

MAWARI PROJECT

Annual Scientific and Steering
Committee Meeting, Addis Ababa,
19th – 24th November, 2007

Sustainable Management of Water Resources in the East-African Rift System

*“Studies of Pollution and Vulnerability to Pollution
of Groundwater in the Kenyan Rift System: Current
Status of the Project”*

by

Prof. Justus Barongo

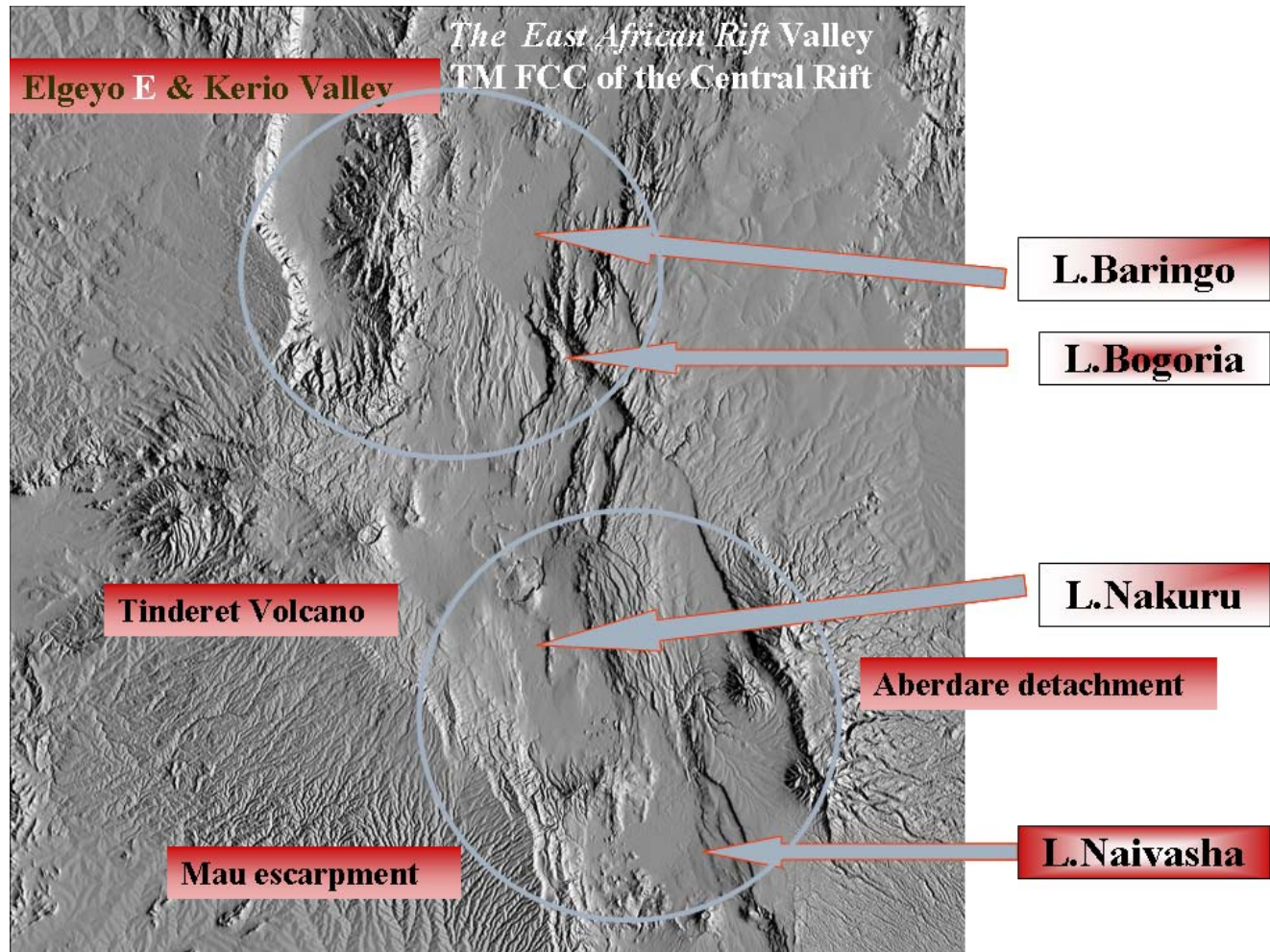
Project participants

Name of Participant	Profession (Other areas of interest)	Roles and activities
<p>Prof. Justus O. Barongo jbarongo@unobi.ac.ke justusbarongo@yahoo.com, UoN</p>	<p>Geophysicist (Geophysics, Hydrogeology, Groundwater Modeling)</p>	<p>Team Leader: Geophysical, hydrogeological and groundwater modeling studies</p>
<p>Dr. Daniel O. Olago dolago@unobi.ac.ke UoN</p>	<p>Geologist (Quat. Geology, Geochemistry, Climate Change)</p>	<p>Geological mapping, geochemical analysis and palaeoclimate studies</p>
<p>Dr. Simon M. Onywere onyweres@yahoo.com KU</p>	<p>Environmentalist (RS & GIS, Structural Geology, Env. Geology)</p>	<p>Structural & geological mapping, surface water modelling, RS & GIS techniques</p>
<p>Dr. Patrick Gicheru narl@iconnect.uk.co NARL</p>	<p>Soil Scientist (Soil Science, Agriculture, Land Use Management)</p>	<p>Pedological (soil) and land use studies (including agricultural activities).</p>

Participants cont...

Name of Participant	Specialization	Roles and activities
Mr. Oyule Ngata oyulengata@yahoo.com	Hydrogeologist (Hydrogeology, G/water Conservation, Water Policy)	Water policy issues, hydrogeological investigations
Dr. Wilber Ottichilo wottichilo@rcmr.org RCMRD	Botanist (RS & GIS, Resource Development and Management, Policy)	Hydrological and land use studies RS & GIS. institutional support to project in terms of technical and material resources
Prof. Twesfaye Korme tkorme@yahoo.co.uk RCMRD	Structural Geologist (Remote Sensing & GIS)	Geological and structural mapping, RS & GIS.
Dr. Eliud M. Mathu	Structural/Metamor phic Geologist	Geological and Structural Mapping

The two project areas: Nakuru-Elementeita-Naivasha (lower circle) & Bogoria-Baringo (upper circle)



Research motivation

- **Increase of population (urban and peri-urban regions – Nakuru, Naivasha etc) introduces anthropogenic influence on both surface and groundwater quality**
- **Diverse farming activities within Lakes Nakuru-Elementeita-Naivasha Basin**
- **High level of siltation due to soil erosion (e.g., Lakes Baringo and Bogoria) and pollution of surface water due to fertilizers, sewerage, pesticides threatening the safety of water (e.g., Lakes Naivasha and Nakuru)**
