


**Timo Vuori**
**Good drinking water at low cost for one million people in western Kenya**
**GENERAL**

The Rural Water Supply Development Project in Western Province of Kenya is based on the Agreement on Technical Cooperation between the Governments of Finland and Kenya, signed 1975. The Project was started in April, 1981 with a mobilization, planning and design phase. During 1981 - 1983 the water supply development plan was elaborated through extensive field investigations including surface and groundwater reviews, a test drilling program, and construction of a series of test wells. The First Implementation Phase of the Project was launched November, 1983 and will end December, 1985. The Ministry of Water Development of Kenya and the Ministry for Foreign Affairs of Finland have jointly accepted the joint venture Kefinco to execute both phases just mentioned. Kefinco has been established by YIT Ltd. (General Engineering and Contracting Company) and Finnconsult Consulting Engineers, both from Finland.

**PROJECT AREA**
Population

The Project area consists of four districts, Kakamega, Busia and Bungoma from Western Province and Siaya from Nyanza Province, covering altogether about 3700 km<sup>2</sup> and 0.85 million people, i.e. population density 230 persons/km<sup>2</sup>. Population growth is about 3-4 % annually. The area is mainly rural, the urban places of the area were excluded mainly because their water supply had already been constructed to a certain extent.

Rainfall

The mean annual rainfall of the area varies between 1100 and 2000 mm, the mean annual pan evaporation ranging from 1600 to 2100 mm. The annual mean of the daily minimum temperature varies from 14°C to 16°C and the annual mean of the daily maximum temperature from 26°C to 30°C.

Geology

The Project area is on a gently sloping peneplained surface, south of Mt. Elgon and west of Nandi Escarpment. In the west the Project is bound by Lake Victoria and the Ugandan border. The main rock type is granite which is intrusive to both Kavirondian and Nyanzian system rocks.

The granite is usually medium to coarse - grained biotite type, often porphyritic. Part of the area consists of Nyanzian volcanics. Sedimentary rocks lie in western and south-western parts of the project area. Superficial deposits, with the exception of laterite, are not common.

Economy

Among the eight provinces of Kenya, Western Province is No. 7 by per capita income, the current average figure being in the project area in the region of 1500 KES per capita annually. More than 95% of people earn their living from agriculture and livestock in small farms, a few hectares at best. Foodcrops consist of maize and cassava, and cashcrops of sugar cane, coffee and cotton.

Water Supply before the Project

The first idea the Project personnel gained from the area was that the water resources, both surface and groundwater, were apparently substantial and quite under-exploited, and uninvestigated. In thirteen months the known list of 30 springs amounted to about 3000 springs and the groundwater resources only were estimated to be ten times bigger than the potential water demand in 2005, of 1.7 million people, making about 5% of the whole Kenyan population. Only a few percent of the people in the project area were within organized water supplies, mainly small piped schemes, frequently failing. Rivers, springs and at worst, occasional ponds of rainwater, served as sources of water. Some hundreds of private wells were identified but they were uncovered without pumps or any other advanced devices for lifting the water, all very much susceptible to contamination. In certain areas, although sporadically, cholera is an annual visitor.

**CHOICE OF TECHNOLOGY**

It was estimated that piped water all over the project area could cost up to 1.7 billion KES (1 £ = 17.81 KES on 27 Feb. 1985) up to 2005 while low-cost alternatives were probably to save roughly 80% of that money resulting in the total of approx. 0.34 billion KES. These calculations were based on the following per capita investment costs: piped water 1000 KES, low - cost technology (handpump wells and spring

protections), 200 KES. This dramatic difference in investment is further emphasized by the fact that the annual running costs of piped schemes were estimated to be in the region of 30 - 40 KES per capita and those of low cost in general less than 10 KES per capita. A general conclusion was also drawn that handpump wells and spring protections are for the time being most appropriate solutions at the current development stage of the area, compact piped water alternatives were evaluated to be feasible in the small centres of the project area.

#### WATER SUPPLY DEVELOPMENT PLAN

The Government's and also the Project's long term objective is to provide the entire population of the project area with the benefits of a safe supply of water by the year 2000. This objective can be fulfilled most economically, and still keeping a good service level, by constructing 7000 handpump wells and 1500 protected springs for 1.6 million people. An augmentation of the present piped water system or a construction of a new piped scheme will be performed for three urban and eight rural centres with a total population of 0.1 million people. In addition, all existing piped systems outside the urban and rural centres are proposed to be rehabilitated.

