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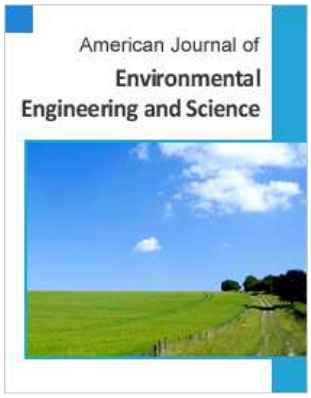

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Assessment of Water and Sanitation Service Levels in 20 Rural Communities of Amuwo Odofin and Ojo Local Government Areas of Lagos State, Nigeria

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Abstract
The current study was carried out to assess the status of water supply and sanitation facilities in 20 communities of Amuwo Odofin and Ojo Local Government Areas of Lagos State. Formal and informal interviews, questionnaires, physical assessment, and secondary data from relevant agencies were used. Water samples were taken from twenty (20) existing wells in the project area to evaluate levels of faecal contamination. From the results of assessment, hand dug wells and boreholes fitted with either electric or hand pumps are the major water supply facilities used by the communities. Water supply service level is generally low across the communities. Low level of service is not unconnected with borehole failure and abandonment of dug wells due to salt water intrusion. All boreholes fitted with hand pumps failed due to faulty pumping system, unserviceable or damaged pumps. It is observed that 39% of boreholes fitted with electric pumps also failed due to damaged pumping system (power surge and non-availability of serviceable parts). Microbiological analysis shows high levels of Coliform bacteria counts (1.10×10^2 to 1.80×10^2 cfu/ml) in water samples from sixteen (16) out of the twenty (20) dug wells, indicating faecal contamination of the water source. Identified sanitation facilities at household level across the 20 communities include pit latrines (mostly without slabs), open pit, bucket, hang toilet and hanging latrine. Improved sanitation facilities necessary to ensure hygienic separation of human excreta from human contact are lacking. The proposed appropriate technological options for water supply among these rural communities are dug wells and boreholes operated by hand pumps. Ventilated improved pit latrine is adjudged the most appropriate sanitation facility for the communities. The study finally recommends active community participation in the provision and management of these facilities in order to ensure sustainability.

1. Introduction

Man's life is dependent on water, as water is needed to grow food, generate power and run industries. Communities and individuals can exist without many things if they have to, they can be deprived of comfort, shelter or food for a period, but no one can be deprived of water and survive for more than a few weeks (Maguvu and Mutengu, 2008). Water supply to a community is very crucial and it is a determining factor in the health of the people.

Globally, 1.1 billion people lack access to safe drinking water, with 84% of this population living in rural areas. Access to safe drinking water is measured by the percentage of the population using improved drinking-water sources such as household connection; public standpipe; borehole; protected dug well; protected spring; and rainwater collection (WHO/UNICEF, 2006, 2012). An improved drinking-water source is defined as one that, by nature of its construction or through active intervention, is likely to be protected from outside contamination, in particular from contamination with faecal matter (WHO/UNICEF, 2006). It has been estimated that about one-fifth of the world's population currently live in areas of physical scarcity, while another 500 million people are approaching this situation. It is further postulated that another 1.6 billion people, about a quarter of the world's population, face economic water shortage (UN-Water, FAO, 2007).

Africa has the lowest total water supply coverage in the world, with only 62% of the population having access to improved water supply source. This figure is based on estimates from countries that represented approximately 96% of Africa's total population (WHO/UNICEF, 2006). From an analysis of data from 35 countries in sub-Saharan Africa with over 84% of the region's population, access to safe drinking water varies greatly with significant differences between the poorest and richest fifths of the population in both rural and urban areas. Over 90% of the richest quintile in urban areas use improved water sources, and over 60% have piped water on premises. In rural areas, piped-in water is non-existent in the poorest 40% of households, and less than half of the population use any form of improved source of water (UN-Water, DPC, 2015). Inadequate or a complete lack of water supply infrastructure essential for water supply intakes both for surface and ground waters is noted to have compounded the problem of access to improved source and safe drinking water in most rural African nations (WHO and UNICEF, 2008).

