UP Gro — Unlocking the Potential of Groundwater for the Poor

Gro for GooD

Improving groundwater management for sustainable growth in Kwale County

QUARTERLY NEWSLETTER

January - March 2016

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PARTNERS

Kwale County Government

Oxford University

Jomo Kenyatta University

University of Nairobi

Rural Focus Ltd.

WRMA

Grupo de Hidrología Subterránea (UPC-CSIC)

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MESSAGE FROM THE PRINCIPAL INVESTIGATOR

Dr. Rob Hope

Groundwater is increasingly important for Kwale's growth and development. It is a widely available water resource of high quality and low cost. Rural communities know this well and have relied on groundwater for generations managing the resource sustainably. With increasing variability in rainfall which supplies small and large dams, groundwater provides an important alternative for new water demands from irrigated agriculture, mining or tourism.

Managing groundwater sustainably so the resource is not over-used or contaminated is challenging. Science can provide support to help make better informed decisions. Oxford University is proud to work with the County Government, Water Resources Management Authority, Base Titanium Ltd., KISCOL, Rural Focus Ltd. and local communities to develop a better understanding of groundwater risks to help protect the resource for everyone.

The Gro for GooD project – Groundwater Risk Management for Growth and Development – competed in an international research competition and was ranked in first place for the innovative and inclusive nature of the project. Working with the University of Nairobi, JKUAT and Rural Focus Ltd. in Kenya and the Polytechnic University of Barcelona in Spain (UPC), the team boasts some of Kenya's and the world's best scientists working on groundwater systems from hydrological, geophysical, geochemical, social and economic disciplines.

After the Governor of Kwale County graciously opened the project in 2015 we are now delighted to share the first of regular quarterly newsletters providing updates to the people of Kwale on the progress of the project. This includes a new project office in Bomani with local staff working with all our partners. We hope you find this newsletter relevant and interesting and look forward to your feedback.

MESSAGE FROM THE Gro for GooD FIELD OFFICE

Mr. Calvince Wara

One year post-launch, we are delighted to share updates of our activities with you through this quarterly bulletin. This bulletin has been produced to share information on Gro for GooD activities with stakeholders, partners and the general public.

The Gro for GooD project management and coordination office in Bomani has been opened, equipped and operationalized, and is located opposite the mosque on the Ukunda-Lunga-Lunga road. As you will read in this newsletter, we are engaged in setting up an environmental monitoring system across the project area, using meteorological, geophysical and hydrochemistry techniques to collect data to assist groundwater management in Kwale County. We will also be supporting the social research team that will be conducting household surveys later in the year.

We take this opportunity to welcome any feedback to improve the Gro for GooD newsletter and look forward to reporting on all aspects of Gro for GooD research as the findings emerge.

Fauzia Swaleh
Office Administrator

Calvince Wara
Research Operations Manager

Suleiman Mwakurya
Project Research Assistant

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3. Gro for GooD ACTIVITY UPDATE

ENVIRONMENTAL MONITORING

The Gro for GooD project is collecting environmental data that will enable us to monitor key elements of the groundwater system – namely, groundwater level (how much water is stored underground), groundwater extraction (how much is being used by people and industry), groundwater recharge (how much is falling as rain, how much runs into rivers and streams and how much soaks into the ground) and groundwater quality (whether the groundwater meets standards for drinking water and environmental protection). These are all key indicators for the security of Kwale's water supply. For example, if groundwater levels are decreasing, this indicates that groundwater is being extracted faster than it is being recharged by rainfall; if groundwater in coastal areas is increasing in salinity (saltiness), this may also indicate that extraction levels are too high.

An Environmental Monitoring Strategy (EMS) is being developed to generate relevant, timely and cost-effective data on rainfall, streamflow and groundwater recharge in the Kwale study area. The installation of environmental monitoring equipment is underway The environmental data being collected will be used in the development and running of a Groundwater Risk Management Tool, which will include a hydrogeological numerical model. This model will be able to simulate and predict the effects of different levels of extraction and rainfall on the system, helping Kwale County to make plans to ensure that it has a good and sustainable water supply for people and industry.

Automatic weather stations

Two automatic weather stations (AWS) have been installed near the coast (Msambweni Sub-County Agriculture office) and in the upper part of the study area (Kidongo Gate, Shimba Hills). Instrumentation (anemometer, rain gauge [drip counter & tipping bucket], pyronometer, and barometer) is provided by the Trans-African Hydro-Meteorological Observatory (TAHMO) project which is hosted by Kenya Meteorological Services.

TAHMO Engineer (Zack) & KMS Director Kwale (Dominic) Installing AWS at Kidonge Gate, Shimba Hills National Reserve

Measuring rainfall

To capture spatial variability of rainfall over the study area and the Mkurumudzi and Ramisi River catchments, 20 manual daily rainfall stations have been installed to complement existing stations run by KMS, Base Titanium Ltd., WRMA & KISCOL. Gauge readers have been trained to take readings at 09:00

Rainfall stations have been installed in local schools. As well as contributing to monitoring, they can also use the manual rain gauges for educational purposes.

