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Access to Safe Water Supply and Sanitation in Lower Orashi River Basin, Rivers State, Nigeria

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ABSTRACT

This study was aimed at examining the main constraints to safe water supply and sanitation in Lower Orashi River Basin System, Rivers state; with a view to provide the best solution through the adoption of a procedural and analytical model. The study adopted the spatial analysis approach using field surveys, laboratory analysis of water samples; and the use of 2,500 copies of questionnaire on 2,500 households within 50 sampled communities. Six research questions and one hypothesis guided the study. The study revealed that the main sources of drinking water in the area includes borehole water, hand-dug wells, rivers, burrow-pits, rainwater, and sachet water. There is both an unequal and low access to safe water supply and sanitation; mean distance to main sources of water supply in the area is 0.31km (310m); also access to water supply coverage is 31%, and sanitation 22%. The main constraints to safe water supply and sanitation in the area include environmental pollution and water quality failures, mechanical/technical failures, hydro-geologic/hydraulic failures, power outage, lack of proper environmental audit, and unstable government policies. The study therefore recommends the adoption of the SSWS/PG-model in order to promote the development of the area and ensures improved access to safe water and sanitation.

Keywords: *Access, challenges, development, safe water, sanitation, water supply*

1. INTRODUCTION

Clean and safe water is both food and health! Potable, adequate and accessible water is therefore a public asset and a vital social welfare facility to measure levels of development in space. The people must drink quality water and live in clean environments in order to remain healthy; and only a healthy nation can make reasonable progress. The Niger Delta Region where this study is located is well endowed with lots of water resources. However, much of this water is not safe and not readily available for use by the people. In some cases, rapid urbanization, increasing urban populations and associated high rates of waste generation as well as environmental pollution arising from mineral mining and industrial manufacturing activities are some of the problems facing the areas' quest for safe water supply.

Access to safe water supply and sanitation is a global issue and varies significantly across the globe. The World Bank Group in their study argued that nearly half of the world population lack access to safe water supply and basic sanitation, and the situation is most appalling among the developing countries [1].

Access to safe water is measured by the number of people who have a reasonable means of getting safe and adequate water for drinking, washing, and other essential household activities and is normally expressed as a percentage of the total population. Safe water and sanitation reflect the health of the country's people and their capacity to collect and distribute clean water to consumers. Access to safe water supply should therefore be within 200m of households [1]. Thus, by 2008 the WHO-UNICEF Joint Monitoring Programme (JMP) on global access to safe water supply and sanitation coverage, argued that whilst access to safe water supply rose from 77% to 89% in water supply coverage and from 54% to 77% in sanitation coverage mostly in the developed countries, access to safe water supply and sanitation is still very low in the developing counties [2]. In the same vein, the WHO-UNICEF update on global access to water and sanitation revealed that in 2006, about 64% of Africa's population lacked access to potable water supply and that sub-Sahara Africa would only reach the MDG-Goal 7 targets for water services by 2040 and those of sanitation by 2076 [1]. Also WHO and UNICEF observed separately the lack of access to safe water supply and sanitation and argued that they are often the root causes of the emergence of water borne diseases which kill over 1.8 million people annually in the world, mostly children under the ages of five [3,4]. In Nigeria, these diseases kill over 194,000 people annually with children below 5 years being the most affected. This translates into the water related death of 868 children on a daily basis [4, 5].

Relying on the 1995 study Report of the Assisted Water Resources Master Plan for Nigeria, the Federal Ministry of Water Resources (FMWR) argued that Nigeria has huge water resources potentials estimated at 267billion cubic meters of ground water [6]. Yet, the current water supply service coverage in the country is still very low, about 58% (i.e. about 87million people have access to safe water supply), while access to sanitation was 32% (about 54 million people). Again, that about half of Nigerian population (i.e. over 70 million people) did not have access to potable water supply. This represents about 6% of the world's population who do not have access to safe drinking water [6]. According to this document, improved water supply now stands at 49.9%

for the rural and 69.3% for the urban regions and a National average of 54.3%. Access to safe water is very appalling in the rural regions where the poor having no choice to make rather than to rely upon unprotected wells, surface streams/rivers and swamps/ponds. These sources are often times very vulnerable to pollution [7, 8, 9].