- **Lack of adequate supply of clean, uncontaminated surface and groundwater (policy on groundwater exploitation)**
- **Large portion of the area is nearly semi-arid – largely depends on ground water (e.g. Nakuru town 75% is groundwater supply) for domestic & irrigation.**
- **Losses in borehole yield (frequency of drying of boreholes) due to over-exploitation and destruction of forests on catchment areas**

Research motivation cont...

- **High fluoride levels in water resources (in Kerio Valley, mining fluorspar has taken place for many years)**
- **Problem of fluoride rich waters - health implication**
- **A lot of human activities around the mine –immobilisation of fluoride**
- **Experience of pollution from fluorspar processing**
- **Need for vulnerability studies required**

Research objectives

- **(1) To understand the natural and anthropogenic elements that contribute to surface and groundwater pollution in the Rift Valley.**
- **(2) To understand the hydrological, hydrogeological and hydrodynamic processes controlling the groundwater distribution and flow in the Rift Valley.**
- **(3) To understand the physiographic, geological, pedological and hydrogeological factors that contribute to vulnerability of groundwater to pollution in the Rift Valley**
- **(4) To provide information support for development of policies and measures to enable protection of groundwater from pollution in the Rift Valley**
- **(5) To build institutional capacity for national and regional collaboration in the promotion of research in sustainable water resources management in the Rift Valley**

Activities accomplished between February and November, 2007

- **Researchers and students carried out research on pollution and vulnerability of groundwater to pollution in the Kenyan rift system in the two project areas**
- **Two researchers and two students attended a Mawari Groundwater Modelling Workshop in Djibouti in February**
- **One researcher and three students attended a Mawari Geochemistry Workshop in Ethiopia in early March**
- **All Kenyan Mawari supported students and some researchers attended a successful Mawari Regional training workshop on Remote Sensing and GIS held at the Regional Centre for Mapping of Resources for Development (RCMRD), Nairobi, Kenya, during the last week of March**
- **Five prospective PhD students were interviewed by members of the Mawari consultative scientific committee in April and only one was selected to begin his studies at the University of Poitiers, France, with effect from September. He is yet to report to Poitiers.**

Activities accomplished between February and October, 2007 cont...

