

## **KONKOLA GROUNDWATER - A SOURCE OF DOMESTIC WATER SUPPLY TO CHILILABOMBWE DISTRICT - ZAMBIA**

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### **ABSTRACT**

Chililabombwe town is situated north of the Zambian Copperbelt near the border with Zaire and lies about 450km west of Lusaka, the capital city of Zambia. Konkola Underground Mine is located in this town.

This paper examines the quality, quantity, demand and supply of ground water for domestic use in Chililabombwe district.

The 1990 population census indicate that Chililabombwe town has a population of about 100 000 people. The total piped water supply is 50 600 000 litres per day. This means there is about 500 litres/d of water per person in the district.

About 30 800 000 litres/d is pumped from the Kafue River out of which only 26 600 000 litres/d is treated for domestic use. It costs US6.00 cents (K33.00) to pump 1 000 litres of water from Kafue River for domestic use.

An average of about 300 000 000 litres/d is pumped from Konkola Mine. Domestic water supply statistics reveal that there is currently a shortfall of 15 300 000 litres/d. This shortfall can be eliminated by using groundwater from the mine.

Analysis of the quality of the Konkola groundwater reflects that its chemical and biological composition meets the requirements for domestic water supply and falls within the standards set by the World Health Organization and the European Economic Community. Against this background, provision of wholesome water for domestic use should depend on the groundwater resources in the Konkola basin. A significant saving of US\$ 674 545 (K371 million) per annum can be achieved by adopting this method.

It is thus necessary to utilise water pumped from the mine for domestic use as this will ultimately reduce the total cost of mining.

## 1.0 INTRODUCTION

Ever since the mine started in 1955 a large amount of water has been pumped. Currently Konkola Mine pumps about 300 000 000 litres/d of water. This figure shows that Konkola has a large groundwater resource.

Chililabombwe district has a population of about 100,000 people. This population constitutes mainly of the mining community.

Domestic water supply for the town is sourced from Konkola underground water and the Kafue River. There are two water treatment plants in the district - Chililabombwe District Council and Mine Water Treatment plants.

The Chililabombwe District Council Water Treatment Plant treats 24 000 000 litres/d using raw water sourced from Konkola underground mine. It has a capacity to treat about 48 000 000 litres/d.

About 30 800 000 litres per day is pumped from Kafue River out of which only 26 600 000 litres is treated at Chililabombwe Mine Treatment Plant. It costs US\$6.00 cents (K33) to pump 1000 litres of water from Kafue river. The mine water treatment Plant, with a capacity of 54 600 000 litres/d, only treats 26 600 000 litres/d using raw water sourced from the Kafue River.

There is a shortfall in the piped water supply for domestic use in the district. It is envisaged that this shortfall can be easily eliminated by making maximum use of the water pumped from the mine. Against this background, this paper examines the necessity, quality, quantity demand and supply of groundwater for domestic use in Chililabombwe District.

## **2.0 HYDROGEOLOGICAL SETTING**

Konkola Mine groundwater originates from generally two sources namely; The Hangingwall Aquifers and the deep seated regional aquifer - Footwall Aquifer.

The Hangingwall Aquifer comprise the Kundelungu limestone Aquifer, Upper Roan Dolomite, the Shale-With-Grit and the Hangingwall Aquifer formations. The Footwall Aquifer consists of the Footwall Quartzite (FWQ), the Footwall Aquifer Formations and the Lower Porous Conglomerate (LPC).

In summary, the orebody is sandwiched between major Aquifers. The Hangingwall Aquifer consists of dominantly Carbonate rock and Siliceous rocks constitute the Footwall Aquifers (Figure 1.0 and 2.0)

## **3.0 GROUNDWATER QUALITY**

It is a well known fact that the quality of any groundwater world wide depends upon, among other things, the geological environment (host rock chemistry), its flow path and the source. The criteria used to measure groundwater includes chemical physical, biological and radiological analyses (Todd 1980). A comparative assessment of Konkola ground water quality against domestic water standards in various regions of the world is shown in Table 1.0

TABLE 1.0 Comparison of International Domestic Water Standards with Konkola Groundwater (Permissible Limits)