Sanitation is the provision of facilities and services for the safe disposal of human urine and faeces (WHO/UNICEF, 2013, WHO, 2014). The word 'sanitation' also refers to the maintenance of hygienic conditions, through services such as garbage collection and wastewater disposal. Lack of sanitation systems or its inadequacy impacts the health of the community. It also can have a negative impact on the environment (Moilwa and Wilkinson, 2004, Pérez, 2011). Inadequate sanitation facilities can lead to spread of diseases through rodents, flies and other animals can contaminate both the ground and surface water supplies (Depledge, 1997). It has been estimated that 2.1 million people die annually from diarrheal and associated complications and that 10% of the population of the low income countries suffer from parasitic worm infections related to improper waste and excreta management (WHO et al., 2000; WHO, 2001). Nearly two million of these deaths are recorded in the less-industrialised countries of the world. Globally, it has been estimated that 62% of people in rural areas do not have access to adequate sanitation compared to 14% in urban areas. In Africa, the situation is very critical as 84% and 45% of both of urban and rural residents respectively have no access to basic sanitation (WHO et al., 2000). Access to sanitation is measured by the percentage of the population using improved sanitation facilities. Improved sanitation includes sanitation facilities (such as those with sewer connections, septic system connections, pour-flush latrines, ventilated improved pit latrines and pit latrines with a slab or covered pit) that hygienically separate human excreta from human contact (WHO/UNICEF, 2012).

Safe water and good sanitation are still a luxury for many of the world's poor population. Over 1.1 billion people lacked access to improved water supply, and 2.6 billion to adequate sanitation. This is high in rural areas as compared to urban areas (WHO/UNICEF, 2006). Efforts at preventing deaths from diarrhoea or reducing diseases such as ascariasis, drancuculiasis, hookworm, schistosomiasis and trachoma will be in vein without access to safe drinking water and basic sanitation. About 3.41 million people die from water, sanitation and hygiene-related causes each year (WHO, 2008). Every 21 seconds a child dies from diarrhoea which amounts to approximately 4,100 deaths a day (UNICEF/WHO, 2012). Water and sanitation related sicknesses put severe burdens on health services and impact education. Achieving targets towards improved sanitation coverage is a challenge for the global community which must be addressed with urgency. The clear need for basic water and sanitation services for the poor especially assumes even greater significance when the linkages with other dimensions of poverty are considered (Oldfield, 2006). Hence, unsafe water, inadequate sanitation and hygiene in small rural communities among developing nations are some of the world's most important; timely challenges (Oldfield, 2006). Inadequacy in safe drinking water will also impact negatively on sanitation and health.

In Nigeria, access to safe water supply and sanitation is a major challenge, coverage rates are among the lowest in the world (UNICEF/WHO, 2012, WHO/UNICEF, 2013). From available statistics, twenty four (24) million people in urban areas remain without access to improved sources to safe drinking water compared to 50 million people in the rural areas as at 2006. Correspondingly, 45 million and 53 million people in urban and rural areas respectively had no access to improved sanitation facilities during the same period (UNICEF, 2008). Water supply services, where they exist, are unreliable, of low quality and are not sustainable. Adjudged reasons for the above are difficulties in management, operation, pricing and failure to recover costs (Longe et al., 2009a, Longe et al., 2009b). Many water supply systems show extensive deterioration and poor utilization of existing capacities, due to under-maintenance and lack of funds for operation. The present study was aimed at assessing the state of water supply and sanitation facilities in 20 communities in Amuwo-Odofin and Ojo Local Government Areas of Lagos State.

2. Materials and Methods

2.1. Study Area

This study is a continuation of a comprehensive study on status and coverage levels of water and sanitation services in the rural riverine areas of Lagos State (Longe et al., 2009a and 2009b). Lagos State is located in the South Western part of Nigeria, bounded in the south by Atlantic Ocean, in the north and east by Ogun State and in the west by Republic of Benin. It occupies an area of about 3,577 square kilometres with a population of about 14 million. About 80% of the population resides in the metropolitan Lagos, making the state the most urbanized in the country (Longe and Williams, 2006). The remaining 20% of this population lives in the riverine rural area. Two out of the 10 Local Government Areas that are riverine were considered for this study. The study area consists of 20 riverine communities (ten each) in Amuwo Odofin and Ojo Local government Areas (LGAs). These riverine communities are characterized by creeks and lagoon systems. Lagos creeks and lagoons have high level of pollution from human activities (discharges of domestic sewage, commercial and industrial effluents) and influx of salinity from the ocean. Two main factors are responsible for the high salinity within the coastal lagoon system; influx of floodwater from rivers and creeks surrounding wetlands and tidal seawater inflow through the Lagos harbour.

