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MAXIMIZING THE BENEFITS FROM WATER AND ENVIRONMENTAL SANITATION

Groundwater resources management in urban areas of Uganda: Experiences and challenges

C. Tindimugaya, Uganda

Groundwater development for urban water supply has been ongoing since early 1990. In some urban areas however, groundwater is heavily abstracted resulting in lowering of groundwater levels and sometimes competitive pumping between water sources. The lack of sewerage systems in urban areas has also lead to construction of onsite sanitation systems in form of septic tanks and pit latrines, which have caused contamination of groundwater resources in many areas. Protection of groundwater in terms of quality and quantity is therefore needed to control overexploitation and pollution of groundwater. This requires undertaking studies to resolve key practical groundwater management questions in order to guide optimum groundwater development and determination of groundwater protections zones around boreholes in fractured rocks. Furthermore, an institutional framework for groundwater resources management combined with an adequate awareness raising programme on water resources management are required to enable the water users actively participate in groundwater management and protection

Background

There is heavy reliance on groundwater in many areas of Uganda for domestic water supply due to its wide distribution and general good quality.

Groundwater development in Uganda started in the 1930s, for domestic rural water supply through deep boreholes and springs. Similarly, since early 1990s there has been an increase in groundwater development for urban water supply due to the need to have water supply systems that can easily be operated and managed by the users. Thus, under the urban water supply investment plan, it is planned to supply piped water to over 250 urban areas and towns and over 80 of these are already in operation based on groundwater from deep boreholes. Over 30 urban water supply systems are currently under construction and many more planned for construction in the next few years.

Groundwater resources management issues in urban areas of Uganda

Groundwater is the preferred source for piped water supplies in small towns due to the relatively low cost of its development and the good quality of the water. Groundwater development for urban water supply especially in small towns is however only possible where the geological formation possesses moderately high permeability and or high storage volumes and major systems flow. The use of groundwater is thus restricted to relatively few high yielding boreholes which are operated by urban water authorities.

The growths of towns have had profound effects on the groundwater resources due to poor land use and waste disposal and sanitation practices. Population growth in urban areas has moved at a higher pace than the ability of the government to provide the necessary infrastructure to handle domestic and industrial effluents and this has lead to widespread contamination especially of shallow groundwater. The onsite sanitation systems in form of septic tanks and pit latrines are the main means of waste disposal because of the high cost of installing conventional sewerage systems.

In addition, the geological formations in Uganda are made up of metamorphic rocks and are usually weathered and fractured to form aquifers. In fractured rocks where the aquifer is close to the surface and the water table is shallow, the use of onsite sanitation has resulted in a high risk of contamination of nearby groundwater sources by bacteria. Pollution has already happened in some densely populated areas and in areas where water sources and onsite sanitation systems are constructed next to each other.

Furthermore, in some urban areas, there is heavy groundwater abstraction that has resulted in lowering of groundwater levels and competitive pumping between water sources, ultimately resulting in increase in the cost of operation of water supply systems. For the urban water supply authorities, their main concern therefore should be decreasing availability and deterioration of quality of groundwater, which may lead to rising water production costs, customer complaints regarding water quality and public health risks. The above problems are diagrammatically presented in Figure 1 overleaf.

Due to the above issues protection of groundwater in terms of quality and quantity is needed to avoid reduction in available groundwater resources, escalating water supply costs and potential impacts on human health. Poor qual-

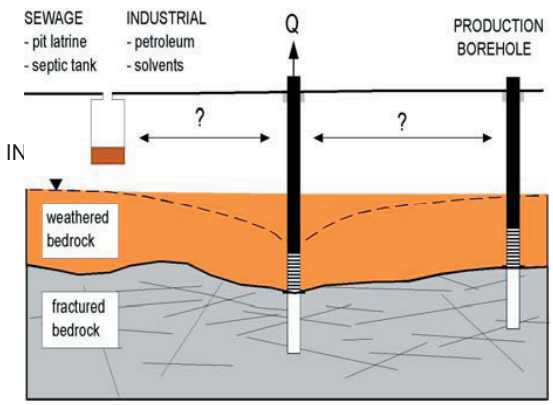


Figure 1. Schematic presentation of groundwater management problems in urban areas of Uganda

ity and unreliable groundwater supply have far reaching consequences on the economy and the social fabric of the country. For example, industries that require good quality and reliable water supply may easily relocate to other areas if the groundwater resources fail to meet their requirements. Thus, the groundwater management issues that threaten the sustainability of groundwater based urban water supplies in Uganda include inadequately controlled groundwater abstraction and excessive contamination load to groundwater.

There is therefore a need to improve management of groundwater resources in urban areas in order to mitigate the actual and potential problems caused by overexploitation and inadequate control of pollution of groundwater resources.

Current experiences and challenges in groundwater management

In mid 1990, Uganda Government realized the need to understand groundwater dynamics in order to ensure sustainability of urban water supply systems. It was recognized that groundwater problems usually evolve over long periods of time, that groundwater overexploitation and pollution problems are normally difficult to address once they have happened and that the benefits of groundwater management are normally realized after along time.