Arising from the above background, this study sought answer to the following pertinent questions:

a. What is the current level of preparedness by Nigeria and other African countries in meeting the UN-MDG Goal 7 target by 2015?
b. What is the true and actual level of access to improved safe water supply and sanitation in Nigeria especially in the rural regions which are often neglected?
c. What is the current level of research and development on access to safe water supply and sanitation in the rural areas?
d. What are the constraints to safe water supply and sanitation in the rural areas?
e. Is there any significant relationship between mean distance to water supply points and disease occurrence?
f. What are the best possible solutions to these problems?

1.1 Research Hypothesis

There is no significant spatial difference in the level of access to safe water supply across the area

1.2 Brief Geography of the Study Area

The larger Orashi River Basin System stretches from Ndoni- Onelga (where the Orashi River starts) to the sea via Abonnema- Asalga. Hence, the basin is made up of all surrounding lands that the Orashi River passes through and these include the geographic space occupy by Ogba/Egbema/Ndoni, Ahoada East, Ahoada West, Abua/Odual, DEGEMA, Akuku-Toru, Asari-Toru local governments areas of Rivers State. However, the real limits of the Lower Orashi River Basin System (LORBS) can be delineated to include only the territories of Ahoada West and Abua/Odual and parts of Ahoada East which are primarily drained by the Orashi River. It is in the western border of Rivers state with Bayelsa state. It is almost a buffer region between the two states with no clear-cut boundary demarcation, a problem the National Boundary Commission is yet to settle. The region lies in the southern fringe of the tropical rainforest belt. It is located between latitudes $4^{0}32^{1}$ and $5^{0}23^{1}$N, and longitudes $6^{0}24^{1}$ and $6^{0}59^{1}$E. It shares boundary with the following local governments areas: Ahoada East and Ogba/Egbema/Ndoni in the north; Akuku-Toru in the south; Degema and Asari-Toru at the south-south east; Ahoada East and Emohua in the eastern flank; Yenegoa at the north-west, and Brass (Nembe) and Ogbia (Kolo Creek communities) local government areas of Bayelsa state at its south-south west and west respectively.

Its land mass is approximately 1,393 km^2. In 1991, its population was 225,613 with a population density of 411.03 persons per square km. The area's population rose to 531,642 in 2006 with a population density of 1,044 persons per square km; and a total of 112,208 regular households. The region's population was projected to be 609,093 persons in 2010 [10, 11]. There are over 117 towns and villages in the study area .Over 70% of the people of the area are engaged in primary activities such as farming, fishing, quarrying (fine sand, gravels), timber lumbering, oil palm milling and local gin production. Agriculture is therefore the main sustainer of the rural economics of the area.

The region is crises-crossed by numerous south-flowing rivers and creeks with the River Orashi being the largest. It is a low lying region between 0-5 5 meters above sea level. Its hydro-geologic profile is characterized by alluvial sedimentary strata composed chiefly by poorly leached loosed porous sandy to fertile loamy soils. These soils are mostly made up of clayed to sandy-clay [12]. It is also prone to environmental degradation arising from crude oil spills, artisanal refining activities, use of poorly built pit latrines, poor refuse disposal methods, high rate of deforestation, and bush burning.