2.2. Study Approach

Data collection was through primary and secondary sources. The primary source was based on questionnaire administration, direct field observations and interviews with the local government officers, councillors, community chiefs, leaders and residents in the study area. The questionnaire covered such issues as existing facilities, adequacy of facilities and their perceived causes of failure. Secondary data was obtained through information gathered from books, journal publication and articles, from relevant state ministries such as Lagos State Ministry of Rural Development and Infrastructure, Centre for Rural Development (CERUD) and National Population Commission (NPC). The survey was helpful in identifying the most appropriate and type of water supply and sanitation facilities that are adaptable, economically feasible and sustainable. The study covered twenty coastal rural communities and their selection was based on accessibility and location; so as to give a good representation of the riverine rural coastal communities in Ojo and Amuwo Odofin LGAs. Water samples from existing dug wells were collected and analysed for heterotrophic bacterial densities and total coliform counts. Coliforms are indicator bacteria of the presence of pathogens in water. The choice of Coliforms is based on their relative ease of identification and is usually present in large numbers than pathogens. Their presence in drinking water is therefore a reasonable indication, of whether other pathogenic bacteria are present. Standard methods were employed for the isolation and enumeration of bacterial population (APHA, 1999). Table 1 presents the statistics of the selected water supply facilities and characteristics.

All surveyed boreholes are shallow bored wells and publicly owned. There is no existing borehole record on depth, well log and aquifer yield. The boreholes were however completed with polyvinylchloride (PVC) casings and screens. They are referred to as “boreholes” in this work. The hand dug wells are privately owned, fitted with concrete rings, depth ranged from 3 to 10 metres and on average 6 metres. The depth to water level varies with the two main climatic seasons, the rainy (wet) and harmattan (dry) seasons. The wet season is from the month of April through October with a short break in mid-August, while the dry season is from the month of November through March. Water table level could be as high as 0.3m and as deep as 2m during the wet and dry seasons respectively.

3. Results and Discussion

Table 1 presents the three types of water supply facilities available in the 20 communities investigated, the number of each facility in each community, current state of facilities as at the time of investigation, the nature of the problems facing the facilities, and the quality of water.

3.1. Profile of the Twenty Communities

As shown on Table 1, the entire population of all the 20 communities is 31,451 people with an average population figure of 1,573. Only six communities, Ibeshe, Ibasa, Ilashe, Irewe and Tafi-Awori have population figures higher than the average population of 1,573 across the communities. The population range among these communities is between 1,652 and 4,014. The highest population figure of 4,014 was recorded for Ibeshe while Odun had an exceptionally low population of 301. The noted high population in Ibeshe is due to availability of social amenities thus giving it the status of a centre of commercial activities. Ibeshe also has two healthcare facilities, a maternity and a health centre. Among identified social amenities were primary and secondary schools, community halls, health centres, markets, maternities, dispensaries and religious centres. Maternities and Health centres are only available in Ibeshe and Irewe while Ibeshe is the only community provided with electricity supply.

3.2. Sources and Status of Water Supply

The communities investigated depend on groundwater as their main source of water supply. The creek and lagoon waters are no option as high level of pollution from anthropogenic activities and salt water intrusion from the ocean make both unfit for domestic usage. Groundwater is harnessed through boreholes and dug wells. Hand dug wells are the most widely available facility among all other facilities. Total number of enumerated boreholes across the twenty communities is 83 out of which 30 were fitted with hand pumps and 53 with electric pumps (Table 1). Hand dug wells were 132 in number, representing 61% of the total number of

water supply facilities across the communities (Fig.1). It is interesting to note that all the 30 boreholes fitted with hand pumps across the 20 communities were out of order at the time of this investigation. Failure of water supply facilities impacts on service delivery of potable water, it impinges also on the quality and quantity of access to safe drinking water and good functionality of water based sanitation facilities. Failure of facilities therefore portends environmental and health risks to the people. The observed failure of boreholes fitted with hand pumps was mainly due to faulty or failed pumps (Fig.2). In the contrary, out of the 53 boreholes fitted with electric pumps 33 (62%) were in good condition at the time of survey while 20 (38%) of the boreholes had failed.

