



Water Exploration in Puntland, Somalia (WPS)



TERRA



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Background

WPS is a water project that is targeted towards the eastern part of the Bari region of Puntland Somalia. The project's main objective includes many villages located both in Qandala and Iskushuban districts in Bari region. The intention is to continue not only in this area but other parts in Puntland as well in the future, particularly the most affected areas of drought.

Qandala is situated south of Bossaso in the Gulf of Aden. Bossaso is the capital of the Qandala district with approximately 600 000 inhabitants. Bossaso has a large port, which is also used by Ethiopia and southern Somalia. Iskushuban is situated east of Bossaso, near to the Indian Ocean.

These areas hardly have any form of water wells. People drink principally rain water stored in handmade water reservoirs. It is unpurified and this can cause many diseases. The climate is very dry, which makes the cultivation of food too difficult. The population depends on livestock, basically goats and sheep. The majority of the inhabitants of the region live in villages as nomads.



There are no real schools in the area and most of the inhabitants are illiterate. Medical and health organization is poor or none-existent. Life expectancy is between 40 and 45 years, when common diseases of the past are often prevalent. Diet consists of milk, rice and occasionally meat. The lack of other types of food causes many types of deficiency diseases. The availability of clean water is minimal and water from the parsimonious rainfall often only evaporates before it can be taken care of. Pathways for effective communication do not exist, a visit to the hospital will last for two days, travelling on a truck or a similar vehicle.

There are three local issues that must be given priority:

1. Access to clean water.
2. Schools (so that every child, girl and boy, can get good education).
3. Health care, prevention and intensive care units.

Realization

The project has carried out two field studies in Puntland, Somalia. The first one in the summer of 2008 and the second in the summer of 2011.

In the field studies in 2011 the project made investigations with the aim to find water wells in 9 villages. Two more cities were benefited. Those cities are Garoweh, the capital city of Puntland and the city of Armo. The methodology used was the VLF-method, which finds structures where useful quantities of underground water may be trapped in rock fractures and cavities.

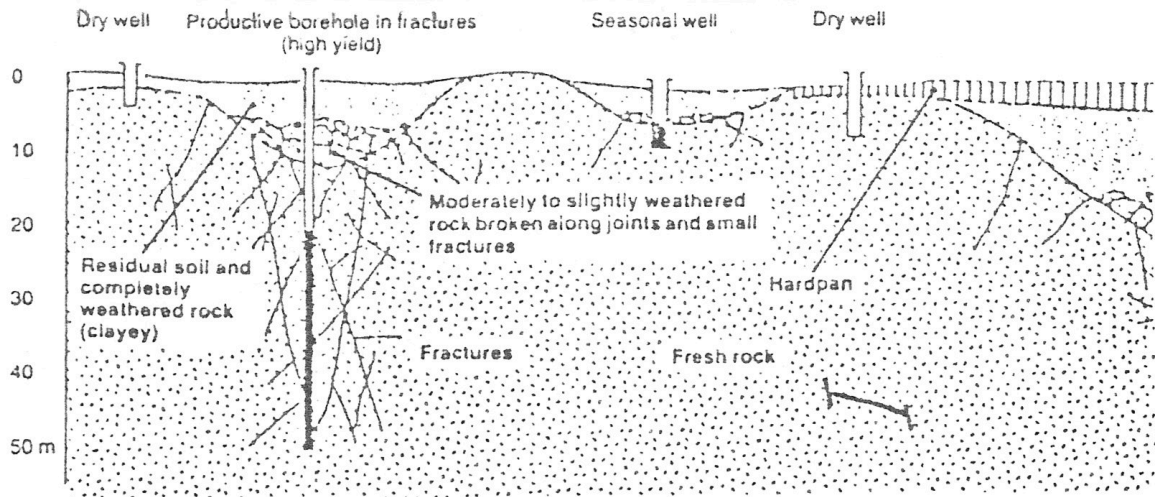
To our knowledge no VLF-investigations have ever been done in Puntland and the field work was initial to find out if it was possible to use the VLF-method.

The results of the investigations indicate that there are good possibilities to find water in the explored areas.

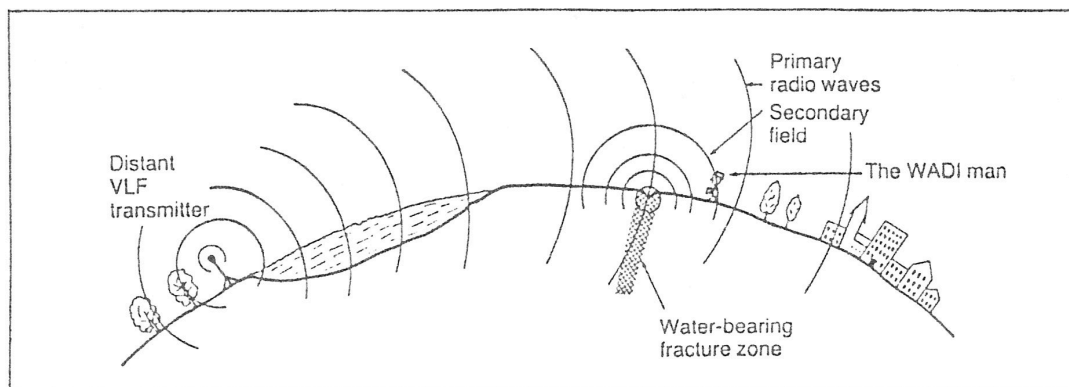
This report describes the methodology used for searching water wells, the field studies and the results of the search for water. The report also includes a recommendation of what type of drilling equipment to use when exploring the water wells.