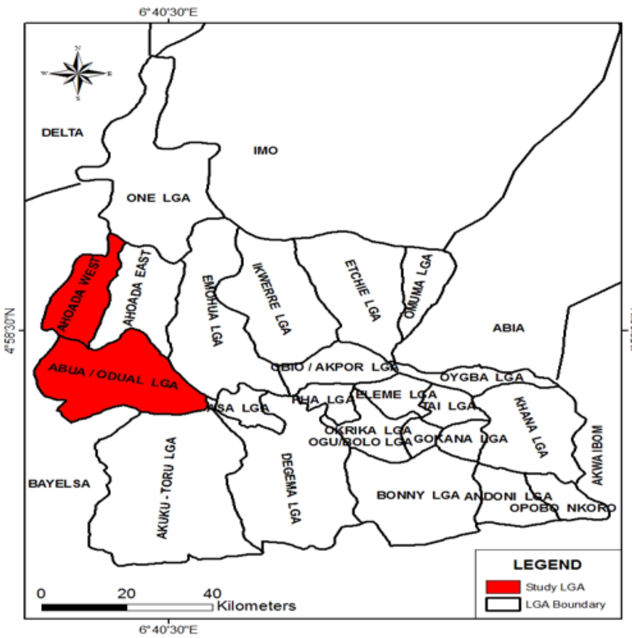

Fig 1: Rivers State showing study area (both Loc. Govt. Areas)

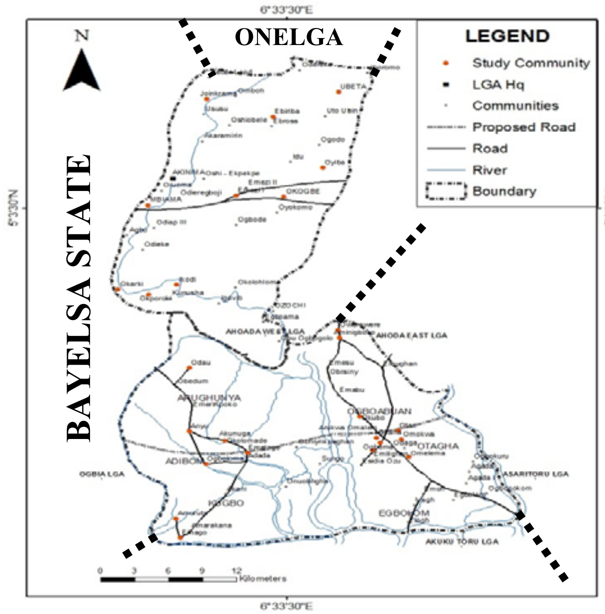

Fig 2: Study area showing selected (both Loc. Govt. Areas) communities

Sources: Digitized from the original map of Rivers state, Ministry of Lands and Survey, Port Harcourt

2. METHODOLOGY

Being an environmental and social research with focus on enhancing the development of the area, the study adopted the spatial analysis and ecological approaches in its investigation and discussions using both primary and secondary sources of data. While the primary data were generated through field surveys and 2,500 socio-economic questionnaire administered on 2,500 sampled households from 50 sampled towns and villages, linear measurements of distances to main sources of water supply, and laboratory analysis of water samples; the secondary data included records of disease occurrences from hospitals, primary health centres, and from Community Health Workers who treat people using their Patient Drug/Chemist stores and outlets, and other relevant information from the Ministries of Lands, Health, Environment, and Water resources. Data were analyzed with the student's t-test statistics.

3. RESULT AND DISCUSSION

3.1 Main Sources of Water Supply in the Area

The people of the area get their water supplies for all purposes from a number of sources. There are four principal sources of water supply in the area. These are:

a. Ground water sources
b. Surface water sources
c. Rain water
d. Sachet water.

a. Ground Water Sources of Supply

Ground water sources in the region is extracted through the sinking of boreholes (electrical motor pumps and hand pumps) with either surface or overhead storage tanks especially with the submersible motor pump boreholes. Though, in most cases, the storage tanks are under sized for the targeted population. Another form of tapping ground water is through the use of hand dug wells. Most of these wells are unprotected hence; the water is also not safe for drinking. Also, these wells are shallow hence, some dry-up easily during the dry seasons.