- **An MoU document between CIFEG and University of Nairobi signed by the heads of the two institutions a few weeks after the Nairobi Remote Sensing and GIS workshop**
- **Project leader joined two geophysics professors from Brest University, France, in a resistivity tomography field project in Djibouti in early April**
- **Three Kenya Mawari researchers attended a Mawari scientific meeting at the University of Brest, France, in May**
- **Three University of Nairobi MSc students on Mawari support graduated in September with degrees in groundwater related fields. Copies of their dissertations were later handed over to CIFEG Managing Director, Mr. Francois Pinard, in early October when he visited Nairobi to assess the progress of the project. The results in these documents form the basis of the scientific presentations in this Annual Project Follow-up Meeting here in Addis Ababa, Ethiopia**

Activities accomplished between February and October, 2007 cont...

- **Three of the four Mawari sponsored University of Nairobi MSc students visited Djibouti for a two months' field and laboratory training on groundwater management. The students travelled to Djibouti on 15th August and came back on 11th October, 2007 after successfully completing the training.**
- **The CIFEG Managing Director, Mr. Francois Pinard, visited Nairobi in early October to assess the progress of the Mawari project in Kenya and also to talk to authorities at the French Embassy in Nairobi, IFRA and Kenya Ministry of Water and Irrigation on matters related to the Mawari project**
- **French Ambassador and her officials visited the University and Department of Geology in November, 2007**
- **An Iris Syscal R1 Switch 72 resistivity tomography equipment was purchased by CIFEG for the Kenya Mawari project in September, 2007**

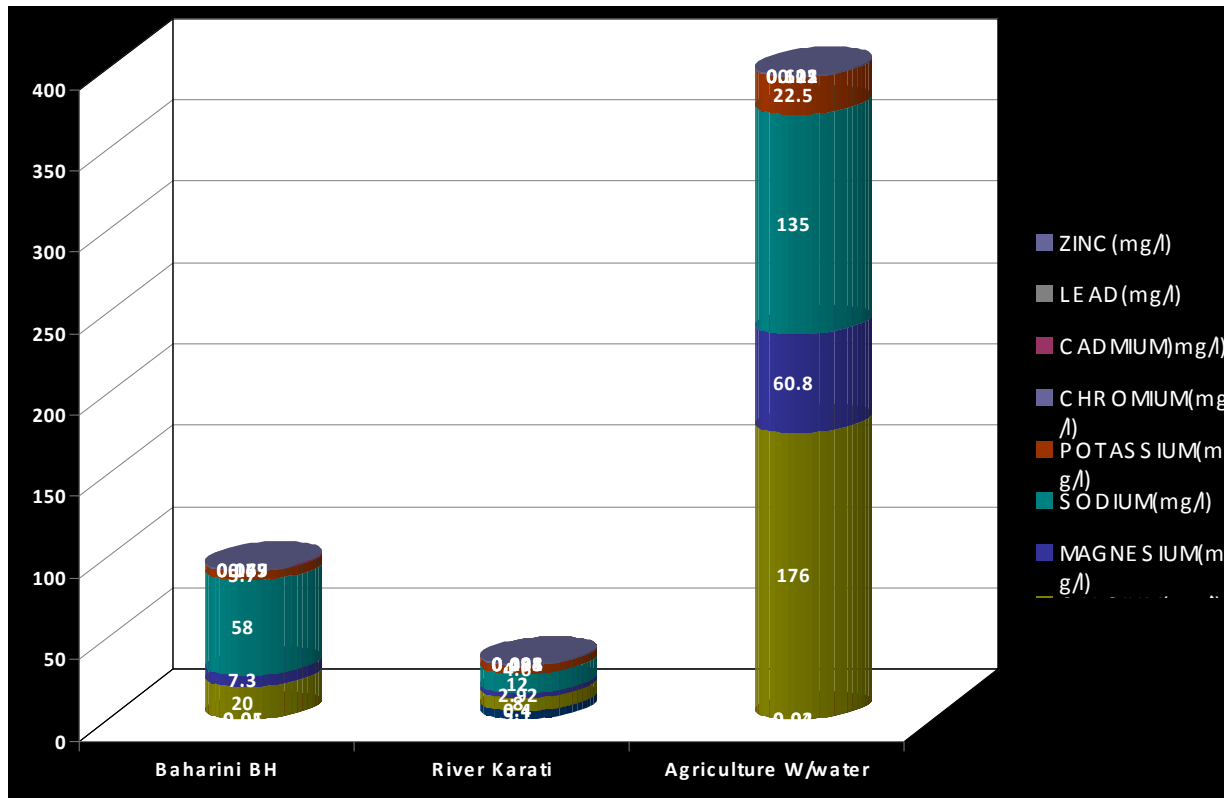
One of the effluent loaded rivers entering Lake Nakuru posing danger to the millions of flamingoes residing on the lake banks



