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Groundwater mapping and its implications for rural water supply coverage in Uganda

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Groundwater plays a significant role in rural water supply but its development has been made with very little information on the hydrogeological conditions and groundwater potential of various areas of the country. This has not only resulted in unsuccessful water sources but also in resources being spent on very expensive water supply technologies when cheaper and more sustainable ones are possible. This in turn has affected government's efforts to increase rural water supply coverage, which currently stands at 58 percent. In order to significantly improve water supply coverage in the country using low-cost, simple water-supply technologies, Uganda has initiated a Groundwater Mapping Programme to prepare maps representing groundwater resources in terms of their quantity and quality and summarizing this information spatially. Six different types of maps have been prepared all of which are important in guiding proper planning of groundwater development activities. Groundwater maps are guiding district political and technical officials on the most feasible water supply technology options to consider in various areas and are also providing them with indications of areas with low water supply coverage, which require more attention. The districts are now exclusively constructing shallow wells in areas where they are indicated as feasible as opposed to the past practice of construction deep boreholes everywhere. The people with the lowest water supply coverage are also using the maps to bargain for their equitable share of government resources. It is expected that with the availability of groundwater maps there will be a reduction in failure of wells and cost of water supply systems resulting in increase in water supply coverage and hence more benefit to the people

Background

Groundwater plays a significant role in domestic water supply in Uganda with its development commencing in the early part of this century. This is based primarily on construction of deep boreholes, shallow wells and protection of springs. Groundwater development is however greatly influenced by the varied geological conditions, which consist of very old Precambrian rocks that underlie over 90% of the country. Thus aquifers occur in the weathered overburden (regolith) and in the fractured bedrock.

Groundwater development plans at both the national and district levels have however been made with very little information on the hydrogeological conditions and groundwater potential of various areas. This has not only resulted in unsuccessful water sources but also in resources being spent on very expensive water supply technologies when cheaper and more sustainable ones are possible. Similarly, water sources have sometimes been constructed in areas with poor water quality leading to abandonment while others have been constructed too deep making them very expensive to construct.

The current national rural water supply coverage is estimated at 58 percent and is to be significantly improved to at least 95 percent by 2015. The focus is on groundwater development using low-cost, simple water-supply technologies. There is thus a need to assess and map groundwater resources of the country so as to guide planning of groundwater development activities thereby targeting poorly served areas.

Groundwater resources mapping

Uganda has initiated a Groundwater Mapping Programme whose aim is to assess and map groundwater resources at district, regional and national level in order to guide efficient and cost-effective water resources planning and development. The maps prepared represent groundwater resources in terms of their quantity and quality and summarize this information spatially.

So far groundwater maps have been prepared for 10 districts out of 56 districts in the country. Six types of maps have been prepared namely:

- Water supply coverage maps
- Hydrochemical characteristics maps
- Water quality maps
- Hydrogeological characteristics maps
- Groundwater potential maps
- Groundwater supply technology options maps

Groundwater maps and their usefulness in improvement of water supply coverage

Some of the groundwater maps prepared are very useful in improvement of water supply coverage as discussed below:

Hydrogeological Characteristics Map

The hydrogeological characteristics of an aquifer in an area are illustrated by means of parameters measured during the drilling process. These measured parameters are then presented as separate insert maps, namely Overburden Depth, First Water Strike, Main Water Strike, and Static Water Level. The Overburden Thickness Map is useful when planning future drilling campaigns, as it enables estimates of the amount of casing that will be required, as well as assisting in defining the drilling method that may be most appropriate in order to develop a successful water source. The Water Strike Maps assist in planning drilling contracts as they give indications of the likely depths that should be drilled to encounter groundwater. The Static Water Level Map assists in planning future pumping equipment requirements as it indicates the level at which the groundwater will stand in the well, and hence the minimum depth that the pump has to be installed. The Hydrogeological Parameter Maps are also used in preparation of the Water Supply Technology Map. Use of the above maps will result in groundwater development being carried out in a cost effective manner leading to construction of more water sources using the same resources thereby increasing accessing to safe drinking water to the population of Uganda.

Groundwater Potential Map

Groundwater potential is a very broad term and may be influenced by many factors but the definition of 'groundwater potential' used in the development of this map is the simplest possible and may be stated as *"the ability of a particular area to supply an adequate quantity of groundwater of potable quality to satisfy the demand of that area"*.

In order to categorise 'groundwater potential' it is necessary to categorise the principal factors that influence it i.e. well yield and water quality. Well yield is measured with the aim of assessing the ability of the source to sustain a handpump whose maximum capacity is 1 m^3/hr and satisfy the minimum yield requirements of 0.5 m^3/hr for a rural water supply source. For map preparation purposes well yield is thus classified into four categories namely >1 m^3/hr, 0.7-1 m^3/hr, 0.5 – 0.7 m^3/hr and <0.5 m^3/hr. Water quality is also grouped into three categories of Potable water, above Guideline Value (GV) and above Maximum Acceptable Value (MAV).

The final map is categorization of 'groundwater potential' that combines both the yield and the water quality factors. Groundwater potential is depicted on the map by a colour designation of a range of yields, overlain by hatched areas relating to the water quality characteristics. It is thus possible to have a particular area that has 'good potential' with respect to yield, but 'poor potential' with respect to water quality.

The Groundwater Potential Map is used when planning future water supply activities in an area to indicate the zones of lower potential in which more investigation efforts will be required in order to develop a successful water source or where groundwater development should be avoided altogether. Use of this map will not only reduce the number of unsuccessful water sources but will also ensure that areas with unacceptable water quality are not targeted for groundwater development. An example of such a map is presented in Figure 1 below.