b. Surface water Sources

Surface water sources in the area include rivers/streams, rivulets, creeks and inland fresh water swamps and ponds. In some places, burrow-pits are used. The main problem with surface water in the area is that these sources are highly vulnerable to pollution from all sources, especially hydro-carbon mining. Hence, the water is never safe for any desired use.

c. Rain Water

Rain water is often the choice of most households where they collect rain water (during the wet season) falling from the roof of their houses into buckets, basins or drums. This they store for drinking even up to the dry seasons. Again, rain water is never safe for drinking because of its compositions especially weak acids, black carbon and $SO4^{2+}$ through gas flaring and industrial activities, including the harmful effects of the Oloibiri Gas Turbine in Bayelsa State and the ELF-Egi plants in Onelga- Rivers State. Both are not too far from the area of study with the Oloibiri Gas Turbine and SPDC facilities at the Imiringi flow stations occurring just about 2km on land from the Odual area. The number of households (% population) using these various sources of water supply is presented in table 3.1 below.

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Table 3.1: Households Sources of Drinking Water

	Sources of Drinking Water	Total	%
1	Public boreholes	610	24.4
2	Hand-dug wells	711	28.44
3	Rivers, streams	640	25.6
4	Rain water	305	12.2
5	Swamps, ponds	60	2.4
6	Burrow-pits, others	54	2.16
7	Sachet water	120	4.8
G. Total		2,500	100

Source: Authors' field survey, 2012

d. Sachet water.

This source apart from constituting environmental nuisance and hazard (as polythene bagsand papers litter surroundings), the quality of the water is low and increases the occurrence and spread of waterborne diseases in the area.

3.2 Access to Safe Water Supply in the Area

Mean access to identified sources of drinking water supply was calculated out using mean distance and time taken to get water from the sources by sampled households in each of the sampled communities. There is significant spatial variation in access to sources of water supply in the area. Some communities along the Orashi River used the river as their main source of water supply especially in those areas where there are no functional boreholes or wells. Results from the analyses of water samples from the laboratory revealed that the river and majority of the well water have high level concentration of microbial parameters. Generally ground water in the area have $Fe2^{+}$, SO_4^{2+}, turbidity, oil and grease contents higher than WHO and NESREA recommended levels for drinking water [3, 13, 14].

In summary, mean access to water supply services in the area stood at 0.31km (i.e. 310 meters), which is a reflection of low and poor access because it is above the international standard of 200m [1]. This is further explained by figure 3 below. It takes the people between 60-80 minutes to get water from a public borehole; 90-108 minutes from the rivers and streams; and 120-125 minutes to get water from hand-dug wells centrally located.

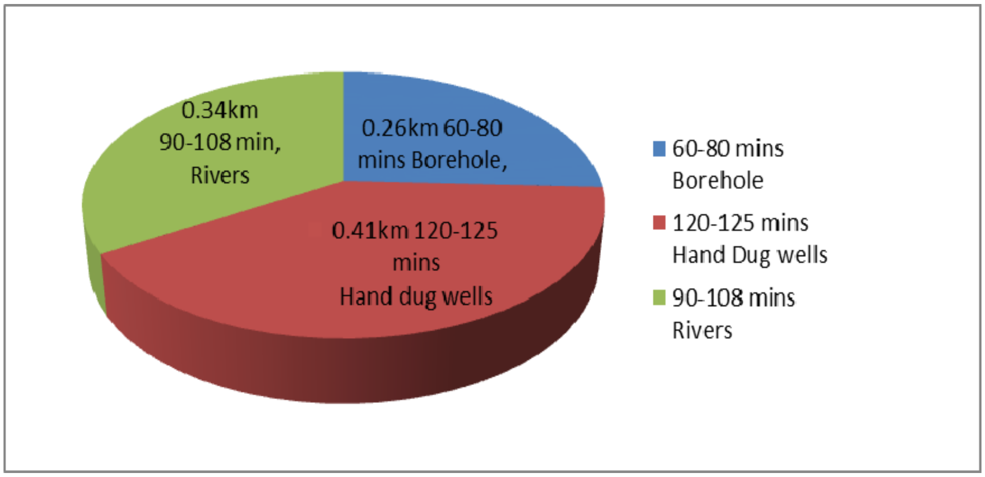

Fig 3: Pie Chart of Access to main sources of water supply points (Distance/Time)

