ASPECTS OF LAND-BASED POLLUTION OF AN AFRICAN COASTAL MEGACITY OF LAGOS

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INTRODUCTION - LAGOS MEGACITY

Lagos State is and African megacity which is located in southwestern Nigeria on the West Coast of Africa, within latitudes 6° 23′N and 6°41′N and longitudes 2°42′E and 3°42′E. The State is flanged from the north and east by Ogun State, in the west by the Republic of Benin and the south by the Atlantic Ocean/Gulf of Guinea. The total landmass of the State is about 3,345 square kilometres, which is just about 0.4% of the total land area of Nigeria. It is the physically smallest but the most highly populated state in the country with an estimated population of about 10 million inhabitants which is about 10% of the total population of Nigeria, Africa's most populous country. Water is the most significant topographical feature in Lagos State; water and wetlands cover over 40% of the total land area within the State and an additional 12% is subject to seasonal flooding. Most of the land in Lagos State has an elevation of less than 15m above sea level. The land surface in Lagos State generally slopes gently downwareds from north to south, and is particularly low0lying and flat in Victoria Island, Lagos Island/Ikoyi, and Apapa. Large parts of the mainland Lagos are built on a slightly higher north-south ridge. A considerable part of the State area is made up of Lagoon and creeks. Lagos State is naturally made up of depositional landform, which include; wetland, barrier island, beaches, low-lying tidal flats and estuaries. The climate is the wet equatorial type influenced by nearness to the equator and the Gulf of Gu inea. There are two main seasons, namely; the rainy season and dry season, which usually lasts from April to October and October to March respectively. The rainy season has two peak periods; May to July and September to October, with rainfall being heaviest during the first peaked period. Floods usually results at these periods, which are aggravated by the poor surface drainages systems of the coastal lowlands. The mean annual rainfall varies from one location to another with Ebute-metta, Yaba, Bariga on the mainland areas recording 1750mm, Badagry in the extreme west of the state recording1636.1mm, Epe in extreme north-east records 1676.5mm and Agege in the north-west recording 1567.2mm. Lagos State has a constant high temperature, with mean monthly maximum temperature of about 30°C. The State experiences the highest temperature around November to December and February to March, while the lowest temperature occur around June to July which coincides with the middle of the first peak of the rainy season. The humidity level is generally high all over the State throughout the year. Lagos consists of two main regions, namely; the Lagos Island and Mainland. The original city and Ikoyi, Victoria Island and Lekki corridor areas are referred to as Lagos Island, while Mainland encompasses the other part of the State. The Mainland part of the State had developed and still developing rapidly and approaching an eventual merger with the more distant part of the Mainland including Ikorodu, Epe and Badagry. The more developed Mainland and Lagos Island make up what is referred to as Metropolitan Lagos. Lagos metropolis is inhabited by about 80% of the population of the State making it the most urbanized State in the Nigeria. According to projected population growth studies, it has been found that Lagos State population will reach 25 million inhabitants in the next 10 years (2012), making the city the third largest in the world.

Lagos is undoubtedly the commercial nerve-centre of Nigeria (and possibly Africa), with the largest concentration of industries, even though, the administrative and political headquarters of the country had been transferred to Abuja over ten years ago. The State still accounts for more than 70% 0f the nation's industrial and commercial establishments. All these industries and commercial outfits centered round the metropolis, i.e. Lagos Island and Mainland. Also, 90% of the nation's foreign trade and about 80% of the country's total value imports (excluding oil). The two major seaports in Nigeria, namely Apapa port and Tin-can Island port are in Lagos metropolis. Likewise, the busiest international airport in the country (Murtala Mohammed International Airport (MMA)) is also located in Lagos metropolis. While, the domestic wing of the MMA is similarly the busiest domestic airport in Nigeria and the whole of Africa.

WATER POLLUTION PROBLEMS

Water resources in Lagos for domestic, industries and commercial is becoming scarce as a result of pollution of water bodies by wastewater, which contains heavy metals, bacteria (pathogenic) etc. Flooding is a serious problem in Lagos metropolis because poor drainage systems, the relatively high water table and the flat topography of Lagos (except in the northernmost part), which retards the flow of surface water run-off and prevent rapid discharge into the sea. Flooding of Lagos metropolis is usually caused by a combination of human and natural factors. The human factors are as a result of poor wastewater disposal and other sanitation practices (e.g. blocked drains by refuse, silt, sludge, etc). The natural factors include rainfall, flat topography and poor infiltration, the negative effects of which can be very considerably reduced by appropriate planning, design , operation and maintenance of the drainage facilities.

