FEDERAL UNIVERSITY OF TECHNOLOGY MINNA

THE GROUNDWATERS OF NIGERIA: A SOLUTION TO SUSTAINABLE NATIONAL WATER NEEDS.

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1.0 INTRODUCTION

1.1 Groundwater

Water is life. Without water there can be no life. Every aspect of agriculture requires adequate and timely supply of water to succeed. Groundwater has sustained agriculture in some desert regions of the world and in Nigeria through tubewells and washbores. The pattern and level of life development depend to a great extent on the quality, quantity and rate of water supply to the species. Civilizations have flourished with the development of reliable water supplies and have collapsed as the water supplies failed (Fetters 1972, Troften, 1973). Groundwater offers the most abundant source of water to man. It is the cheapest and the most constant in quality and quantity. Because it is not visible on the surface and probably because of misinformation about groundwater, many people undervalue the importance of ground water in sustaining water supply needs.

Groundwater exists in three major rocks in Nigeria- Igneous rocks, sedimentary rocks and metamorphic rocks. Each of these rock types has many varieties which need careful studies by geologists. Experience has shown that most important organs of the human body are not seen outside. For example blood and the heart that pumps it are not visible yet they are very important. The existing situation whereby greater emphasis is placed on surface water than groundwater can be likened to a woman using costly soap and detergent to kill germs on her body without caring for the infections in the blood which have caused skin diseases.

The money, time and emphasis given to surface water development in Nigeria at the expense of groundwater development has not been justified in terms of meeting water needs. A study of water supply for irrigation, domestic purposes and hydro-electric power generation up to 1993 shows that 63 large dams and 99 small dams had been constructed (JICA, 1993; FAO, 2005). Out of these, 31 large dams and 45 small dams were used to irrigate 418,620 hectares and 45,880 hectares of land respectively. Twenty six (26 number) large dams and 53 small dams were used to supply water to 5,718,500 people and 2,298,300 people respectively. Six large dams were used to supply 4,978 MW of hydro-electricity and one small dam used to supply 16 MW. The huge amount spent without water reaching enough people could have been complemented with a conjunctive development of groundwater sources with better results (Olasehinde, 1983; 2003; Olasehinde and Awojobi, 2004).

1.2 Water Supply in Nigeria

The population of Nigeria has been increasing at a rate of about 3% yearly since 1991 (FOS/ Population Commissions, 2001) (Table1). Water supply has not followed the same trend, rather it has been stagnant. Water supply coverage of Nigeria has remained at 57% level for long. This percentage can be greatly improved upon by a conjunctive use of surface and groundwater sources. One of the limiting factors has been poor knowledge about the possibilities of groundwater sources and uses in Nigeria.

Table 1: Population of Nigeria (1952 – 2015)

Year	Population (millions)
1952	31
1963	56
1991	89
1993	94
1994	97
1995	99
1996	103
1997	105
1990	86 Projected
1995	99 Projected
2000	115 Projected
2005	134 Projected
2006	140 Projected
2010	155 Projected
2015	179 Projected

(Source: FOS/Population Commission 2001)

It has been observed that, poor health delivery, poor sanitation and low agricultural productivity are linkable to inadequate water supply or water "crises" (UN Water Report, 2003). This is true of Nigeria which ranks 151 out of 171 countries studied in 2004 (Offodile, 2009). The study shows that 70% of Nigerians are poor. Although there has been continuous decrease in infant mortality, the rate is still high. The government's water resources development program of 1999 has resulted in the rapid decline in reported cases of water related diseases such as cholera, hepatitis, diarrhea and guinea worm infestations. Also, the supply of electricity in Nigeria has depended more on hydro-electric sources than others. It is therefore pertinent to look into how water supply can be improved upon by complimentary use of groundwater and surface water sources in Nigeria. Water,

must be seen as a social and economic resource as articulated in the African Vision for Water Resources Management at the Second World Water Forum held in the Hague (The Netherlands) in 2000. African governments under the New Partnership for African Development (NEPAD) also recognized the role of water in economic development of the continent. Among the ten point agenda of the African Vision, five deserve mention here that:

1. There is sustainable access to safe and adequate water supply and sanitation to meet the basic needs of all.
2. There is sufficient water for food and energy security.
3. There is an adequate number of motivated and highly skilled water professionals.
4. There is an effective and financially sustainable system for data collection, assessment and dissemination for national and trans-boundary water basins.
5. There are effective and sustainable strategies for addressing natural and man made water resources problems, including climate variability and change.

The other five points relate, mainly to institutional frame work for attaining the vision which will be considered later. Clean water is a *sine qua non* for enhancing people's health and wealth. Out of a sampled world population of 8 billions, over 1,100 billion people did not have access to safe and clean drinking water by (WHO, 2004). This led to the setting of 2015 as the United Nations year of reducing the number of people without clean water by half (United Nations, 2000, Millennium Development Goals). In Nigeria water resources, including rain harvesting, surface water and groundwater are obtainable in varying quantity from place to place. The least understood of these sources is the groundwater source, yet, it is the most abundant, most reliable and cheapest to harness. These undisputable realities motivated the Nigerian Association of Hydrogeologists (NAH) to organize a Mini Summit in Jos on 10th and 11th September 2009. Many of "my people are destroyed for lack of knowledge" of groundwater (Hosea 4:6, Bible King James Version). A look at the global water situation will convince all on the need to study, understand, and invest more in the more abundant groundwater resources for both the rural and urban areas of Nigeria. A passionate commitment to solving water supply problems and management in Nigeria is highly needed. Accurate information and appropriate expertise are essential to achieving this goal.

