MINISTRY OF WATER AND ENVIRONMENT

APPROPRIATE TECHNOLOGY CENTRE FOR WATER AND SANITATION

Terms of References for designing and installation of deep injection wells for ground water recharge in selected sites

1. Background

Water supply in Africa relies on both surface and ground water however, the security of this is compromised partly due to disruption of the water cycle. Poor management and the increased consumption trends have resulted into water related stress. Particular of ground water there is a noticeable decline of the aquifer heads and deterioration of water quality. This has had far reaching negative effects on the ecosystem and land subsidence. On the other hand, surface water is equally threatened by uncontrolled exploitation, land use change characterized by deliberate efforts to fill up water ways with soil and clearing of wetlands. Another related challenge is the 80% of the world's wastewater that is currently discharged into the environment without prior treatment and this among other factors worsens the water quality. There is evidence of declining water table, deteriorating water quality as well as drying of aquifers and this is attributed to exploitation of the aquifers above the rate of replenishment, clearing of natural sinks that prior catalyzed percolation and overall environmental degradation. A 2015 study of NASA satellite data found that more than half of the world's major aquifers were overdrawn or over stressed. Consequently, increasing low, marginal yields and in some cases complete drying out of boreholes are on the increase. The situation becomes worse during the dry period of the year.

The dwindling water table amidst the growing need for portable water has driven the world to search for new ways of storing and reusing water. Managed aquifer recharge is positioned as the answer to the patient challenges. There are about 1200 managed aquifer recharge projects in 62 countries. Artificial groundwater recharge involves planned augmentation of the ground water reservoir at a rate that exceed the augmentation rate under natural conditions of replenishment. Success of augmentation is influenced by the topographical, geological, economic viability and social acceptability among others.

Recharge well technology, recharge pits and shafts, dug wells, borehole flooding, and cavity fitting have been recently developed as direct initiatives to replenish ground water resources. Recharging ground water through artificial means involve systematic harvesting, treating and injecting of water into the sub-surface through a well bore. This technology was found to be the most credible alternative water resource. In the Semi-arid regions of Iran, the technology has been piloted on 30 wells with high success i.e., the water table level rose by 20m at a rate of 1000m^3/d from each well in one year. Other countries that have piloted ground water recharge include India, Namibia and South Africa among others.

Uganda

Water security is key for Uganda's continued struggle for universal access to safe water for all however, overexploitation of ground water resources and the consequent decline in the water table causes serious concerns and need for a solution. Some water supply sources i.e., boreholes either become non-functional or produce reduced yields as a result of the declined water table. Areas like Buyende Town Council (Buyende district) and Lwabiyata sub-county (Nakasongola) have very low access to safe water (i.e., 28% and 37% respectively). 44 point water sources in the Buyende and 67 in Nakasongola have been non-functional for five years partly because sources dried up. Early this year, there was a noticeable rise in the level of surface water especially in areas around Lake Kyoga-Victoria basin. This rise was among other factors triggered by torrential rains in the respective catchment systems. The rise turned out catastrophic, destroying settlements, water supply and sanitation systems among others. Consequently the quality of surface water deteriorated significantly as a result of pollution and there is a high likelihood of the polluted water ending up into the ground. Water would be expected to percolate into the ground leading to eventual receding of surface water level. However, with human activities such as paving the ground, deforestation, clearing of vegetation cover and industrial development, the percolation ability of surface water into the ground is reduced and this translates into prolonged flooding. There is therefore need to catalyze replenishment of ground water aquifers through runoff harvesting, cleaning and direction into the ground to augment ground water.

1.1. Objective

The objective of this study is to pilot managed artificial recharge for improvement of ground water potential for water stressed areas.

1.1.1. Specific objectives

i) To demonstrate ground water recharge technology as a mechanism for optimization of ground water quantity and quality.
ii) To document effectiveness of ground water recharge as a technology for increasing infiltration of rainwater into the sub-surface
iii) To monitor the quality of water injected into the ground through recharge wells.

2. The Consultancy

The overall objective of the consultancy is to assist ATC/MWE to design and install deep injection wells in five selected sites.

2.1. Specific objectives of the consultancy

i) Engage the different stakeholders including ATC, MWE, communities of the selected sites among others to gather information necessary to inform designing of the respective deep injection wells
ii) Study the hydro-geological flow of the selected site and document suitability
iii) Design, develop drawings and state technological technical specifications
iv) Install deep injection wells in two selected sites
v) Develop monitoring tools and carry out capacity building of ATC/MWE staff to enable them undertake monitoring of system functionality for a specified period of time
vi) Develop operation and maintenance strategy for the installed systems

2.2. Out puts

- Inception report
- Preliminary Design Report
- A complete Detailed Designs Report, including Engineering drawings and Engineer's Estimate and Bills of Quantities, Technical specifications
- Installed deep injection wells demonstrations
- Monitoring tools
- Operation and Maintenance (O&M) Manual
- Scale up strategy
- Environment and Social Impact Assessment

3. Project Area

The intervention is expected to be implemented in the districts of Kayunga and Mukono for easy monitoring and follow up.

3.1. Scope of services

The work under this consultancy for will consist of;

- Conducting hydrologic and geological surveys, geotechnical investigations and tests
- Technical appraisal of feasible options
- Detailed engineering designs of the deep injection wells
- Supply and installation of deep injection wells demonstrations
- Development of injection well monitoring tools and training of staff on using the tools
- Development of Operation and Maintenance manual for the installed injection well systems