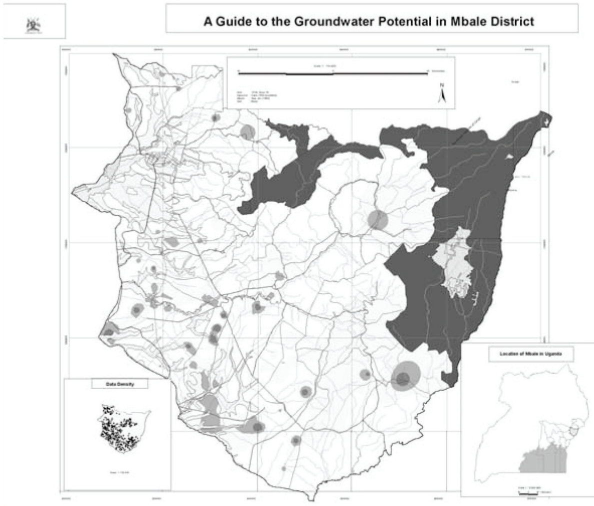


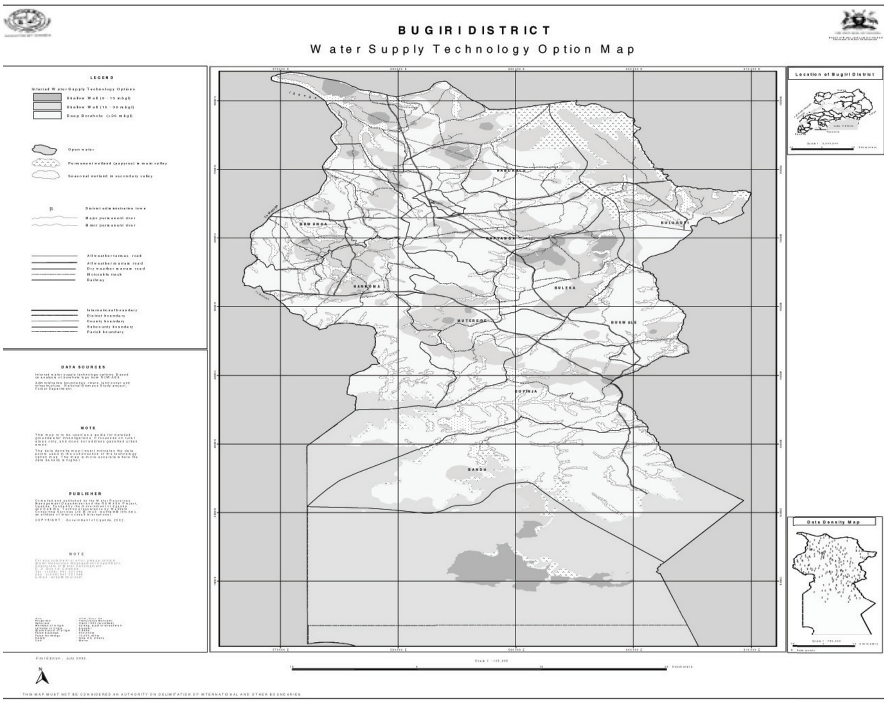
Figure 1. Groundwater potential map

Water Supply Technology Options Map

This map demonstrates the suitability of different areas for different possible technical options for groundwater development. This map is the most important map with respect to groundwater development planning as it serves to indicate the type of technology that may be appropriate in different areas. The map is prepared by considering the distribution of the first and the main water strikes, the estimated well yields during drilling and whether they occur in the overburden or in the bedrock. If water strikes occur shallower than 15m below ground level in the overburden and minimum yield of 0.5 m3/hr was estimated, such an area would be suitable for shallow dug wells. If the water strikes with minimum yield of 0.5 m3/hr occur between 15 and 30m in the overburden then the area would be suitable for shallow drilled wells while if they occur deeper than 30m whether in the overburden or bedrock, then the area would be suitable for deep boreholes. In financial planning terms the choice of technical option will also clearly have a very significant influence on the overall cost of water source provision in an area and hence water supply coverage. An example of such maps is presented in Figure 2 on page 3.

Conclusions

Groundwater mapping is very important in supporting water development programmes by providing them with information on the distribution of groundwater resources and the feasible water supply technology options. This will not only result in sustainable groundwater development plans but will also lead to cost effectiveness and hence rapid increase in water supply coverage to the population of Uganda. Groundwater maps are currently guiding district political and technical officials on the feasible water supply



Source: Groundwater mapping report for Bugiri

Figure 2. Water supply technology options map

technology options to consider in various areas and are also providing them with indications of areas with low water supply coverage which require more attention. The districts are now exclusively constructing shallow wells in areas where they are indicated as feasible as opposed to the past practice of constructing deep boreholes everywhere. The people with the lowest water supply coverage are also using the maps to bargain for their equitable share of government resources. Although an evaluation of the usefulness of the groundwater maps has not yet been carried out, there is no doubt that the maps have provided an overview of the groundwater resources and water supply situation in the various district for use in planning of future water supply projects. It is expected that with the availability of groundwater maps there will be a reduction in failure of wells and cost of water supply systems. Fund saved would be used to further increase water supply coverage hence benefiting the people more. The success of groundwater resources mapping however depends on availability of good quality groundwater data, which is currently not readily available and will require a big effort to collect.

References

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