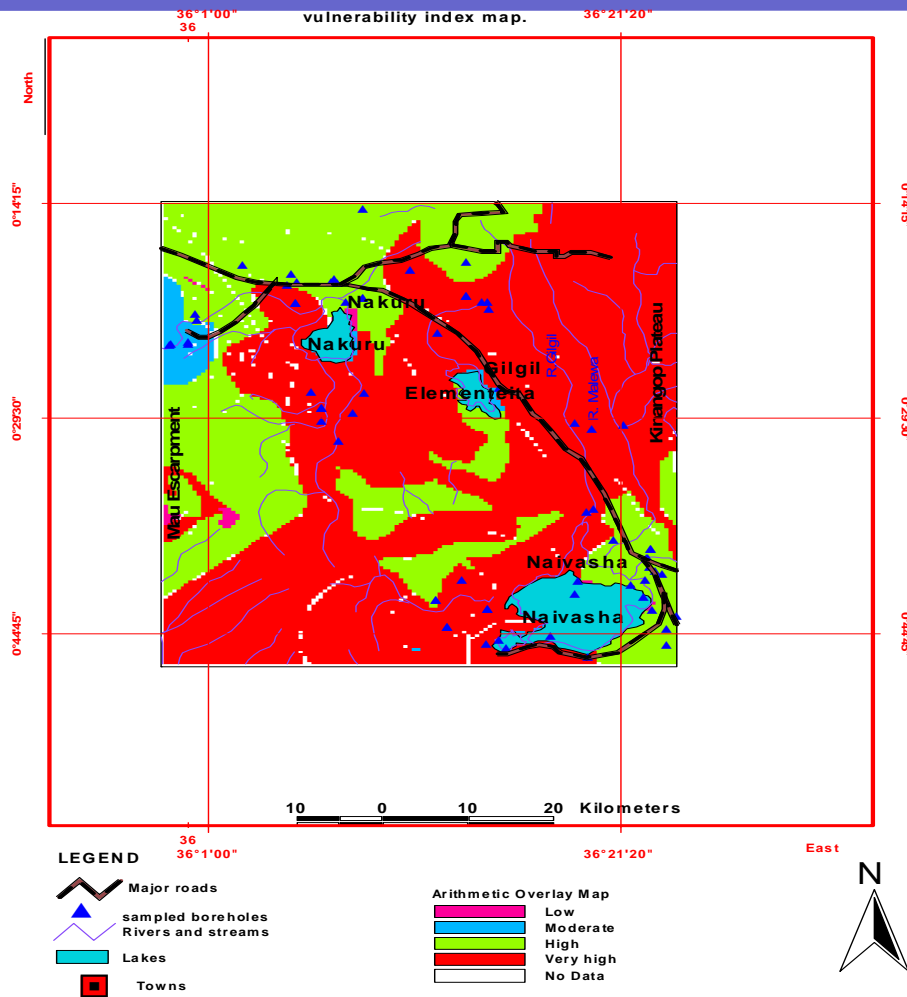
A student collecting a water sample from a borehole at Egerton University and a researcher taking a GPS reading, Nakuru basin



