



2015 UN-Water Annual  
International Zaragoza  
Conference  
15-17 January 2015

Water and Sustainable Development  
**From vision to action**

UN WATER



# Unlocking the Potential of Groundwater for the Poor (UPGro)

---

John Chilton, International Association of Hydrogeologists

## Short summary

---

The research summarised here has been undertaken under the UPGro programme. Unlocking the Potential of Groundwater for the Poor (UPGro), is a seven-year international research programme jointly funded by the UK's Department for International Development (DFID), Natural Environment Research Council (NERC) and the Economic and Social Research Council (ESRC). It focuses on improving the evidence base around groundwater availability and management in Sub-Saharan Africa (SSA) to enable developing countries and partners in SSA to use groundwater in a sustainable way in order to benefit the poor. UPGro projects are interdisciplinary, linking the social and natural sciences to address this challenge.

There is increasing, but often anecdotal, evidence that substantial numbers of rural water supplies in SSA based on boreholes with handpumps are failing within a short time of their installation. The work in our project was aimed at developing a methodology for unravelling the complex and often interlinked technical, institutional and social reasons for this high level of failure. Working in two districts in eastern Uganda, the project team has undertaken fieldwork comprising community surveys and detailed technical examinations of pumps and boreholes. The results of this pilot study have shown that, in this area, symptoms in the field resulting from poor siting and construction can be traced back to underlying conditions and root causes at programme level.

## Keywords

---

*Universal and equitable access to drinking water; Adequate and equitable access to sanitation for all; Consider needs of women and girls in access to sanitation; Increase water use efficiency across sectors; Ensure sustainable withdrawals; Ensure supply of freshwater to address water scarcity; Implement IWRM; Water cooperation; Reduce number of deaths and number of affected people; Reduce economic losses; Protection of the poor and vulnerable*

## Issues addressed

---

**WASH (inequalities, schools, health centres, refugee camps, women and girls):** These are not covered explicitly in the project, but the results of the work are important for rural water supplies for all types of users. Some of the study sites were at schools.

**Water resources management (water-use efficiency, integrated water resources management, transboundary cooperation, sustainable extraction and supply of freshwater, restore ecosystems and aquifers):** Sustainable extraction and supply of freshwater; Lack of technical siting of boreholes in aquifers where obtaining adequate yields is problematic is one contributory factor to failure. Even where siting is undertaken, wrong methods or poor application may also contribute to inadequate yields and/or seasonal deficiencies in water supply. Lack of understanding of local groundwater conditions may result in poor borehole designs. Where supplies are already marginal, the impacts of land use change and climate change on groundwater recharge may worsen the situation.

**Water quality (pollution, dumping of toxic materials, wastewater management, recycling, reuse):** In the pilot study area, the use of galvanized iron pump materials in an area of known low pH and Eh groundwater, produced corrosion of pump components, resulting in mechanical handpump failure and poor quality (iron-rich) supplied water. This is a common problem in crystalline basement aquifer areas in SSA.

**Risks (mortality, economic losses caused by natural and human-induced disasters):** Risks of increased health problems and loss of investment; Loss of access to improved rural water supplies compromises expected health benefits. This applies both to total failures and to those at which breakdowns result in long interruptions to supply. There is significant loss of investment if large numbers of supplies fail soon after construction.

## Tools for implementation

---

**Financing / economic instruments:** An underlying condition and root cause of the problems is often the method of financing and procurement of the improved supplies, and this was true in our pilot project.

**Governance: Institutions / legal framework:** The legal framework behind private sector involvement and contracting is an important underlying condition investigated in this study. Institutionally, the way responsibilities are spread amongst different levels of government and the recipient communities is an important underlying factor investigated.

**Technology:** The taking apart of the boreholes and pumps, and careful examination, test pumping, observation of water levels and condition of the borehole and pump were the technical parts of the study.

**Capacity development:** Local partners were fully involved in the research, so in-country research capacity is being developed. This is an objective of the UPGro programme. The results will help to build capacity in communities, implementing agencies, contractors, and governments for greater resilience of rural water supplies.

**Who is involved?:** This is a multi-disciplinary research project. The partners included the groundwater programme of the British Geological Survey, WaterAid in London and Kampala, ODI and Makerere University, together with district water office staff. These partners provided hydrogeologists, engineers, social scientists and field practitioners.

**What objectives?:** This was not an “intervention”, it is a research project. The aim of the research was to show that the underlying causes of failure of groundwater-based water supplies are complex and multifaceted, but with the correct expertise and methodologies the reasons for failure can be understood, diagnosed, predicted and mitigated. The pilot project’s objective was to develop methodologies for unravelling the causes of supply failure.

**Implementation challenges:** One of the challenges in this study was to use the limited funds effectively to meet the objectives. The team therefore selected field areas in two adjacent districts where rural supplies draw from the weathered basement aquifer, and chose boreholes and handpumps which had completely failed. This pilot study does not, therefore, address the intermittently working pumps, which in many programmes are likely to be the majority. Another challenge, particularly in relation to seasonality of yields was that the small pilot study is a snap shot at only one time. Many logistical challenges in the field were overcome by the excellence of the local partners in the project.

**Main task/activities undertaken /Tools used:** The first task was to review previous work on groundwater source failure. We then set up a conceptual framework of the linkages between symptoms observed in the field (low yields, poor water quality, mechanical breakdown), causal factors (poor siting, poor construction, wrong materials, wrong borehole design, lack of supervision and many others) and the underlying conditions of lack of hydrogeological understanding, weak procurement processes and lack of technical and financial capacity of communities. Fieldwork consisted of community surveys at 24 pumps and detailed technical investigations at 10 of these, with pumps removed, observed, photographed, water levels and borehole depths and verticality measured, CCTV investigations, test pumping, and full chemical analyses.

**Main outcomes / impacts (what has changed?):** At the 10 pilot study sites, symptoms of poor water quality, inadequate yields and mechanical failure were observed. In this particular area, low natural groundwater pH and Eh; use of GI materials, borehole design inappropriate for the aquifer; poor siting; low groundwater potential; high water demand and a limited capacity of community to maintain were the main causal factors. This might not be the same in other groundwater conditions. The underlying conditions are those mentioned above. The results have been reported and debated by the Ministry of Water in Kampala and by the district water offices in meetings facilitated by WaterAid. The final report is being prepared.

## Lessons Learned:

---

**Barriers:** The research has confirmed that it is often the underlying conditions and root causes determining the outcomes of the process of providing new water supplies. We have known this, but it is good to be able to collect real field evidence for it. We have been campaigning for better procurement processes and contract preparation, letting, supervision and payment for a long time. Many of the underlying conditions can be related to lack of technical and managerial capacity in all levels of government, international agencies, NGOs, the private sector and communities.

**What has worked well?:** Addressing the above barriers. In the study, the taking apart of the boreholes and pumps in the field has been one of the novel aspects of the study. This has helped to turn anecdote into evidence, and this was the objective of the UPGro programme.

**What can be improved?:** At programme level, addressing above underlying conditions. For example, small programmes in which drilling rigs are very widely dispersed almost completely prevents proper supervision. In the research, looking at a larger sample size in a range of social and physical conditions, examining the roles, responsibilities and capabilities of the several levels of government, looking at the relationship between community management and wider governance and institutional arrangements, look harder at the various roles of the private sector, look at seasonal and time factors; both technical and community investigations were “snapshots”.

**The way forward:** We have an opportunity to do all of these things in the large UPGro consortium project starting in 2015, and extending to Malawi and Ethiopia as well as Uganda.

**Links** <http://upgro.org/>

---

