Available online at www.worldscientificnews.com

World Scientific News

An International Scientific Journal

WSN 94(2) (2018) 217-235 EISSN 2392-2192

Spatial Distribution of Government and Donor Organization Provided Public Water Facilities in Uyo Metropolis, Niger Delta Region, Nigeria, Using Geographical Information System

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ABSTRACT

Crisis of water scarcity, pollution and pricing is universal and of international concern. Its consequence is worse than that of terrorism, war, nuclear and chemical weapons. Withdrawal or pollution of all water sources can cause death of all mankind, plants, living things and the ecosystem at large. Influenced by the above and the fact that availability of potable water sources, adequately distributed is a requirement for development, the authors conducted research to evaluate spatial distribution of public water facilities in Uyo metropolis in the Niger Delta Region of Nigeria. Primary data obtained through direct exploratory survey of public water facilities within Uyo metropolis and their respective geographical locations using GIS (Geographical Information System). Result indicate that public water facilities located within Uyo metropolis are not evenly and adequately distributed, hence scarcity in public water supply, causing the inhabitants to depend mainly on untreated private borehole water. This does not guarantee healthy living, thus, a negation of achievement of Millennium Development Goals (MDGs).

***Keywords*:** Borehole Water, Groundwater, Public Water Supply, Spatial Distribution, Uyo Metropolis

(Received 29 January 2018; Accepted 15 February 2018; Date of Publication 16 February 2018)

1. INTRODUCTION

Water is basically indispensable natural resources, most necessary requirement of life after air According to Adedeji et al (2010), George et al (2014) and Molden et al (2001a), availability of reliable source of water is an essential requirement for sustainable development. It is one of the world development indicators. Water has no known substitute in many of its numerous uses. Portable water is one that is safe to drink, pleasant to taste and very un-objective and colorless (Nigerian Standard for drinking water quality 2007). Water usage transcend domestic to agriculture, industrial, maintenance of ecosystem, hydro-electric energy generation among others (Jiya and Bakare 2002; Smaktin 2002; Oweis and Hachum 2001; Rosegrant et al 2002; Oweis et al 1999; Johnson et al 2001; Gracia et al 2001; Molden, 1997, Molden et al 2001b; FAO 1996; Etuk et al, 2016a; Etuk et al, 2016b). The above notwithstanding, increased demand for urbanization affects natural water resources (McMahon, 2010).

Urbanization leads to depletion of natural resources, such as deforestation, drying or destruction and pollution of surface water as well as contamination of ground water. Moreso underground water aquifer are drained at a rate faster than the water can be recharged, hence depletes groundwater (Hinrichsen et al, 1998; Garg and Garg, 2008; Rosegrant, 2002), as a result of overpopulation and expanded utilization of fresh water (Garg and Garg, 2008; Gleick 1998; Gleick 1999; Gleick et al, 2000; Gleick et al 2002; Resegrant, 2002; Molden et al 2001a). Thompson and Hickey (1996) posit that a major urban area that includes a large central city surrounded by several smaller incorporated cities and suburbs that join to form one large recognizable municipality is termed metropolis.

Uyo, the state capital of Akwa Ibom State within the Niger Delta region of Nigeria, falls within the description of a metropolis. This research on spatial distribution of public water facilities provided by Government and donor agencies in Uyo metropolis, becomes necessary because of the metropolitan nature of Uyo and the associated potable water problems. Justification of this study is in the fact that the extent of urbanization of Uyo as a state capital, considering its metropolitan status has led to increasing population and depletion of natural water resources, such as stream, lake, spring coupled with pollution of water aquifer and rain water (Ekong et al 2012, Agbasi and Etuk 2016), which the inhabitants have hitherto been relying on. Municipal source comprising: leakages from liquid waste and solid waste from land fill, kitchen waste, waste from trading activities and sewage; Industrial source including pipeline leakages, oil fields and brines, liquid waste tank, gas flaring and fumes from exhaust pipe; agricultural sources consisting of irrigation return flow, animal droppings, fish pond waste water, fishing chemical and fertilizer are some of the causes of this water problem. This gives rise to scarcity of fresh water, hence, subsequent demand for alternative sources of water such as hand dug wells and boreholes, as well as water from government and donor agencies' water facilities, which is often considered as treated water. The report of this study plausibly will assist in achieving Vision 2020 as well as Water and Food 2025.

2. STUDY AREA

Uyo metropolis comprises the entire Uyo, parts of Itu, Uruan, Nsit Ibom and Ibesikpo Asutan Local Government Areas in Akwa Ibom State.