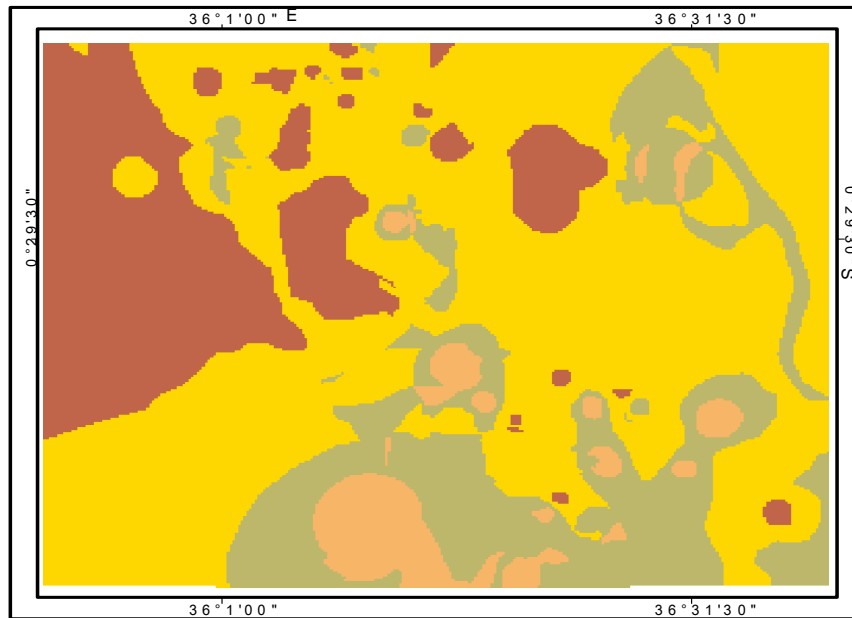
Comparison of metal concentrations from 3 sources of sample media in mg/l



Vulnerability to pollution map of the project area using three parameters of the DRASTIC model – Depth to water-table, Soil media and topography



Vulnerability to pollution map of the project area using four parameters of the DRASTIC model – Recharge, Aquifer media, Impact of vadose zone and Hydraulic conductivity