A variety of sanitation systems are currently in use in Lagos. These include private and government arrangement. The different types of sanitation practices in use in Lagos metropolis range from "bush" (or no system), pit latrines, VIP latrines, flush toilets modified into pour-flush toilet (because of lack of water) and conventional water closet and water

borne sanitation and sewerage systems in some estates. Many areas still have inadequate sanitation coverage to meet the people needs in the State. This situation is becoming more visual since many now defecate into plastic bags and dispose of the same at random. The diffuse pollution associated with this practice is extensive and serious.
The risks of ground, surface water (both domestic and commercial) are usually high in many areas of Lagos, because of unhygienic and inadequate excreta and sewerage disposal provisions.
The main sanitation systems available in the major residential areas of metropolitan Lagos are the traditional pit latrines and water closet septic tank. However, the major environmental concerns in Lagos metropolis are the collection, treatment and disposal of sewage and other related wastewater. Although the use of pail system (bucket latrine) in Lagos metropolis has been banned, yet the government machinery via the Sewage and Water Department of the State Ministry of Environment has currently not devised an efficient system of disposing of the septage from septic tank / soakaways.
Therefore, all these untreated excreta, together with the commercial and industrial wastewater are usually discharged into the Lagos lagoon system, other surface water points and in some cases find their ways into ground water. This brings about the risks of water pollution and destroys marine animal and aquatic food sources in the metropolis.
The domestic water pollution problems result from the fact that in some areas of the metropolis the water table is very high and even some areas the water table is near the surface, for example within 3 metres of digging you will get water. The soil is usually porous and this increases the chances of sewage and other wastewater infiltrating and polluting ground water and well water, which are the major sources of water in many areas.
Furthermore, extensive flooding, during which sewage compounds contamination of water sources, sullage are carried into wells. Also, there may be seepage from soakaways, industrial, and commercial storage systems into ground water systems.
It is obvious in most houses in the metropolis that the disposal of their sullage is unhygienic and inappropriate. For example, only toilet wastes are connected to septic tanks, while other household liquid wastes are discharged directly to storm water drains in front of the houses. Where there is no drain it will be discharged on the street in high-density areas.
Unhygienic disposal of industrial and domestic liquid waste (both toxic and non-toxic natures) and faecal matters leads to extensive soil contamination and ground/surface water pollution especially in the coastal city like Lagos.
Solid waste collection, transportation and disposal are also a very big problem in Lagos. Due to the high population of the city, the rate of solid waste generation is very high and the facilities require for proper disposal is not adequate. In some areas where landfill sites are designated for the disposal of the waste, the leachate resulting from the decomposition of the biodegradable matters in the wastes find their way into the ground / surface water, because there are no mean of collecting the leachate. Hence, heavy contamination of the water resources results.
The government has successfully eliminated the use of the pail system in Lagos metropolis and reduced its use in the peri-urban areas of the State. The government has also constructed sewage treatment plants in some of the housing estates as a means of managing the human wastes generated within the estates, but due to the high electromechanical components involved and the lack of constant electricity in the country the treatment plants are not functioning. It has not yet devised an efficient system of disposing of the wastes from septic tanks / soakaways, because majority of the properties in Lagos use septic tanks / soakaways. The untreated septage, along with trade effluent are dumped / discharged into the Lagos Lagoon and many surface water sources in the State. PHOTOGRAPHS 1 –17 show the current systems of wastewater treatment in the Lagos State of Nigeria.

There is clearly a need to employ environmentally sound wastewater treatment technologies, that would be easy to operate, affordable, efficient, effective and will encourage re-use of the treated waste water and reduce the ground / surface water pollution especially in Lagos State that is surrounded by water.

IMPACTS OF LAND-BASED POLLUTION ON COASTAL WATERS

The consequences of this unhealthy situation expose the environment to serious water pollution and the resultant health hazards that may lead to serious epidemic not only in Lagos but also in neighbouring coastal areas. The septic tank /soakaways and pit latrine systems also have negative impacts on groundwater to gradual and steadily increasing pollution from septage indiscriminately discharged into the Lagos logoon system, since the water table of the State is very high, because majorities of the land are reclaimed land.

Human excreta contain a lot of organisms, which are major vectors of water-related diseases. These organisms include viruses, which can cause poliomyelitis, viral meningitis, hepatitis, fevers, diarrhea: Bacteria, which can lead to cholera, typhoid / paratyphoid, and diarrhea: Protozoa, which cause dysentery, colonic ulcers and diarrhea: Helminths, which result to guinea worm, round worm, live flukes and schistosomaiasis.