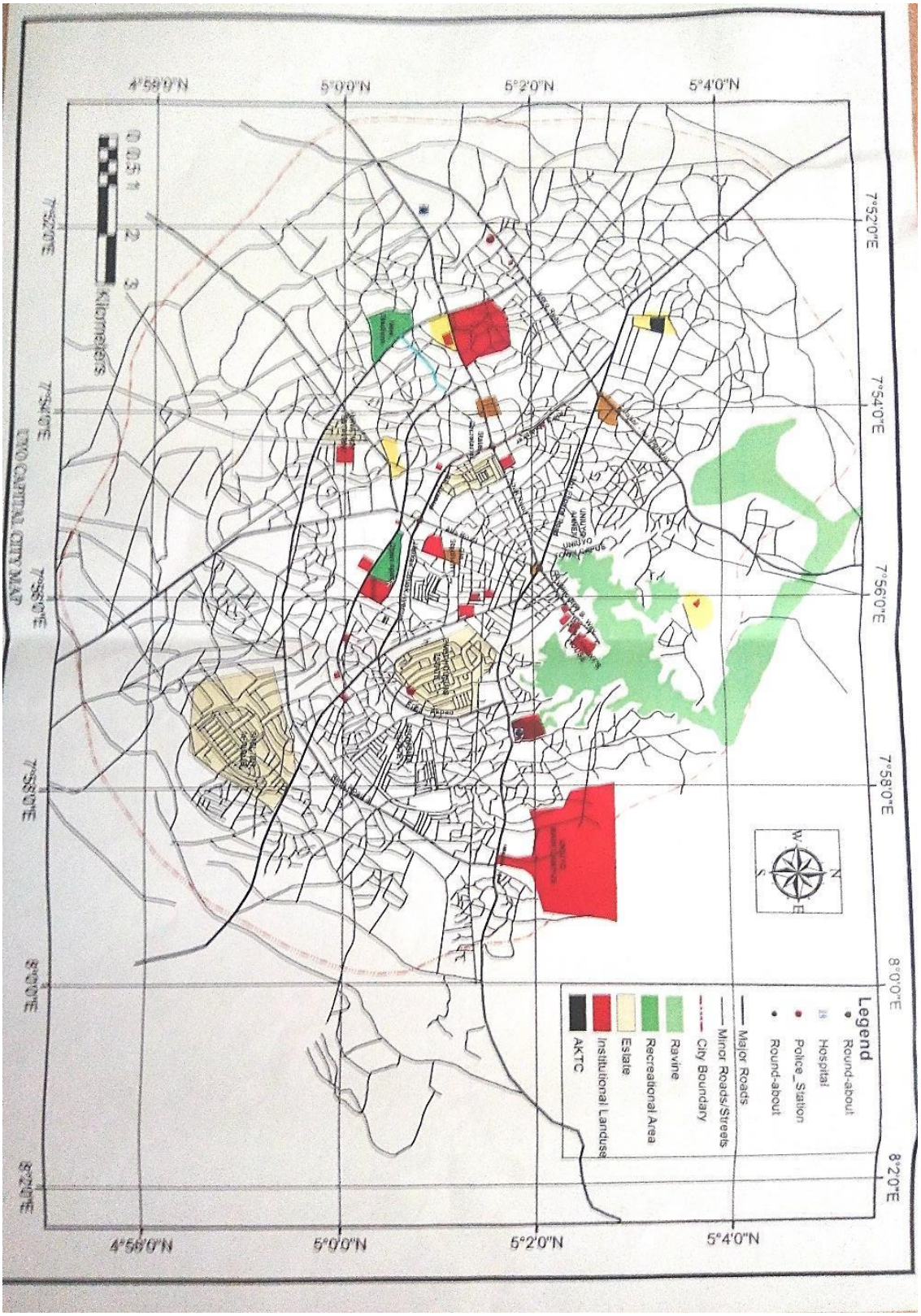

Figure 1. Map of Uyo Metropolis

It situates at Latitude and Longitude between 7°47' and 8°03' North and between 4 °52' and 5°07' East respectively (James et al 2012) with an altitude ranging from 44 to 70m. Rainy season here starts March to April and ends in mid-November, having about eight months of rainy season. Rainfall is between 1500 mm to 2000 mm with July to September as the wettest months and December as the driest. Temperature is moderately high throughout the year with a low range. The mean annual maximum and minimum temperature are 36 °C and 26 °C respectively. Duration of rainy season has positive effect on the groundwater, whereas the reverse is the case during the dry season (November – February). Uyo metropolis has rainforest vegetation. The topography is gently undulating sandy plains, underlined with sedimentary formations of late tertiary and Holocene ages consisting of coastal planes sands, now weathered into laterite layers quartzite complexes. Quartz is the sole framework elements and monocrystalline quartz constitutes about two-third of the quartz varieties.

Dwellings are compacted together. Due to problem of physical planning, wastes are not properly disposed of and has a poor drainage system (James et al 2012).