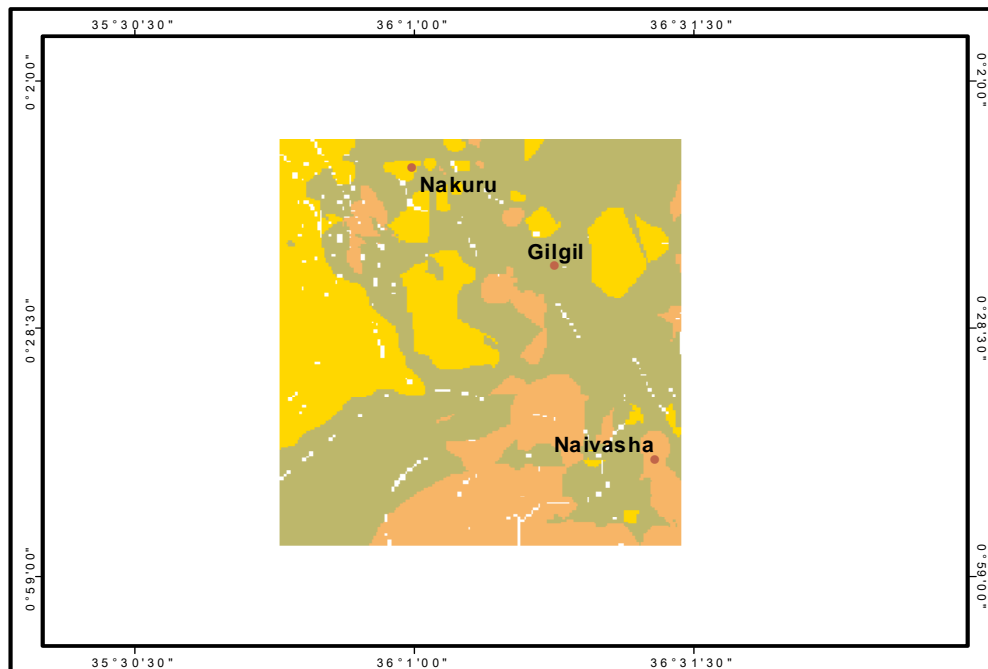
Pollution potential

- Low
- Medium
- High
- Very high

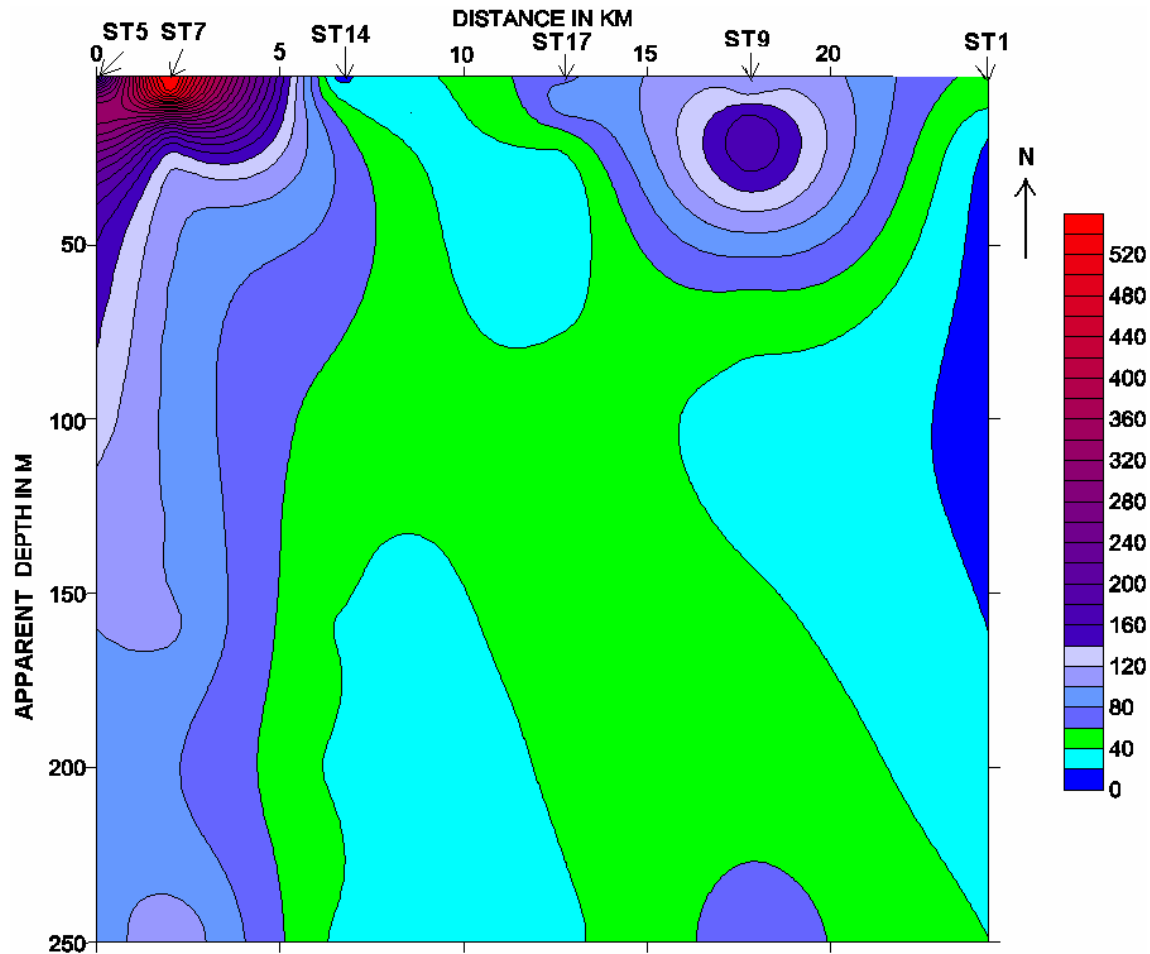


20 0 20 40 Kilometers

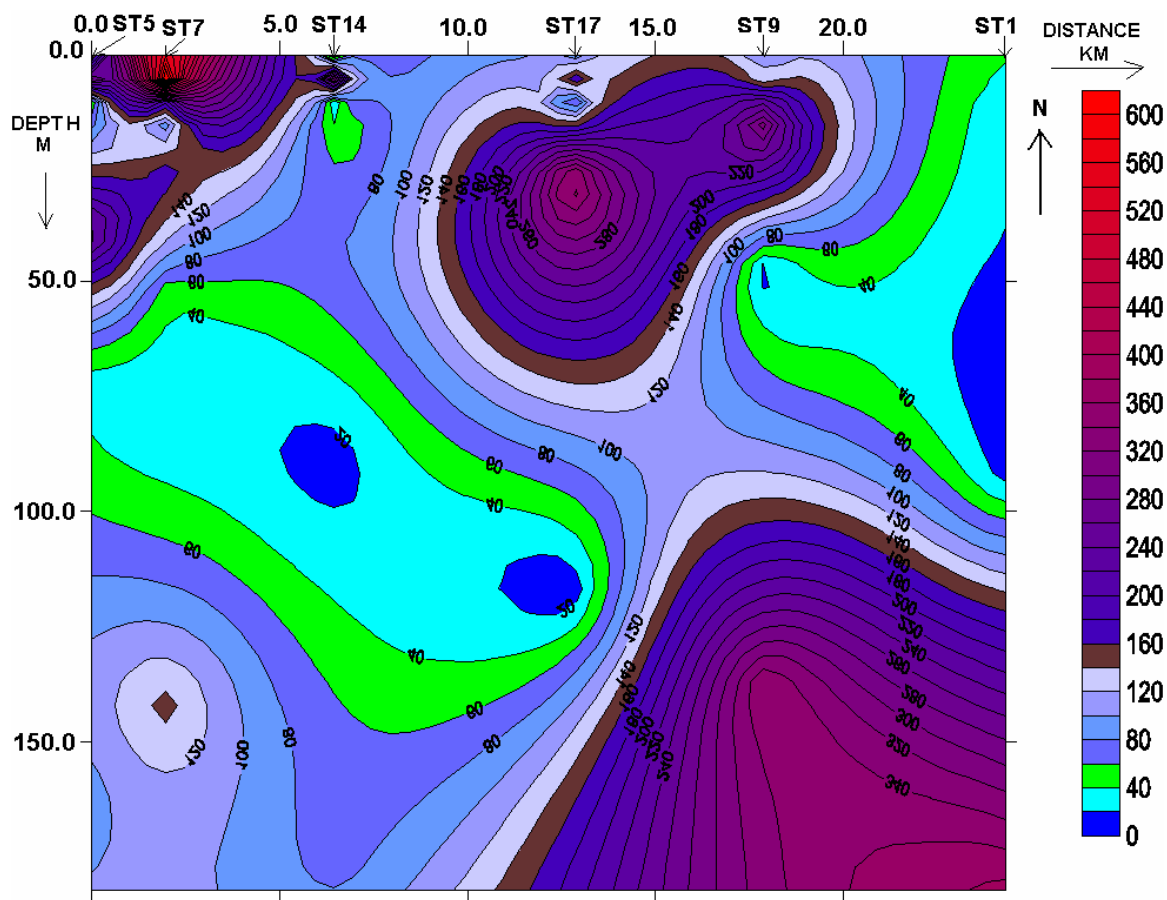
The final DRASTIC model map for the project area



Vertical section of apparent resistivity along traverse III-IV (shown earlier) in Nakuru basin. The groundwater flow and distribution appears to be highly controlled by the N-S deep trending faults in the rift



Vertical section of interpreted resistivity (true) along traverse III-IV (shown earlier) in Nakuru basin. The geology appears complex and N-S trending deep faults control the flow and distribution of groundwater



Our MSc students who visited Djibouti for training pose for a photograph at the Atar Hydrogeological Experimental Site



