigation measures for each impact)

To minimize deterioration of the local and regional environment, the mining authorities (DPEM) should be encouraged to impose uniformly rigorous environmental management/ pollution control standards on all mining/ mineral processing projects.

Nevertheless, increasing industrial activity will eventually result in increased absolute quantities of pollutants entering the environment, causing a decline in environmental quality. (See ESMP Action nr 2: environmental and social monitoring and reporting programme; and 4: environmental and social management plan)

Particular benefits may accrue if a regional approach to assessment is taken for surface water, notably catchment management and planning, and groundwater resources. A regional land use and land capability assessment, incorporating the demands on land for all new potential facilities such as waste rock dumps and tailings dams, as well as the potential demand for locally grown crops, would also benefit the area, and may result in a simple 'zoning' policy of separating industrial, residential and agricultural land uses. (ESMP Action Plan nr 13: management of cumulative impacts)

Modelling studies should be implemented centrally/by government to estimate the assimilative capacities of all environmental media, in order to ensure orderly long term planning for sustainable industrial development in the area. Modelling and monitoring of ambient noise, air quality and radioactivity levels should also be undertaken, to monitor changes and ensure unacceptable levels are not reached which may pose a risk to human populations.

Particular attention should be paid to the potential for increasing water quality impacts in the Luilu River and the consequences thereof in the Lualaba River; and in the Musonoi River/ canal and Lake Nzilo. The existing water quality monitoring programme should include an assessment of the conditions at Nzilo Lake and the Lualaba River. (ESMP Action Plan nr 13: Participate in monitoring of Lualaba River (water quality and biodiversity) and greater Kolwezi modelling of assimilative capacity).

Regional authorities should look at innovative ways of generating revenue (through dedicated taxation/ levy instruments) or cost-sharing through public-private partnerships (PPP), to fund the timeous upgrading of infrastructure, notably transport infrastructure and municipal services. (Capacity building of local authorities will be part of the Community Development Plan; ESMP Action plan nr 19)

Campaigns to raise awareness of HIV/AIDS and malaria should be implemented early in the development cycle, to prevent a rapid rise in the disease's prevalence which might be expected to accompany a period of pronounced socio-economic change. (KMT Community Development Plan and regional cooperation)

A local DPEM office would also be extremely valuable, given the predicted levels of mining activity in the area. An analytical laboratory, either run by DPEM or independently, would solve the problem of getting samples analysed reliably, by an accredited laboratory that all companies working in the area currently face.

A constant sharing of information and the development of a joint strategy on security, artisanal mining and influx management amongst the mining companies active in and around Kolwezi would be extremely useful for the mitigation of most of the cumulative social impacts (ESMP action nr 13: regional management of cumulative impacts, Annex H: influx management strategy and I: artisanal mining strategy).

Figure 9.1: Location of the various projects planned in the Kolwezi area

Figure 9.2: Boundaries of other mining concessions which immediately surround the KMT concession

Figure 9.3: Schematic layout of scenario of potential discharges into the Luilu and Lualaba rivers