3. SOURCES OF WATER IN UYO

Prior to the urbanization of Uyo and the creation of Akwa Ibom state and the pronouncement of Uyo as the state capital about three decades ago, on the 23rd September 1987 precisely, the area now known as Uyo metropolis was far less populated than what it is today. The people then depended mainly on the natural source of water, namely; stream and spring, and rain water during rainy season, while some depended on hand dug well, unprotected (open) well, ponds and sparingly on public stand post outside dwelling and very scanty private boreholes.

The area at creation of Akwa Ibom state witnessed heavy migration of people from Cross River state and other neighboring states and even other countries to Uyo, most were public and civil servant and some business people, thereby increasing the population of the area. Many houses being built, coupled with increasing commercial activities, poor drainage, poor sanitation habits and lack of enforcement of environmental sanitation laws, as a result of poor town planning and control system, deforestation and the resultant pollution and destruction of existed natural water resources, force many to look for alternative water source (Ukpong and Abaraogu 2015). Activities of petroleum industries including gas flaring and oil spillage and pipe leakage and fumes from exhaust pollute rainwater resources, hindering rainwater harvesting, forcing the inhabitants of Uyo, to depend on ground water harvesting, such as borehole and hand dug wells with some located within the proximity of soak away and pit latrines. Efe et al (2015) and Saba and Baba (2004) observe that the quality of ground water resources depends on the management of human waste as well as the physic-chemical characteristics of the catchments areas.

Chilton (1996), Essien and Bassey (2012), Linsley et al (2006) however consider borehole water to have better microbial quality than that of hand dug well water because borehole water is from deep aquifer while hand dug well water is from shallow aquifer making it more susceptible to microbial pollution. Whereas, Linsley et al (2006), Badmus et al (2001) posit that water discharged from boreholes closed to dump site have been observed to be heavily contaminated. Makeig (1982) reports that groundwater contamination, apart from being as a result of rain washing debris out of piles of refuse into surface water, also

occur due to contamination potential of leachate from the waste. This is in support of Schneider (1970) which, has it that leachates from open dumps and sanitary landfill normally contain both chemical and biological constituents, and is also supported by Lawal et al 2013. This is plausibly due to the fact that water level values for Uyo metropolis ranges between 40 and 55m. It is within a coastal plain sands (Akpabio and Ekanem, 2009). This is in agreement with the report of Laouini et al (2017).

Water is observed to get easily contaminated if not well treated and adequate protection given to its flowing channels. Essien and Bassey (2012) list sources of water pollution to include insanitary condition during borehole construction, flooding of runoff into boreholes to septic tanks, injection of hazardous waste into the underground geologic formation. Hart and White (2006) has it that absorbed toxins in rainwater percolating through garbage in landfill contaminate water to a shallower depth of about 33m when it infiltrates into the soil. Pollutants of storm runoff sinking into the soil pollutes underground water located at a shadow depth (McMahon 2010). Elshazly and Konsowa (2003) observe that one of the most water polluting industries is the metal finishing industry due to the heavy metal ions content.

3. 1. Problem Statement

Uyo metropolis with massive population and heavy population density, with depleted natural water resources, crowded housing, poor sanitary habit and policy and poor drainage system is bound to have contaminated water from hand dug water wells and untreated private boreholes, whereas water from government provided public water facilities, government agencies and International water donor agencies is always located away from sewage and other sources of contaminants. This is because government unlike private individuals is capable of acquiring land for locating of water source far away from residential estates and industrial areas for good water quality and can take care of the cost required for proper treatment of water for healthy living. This research is our response to the shared interest of the International Food Policy Research Institute (IFFRI) and International Water Management Institute (IWMI) on water and food security in the 21st century.

4. MATERIALS AND METHOD

4 .1. Materials

Global Positioning System meter (GPS): was used to record the geographical locations where public water facilities provided by government and donor agencies are located in Uyo metropolis. A tricycle was also employed to enhance movement from street to street for the purpose of the survey and taking of statistics of such water facilities.

4. 2. Methods of Data Collection

Movement from street to street within Uyo metropolis was embarked upon to locate and identify all the Public water facilities provided by government at all level, government agencies and International non-government donor agencies. Direct counting by tally and record method was employed. The Latitude, Longitude and Altitude of each location of the public water facilities were read using the GPS and recorded for the location of the facility, coupled with a face to face interview with residents living or doing business very close to the location of the facilities to know the functional and the nonfunctional facility.