Thus, a number of approaches have been employed in order to address the key groundwater management issues in urban areas.

Groundwater regulation

Improvement of groundwater management requires a strong institutional framework, which includes legislation so as to issue water rights for groundwater abstraction and supervise and enforce the various water licensing processes. Regulation of groundwater use in Uganda was initiated in late 1990s and is done through issuance of groundwater abstraction permits that assist in controlling groundwater abstraction. Conditions attached to an abstraction permit include recording pumping discharges in the pumping borehole and monitoring groundwater levels in a monitoring well. Through this process, it is possible to control groundwater abstraction and avoid overexploitation.

A permit is issued for a maximum period of 5 years after which the permit holder is required to apply for renewal.

Furthermore, drilling of boreholes in some urban areas is restricted and is only done after issuance of a drilling permit. Through this process, groundwater abstraction is controlled and drilling permitted once it is known that the groundwater resources will not be affected by the planned abstraction.

However, there are a number of groundwater abstractors in many towns who have not yet applied for permits and hence their abstractions are not regulated. In addition, regulation of groundwater pollution from onsite sanitation is currently not regulated because of the difficulties involved.

Furthermore, groundwater licensing is constrained by inadequate hydrogeological knowledge about the available groundwater resources in terms of recharge and storage, and the likely scale of side effects of exploitation.

Groundwater resources assessment and monitoring

Groundwater is often degraded because of lack of knowledge of the aquifer system and or uncontrolled development. Promotion of urban groundwater resources management and protection thus requires an understanding of the hydrogeological conditions and groundwater dynamics of an area. This is achieved through evaluation of the aquifer status, susceptibility of groundwater to overexploitation and pollution, delineation of water source protection zones and identification of priority actions for control of groundwater abstraction and water source protection.

Studies aimed at assessment and monitoring of groundwater resources for sustainable town water supplies were initiated

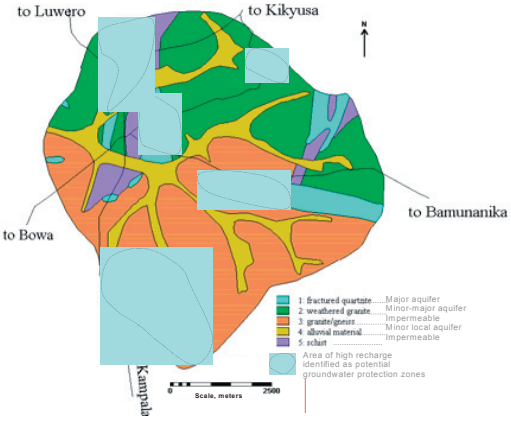


Figure 2. Hydrogeological map of Wobulenzi with potential protection zones

in mid 1990s. Groundwater assessment and protection studies have been undertaken in Wobulenzi, Kisoro and Rukungiri towns, all of which are based on groundwater. Under these studies key areas of groundwater recharge to water supplies have been identified and zoned and recommended for protection by the water supply authorities. Example of areas recommend for protection in Wobulenzi town is shown in Figure 2 below.

Key outstanding issues

While substantial efforts have been put into improving groundwater management and governance in urban areas of Uganda a lot remains to be done.

There is a need to develop procedures for determination of groundwater protections zones around boreholes in fractured rocks and to prepare and implement guidelines for groundwater resources protection. In addition, there is need to develop an institutional framework for groundwater resources management and to improve awareness raising on water resources management to ensure that the water users actively participate in the management and protection of the resource.

Similarly, assessment studies have been carried out in a few areas with varying geological conditions and the key challenge is to undertake studies in various other geological environments in order to develop guidelines that are representative of the whole country.

Furthermore, control of groundwater abstraction and pollution in urban areas through preparation of optimum groundwater development strategies and groundwater source protection guidelines require carrying out studies to resolve key practical hydrogeological questions such as protection of wells from competitive pumping and siting of wells in relation to onsite sanitation systems.

Conclusions and recommendations

Heavy groundwater abstraction in some urban areas of Uganda has resulted in lowering of groundwater levels and sometimes competitive pumping between water sources, ultimately resulting in increase in the cost of operation of water supply systems. The onsite sanitation systems in form of septic tanks and pit latrines have caused contamination of groundwater resources in many areas. It is therefore necessary to protect groundwater in terms of quality and quantity in order to avoid reduction in available groundwater resources, escalating water supply costs and potential impacts on human health. There is therefore a need to improve management of groundwater resources in urban areas in order to mitigate the actual and potential problems caused by overexploitation and inadequate control of pollution of groundwater resources.

It is therefore recommended that hydrogeological studies be carried out in various geological conditions to resolve key practical groundwater management questions in order to guide optimum groundwater development and determination of groundwater protections zones around boreholes in fractured rocks. In addition, it is recommended that an institutional framework for groundwater resources management in the urban areas be developed and be reinforced by an adequate awareness raising programme on water resources management to ensure that the water users appreciate the benefits of groundwater management and protection.

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