Table 1. *Water Supply Facilities and Characteristics*

BOREHOLES WITH HAND PUMPS						
S/No	**Community**	**Population**	**Quantity**	**Number Functioning**	**Number Not Functioning**	**Reason for Non Functionality**
1	Irede	1,254	2	0	2	Failed pumping system
2	Iyagbe	1,515	3	0	3	Failed pumping system
3	Ibeshe	4,014	4	0	4	Failed pumping system
4	Ibasa	2,177	2	0	2	Failed pumping system
5	Imore	1,007	1	0	1	-
6	Ilado	1552	1	0	1	Failed pumping system
7	Ilashe	2706	2	0	2	Failed pumping system
8	Ikare	1,146	1	0	1	Failed pumping system
9	Okun Ikare	1312	0	0	0	Faulty pump
10	Odun	301	0	0	0	-
11	Irewe	1732	3	0	3	Faulty pump
12	Itogbesa	1,003	1	0	1	-
13	Origele	1,458	2	0	2	Faulty pump
14	Igbojanla	1,206	1	0	1	Faulty pump
15	Ibode	1,223	2	0	2	Faulty pump
16	Olomometa	1,395	4	0	4	Faulty and failed pump
17	Okogbado	1,358	1	0	1	Faulty pump
18	Tafi-Hausa	1652	0	0	0	Failed pumping system
19	Tafi-Awori	1502	0	0	0	Faulty pump/coloured water
20	Egira	1,938	2	0	2	-

Table 1. *Continue*

BOREHOLES WITH ELECTRICAL PUMPS						
S/No	**Community**	**Population**	**Quantity**	**Number Functioning**	**Number Not Functioning**	**Reason for Non functionality**
1	Irede	1,254	4	0	4	-
2	Iyagbe	1,515	2	1	1	Uncompleted
3	Ibeshe	4,014	10	4	6	Faulty pump and damaged overhead tank
4	Ibasa	2,177	10	10	0	No electrical pump
5	Imore	1,007	2	0	2	Pump stolen
6	Ilado	1552	0	1	2	-
7	Ilashe	2706	3	0	3	No pumping machine & generator
8	Ikare	1,146	3	0	3	Uncompleted
9	Okun Ikare	1312	3	1	2	Faulty pump and No Power generating set
10	Odun	301	0	0	0	No pumping Station
11	Irewe	1732	6	3	3	Uncompleted
12	Itogbesa	1,003	2	0	2	-
13	Origele	1,458	0	0	0	Faulty pump, No electricity/generator
14	Igbojanla	1,206	1	0	1	-
15	Ibode	1,223	1	0	1	High iron and faulty pump
16	Olomometa	1,395	2	0	2	Generator and pumping machine failed
17	Okogbado	1,358	0	0	0	
18	Tafi-Hausa	1652	0	0	0	
19	Tafi-Awori	1502	0	0	0	
20	Egira	1,938	1	0	1	-

Table 1. *Continue*

HAND DUG WELLS						
S/No	**Community**	**Population**	**Quantity**	**Number Functioning**	**Number not Functioning**	**Reason for Non Functionality**
1	Irede	1,254	6	6	0	-
2	Iyagbe	1,515	12	10	2	-
3	Ibeshe	4,014	10	8	2	-
4	Ibasa	2,177	17	15	2	-
5	Imore	1,007	8	8	0	Salty and coloured water
6	Ilado	1552	13	10	3	High iron level

HAND DUG WELLS						
S/No	Community	Population	Quantity	Number Functioning	Number not Functioning	Reason for Non Functionality
7	Ilashe	2706	6	6	0	-
8	Ikare	1,146	7	6	1	Dried up
9	Okun Ikare	1312	5	1	4	Dried up
10	Odun	301	3	3	0	Coloured water
11	Irewe	1732	6	5	1	Dried up
12	Itogbesa	1,003	4	2	2	Coloured water
13	Origele	1,458	4	3	1	Coloured water
14	Igbojanla	1,206	5	3	2	Coloured water
15	Ibode	1,223	3	2	1	Coloured water
16	Olomometa	1,395	5	3	2	Coloured water
17	Okogbado	1,358	4	2	2	Coloured water
18	Tafi-Hausa	1652	4	4	0	-
19	Tafi-Awori	1502	4	3	1	Coloured water
20	Egira	1,938	6	4	2	-