5. RESULT AND ANALYSIS

The data collected was purely primary data. Table 1 is the table showing the location and code names of the locations, while table 2 shows code, latitude, longitude, altitude in meters and distance in Kilometers, from the reference point (Ibom Connection) to each of the public water source within the study area. Table 3 shows the type of public water facilities provided by government and donor agencies in Uyo metropolis. Table 3 shows that there are six main state water major water pumping stations and water distribution reservoir facilities operated by Akwa Ibom Water Company at Ekpenyoung street/Paul Bassey street, Itam/Ikot Ekpene road, Akwa Ibom state secretariat Abak road/Babangida Avenue, Idu/Nwaniba Road, Ifa/Oron Road, and behind Ibom International Stadium. Two other sub stations are located at Ewet Housing Estate and Shelter Afrique. Water Kiosk having four (4) taps each serving as public water stand post located at the locations geographically described in table 2. The result of face-to-face interview with the residents of the study areas revealed that 81.82% of the water kiosk stations are functional, while 18.18% are not functional. The survey equally shows 37 number of water projects with borehole, water tank and stand with water pump, some of which are tagged solar power operated designated Niger Delta Development Commission (NDDC) water project. The result of oral face-to-face interview with the residents reveals that Niger Delta Development Commission (NDDC) sponsored water projects often becomes nonfunctional soon after commissioning. It was gathered that in most cases the water pumps go bad in less than three (3) months, as a result of inferior quality of pumps installed by Niger Delta Development Commission (NDDC), whereas some are immediately removed by thieves' consequence upon lack of community participation, hence, lack of adequate and functional security.

Other public water facilities provided are found at public institutions premises such as University of Uyo which has three (3) mini pumping stations, one (1) per campus and one (1) at the University of Uyo Teaching Hospital. The Community Based Urban Development Project, World Bank sponsored water project are seen at Ikot Udoro and Akpan Essien Street. The response of residents within the vicinity where they are located reveals that none has ever functioned since the facilities were installed.

92% of the respondents of structured face-to-face questionnaire indicates that majority of the population of Uyo metropolis depend on private borehole water for their water. This is so because flow of water from the public stand point water taps that are even considered functional is irregular, very sparing and epileptic, the situation 13% of the face-to-face interviewed respondents say is synonymous to the electricity power supply situation in the state, since water pumping depends on availability of electricity, whereas 38% attribute it to nonchalant attitude of those responsible to government own facilities, while 49% associate the situation to corruption on the parts of the operators and managers of the project. 4% of the respondents claim to depend on stream water for their daily water supply. The 4% are from extreme end of Nwaniba, Uruan, Nsit Ibom, Itam and Ibesikpo, Asutan part of Uyo metropolis.

Judging from Figure 2, It can be seen from the 2D contour showing altitude of the study area that the lowest altitude is 47.6m (University of Uyo, permanent site), while the highest Altitude is 79.3 m (community secondary school, Ibiaku Itam, Urua Ekpa, Calaber Itu Expressway). The closet distance from the reference point (Ibom Connection) to a water source is 0.8989km at Ekpenyong Street, while the longest distance between the references

points (Ibom connection) and a water source is 10.5953 km at Nwaniba Road, point 6. The longest distance between two Public water sources is 14.387 km (Mbak Itam 3 to Akwa Ibom Water Company limited, Idu head works). While the shortest distance between two public water sources is 0.4068 km (IBB to Aka Akapube street motherless Babies center). 95.32 km^2 is the total square meter of the study location as compared to the total square meter of Akwa Ibom state which is 7081 km^2. The public water sources are not evenly distributed with respect to the altitude of the study area.

Table 1. Location and Code Name for the Study Area

Location	Code
Nung Oku	A
Nung Oku Point 2	B
Aka Akpaibe Street motherless Babies' Center	C
IBB	D
AK state secretariat Akwa Ibom water company Limited state secretariat HQ Uyo	E
Abak opposite mechanic village	F
Akwa Ibom water company limited Idu Head works	G
Abak road opposite Government secondary school Afaha offot	H
Abak road	I
Abak Road, Primary Health Centre, Ikot Okubo, Offot 1	J
UUTH Abak Road	K
Itam Government Board	L
Ikit Itam	M
Mbak Itam 3	N
AKTC Park	O
Itam Central Motor Park	P
Community Secondary School Ibiaku Itam Urua Ekpa Calabar Itu Expressway	Q
AKBC	R
Afaha Oku	S
ITU Road	T
University of Uyo Town Campus	U
University of Uyo Town Campus Annex	V

