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title: **Pollution of groundwater in shallow aquifers - a critical moment in Uganda**

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INTRODUCTION

Ground water is the main and safest sources of drinking water and other domestic use for the people of Uganda. However water contamination within the densely populated lowlands (swamps) threatens the livelihood of the inhabitants.

About 60% of the inhabitants of Kampala reside in such areas with very little formal structure, therefore here people depend on polluted springs for drinking water.

Bwaise slum is one of such areas which we are going to look at in this paper. It has a very shallow water table some time up to the surface of the ground and not greater than 1.5 m.

In this area the pit latrine is the main technology used and no proper dumping of the solid waste garbage.

Bwaise is in peri-urban Kampala about 4km in the north, it fringes on the lowland of Lake Victoria with a population density of about 27000 people per square kilometer.

This situation leads to the contamination of the water in the area posing serious threats epidemics of water borne diseases like cholera diarrhea which has led to loss of life.

Due to pit latrine, solid waste management and sullage dumps, the animal yards and car washing bays and garages the studies put the concentration of coli form at $1-16 \times 10^7$ cfu/1000 ml, nitrate at 0.10-779 mg/l and phosphorous at 0.001-13 mg/l.

Of all these the main pollutant is pit latrine.

However the bedrock is about 30m below the clay containing clean water in the fracture network. The problem is the technology and fund to be able to extract this clean water for the community to use.

The problem of contaminating the ground water has been helped by the following reasons:

Over population the

The population density as already stated is 27000 people per square kilometer which is one of the highest in the country. Typical of the peri-urban development in low land (swamps) with the water table just on the surface of the ground. The inhabitants mainly use on site septic tanks and pit latrine coupled with dumping the solid waste in the area. This means that the waste products get direct contact with the ground water which is the source of drinking water in the area for more than 90% of the inhabitants.

Ignorance

Most of the inhabitants of the area are semi or illiterate therefore have no access to information, so many are not aware of the dangers of poor sanitation in the areas.

Being illiterate means that the written literature is useless to them. And further still attending sensitization programmes might be very difficult as some are always busy with work and even believe that these are for literate community members. Well as such programmes could help to inform them on the dangers of consuming untreated and contaminated water.

Poverty

The inhabitant of the place are poor people living in congestion, therefore cannot afford appropriate sanitation facilities such as flush toilet which would suit the areas with high aquifers. Some cannot even afford the pit latrine and have no space for it. These therefore resort to flying toilets (defecating in a polythene bag and through it away at night). This means littering the whole areas with faecal materials as each home is throwing to the other.

Lack appropriate technology

The residence lack the appropriate technology applicable in order to protect shallow aquifers when designing water and sanitation schemes in the area. Having access to only pit latrine technology does not help the situation when the best technology would have been either ecosan or flush toilet for a swampy area.

Culture

As such areas attract too many low income earners, therefore bringing in people of all walks. Hence collecting different cultures which have many negative attitudes towards good water sanitation behaviours.

Some cultures believe that pregnant women must not use pit latrine and others know that faeces from babies have no harm. Others believe in drinking water without a simple treatment such as boiling.

Government policy

The government's failure to fully plan for peri-urban areas mainly in swamps. And to make matters worse its corrupt officials fail to implement the laws so that these areas are developed according to plan. By law the wet lands are supposed to be preserved as filters for the contaminated water before getting to Lake Victoria.

However many government officials turn a blind eye to these development which has led to a number of catastrophes such as floods further more contaminating the ground water, leading to diseases like cholera.

Land Tenure system

The land ownership in the country also does a lot to promote these problems as it encourages the unrealistic development of the area. This is because in some instance the land is owned by two people the land lord and the scoter if there is a disagreement the development is of area is affected.

The economic activities

Some of the economic activities in the area pollutes the ground water such as oil from garages, detergent from the washing bays and waste products from brewing. Given that these activities are not using advanced equipment they end up leaving the waste products to go to the streams or bear ground which contaminate the ground water. And they actually take no trouble to have remedies to the problem and the government supervision is not sufficient.

Negligence

Some people are just negligent in that they have been sensitized on the water and sanitation good practices. And they are fully aware of dangers of using polluted ground water. However they end up doing the same. They even fail to pass on the information to the neighbors because of the I don't care attitude.

Alcoholism and drug abuse

Given the nature of the inhabitants, there is a lot of alcoholism and drug abuse, turning the people into nuisance hence defecating and urinating any where. They dump the waste materials in wrong spots which contaminate the water.

However the situation can be saved so that this contaminated water can be rendered usefull for consumption in the area for the inhabitants. The following must be addressed properly in order to mitigate situation.

Flexibility of the design

A flexible design which is appropriate and can be adopted by the community should be thought. It must be easy for the local technicians to construct and must be affordable to most of the inhabitants so as to solve this problem effectively. In this case an ecosan toilet technology is best for this situation if the users are sensitized to appreciate its application and advantages.

Insitutional and funding options

The funding of the water and sanitation schemes should be made relevant to the prevention of polluting the ground water in the area. Funding should be made adequate for both the hardware and software in order to solve the problem of operation and maintenance of these facilities to be done by the community or end users.

Participatory implementation

All the stake holders must be involved in all stages of the planning for a water and sanitation scheme, so as to listen their views as they could be very useful in solving the problems as they are aware of the background of the area, therefore could provide very useful information in the design of the scheme.

Social Cultural dimension

The people in the area should forge a common way of behavior to suit the area they are living in concerning the water and sanitation attitudes. For example irrespective of their different cultures they must adopt those which suit shallow aquifers in order to stay in this are healthy.

Sufficient hygiene education and Health aspect must be addressed

The community members should be sensitized about the dangers of unhygienic behavior which lead to the contamination of the ground water in their community. They must be informed the effect of contaminating the drinking water to their healthy and the diseases which attack them and some times kill some of them.

Environment concern

The environment degradation behaviour and the effect of the people activities in the area to the climates should be addressed. The community members should appreciate their contribution to the problems which affect them in their daily life. And also teach them how to mitigate.

Land requirement

An appropriate land laws and policies which would avoid double ownership so as to give confidence to who ever is on the land to fully develop it without fear for the good of the area. This will help to curb the pollution of the ground water problems caused by land ownership in the country.

CONCLUSION

Pollution of ground water in Ugandan is at critical moments due to population explosion as many people are settling in swamps which are low land with high aquifers.

Unless all the stakeholders come on board shallow aquifers in Ugandan will be polluted because there is no filter, hence multiplying the problem to all water sources e.g lake Victoria.

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