KMS Director Kwale and Gro for GooD manager training a Field Monitor during rain gauge installation at Ukunda Vet. Station; [left] KMS Director Kwale explaining how the rain gauge works to children at Foot Print Children's Home

Rain water quality sampling is being undertaken at 12 selected rainfall stations in the study area. Rainwater samples will be collected and analyzed in order to calculate the amount of water infiltrating into the groundwater system.

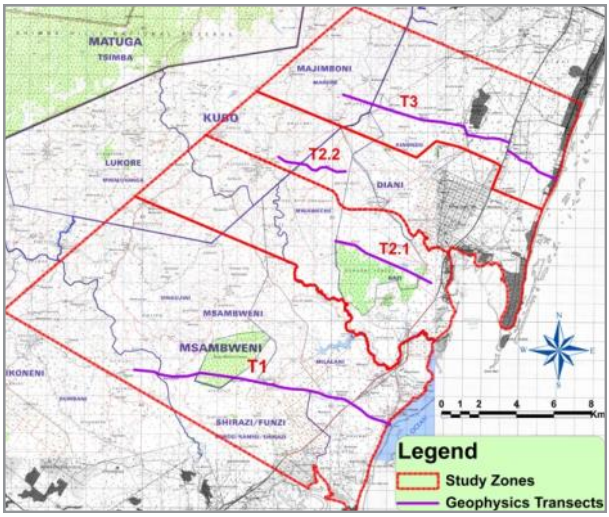
Instruments used for ground and surface water monitoring

Streamflow monitoring

Streamflow of the Mkurumudzi and Ramisi Rivers will be monitored to determine the water balance of the rivers at different points, thereby determining the inputs/ outputs to the groundwater model along the water course. To enhance surface water monitoring in the study area, a Heron Water Level Logger has been installed at WRMA's 3KD06 river gauge site near Shimba Hills, and at two other sites: the irrigation intake near Bomani shopping centre on Mkurumudzi river, and at Eshu bridge.

GEOPHYSICS FIELD SURVEY

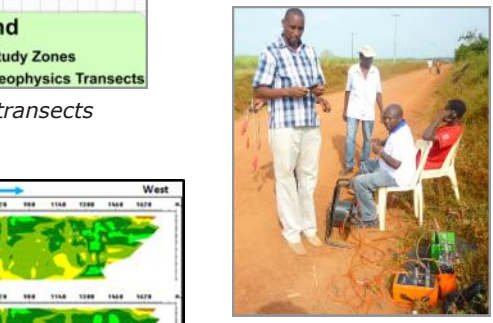
We can also use geophysical methods to provide information about groundwater. Knowledge of the geological structure beneath the surface of the ground is the key to understanding how groundwater moves through and is stored in different aquifer systems. The rock types which water passes through and sits in underground may also affect water quality. However, there are only a few boreholes in the study area which provide relevant information and most reports are based on surface geology. The Gro for GooD project is using 2D Electrical Resistivity Tomography to 'see' underground and assess the groundwater profile along a number of transects across the study area.



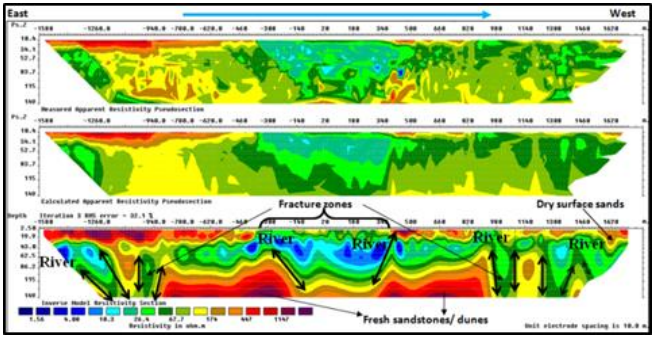
Study area map showing geophysics transects

2D Electrical Resistivity tomography was conducted by a team consisting of WRMA, University of Nairobi and Rural Focus, using ABEM Terrameter equipment during December 2015 – January 2016. 3 transects were surveyed as shown in the map.

(T1, T2.2 & T3. T2.1 had been done previously by Base Titanium.)