Likewise, the industrial wastewater is full of heavy metals, which results into chemical pollution of the water bodies. Such heavy metals are mercury, arsenic, copper, cyanide, iron, lead, cadmium, chromium, nickel, phenols etc which cause chronic diseases such as cancer in the inhabitants of the State and and neighbouring countries using the same coastal waters, because pollution has no boundary.

As have been indicated above, the high level of urbanization and industrialization of the Lagos megapolis and its environs with the inevitable generation and lack of management of land-based (point and diffuse) pollution sources have led to undesirable impacts on the nearshore coastal aquatic environment and biota. Primary concerns are the effects of land-based pollution (point and diffuse) on bio-diversity, the maintenance of a hitherto viable artisanal commercial fisheries and the safety of humans exposed to the pollution occupationally and through trophic relationships. The pollution impact are

exacerbated in these low energy microtidal environment by a restricted circulation, and shallow interconnecting creeks which are also sites of active silting and deposition of mud resulting in habitat modification or loss for the benthos. The brackish region is of interest for coastal dynamics and transport of pollutants from the hinterland and immediate shores of the lagoon.

CURRENT INITIATIVES AND CONSTRAINTS

Since 1916 to the present, there have been many initiatives and studies aimed at addressing the water pollution problems of the Lagos State but these have not resulted in any coherent and comprehensive actions by the Lagos State Government which was created on 27th May 1967. The most authoritative and comprehensive of these studies would appear to be "The Master Plan for Metropolitan Lagos" prepared in 1979 by Wilbur Smith and Associates in collaboration with the UNDP and the Lagos State Government. Other studies and projects have used the aforementioned Master Plan as their basis. Between 1986 and the present, the Lagos State Govemment has commissioned about four major drainage, wastewater treatment and water pollution studies co-funded with such international agencies as the World bank, the United Kingdom Department for International Development (DFID). Most of these studies generally do not last for more than two years and are usually carried out with very limited funding and also in a fragmented manner (unco-ordinated roles of collaborating executing agencies). As a result, the objectives of the studies are rarely achieved. Examples of these studies and projects include the following : Study and Preparation of Conceptual Design for the Treatment of Septic Tank Sludge and Liquor and the Rehabilitation of Existing Treatment Plants (pending award and implementation since 2002); *The Lagos Lagoon Monitoring Project* executed by Allott (Nigeria) Ltd and WEDC University of Loughborough, UK. (1996 – 1998); *The Inventory and Performance of Existing Sewage Works in Lagos State* executed by Shokunbi Mek-Ind Associates and Keneviron Associates (1994 –96); *Lagos Sewerage and Sanitation Works Feasibility Studies and Detailed Design* executed by Haskoning Consulting Engineres and Konsadem Associates Ltd (1993); *Study and Design of Treatment Plants for Septic Tank Sludge and Liquor* executed by Adeyemi Ogundipwe annd Partners Consulting Engineers and the Public Health Engineering Laboratory of the University of Lagos, Nigeria (1986 – 88).

There have also been various "ad-hoc" and un-coordinated individually executed research studies on the water quality, land-based pollution and tidal aspects of the near waters of the various stretches of the Lagos lagoon by Nigerian university academics and the research staff of the Nigerian Institute for Oceanographic and Marine Research. These laudable initiatives are often hampered by lack of funding for experimental facilities and also regular collaborative interaction with other national and international academic institutions and research organizations (e.g. Global International Waters Assessment – GIWA). There also appears to be lack of collaborative work with relevant State Government ministries and local end users of the products of the research studies. There is a need to establish a mechanism for the transfer of the valuable applied research being undertaken by the academic institutions and research organization to the local and national end-users (government ministries, industrialists, engineering consultants, etc).

MAJOR IDENTIFIED NEEDS

The immediate major needs identified in addressing the land-based coastal pollution of the Lagos State of Nigeria are several but the following would appear to be the most prominent:

- Integrated Environmental Health Impact Studies of the current sanitation systems in use in the State;
- Selection and adoption of sustainable water and wastewater treatment technology and management systems for various parts of the State;
- Integrated Water Quality Monitoring of the Lagos lagoon and a detailed study of the self-purification/assimilative capacity of critically selected sections of the lagoon system;
- Establishment and development of a properly coordinated institutional framework that would involve all stakeholders in the Lagos State aquatic ecosystem.
- Updating of the current topographical mapping of the whole of Metropolitan Lagos to facilitating Master Planning development and project planning and implementation .