Ikot Udoro	W
Akpan Essien Street	X
Atiku Abubaka Way	Y
Ekpenyong Street	Z
Brook Street	AB
Nwaniba Road Point 1	AC
Nwaniba Road Point 2	AD
Nwaniba Road Point 3	AE
Nwaniba Road Point 4	AF
Nwaniba Road Point 5	AG
Nwaniba Road Point 6	AH
Nwaniba Road Point 7 De Meridain Ibom Hotel and Resort Golf	AI
Nwaniba Road Point 8	AJ
Nwaniba Road Point 9	AK
Nwaniba Road Point 10	AL
Nwaniba Road University of Uyo Permanent Site	AM
Oron Road	AN
Oron Road Mbiobom Ikot Udo Obot Etoi	AO
Etoi Oron Road AKWCL IFA ATAI HEAD WORKS	AP
Etoi Oron Road AKWCL IFA ATAI HEAD WORKS 2	AQ
Ifa Ikot Obong Oron Road	AR
Ifa Ikot Akpan Oron Road	AS
Ifa Ikot Akpan Oron Road Point 2	AT
Ifa Atai Etoi Oron Road	AU
Oron Road Point 2	AV
Oron Road Point 3	AW
Shelter Afrique	AX
Shelter Afrique 1	AY
Ewet Housing Estate	AZ
Etoi/Ibom International Stadium	ABB
Udo Ekpo Mkpo	ABC

University of Uyo Permanent Site (Inside)	ABD
Itam Junction	ABE
Ikot Obio Enang Itam	ABF
Medical students hostel college of medical science campus abak road	ABG
Ibom Connection	ABH

Table 2. Showing the Code, Latitude, Longitude, Altitude and Distance between the various water source and center of Uyo Metropolis

Code	Latitude (o)	Longitude (o)	Altitude (m)	Distance (km)
A	4.9971	7.9188	60.1	4.3114
B	4.9923	7.9220	57.5	4.7693
C	5.0138	7.9157	64.8	2.7018
D	5.0156	7.9125	67.0	2.7379
E	5.0211	7.9054	62.2	2.9286
F	5.0249	7.8990	53.3	3.3935
G	5.0252	8.0087	77.6	8.9967
H	5.0238	7.8964	56.2	3.7055
I	5.0215	7.8918	57.9	4.2711
J	5.0197	7.8861	60.4	4.9324
K	5.0132	7.8589	65.9	8.0170
L	5.0510	7.8817	64.3	5.4322
M	5.0497	7.8965	63.0	3.8601
N	5.0603	7.8836	64.7	5.6732
O	5.0569	7.8850	63.4	5.3561
P	5.0514	7.8945	69.3	4.1418
Q	5.0603	7.9165	79.3	3.1065
R	5.0690	7.9209	53.9	3.8809
S	5.0545	7.9279	66.9	2.1892
T	5.0519	7.9177	77.7	2.2160
U	5.0519	7.9177	77.8	2.2160

V	5.0422	7.9222	76.2	1.0433
W	5.0426	7.9094	78.4	2.2340
X	5.0378	7.9145	67.6	1.5311
Y	5.0322	7.9036	67.6	2.7164
Z	5.0317	7.9355	64.6	0.8989
AB	5.0309	7.9409	74.3	1.4923
AC	5.0287	7.9693	77.4	4.6218
AD	5.0278	7.9693	70.9	4.6375
AE	5.0249	7.9896	53.7	6.9071
AF	5.0253	8.0093	75.5	9.0614
AG	5.0294	8.0167	78.9	9.8371
AH	5.0412	8.0235	73.2	10.595
AI	5.0389	7.9095	65.1	2.0979
AJ	5.0378	8.0225	71.3	10.466
AK	5.0262	7.9834	65.4	6.2066
AL	5.0260	7.9826	74.8	6.1227
AM	5.0266	7.9732	67.8	5.0858
AN	5.0276	7.9657	65.0	4.2493
AO	4.9885	7.9712	71.5	7.0244
AP	4.9884	7.9831	67.5	7.9870
AQ	4.9845	7.9894	71.6	8.8002
AR	4.9804	7.9894	70.0	9.0964
AS	4.9718	7.9947	74.7	10.175
AT	4.9741	7.9944	74.3	9.9765
AU	4.9776	7.9927	74.1	9.5762
AV	4.9855	7.9809	72.6	8.0192
AW	4.9869	7.9755	60.6	7.4822
AX	4.9839	7.9603	60.7	6.6917
AY	4.9838	7.9604	62.2	6.7070
AZ	5.0190	7.9449	74.5	2.5657
ABB	5.0056	7.8875	69.6	5.5344

ABC	5.0226	7.9575	70.0	3.5358
ABD	5.0350	7.9796	47.6	5.7120
ABE	5.0460	7.8973	58.6	3.6191
ABF	5.0477	7.8893	67.3	4.5174
ABG	5.0184	7.8710	77.3	6.5677
ABH	5.0348	7.9280	74.5	0.0000

Table 3. Type of Water Source and their functionality (Yes)