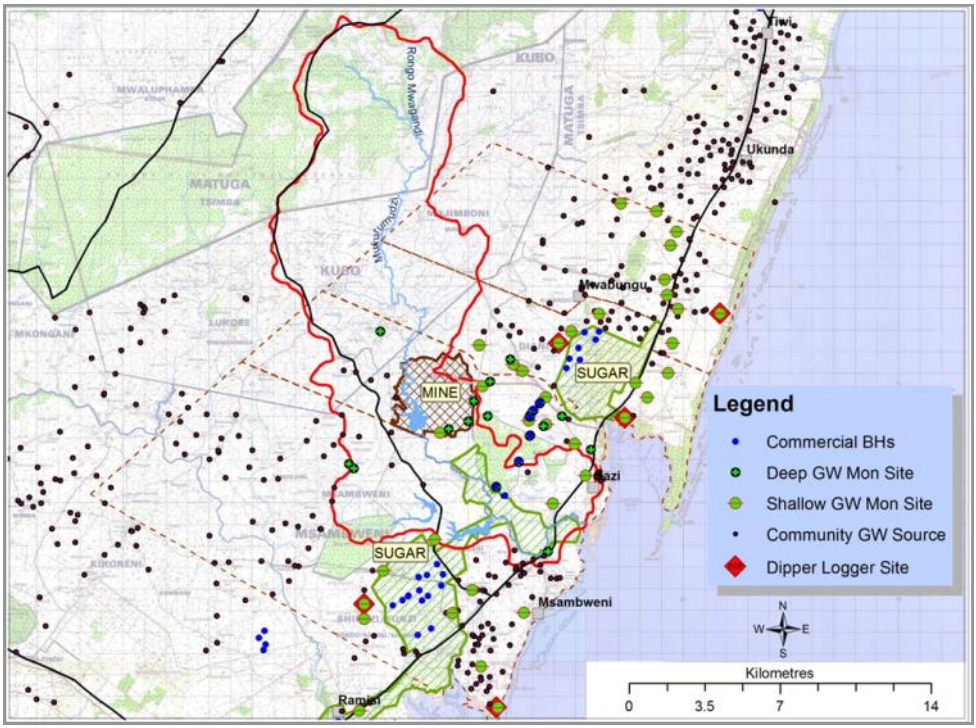
WRMA's Geophysics field team with 2D tomography equipment



An electrical resistivity tomography profile from the southern part of the study area

GROUNDWATER HYDROCHEMISTRY FIELD SURVEY

The project team is also conducting a detailed hydrochemistry field survey in the study area. The chemical composition of groundwater provides useful information about the flow of water into and through the underground aquifers. Chemical and biochemical analysis also allow us to monitor substances which affect the safety and taste of drinking water.



Map of groundwater monitoring network – BH = borehole

Wet/Dry season sampling campaigns

The research team conducted the first groundwater sampling campaign for water quality during September - Oct 2015. 81 sample sites were identified and 77 sites were sampled.

The second groundwater campaign will start at end of February 2016 and last for about a month.

Regular monitoring of water quality is also being carried out at 36 sites within the study area on a fortnightly basis. Measurements include pH, conductivity, temperature, total dissolved solids, and turbidity.

4. PROJECT PARTNERS AND STAKEHOLDER ENGAGEMENT

Sustainable development in the water sector can only be achieved through stakeholder and project partner engagement. Gro for GooD project is engaging project partners, stakeholders and the general public through workshops, conference and local involvement in fieldwork.

Eng. Mike Thomas gives presentation to the participants during the project partners' workshop held on 8th October 2015 (WRMA, Base Titanium, Kwale County Government, KWS, KEMFRI, Oxford University and Rural Focus Ltd.

Msambweni Sub County Irrigation Officer (S. Rojo in Reflector jacket) and Village Chairman explain Water Level Monitoring to the community in Mukumudzi before installation of monitoring equipment.

5. Gro for GooD GALLERY

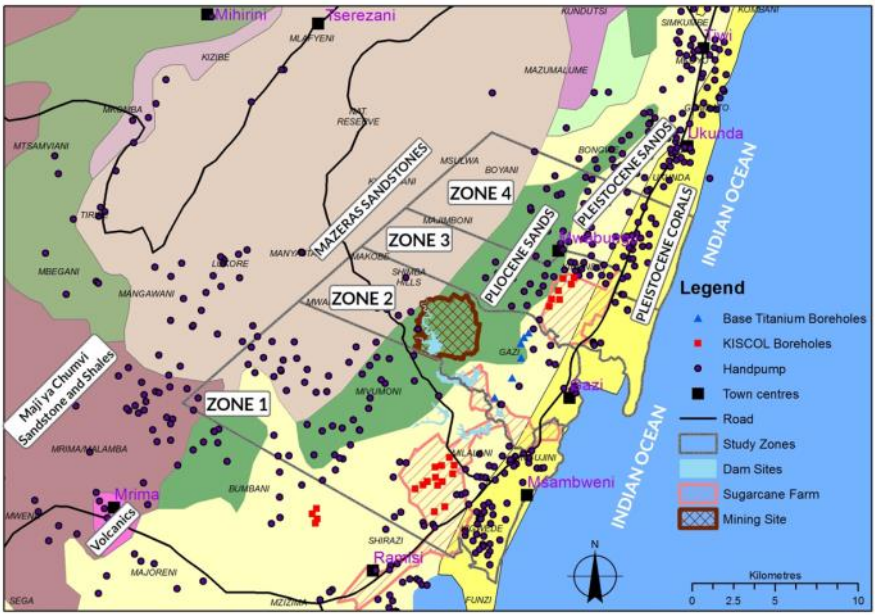
Research Team collects samples from a borehole during the first groundwater sampling campaign in Sep – Oct 2015

Training a field monitor to use a rain gauge to collect daily rainfall data

Gro for GooD Project team in a meeting with WRMA officials in WRMA's sub-regional Office, Mombasa

Inspection of hand pump borehole prior to installing water level


© Margot Leger



Map of the Gro for GooD study area

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