Methodology Used – the VLF-Method

Good drinking water can be obtained from the bedrock, but drilling without previous investigation seldom yields water in usable quantities. Effective water development programmes must include carefully conducted geological and geophysical investigations.

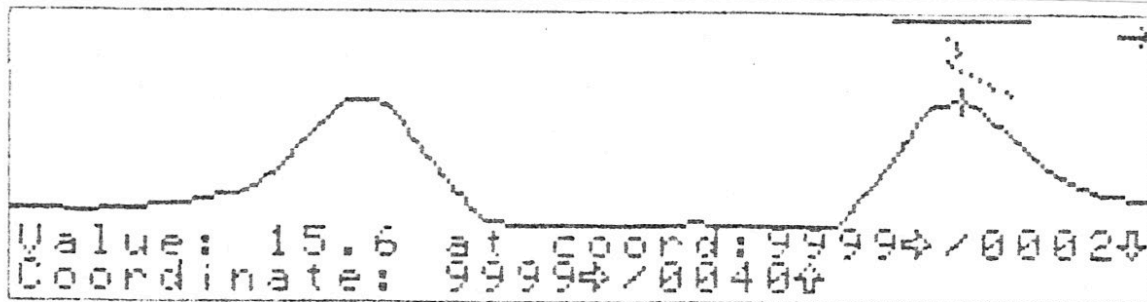


Highly productive water wells are obtained by drilling in rocks that are broken along joints and fractures. The VLF-equipment mostly finds structures where useful quantities of underground water may be trapped in the rockfractures and cavities, thus enabling drillers to select the most promising sites for water well drilling.



For VLF-measurements, use is made of a distant radio transmitter station, which transmits on the VLF-waveband (Very Low Frequency: i.e. 15 – 30 kHz and a long wavelength). Such radio waves are capable of penetrating deep into the ground (or water) and are in fact used for military communications and navigations. These radio waves are disturbed by extensive electrically conducting formations in bedrock, which may be electrically conductive types of rock or concentrations of certain minerals. They may also be steeply dipping, water-bearing fracture zones. These disturbances, or anomalies, may be recorded by means of VLF-measurements and utilized to find the optimum location from where drilling can be done for best quantities of groundwater.

The WADI – VLF (used in Puntland 2011) is a state-of-the-art geophysical instrument designed for easy use. A built-in program makes it possible to interpret measurements immediately, right on the site. However, like other geophysical instruments the WADI simply finds physical structures in the ground and bedrock and can not guarantee water supply in the fractures.



Example of the anomalies shown on the display of the WADI-VLF equipment.

Aim of the Project

The aim of the project has been to find out the possibilities of using the VLF-technique to make quantities assessments of groundwater reserves in large fracture zones in the limestone, by analysis of the amplitude of the VLF-anomalies.

To our knowledge no VLF-investigations have ever been done in Puntland before and the field work was initial to find out if it was possible to get connection to any VLF-transmitter in Europe or Asia.

Terra – an Established Company with High Competence

Terra is a Swedish established company, with its office in the city of Uppsala, Sweden, with chief executive **Birger Fogdestam, Senior Hydrogeologist**, who during most of his active years has been employed by the **Geological Survey of Sweden**.

B. Fogdestam has worked at the Geological Survey of Sweden during more than 30 years. Most of the tasks during the employment has been dealing with groundwater mapping and groundwater investigation in Sweden.

Fogdestam has also been employed by other organisations, consultants and aid organisations during the past years, mostly working on the continent of Africa, i.e. **Libya, Namibia, Botswana, Malawi and South Africa**. During the last year (2011) works have also taken place in **Puntland, Somalia**. Most of the field works abroad have been dealing with VLF-investigation (Very Low Frequency).

Fogdestam has during a period of 5 years been **Head of the National Well Record Section** and during more than 10 years **Head of the Division of Hydrogeology at the Geological Survey of Sweden**.

The aim of the Terra Company is to serve as a consultant, **specialized in prospecting groundwater in sedimentary and crystalline rocks** in Africa, Asia and Europe.

The geophysical equipment used for the prospecting fieldworks will mostly be the Swedish geophysical designed **WADI-VLF equipment**.

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Field Studies in 2008

Mursal Ismail Isa, initiator of the project, made field trials in the area in the summer of 2008. He first visited villages of the Qandala district. Qandala consists of five communities: Unuun, Beelwacatay, Tuurmasaale, Balidhidin and Buq Atoti. These five areas have in all approximately 10 000 inhabitants. Other villages and towns covered in the project were: Barako, Hiriiro, Hubays and Armo. These four areas have in all about 20 000 inhabitants.