Code	Type of water source	State of Functionality
A	NDDC Tank	NF
B	NDDC Tank	NF
C	AKWC Water Board Tank	F
D	AKWC Water Kiosk	NF
E	AKWC Water Board Station	F
F	AKWC Water Kiosk	F
G	AKWC Water Board Station	F
H	AKWC Water Kiosk	F
I	AKWC Water Kiosk	F
J	MDGs Solar Powered	F
K	Federal Government water Station	F
L	AKWC Water Board Station	F
M	NDDC Tank	NF
N	Basin Authority Provided Water Tank	NF
O	AKWC Borehole	F
P	AKWC Borehole	F
Q	AKWC Borehole	NF
R	AKWC Borehole	F
S	AKWC Borehole	NF
T	AKWC Borehole	NF
U	Federal Government water Station	F

V	Federal Government water Station	F
W	CBUDP	NF
X	CBUDP	NF
Y	AKWC Water Kiosk	F
Z	AKWC Water Board Station	F
AB	AKWC Water Board Station HQ	F
AC	AKWC Water Kiosk	NF
AD	AKWC Water Kiosk	F
AE	NDDC Tank	NF
AF	AKWC Water Kiosk	NF
AG	AKWC Water Kiosk	F
AH	AKWC Water Kiosk	F
AI	AKWC Borehole	F
AJ	AKWC Borehole	NF
AK	AKWC Water Kiosk	F
AL	NDDC Tank	NF
AM	AKWC Water Kiosk	F
AN	AKWC Water Kiosk	F
AO	AKWC Water Kiosk	F
AP	AKWC Water Board Station HQ	F
AQ	AKWC Water Kiosk	F
AR	AKWC Water Kiosk	F
AS	AKWC Water Kiosk	F
AT	AKWC Water Kiosk	F
AU	AKWC Water Kiosk	NF
AV	AKWC Water Kiosk	NF
AW	AKWC Water Kiosk	F
AX	AKWC Water Kiosk	F
AY	AKWC Water Tank	F
AZ	AKWC Water Board Station with Tank	F
ABB	AKWC Water Board Station with Tank	F

ABC	NNPC/Mobil Producing Nigerian Joint Venture	NF
ABD	Federal Government water Station	F
ABE	AKWC Water Kiosk	F
ABF	AKWC Water Kiosk	F
ABG	AKWC Water Kiosk	F
ABH	Ibom Connection	-