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Again, only 31% of the population has access to safe water supply in the area. This is further proven with the null hypothesis of no significant variation in the level of access to potable water supply in the area as summarized below.

Analysis of hypothesis

Ho: There is no significant difference in the level of access to potable water supply in the area

Table 3.2: Summary of t-calculation

N	Cal. T	df	Sign. Level	t – critical	Decision
24	5.06	22	0.05	2.074	Ho1 Rejected

From table 3.2 above, calculated t-5.06 is greater than t-critical 2.074 at the 0.05 significance level hence, the null hypothesis of no significant difference in level of access to safe water supply in the area is hereby rejected and this imply that, there is significant difference in the level of access to safe water supply in the area.

Analysis of the Orashi River water showed that the water has been severely contaminated with both microbial and physicochemical parameters (due to artisanal refining activities and dumping of wastes including human excreta) as shown in table 3.3 below. To reduce the impacts of pathogens in the water, some people boil their water before drinking.

Table 3.3: Analysis of Water Samples at Locations along the River Orashi, March, 2013

Parameters	WHO Accepted Limits	WHO max. Permissible Limits	NESREA max. Allowable	Communities				Mean
				1	2	3	4	
P^H	7.0-8.5	8.5	6.5-8.5	6.5	6.5	6.6	6.5	6.525
Oil & Grease	0.01		ND	2.86	2.88	2.91	2.98	2.9075
$Fe2^+$	0.1	1	0.03	1	0.9	1.1	0.8	0.95
E.Coli	0	0	0	213	180	171	209	616.25
Coli Form	0	0	0	404	391	340	102	309.25
Salmonellae	0	0	0	117	97	103	90	101.75
Vibro Cholera	0	0	0	12	3	3	7	6.25
Typhi spp.	0	0	0	320	101	15	81	129.25

Source: Author's Field, 2013. ND – not determined

3.3 Access to Basic Sanitation in the Area

In similar vein, we investigated the sanitation situation and discovered that over 78% of the 2,500 households did not have good access to toilets and sanitary facilities in their homes neither did the 50 communities investigated has public toilets or refuse disposal points, except very few riparian communities of Odual, Kugbo and Engeni who used public toilets sited on the rivers – thus, polluting these fresh water sources. Others used sources that are also not too hygienic such as traditional pit latrines, 'short-putting' (OS-defecation). The same thing applies to wastes (refuse); which are disposed off indiscriminately either into the rivers, flood plains, orchards or nearby bushes without minding the danger such acts pose on drinking water sources.

Generally, access to good sanitation coverage in the area is less than 22%. See Tables 3.4 and 3.5.

Table 3.4: Percentage of Households accessed to Sanitary Facilities

	Facility	No. of Households	%
1	Flush toilets	215	8.6
2	Ventilated improved pit latrines (VIP)	190	7.6
3	Traditional pit latrines (TPL)	690	27.6
4	Defecation in the bush/orchards	898	35.92
5	Defecation into streams	507	20.28
	Ground Total	2500	100%

Source: Authors' Field survey, 2012-2013

Table 3.5: Households Refuse Disposal Methods

	System of Disposal	No. of households	%
1	Disposal into orchard/farms	910	36.4
2	Disposal at near-by bush	790	31.6
3	Disposal into streams	210	8.4
4	Along the road, flood plains	240	9.6
5	Govt. silos or community sites	65	2.6
6	Composting	100	4
7	Incineration/open burning	185	7.4
	Ground Total	2500	100%

Source: Authors Field survey, 2012-2013

3.4 Constraints/Challenges Encountered in Water Supply Services in Lower Orashi River Basin

The main challenges encountered by both previous and current efforts in improved water supply services in the area are summarized in the table 3.6 below.