#### I Implementation Phase Nov 1983 - Dec 1985

The current phase includes the following components:

- Construction of altogether 845 handpump wells and 120 spring protections
- Design and construction of two piped water supply schemes, (Butula, Chwele)
- Rehabilitation of six existing piped water supply systems, (Kakamega, Shikusa, Malava, Alupe, Segal, Moding)
- Monitoring the quality of water in the wells of the project and monitoring the utilization of handpump wells,
- Achieving an operation, maintenance and revenue collection system for the handpump wells,
- Continuation of the hydrogeological field investigations,
- Preparation of training programme and commencement of its implementation, and
- Preparation of the programme for the Second Implementation Phase 1986 - 1988.

By the end of 1984 the Project has reached almost half of the above figures, this means that the programme is executed according to the schedule.

#### Costs and Financing

The cost of the First Implementation Phase up to the end of 1985 is estimated to be 85 mill KES, from which 75 mill KES on grant terms from Finland.

#### TECHNICAL SOLUTIONS

Hand-dug wells are normally lined with concrete rings, diameter 80cm - 100cm. Brick-lining has been tested but so far the results were not very promising. Special attention is paid to the general arrangement of the above ground part of the well, a proper concrete slab with drainage downwards, preferably to a small vegetable garden, can hinder contamination of the well.



Hand-digging of a well



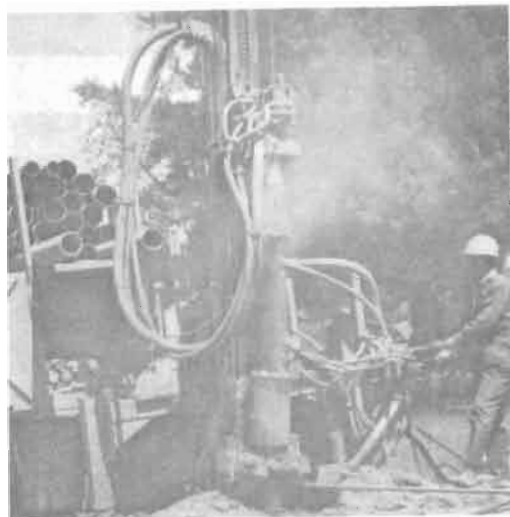
No more extra miles to walk for water

A spring protection consists of retention wall, filter bed, shielding plantation. Where applicable, hydrams are installed, they are manufactured locally at Weco, see below.

Drilling is carried out by two rigs, AQADRILL 661 and ROTAMEC 50. Steel casings are used to help to penetrate the loose overburden. All wells are testpumped and furnished with proper PVC-casings and screens. Annual production is approx. 200 boreholes, average depth about 50 m. All drilling places have been carefully sited with seismic soundings.



Spring protection furnished with a locally made hydram.



Drilling is the option for the driest areas.

**WATER QUALITY**

In general, the groundwater quality of the area is quite acceptable. Fluoride does not occur in concentrations above 0.5 mg/l and excessive amounts of chlorides are quite rare. Iron above 2mg/l seems to characterize about one fifth of the borehole wells. Measures have already been taken to tame the problem and the Project has developed a practical low-cost iron removal system for handpump wells, it is already operated at two schools.

**COMMUNITY PARTICIPATION**

It was realized in the very beginning that the beneficiaries must be involved both in the implementation and maintenance of water supplies, as well. Community development



Iron removal at Lusumu Primary School. The handpump is locally made.

officers of the Project start to activate the wanainchi at least one month before construction starts. The local leaders have been informed on the Project's philosophy, targets and conditions for wanainchi. At hand-digging sites, people have to dig down to the groundwater level before the Project group comes to complete the well. At spring protection sites, people have to collect construction material like stones for the work. There is a precondition that the pump will not be installed before the well committee is formed and active, as an indicator of which funds collection for future maintenance is one of the most reliable.