F = Functional, NF = Not Functional

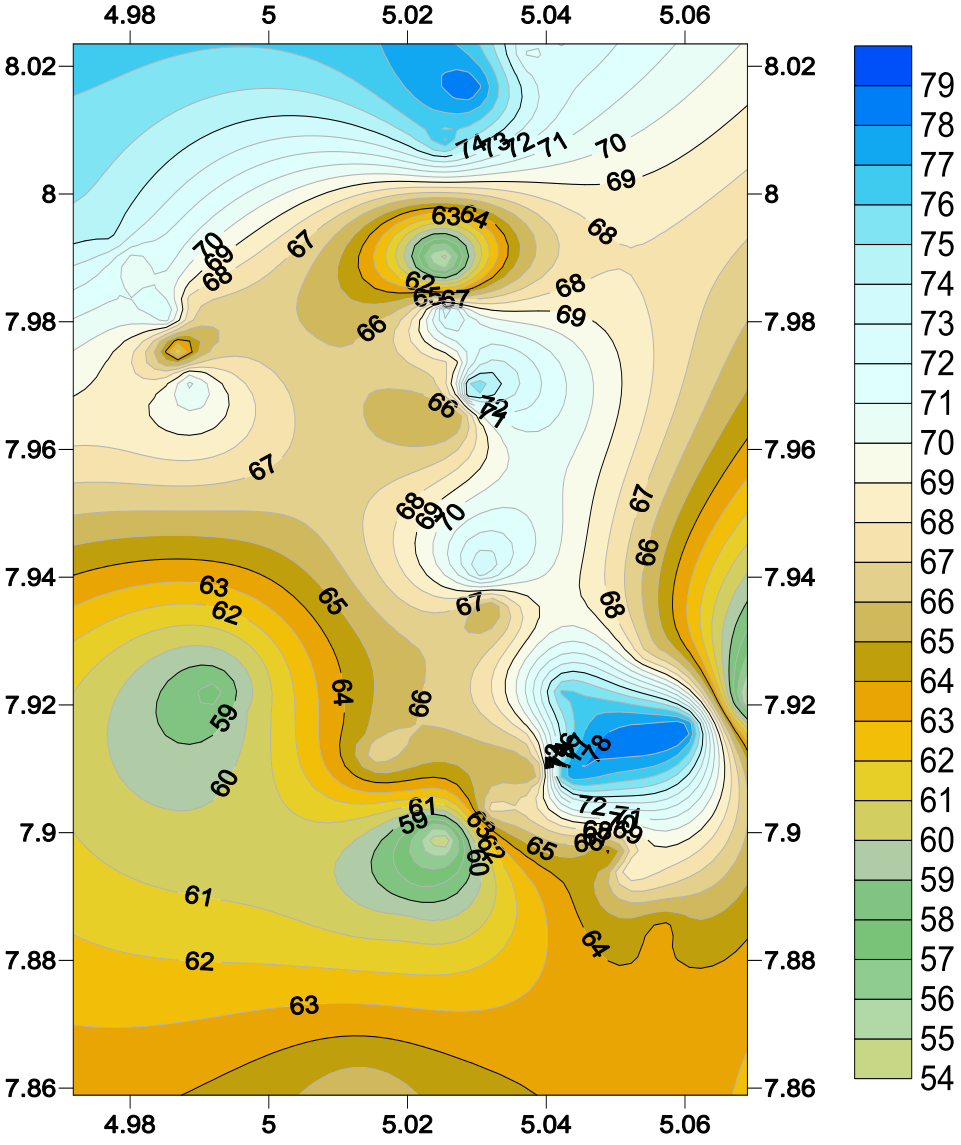

Figure 2. 2D Contour map of the study area altitude

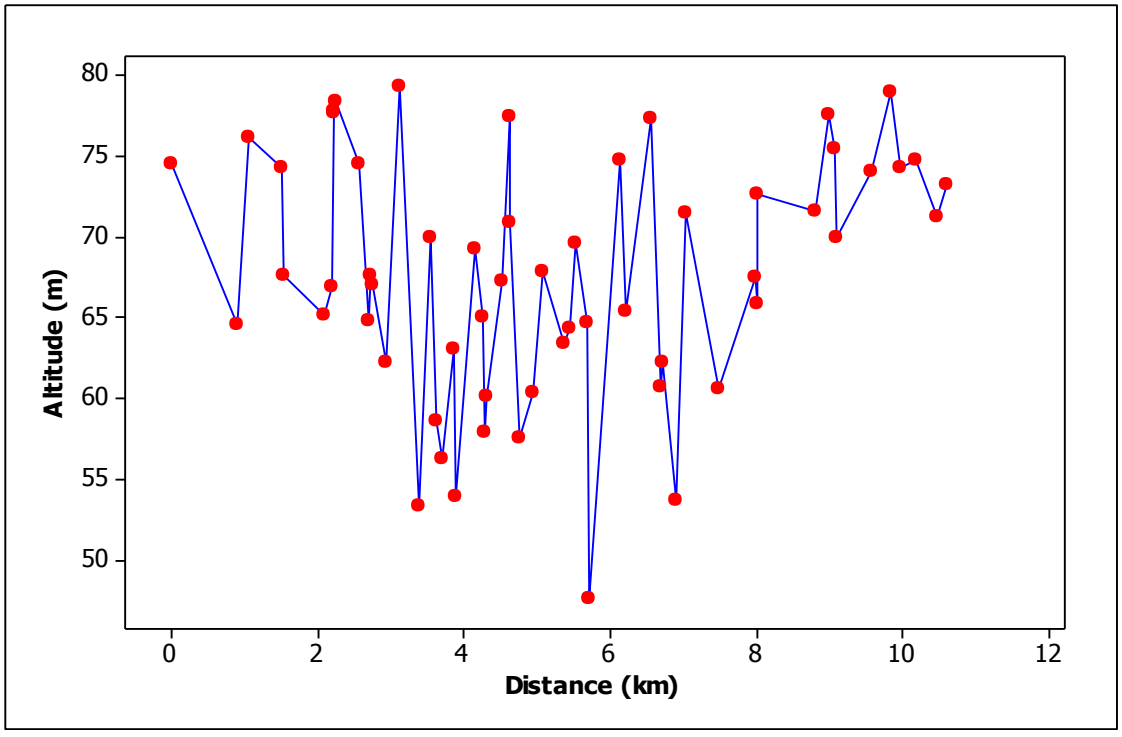

Figure 3. Altitude versus Distance of the study area

The plot of Altitude versus Distance if figure 3 shows available public water facilities clustering within the Altitude range of 55 m and 79 m. The maximum benchmark distance between one water sources to another is given as 500 m (Humanitarian Charter and Minimum Standards in Humanitarian Response (2011)). Longitude and Latitude converter was used to determine the distance between one water sources to another. The distance of the water source was made into a 49 by 49 matrix, this shows that the maximum recommended distance exists between Nwaniba Road Point 1 and Nwaniba Road Point 2; Nwaniba Road Point 2 and Nwaniba Road Point 3; Nwaniba Road Point 10 and Nwaniba Road Uni Uyo Permanent Site only. Others are far beyond 500 m.