Table 3.6: Problems identified in the Supply of Safe Water in the Area

	Problem Type	Description/main issue
1	Mechanical/ technical failures	These include PVC pipe breakage (rupture) due to erosion and old age; pump failure due to fault; electrical power outage/failure (damage generators).
2	Hydro-geologic/ hydraulic failures	Such as collapse of boreholes due to improper casing; inadequate pipe size due to increase in water demands; insufficient system storage capacity of overhead storage tanks; failures due to old pipes with varying degree of roughness.
3	Water Quality Failures	Primarily due to contaminants whose levels exceed maximum permissible levels; concentration of residuals;
4	Social Issues	These include increasing population due to high birth rates; increase in demand of safe and adequate water supply; corruption; shortage of skilled man power in water management; laisser-faire attitudes of public water boreholes attendants; theft and vandalism.
5	Environmental pollution and contamination of drinking water supply sources	Especially the activities of certain people (artisanal refineries) along the Orashi River and its adjourning Creeks; crude oil spills; agro-chemicals (through run-off); and poor sanitary habits such as poorly-built pit latrines, OS-D (on the slot defecation); domestics wastes disposals.

Source: Authors' field survey, 2011-2013

Of all these challenges, the social issues are the most worrisome. A careful observation showed that in actual fact, all these issues are socio-economic in nature, with the exception of hydro-geologic profile as regard to the porous sedimentary strata and collapse of boreholes. This can be overcome if proper casing of boreholes are carried out by borehole experts. In the same vein, environmental pollution is almost an entirely a human-induced factor even though some contaminants (like iron, turbidity, total hardness and total dissolved solids, etc) are naturally occurring, their effects can be reduced through proper water treatment. The percentage impacts of these main challenges are summarized in table 3.7 below.

3.5 Implications of Findings

Findings from the stated hypothesis revealed that there is significant difference in level of access to safe water supply in the area. This implies that there will be lopsided development in the area, arising from the fact that safe water as a critical social welfare facility, is needed by everybody in order to contribute meaningfully to the development of the area. It shows that those areas with relatively favorable access to safe water supply recorded fewer cases of disease outbreak and less impact of the diseases on their health than those places with severe safe water shortages (e.g. Akalamini, Emirikpoko, Obedum, Akaluno, and Ukpelede).

Table 3.7: Percentage impacts of main problems to safe water supply in Lower Orashi River Basin

	Types of Specific problem	No. of Respondents	%
1	Pipe breakage	100	4
2	Power outage	675	27
3	Borehole collapse	125	5
4	Increased in water demand	125	5
5	Corruption, indiscipline	250	10
6	Theft, vandalism of water facilities	375	15
7	Environmental pollution and water contamination	750	30
8	Others	100	4
	Grand total	**2,500**	100

Source: Authors' field survey, 2011-13

3.6 Possible Solutions to the Problems identified

The sure way of addressing the problem of poor access to safe and adequate water supply and sanitation in the area is the urgent adoption of mechanisms aimed at improving safe water supply. Such a strategy must be people oriented and environmentally friendly. Efforts should be aimed at reducing the high occurrences of some of the physicochemical parameters in the ground water as well as contaminations due to microbial pollution. To this end, our model is geared towards providing the much needed solution. See the relevant section of this model. The model is a proactive measure aimed at providing safe water supply with a view to promote good health and stimulate economic growth and development of the area. It imbibes both the procedural and analytical principles of planning from the future to solve an existing problem and envisaged future problems in the water, sanitation and recreation sector. Here, the problem, choice and targeted goal are already known: the challenge of safe water supply and sanitation in the study area (problem identified); and the urgent need to tackle the menace (goal); as a means of promoting development of the area (choice). Hence, they are not recaptured again in the strategic steps of implementing the model. The model consists of eight **(8)** phases or stages as shown in figure 4 below.