The aim of the project was to improve the population's living conditions by supporting clean drinking water, which is the living key to every human being.

The people in the villages have never had water with its original/natural color, because they have always got the brown, green or black tinged water to drink in their daily lives.

The project's other main objective was to transfer knowledge and resources and encourage people to actively try to solve their problems and instead of standing recipients of charity to be participants in a long-term initiative to help their country.

Mursal Ismail has produced a documentary film that was funded by ABF, a Swedish organization. The problems that existed in the area were categorized, and the need of water came into the highest priority. ABF in Sweden and other key individuals have agreed to implement water prospecting in the area in order to establish if there is enough useful water available in the area, before drilling.

Clean water is the most important base for healthcare and sufficient social life. It is impossible to build up any type of healthcare without clean water.

Field Studies in 2011 and Finds

In the summer of 2011 Mursal Ismail Isa and Birger Fogdestam, Senior Hydrogeologist, made investigations in Puntland, Somalia, using the VLF-method.

The field studies were funded by ABF Borlänge Nedansiljan, Sweden and Somali Aid Society (SAS), Puntland, Somalia.

Investigations were made in 9 villages and 2 cities in Puntland in a period of less than two weeks. In every village several profiles were measured. The measurements were made by using a low frequency instrument. The instrument worked with reception of 16.3 kHz.

On the following pages there is a list of the profiles that were investigated in the villages. Figures are indicative of highest to lowest measured value, where 1 is the maximum value. The recommended drilling points are marked on the ground in the villages as cemented stonecones.

In the appendix of this report, there are diagrammes of each one of the profiles.

It is not recommended to drill deeper than 200 metres because of the risk for saline water at deeper depths. Serious recommendations are given to stop the drilling as soon as the water supply seems to be enough, even if it will be at just 100 metres. If the waterwell is polluted by saline water, it will be ruined for a very long time, and it is a fact that fresh water is always underlayed by saline water in the investigated area of Puntland.

Humbays 29 June

Profile		Reading/Value
P. 0302	581 metres	1
	775 metres	3
P. 0303	390 metres	2
	111 metres	4

Hiriiro 30 June

Profile		Reading/Value
P. 0304	342 metres	
P. 0305	510 metres	3
P. 0306	127 metres	
P. 0307	331 metres	
P. 0308	280 metres	1
	327 metres	2

Hamure 30 June

Profile		Reading/Value
P. 0309	195 metres	
	390 metres	
P. 0310	125 metres	
	427 metres	
	582 metres	

Hamure 1 July

Profile		Reading/Value
P. 0311	195 metres	3
P. 0312	36 metres	
	161 metres	1
P. 0313	36 metres	2
	193 metres	

Balidhidin 1 July

Profile		Reading/Value
P. 0314	95 metres	
p. 0315	103 metres	
p. 0316	450 metres	3
p. 0317	720 metres	2
p. 0318	91 metres	1

Beelwacatay 2 July

Profile		Reading/Value
p. 0319	273 metres	1
p. 0320	170 metres	2
p. 0321	230 metres	4
p. 0322	200 metres	3

Unuun 3 July

Profile		Reading/Value
P. 0323	780 metres	1
P. 0324	160 metres	2
P. 0325	265 metres	3

Tuurmasaale 3 July

Profile		Reading/Value
P. 0326	No anomaly	
P. 0327	215 metres	2
P. 0328	280 metres	
P. 0329	85 metres	1
P. 0330	83 metres	

Barako 3 July

Profile		Reading/Value
P. 0331	65 metres	1
	138 metres	
	405 metres	3
P. 0332	No anomaly	
p. 0333	No anomaly	
p. 0334	330 metres	2

Armo 5 July

Profile		Reading/Value
P. 0335	No anomaly	
P. 0336	190 metres	1
P. 0337	151 metres	2
P. 0338 (SE of village)	360 metres	

P. 0339	130 metres	3
P. 0340	284 metres	

Hiddo 5 July

Profile		Reading/Value
P. 0341	640 metres	
P. 0342	174 metres	3
	516 metres	1
P. 0343	110 metres	2
P. 0344	No anomaly	

Garoweh 7 July

Profile		Reading/Value
P. 0345	135 metres	2
	225 metres	5
	350 metres	1
P. 0346	215 metres	4
P. 0347	105 metres	3

Recommended Equipment, Water Drilling, Puntland

Drill rig:	Atlas Copco, Sweden	
Compressor:	Atlas Copco	
DTH-hammer:	Atlas Copco, 2 pieces 6'' Atlas Copco, 1 piece 4''	
Drill bits:	3 pieces 6 1/2''	
	Odex:	165 mm
	Odex:	115 mm
Casing:	150 m	193,7 x 5,5 mm
	200 m	139,7 x 5,6 mm
Drill pipe:	300 m	
Lorry (used military)	2	
Veicle 4x4	1	

Different tools for running the drilling.