This means that, should people depend on public water supply, many have to trek several kilometers every morning and evening in search of water while many others depend on the polluted water from untreated borehole which is inimical to food supply and good health Nwankwoala (2011) and MacDonal et al (2005). Whereas it has been reported elsewhere that the water quality of water from boreholes in Uyo metropolis, in terms of total coliforms count, lead, dissolved oxygen and biochemical oxygen demand level are slightly above the World Health Organization recommended maximum limits (Ukpong and Abaraogu, 2015), while borehole water is acidic in the area. This is plausibly due to the fact that some borehole owners and drills are not careful enough to drill at locations away from septic tanks and other sources of contamination in compliance with the recommendations of appropriate authorities (Essien and Bassey 2012). This may be as a result of lack of adequate land area for good citing of borehole projects by landlords. Moreso, drillers of private boreholes may not drill deep down to the ground water aquifer beyond the depth that surface pollutants may not be able to percolate because of either ignorant or poverty level of the borehole owner. Greater

percentage of man hour that would have been used for other useful and productive activities are used in search of water. This confirms the observation of Ibok and Daniel (2014) in the case of rural water supply situation in the state. Moreso, the available public water facilities are found mainly along the major streets of Nwaniba road, Oron road, Ikot Ekpene road and Abak road, while the tributary streets do not access public water facilities. Some major streets like Aka road, Udo umana, Udoudoma Street are completely left out of public water facilities, hence perpetually patronizing and embracing private borehole water. Evidently, government participation in water supply venture is poor and inadequate. Similarly the report of Akpan and Aster (2010) shows that even rural areas of Akwa Ibom state has very poor access to potable water supply.

6. CONCLUSIONS

Water is known to get contaminated easily at the slightest chance, hence, over dependence on water source that do not guarantee healthy living and good sanitation is a matter of serious concern. Water scarcity and poor water quality leads to poor sanitation and a serious threat to food security and good health, impacting negatively on the work force and development. Acknowledging water as the most important element to the world, describing it as the life blood of the environment, essential to the survival of all living things, whether it is plant, animal or human, it must be stressed that everything possible must be done to maintain its quality and the life inside it for today and the future. The inadequate government participation on matters of water supply portrays that in Africa, the right to safe water and sanitation is a mere political utopia as several millions of people lack access to safe water and basic sanitation. The need for water outweighs the need for crude oil and electricity. One can survive without crude oil and electricity, but survival is entirely water dependent. Development cannot be achieved where water demand outstrips available water supply.

It is surprising therefore to note that despite the role of water in food production, promotion of good sanitation, good health, and sustainance of life, work force, vegetation and ecosystem, industrial operations, building and construction projects less attention is paid to water supply. In other words, nothing could be done without water, yet issues of water scarcity and inadequate rarely attracts mass media major captions, even when the consequences of water scarcity is worse than the effect of nuclear and chemical weapons. Withdraw all the world water supply for only one week and the entire population of human race would die. This means that nobody can do without water. Scarcity of water, therefore requires more publicity and report than other issues. Plausibly, it is in the light of this that access to clean drinkable water and basic sanitation is made a priority in the Millennium Development Goals (MDGs) as adopted by Heads-of-State at the United Nations Millennium Summit 2000. The result of our investigation reveals that public water supply situation within the study area is inadequate, not evenly distributed and where the facilities are available the supply is epileptic in nature.

Recommendations

Existing government owned water companies, cooperation and boards should be restructured, strengthen and empowered for adequate water supply to the public.

Government Partnership with international water donor agencies such as water and sanitation component of the European Union assisted Niger Delta Support Programme (EU/NDSP), United Nations Development Programmes (UNDP) and African Development Bank (ADB) among others for the purpose of providing potable water supply.

Government should allow for and encourage effective private sector participation by apportioning land outside contaminated areas to private organization for clean and potable water projects.

Government should put policies in place for companies operating to at least provide clean a potable water to host communities

Well equips water quality control laboratories be set up for periodic and routine testing of water quality from government water facilities and water donated by companies, donor organizations and private borehole operators. Water facilities / borehole operators. Water facilities / borehole that fail at any time to meet the required or recommended standard should be sealed up and close down.

Water quality control board should be set up to ensure that water samples from water sources are taken and tested and the result published and the control measures applied.

Private borehole operators should be made to register with the Board and the Laboratories, their water sample should be taken by agents of the Board and Laboratories every two months for testing.

Broken water pipes should be repaired or replaced immediately when noticed, to avoid contamination of the water system.

Only men/women of honest report and integrity should be allowed to work in water companies, serve on the board and in the quality control laboratories. This is necessary as the consequences of corrupt workers in water supply organizations and agencies can be more dangerous than that of terrorists.

Adequate security should be provided for water supply facilities and the accessories.

Electricity supply to water pumping units should not be interrupted, hence special electricity lines be allotted or an alternative to electricity from solar or wind sources should be provided to water sector for effective and continuous pumping, distribution and supply of clean water

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