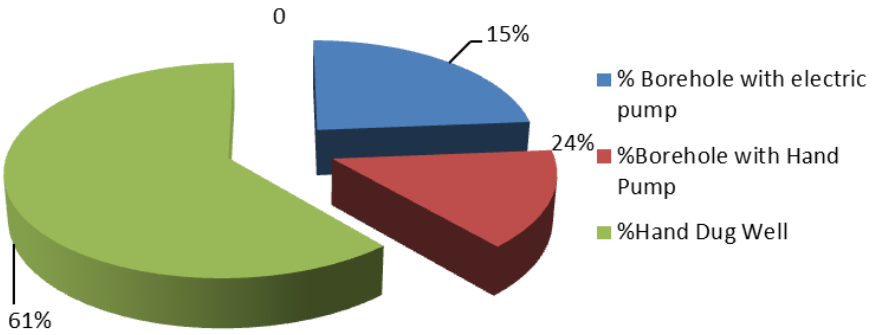

Figure 1. *Water supply facilities across the 20 communities*

Figure 2. *An abandoned hand pump fitted borehole at Ibeshe.*

Adduced reasons for observed failure include over use of facilities, saltwater intrusion, inadequate technical and maintenance skills, non availability of spare parts and irregular power supply. Failure rate of the hand dug wells is very low compared with observed failure in boreholes fitted with electric pumps. Twenty eight (28) out of the total one hundred and thirty two (132) hand dug wells across the communities had failed. This figure represents 21% failure rate compared to 62.3 % failure rate in boreholes fitted with electric pumps. Failure in dug wells is mostly due to quality issue rather than technical and or maintenance issue. Ingress of salt water into the water table aquifer and high iron concentration are major causes of failure. Salt water intrusion and high level of iron content in the shallow wells lead to abandonment rather than failure of the facility. Both features are of great concern in the riverine coastal areas of Nigeria (Oteri and Atolagbe, 2003). Water uses across the twenty investigated communities are for household (cooking, drinking, washing and other culinary), institutional and medical.

3.3. Adequacy of Water Supply Level and Water Facilities

There were 215 water supply facilities expected to serve a population of 31,451 people across the communities investigated. This translates to one facility per 146 people which means on average 2,190 litres of potable water is needed for 146 people per day while less than a third of this quantity can be harnessed from a dug well in a day. This is only true if all facilities were to function properly. Ninety one (91) out of the 215 water supply facilities were either malfunctioning or had failed. The ratio of functional facility to people would be one facility per 253 people. The situation is critical in terms of availability of quantity of safe and potable water needed by the communities. Longe et al., (2009a) reported that water supply situation in Ibeju-Lekki and Eti-Osa LGAs was critical with one water supply facility serving more than 900. The current results could point to expected improvement in water supply delivery in Amuwo-Odofin and Ojo LGAs.

Survey results also indicated water consumption rate across

the rural communities to range between 15 and 20litres/capital/day. It is of importance that the quantity of water delivered and used for households is an important aspect of domestic water supplies, which influences hygiene and therefore public health. Howard and Bartram (2003) estimated a minimum of 7.5 litres of water per capita per day to meet requirements of lactating women who engage in moderately physical activity in above-average temperatures and also for people under most conditions. Water challenge in these communities may not be that of insufficient quantity but includes that of quality. The presence of high iron and salt contents in groundwater in the coastal riverine areas of Lagos is a major potability issue (Oteri and Atolagbe, 2003; Longe et al., 2009a). Hence, water needs should take into cognisance a quality that represents a tolerable level of risk. The above minimum water requirements does not account for health and well-being-related demands outside normal domestic use such as water use in healthcare facilities, food production, economic activity or amenity use.

3.4. Sanitation Facilities

The sanitation aspect of the study was limited to disposal and management of human waste or excreta, sometimes diluted with water as sewage. It also entailed solid waste disposal and other sanitation habits. Access to sanitation here means the availability of hygiene facility for human excreta disposal within a convenient distance from the user's dwelling i.e. not too far to discourage use while an improved sanitation facility is one that hygienically separates human excreta from human contact.