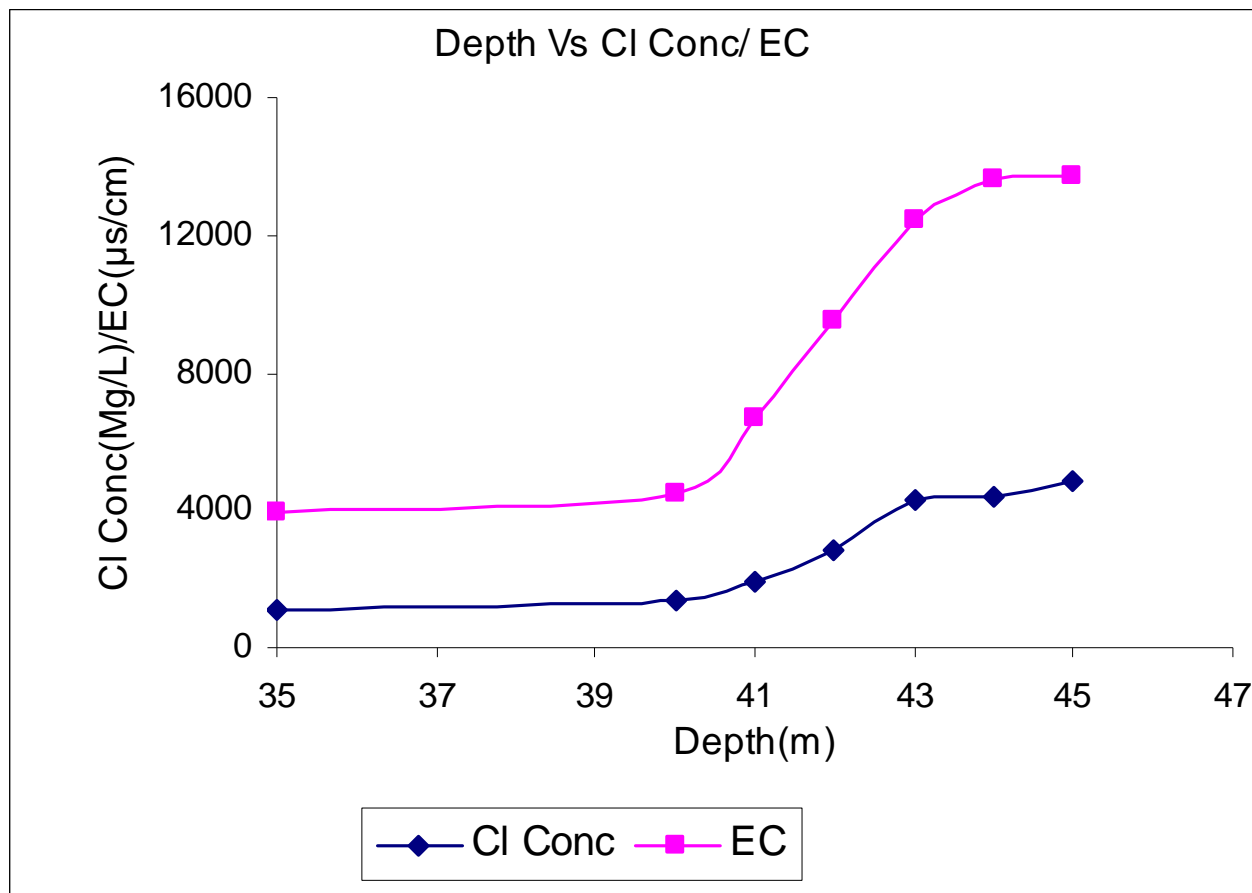
Our students busy conducting their field training at Atar Hydrogeological Experimental Site under the tutorship of CERD staff, Djibouti



The students are taking some measurements at one of the boreholes at the Atar Hydrogeological Experimental Site, Djibouti, with the assistance of the Director of CERD, Dr. M. Jalludin



Relationship between electrical conductivity and chlorine concentration with depth at one of the Atar wells, Djibouti . These are some of the results by the students during their training



The students made a trip to Lake Asal (155 m bsl, background). The Director of CERD and two of the students are in the foreground



During their trip to Lake Asal, the students pose for a photograph with CERD staff including the Institute's Director, Dr. M. Jalludin, with Red Sea in the background



Scheduled activities in the next six months (Nov 2007 – April 2008)

Activity	Nov	Dec	Jan	Feb	Mar	Apr
Completion of coursework by the four (4) second group MSc students and preparation for their end of semester examinations	—————					
Fifteen (15) days' Third (3 rd) Field Mission to project areas in the Kenyan rift (Jan 2 nd -17 th)			-			
Analysis and interpretation of data from 3 rd Field Mission				—————		
Writing of report and research papers incorporating results from 1 st , 2 nd and 3 rd Field Missions	—————					
Scientific Seminar (2 days)			-			

THANK YOU