1.3 Hydrogeology as a Profession

Hydrogeology is all about understanding the occurrence and behaviour of groundwater. Hydrogeology is both a descriptive and an analytical science. It is a branch of hydrology which is the study of occurrence, distribution movement and chemistry of all waters of the earth. The term geohydrology is sometimes used to describe an engineering field dealing with subsurface fluid hydrology (Fetters, 1972). The practitioners are called Hydrogeologists. The Hydrogeologists borrow from other disciplines to enhance the effective supply and management of groundwater. The experience in Nigeria is such that most of these other professionals "take over" the primary functions of the hydrogeologists and hence misinform the end-users when they fail. Some practice "water witching" and carry many people along with them. The myth created about groundwater has been great and has penetrated communities so much that it becomes difficult for the laymen to appreciate the important roles of groundwater in sustaining water needs in Nigeria (MacDonald *et al*, 2005). Before progress can be made these myths must be removed. Groundwater can provide a good avenue to achieving the Millennium Development Goals of the United Nations to reduce by half the number of people without clean water by 2015.

2.0 WORLD WATERS

2.1 Water Transfers

The world waters are perpetually in motion while maintaining a dynamic equilibrium. The constant movement of water from the atmosphere in form of rainfall, dews hailstones and snowfalls to the land and overland as runoff, vertically and horizontally into the ground as groundwater, as base flow and infiltrate into the sea and back to the atmosphere through evaporation and transpiration is called the hydrologic cycle. (Fig. 1).

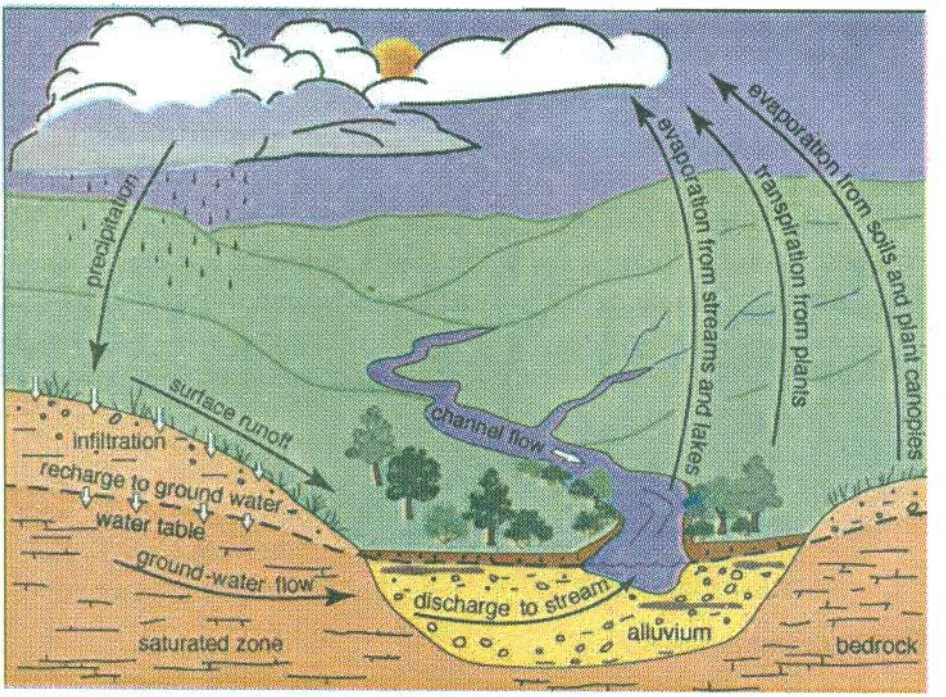

Fig. 1: Sketch of Hydrologic Cycle (http:/en.wikipedia.org/wiki/)

The sun seems to be source of energy that drives the cycle as evaporation from the sea and transpiration from the trees and plants take place to form clouds which condense to form rainfalls, dews, snowfalls and hailstones. The cycle is repeated over and over from time immemorial.

There is however a balance in the amount present in the following major areas of the world (Table 2).

Table 2: World Waters in Major Areas

1.	The Oceans	=	97.10% - 1,350, 400 x 10^3km^3
2.	Snow Field (ice caps and glaciers)	=	1.93% - 26,000 x 10^3km^3
3.	Groundwater	=	0.51% - 7,000 x 10^3km^3
4.	Lakes, Inland Seas	=	0.17% - 230 x 10^3km^3
5.	Rivers	=	0.0001% - 1.7 x 10^3km^3
6.	Atmospheric vapour	=	0.0001% - 13 x 10^3km^3
7.	Soil Moisture	=	Negligible

The amount of freshwater available to man includes:

i. Ice-caps and glaciers 1.9%
ii. Freshwater lakes.....0.009%