There are no improved toilet facilities available to majority of the inhabitants except the few ones provided by the Local Government. Government presence as regards provision of sanitation facilities is very low (Figs.3, 4). Field survey revealed very poor hygienic situation among the people as they were fond of defecating in open spaces due to complete absence or inadequacy of functional sanitation facilities across the communities (Table 2).

Report has it that more than 48% of people in Africa practice open defecation (WHO/UNICEF, 2008). The entire 20 communities lack adequate number of improved sanitation facilities per population though, most households have various types of unimproved sanitation facilities such as pit latrines (with or without slab), open pit, bucket, hang toilet and hanging latrine (Fig. 3). The few existing improved sanitation facilities are built by the government (Figs. 3 and 4). Common types of unimproved sanitation facilities identified include pit latrines (with or without slab), open pit, bucket, hang toilet and hanging latrine. The identified sanitation types are classified as unimproved sanitation facilities that do not ensure a hygienic separation of human excreta from human contact (WHO/UNICEF, 2012). Survey results further revealed that out of the 20 communities investigated, 11communities (55%) had sanitation facilities provision, while the remaining 9 communities (45%) had none (Table 2). This practice has great environmental and health implications to the communities.

Table 2. *Sanitation Facilities across the Communities*

S/N	Community	Population	Public Latrines	
			Functional	Non Functional
1.	Irede	1,254	0	0
2.	Iyagbe	1,515	1	0
3.	Ibeshe	4,014	2	0
4.	Ibasa	2,177	1	0
5.	Imore	1,007	1	0
6.	Ilado	1552	1	0
7.	Ilashe	2706	1	0
8.	Ikare	1,146	1	0
9.	Okun Ikare	1312	0	0
10.	Odun	301	0	0
11.	Irewe	1732	1	0
12.	Itogbesa	1,003	1	0
13.	Origele	1,458	0	0
14.	Igbojanla	1,206	0	0
15.	Ibode	1,223	0	0
16.	Olomometa	1,395	1	0
17.	Okogbado	1,358	0	0
18.	Tafi-Hausa	1652	0	0
19.	Tafi-Awori	1502	0	0
20.	Egira	1,938	0	0

Figure 3. *An unimproved Sanitation facility at Ibeshe (faeces are discharged into the lagoon).*

Figure 4. *Improved Public Latrines at Ibeshe and Imore respectively.*

Figure 5. *One of the few improved Public Solar Toilet at Irewe.*

Finally, if a facility is to serve 250 people, the current 11 sanitary facilities serving all the 20 communities with a population of 31,451 are far from being adequate. In order to be on track with the Millennium Development Goal requirements, the communities will require additional 115 sanitary facilities urgently.

Excreta are an important factor in the transmission of disease causing agents with tendencies of disability and death (UNICEF/WHO, 2012).

Table 3. *Coliform Counts in water samples from dug wells.*

S/N	Community	Total Heterotrophic Bacteria (Cfu/Ml)	Total Coliform (Cfu/Ml)
1.	Imore	$1.40x10^6$	$1.20x10^2$
2.	Irede	$3.20x10^6$	$1.30x10^2$
3.	Iyagbe	$2.30x10^6$	$1.10x10^2$
4.	Ibeshe	$1.70x10^6$	0.00
5.	Ibasa	$2.14x10^6$	$1.80x10^2$
6.	Ilashe	$2.10x10^6$	$1.10x10^2$
7.	Odun	$1.80x10^6$	0.00
8.	Irewe	$1.30x10^6$	$1.50x10^2$
9.	Ikare	$1.90x10^6$	$1.50x10^2$
10.	Okun Ikare	$2.70x10^6$	0.00
11.	Itogbesa	$1.40x10^6$	$1.30x10^2$
12.	Origele	$1.60x10^6$	$1.20x10^2$
13.	Igbojanla	$3.20x10^6$	$1.50x10^2$
14.	Ibode	$1.90x10^6$	$1.80x10^2$
15.	Olomometa	$2.30x10^6$	$1.10x10^2$
16.	Okogbado	$3.30x10^6$	0.00
17.	Tafi-Hausa	$1.80x10^6$	$1.40x10^2$
18.	Tafi-Awori	$2.140x10^6$	$1.30x10^2$
19.	Egira	$2.20x10^6$	$1.60x10^2$
20.	Igbojanla	$1.50x10^6$	$1.70x10^2$

Table 3 presents results of bacteriological assay of water samples from dug wells. Groundwater samples from sixteen (16) out of the twenty (20) communities have coliform counts greater than 10cfu/l which is the allowable concentration for drinking water by the National Standard for drinking Water quality (NSDQW, 2007). The presence of total Coliform bacteria gives a general indication of the sanitary condition of a water supply. This observation is not unconnected with the practice of open defecation prevalent among the people. Groundwater samples from Ibeshe, Odun, Okun-Ikare and Okogbado are however free from faecal contamination.