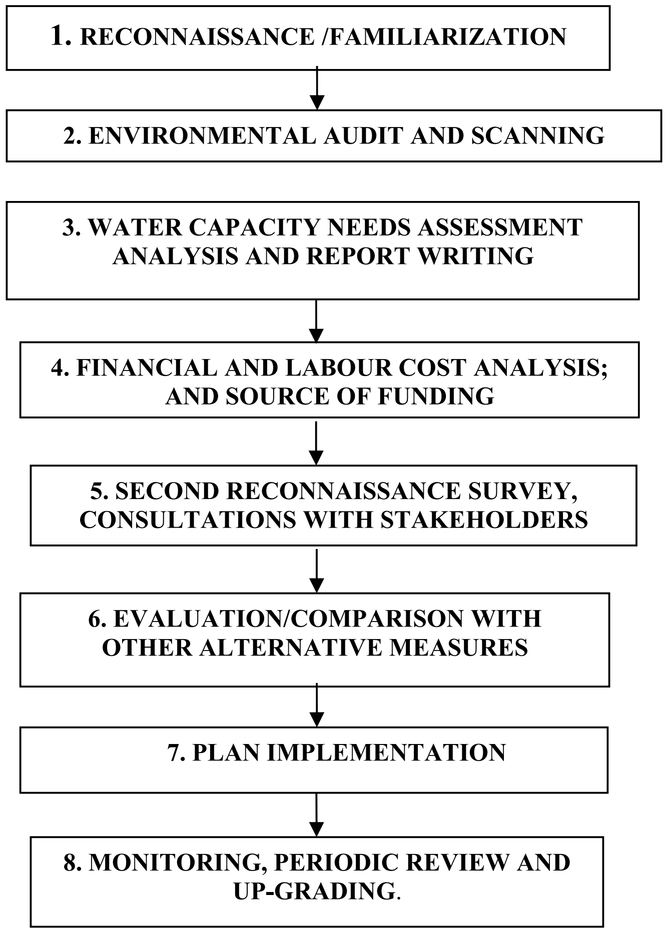

Fig 4: Schematic diagram of the phases of SSWS/GP-Model

5. SUMMARY

The main challenges facing the supply of potable water in the area include: ground water in the area have Physicochemical parameters (e.g. Fe^{2+}, So_4^{2+} , oil and grease, turbidity, TDS, TSS, etc) levels higher than the WHO and NESREA [3,13] maximum permissible limits for drinking water standard. Hence, proper water treatment is necessary but this is lacking at the moment. With very high water tables and collapse of boreholes due to the nature of the porous and soft hydro-geologic sedimentary profile of the area; it is also prone to crude oil spills and artisanal refining; use of pit latrines.

There is significant difference and low access to safe water supply in the area. Mean access to safe water supply in the area is 0.31km (310m) which is above global standard of within 200m of households. Also water supply coverage is just 31%. Access to sanitation is less than 22%.

6. CONCLUSION

Safe and adequate water supply in any region is vital. It is a good social welfare facility or index of measurement of the level of development in any region, but this is lacking in the area. Arising from our findings, the researchers hereby concludes that: there is unequal and low access to safe water supply in the area; mean access to safe water supply in the area is 0.31km (which is above world standard of within 200m of household [1]; and water supply coverage rate of 31%; while access to sanitation coverage stood at less than 22%. Drinking water supply sources in the area are affected by physicochemical and microbial contamination due to environmental pollution-crude oil spills, artisanal refining, use of pit-latrines, and poor reuse disposal systems.

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