**MAINTÉNANCE OF HANDPUMPS**

It has become quite obvious that the rural people cannot afford multimen maintenance groups mobile with four-wheel vehicles. The Project has, since the implementation started, worked to develop a system in which bigger repairs could be carried out by private fundis paid by the well committees, moving with bicycles fitted with toolboxes. The minor faults should be fixed by the pump attendants, every well committee is supposed to appoint one. The training of the fundis is mainly on-the-job based, the pump attendants are educated in groups of thirty in their own locations. The project has developed education and training material from its field experiences. The consumers' price consciousness has been developed. Every committee has the recommended prices for different spare parts, labour and transport. future handpump development will play a major in the success of village level maintenance.

Information on Handpump Maintenance Costs of the Year 1984.

**Labour costs**

	2 foremen - drivers	4 helpers	4 trainees	Total
Salary	36 000	38 400	26 400	100 800
Night allowances	49 500	66 000	26 400	141 900
Housing allowances	14 400	7 200	-	21 600
Overtime	15 000	15 000	12 000	42 000
<b>Total</b>	<b>114 900</b>	<b>126 600</b>	<b>64 800</b>	<b>306 300</b>

<u>Transport Costs</u>	KES
Annual capital costs of 2 Land Rovers (10% interest 4 year repayment time) 0.316 x 2 x 210 000 KES/year	132 700
Maintenance of the vehicle 1 KES/km x 80 000 km	80 000
Fuel 15 l/100 km x 80 000 km x 6 KES/l	72 000
Tyres 4 tyres/25000 km, 13 x 1900 KES	24 7000
Insurance	2 000
	311 420 KES
<u>Spare parts</u>	60 000 KES
<b>GRAND TOTAL</b>	<b>667 700 KES</b>

The project maintenance teams have installed 220 handpumps and repaired 350 breakdowns during the past year. The exact division of costs is difficult to make because both teams have maintained and installed handpumps simultaneously. The average costs of maintenance and installation activities in 1984 were approximately as follows:

Installation  
(39% of salaries and transportation costs) 244 800 KES/year

Maintenance  
(61% of salaries and transportation costs + spare parts) 432 900 KES/year

The average cost of a handpump installation was appr. 1113 KES and the respective repair cost was 1237 KES. The latter figure lays stress on the importance of village level maintenance system and handpump development work.



A baraza, well committee members and the appointed repairman.

Today, two fundis trained by the Project operate within an area of about 80 wells. By the end of the year, at least half of 800 wells will be under similar care. In the meantime, mobile groups are repairing the pumps but even in those cases we insist on full payment by the well committee according to the price lists.

#### HANDPUMP DEVELOPMENT

The Project started the test well production with Finnish NIRA- shallow well pumps. Very soon it became obvious that about half of the wells demand a deep well pump. Two years ago, in 1983, the project had one INDIA Mk II

pump manufactured locally at WECO, Western College for Arts and Applied Sciences, Kakamega. The institute is supported by DANIDA. This year the project will buy more than half of the pumpheads needed, 250 from WECO. In addition to that, the riser pipes and piston rods to all pumps are made locally, only the cylinders are imported so far. Local manufacturing of handpumps seems to offer several advantage over imports such as

- quick and reliable deliveries of pumps
- chances for immediate modifications and improvements.
- improved availability of spare parts
- positive impact on employment
- increased interest of local people and authorities in the low-cost approach in general. The project has ordered 250 pumps for 1984 and other orders to WECO amount to 150 pcs.

Quality of the pumps has been surprisingly good, not a single problem with the pumps cannot be attributed to the local manufacturing.

#### ABSTRACT

Rural Water Supply Development Project in Western Kenya was initiated in 1981 as a part of technical co-operation between Kenya and Finland. The Project represents implementation of low - cost technology in a big scale, the project population is altogether about 5% of the whole population of the country, about 1 million people at the moment. The project was started with an investigation and planning phase when the water resources of the area were studied and the water development plan elaborated. Implementation started November 1983. By the end of 1985 about 400 borehole wells and the same of hand-dug wells will be constructed, equipped with handpumps, and 120 spring protections will be made as well. A few existing piped supplies are to be rehabilitated and two compact schemes constructed. The main target, however, is not the maximum amount of water points produced but promoting the establishment of village level maintenance system for the wells and the pumps. The target is approached through intensive community participation activities. The first pump repairmen are already working in the area mobile with bicycles and tool boxes. They are paid their services by the well committees. Local manufacturing of handpumps is one of the target areas of the Project, as well. The second phase of the Project, under planning right now, will start 1986.