3.5. Sustainable Water Supply and Sanitation Facilities

Sustainability of water supply depends on the adequate availability of the resource with little or no treatment cost, affordable and inexpensive cost of development. This has to bear in selecting the preferable water supply source. Choices for sources of water supply should depend on the quality of raw water, as well as the adequacy of reliability of the sources, from a quantitative point of view together with the potentialities for expansion in future (Longe et al., 2008). Rainwater is not a reliable source of water supply for these communities due to non-point sources of air pollutants from industrial activities in Lagos metropolis. Surface water can serve as alternative sources of water supply, but available ones are polluted and salty and may require expensive and extensive treatment technology (Longe et al., 2009a). The only sustainable water supply source in these communities is groundwater. This is due to its availability, reliability, convenience, and cost effectiveness. The use of hand dug wells as water supply facility appears adequate because they are simple to construct and easy to maintain compared to boreholes. The problem of high risk of contamination with use of this facility must be addressed by adequate well, development, protection and management (Longe and Kehinde, 2005; Longe et al., 2009a).

Sustainability of sanitation facility depends mainly on identifying, designing and implementing appropriate technology for the given community. The most appropriate technology has been defined as that which provides the most socially and environmentally acceptable level of service at the least economic cost. Any of the following improved sanitation facilities; flush or pour-flush toilet, ventilated improved pit (VIP) latrine, pit latrine with slab and composting toilet is appropriate for the communities.

4. Conclusion and Recommendation

Water supply and sanitation facilities of twenty communities were appraised and investigated in the rural riverine areas of Amuwo Odofin and Ojo Local Government Areas of Lagos State. Identified main source of potable water supply across the twenty communities is groundwater harnessed through hand dug wells and boreholes. The current results also corroborate the findings of Longe et al., (2009a) in their work on appraisal of water supply facilities in 42 riverine communities in Ibeju-Lekki and Eti-Osa Local Government Areas of Lagos State. Failure of dug wells was mainly due to

saltwater intrusion while identified reasons for boreholes failure are technical and managerial such as borehole sitting, technology and development. Non-availability of spare parts, constant power failure, poor maintenance skill and culture, and attitudes of the communities to ownership of infrastructure are other important considerations. There is a noted general poor state of sanitation and inadequate presence of sanitation facilities across the communities surveyed. Government presence in terms of provision of water and sanitation facilities is very low especially for sanitation facilities.

From the results of the current study, the following suggestions are made for the overall improvement of water and sanitation service levels in the coastal communities of Lagos state. Hand dug well (fitted with hand pump) is a preferred water supply facility at individual household level for groundwater source. While at the community level, boreholes (fitted with hand pumps) are preferred water supply facilities. The choice of hand pumps is based on their reliability, cost effectiveness, low operational technology, and affordability. It can provide sustainable water supply from the aquifer for the communities both in short and long term.

Ventilated improved pit (VIP) latrine is recommended as the best appropriate sanitation technology that meets the sanitation needs of the project area. The choice of a VIP latrine over other types is based on its low level technology, relatively inexpensive cost of construction and maintenance. It also requires minimal quantity of water for cleaning and it constitutes minimum risk to health.

The reliability and sustainability of water supply and sanitation facilities will depend on availability of spare parts, trained personnel, and community involvement. The government has a key role to play either at the state or local government levels in direct acquisition of spare parts that should be made available to the communities at affordable costs. The government at the local level should encourage a community-based solution that includes decentralized (village-level) decision-making, village-level ownership, locally appropriate technology, and locally sustainable business and financial models to improve on the provision of water and sanitation service levels in the coastal rural communities of the state. It should be noted that for any community based project to be successful and sustainable such should require no external inputs once the project is completed (Oldfield, 2006).

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