PARAMETER	WHO 1984	EEC 1979	ZABS	KONKOLA WATER (Mulenga 1991, Rubio 1993)	LATEST ZCCM 1994
pH	6.5-8.5	6.5-8.5	6.5-9.0	7.53	6.5-8.5
TDS	1000	-	1500	426	1500
TSS					80
Colour	15TCU		15TCU		15TCU
Turbidity	5NTU		10NTU		10NTU
Hardness	500		500	<500	500
Chloride	250	200	250	19.1	250
SO <sub>4</sub> <sup>2-</sup>	400	250	400	45.0	600
Na	200		-	4.1	120
Mg	50		150	32.1	150
Fe	0.3	0.3	1.0	0.0	0.5
Mn	0.1	0.05	-	<0.02	0.5
Al	0.2	-	-	<0.1	0.2
Cu	1.0	0.05	1.0	<0.1	1.0
F	1.5	1.5	1.5	-	1.5
Ag	-	-	0.05	<0.01	0.1
As	0.05	0.05	0.05	<0.06	0.05
Cd	0.005	0.005	0.005	<0.01	0.005
CN	0.10	0.05	0.1	0.0*	0.20
Cr	0.05	0.05	<0.01	0.05	
Hg	0.001	0.001	0.001	-	0.001
Pb	0.05	0.05	0.05	<0.06	0.05
Se	0.01	0.01	0.01		0.01
Zn	5	3	5	<0.26	5
NO <sub>2</sub> <sup>-</sup>				0.00	
HCO <sub>3</sub> <sup>2-</sup>				256.3	
NO <sub>3</sub> <sup>-</sup>	10	50	10	5.1	10

All values except pH in Table 1.0 and where stated otherwise are expressed in mg/l.

WHO - World Health Organisation

EEC - European Economic Community

ZABS - Zambian Bureau of Standards

#### 4.0 CHILILABOMBWE DOMESTIC WATER SUPPLY AND DEMAND

##### 4.1 Mine Township

Currently the water is sourced from the Kafue River.

An average of 30 800 000 litres/d of water is pumped from the river for domestic water supply. Out of this only 26 600 000 litres/d of water is treated at the Chililabombwe Mine treatment plant. It has a capacity to treat 54 600 000 litres/d. This means that the plant has an extra capacity of 51% to treat the envisaged increase in water consumption requirement of Chililabombwe town. It costs about US\$ 6.00 cents (K33) to pump 1 000 litres of water from Kafue River. This means that a saving of US\$ 1 848 (K1 016 400) per day can be achieved by stopping pumping water from Kafue river. Saving per annum would amount to US\$ 674 520 (K370 986 000).

It should be noted that the average daily consumption depends on climate, housing conditions and living standards; whether or not the supply to individual consumers is metered; the cost of water; and the extent to which the area is sewerred (D Barnes et al, 1981).

The present water consumption and quantity required to satisfy the demand for water in Mine Township is given in Table 2.0.

**Table 2.0** Piped water consumption and demand for water in Chililabombwe Mine townships

LOCATION	PRESENT CONSUMPTION IN LITRES/d	QUANTITY REQUIRED TO SATISFY DEMAND IN LITRES/d
Kamenza Township	13 600 000	15 900 000
Chililabombwe Mine Township	9 200 000	22 200 000
Mine Farm/ Golf Club	2 200 000	2 200 000
Backwashing (Cleaning filters)	1 600 000	1 600 000
<b>TOTAL</b>	<b>26 600 000</b>	<b>41 900 000</b>

It is evident from the table that there is a shortfall of 15 300 000 litres/d. In addition, the piped water supply from the mine water works is only able to satisfy 63.5% of the water demand.

4.2 At the moment water in the Municipal Council area is sourced from the Konkola mine ground water.

Out of about 300 000 000 litres/d of water pumped from the mine, approximately 24 000 000 litres/d is pumped to the Municipal Council Water Treatment Plant for domestic water supply. The Plant has a capacity to treat up to 48 000 000 litres/d of raw water.

With the abundant water pumped from the mine, the Municipal Council Water Works could increase its water treatment capacity and consequently increase its potential to supply portable water to the community.

## 5.0 CONCLUSION

- 5.1 Analysis of the Konkola Ground Water has revealed that it is of good quality and compares very well to all portable water standards such as those set by the World Health Organisation and European Economic Community.
- 5.2 Utilisation of the groundwater resource of 300 000 000 litres/d will increase the amount of water available per person from about 500 litres per day to 3 000 litres per day.
- 5.3 It is evident that a saving of US\$ 674 520 (K370 986 000) per annum can be achieved by stopping using Kafue river water for domestic supply. Instead the use of water pumped from Konkola Mine should be maximised. This will ultimately reduce the cost of production.

## REFERENCES

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