

ANALYSIS OF SPATIAL LOCATION OF MUNICIPAL SOLID WASTE MICRO DISPOSAL SITES IN CALABAR METROPOLIS-NIGERIA

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ABSTRACT

Waste management has been a major challenge in urban areas in Nigeria, poor response of constituted authorities especially in recent years is a serious concern. The study investigated the distribution of designated solid waste micro disposal sites in Calabar Metropolis of Cross River State for three years (2020-2023). Data were gathered from primary and secondary sources. Data were gathered through Ground-Truthing Observation (GTOs), micro disposal sites were identified and their coordinate were obtain with Garmin 76CSX hand held GPS. Three hundred and ninety six (396) questionnaires were randomly distributed to residents in the twenty two (22) wards to elicit information on the availability of micro disposal site. Findings reveal that 51.24% of the respondents deposit their waste in designated micro disposal sites, 48.767% dispose waste in an unapproved ways. 23.97% of the respondents walk a distance of 0-100M to dispose waste while, the remaining 73.03% walk a distance of 101-400M+ to dispose waste. A total of 273 micro solid waste micro disposal site locations are in Calabar Metropolis. Data collected were tested using Pearson Moment correlation. With a correlation value of 0.110 and a P value =0.626 the null hypothesis, that there is no association between population and the number of micro disposal sites distributed was accepted. It is recommended that population should be considered in the designation of micro disposal sites, additional 65 sites should be created, refuse bay should be created to cushion delay during waste evacuation from dumpsters, standard dumpsters are required to replace dilapidated ones, dumpsters placed along drainage channels should be relocated. Ministry of environment should embark on sensitization of residents of Calabar Metropolis on the dangers of improper waste disposal.

Keywords: Municipal, Solid, Waste Sprawl, Refuse Bay, Micro, Disposal Sites, Location, Spatial.

1. INTRODUCTION

Waste management will always take a centre stage wherever humans exist. The beauty of any environment lies on its good sanitary condition. This is so because, when an environment is clean it has positive bearing on the wellbeing of residents and their lives are not threatened by diseases and illness (Emri, Nwafor and Ernest, 2019). Waste generation is as old as man's existence on planet earth. Man, in an attempt to satisfy his daily needs, engages in the production of goods and services, in the process wastes are generated. Solid waste is globally described as non-liquid waste materials arising from domestics, commercial, agricultural, industrial activities, public services, (Aibor, and Olorunda, 2006). It consists of everyday items that is used and then thrown away such as, product packaging, glass clippings, furniture, clothing, bottles, food scraps,

newspapers, appliances, paint, and batteries. The New York State Department of Environmental Conservation (NYSDEC) defined waste in simple words as any discarded (abandoned or considered waste-like) materials which can be solid, liquid or semi-solid or containerized gaseous material (Environmental Protection Agency (EPA, 2011). Examples include waste tires, scrap metal, latex, paint, furniture and toys, domestic waste, discarded appliances and vehicles, uncontaminated used oil and anti-freeze, empty aerosol cans. It can also be seen as consisting of everyday items that are used and then thrown away from homes, schools, hospitals, and businesses such as; leaves/twines, food remnants, paper/cartons, textile materials, bones, ash, dust, stones, dead animals, humans and animal excreta, construction and demolishing debris, biomedical debris and household hardware (Babatunde, Vincent-Akpu, Woke, Atarhinyo, Aharanwa, Green. and Isaac, 2013, Okoye and Okoye, 2008). Waste is an unavoidable by product of human activities, economic developments, urbanization and improving living standards in cities, have led to an increase in the quantity and complexity of generated waste. A common front among the definition of waste is that it something that is useless and discarded. However, technically, waste is considered as a resource in the wrong place (Abdullahi 2015).

The inability of successive government to manage solid waste effectively in Nigeria has become an issue of great concern. This is so because apart from the distortion of aesthetic of landscape by the micro waste dumpsites, some of the municipal solid waste (MSW) contains both organic and inorganic toxic, pollutants (heavy metal) that threaten health of human beings. A comprehensive approach to waste management can be achieved when a holistic attention is paid to waste generation, storage/collection, evacuation (transported) and disposal. Waste generation is dependent on the life style of residents, the activities involve in, type of production, consumption pattern. Singh, Gupta, and Chaudhary, (2014) suggested that the management of solid waste should include waste generation, on-site handlings, storage and processing, collection, transport, sorting and recycling, treatment and reuse as well as disposal options etc. Njoku and Okenyi, (2014) noted that waste management differs for developed and developing nations, urban and rural areas, for residential and industrial producers. According to Udo and Iyang (2016), there is phenomenal increase in the volume and diversity of solid waste generation. Proper management of solid waste is critical to the health and well-being of urban resident (World Bank, 2000). In urban areas especially in the rapidly urbanizing cities of developing world, problems and issues of municipal solid waste (MSW) management are of immediate importance. Collection of waste is the starting point of waste management process and it requires utmost attention because the temporal storage facility (micro disposal site and the dumpsters) are capable of promoting the process or inhibiting it. Today, Calabar Metropolis is petted with huge waste at all solid waste micro disposal sites this is a departure from the status of once cleanest city in Nigeria. The once serene environment is now an eyesore; people are seen covering their face with cloth, nose masks; holding their breath and prefer looking the opposite direction of the disposal site just to avoid eye contact with mounds of rubbish that are the new characteristics of disposal sites in the study area, in some cases the median strip is not spared as is the case with Etta Agbor Road. There is waste sprawl in the study area, a situation where the designated micro disposal site is over runs with waste spreading both ways from the dumpsters placed at disposal site parallel to the road. Solid waste dump sites are a global environmental issue that constitutes significant problem in today's world (Jegade and Taiwo, 2019). It has become an overwhelming problem facing both developing and developed economics in the world. The phenomenon is a

consequence of the outrageous growing population and rapid urbanization (Kaza , Yao, Bhada-Tata, Van, Woerden, 2018). The problem is especially severe in most developing countries where poor planning and lack of adequate resources contribute to the poor state of municipal solid waste management.

The concern of the researchers is to investigate the appropriateness in terms of the location/allocation of municipal solid waste micro disposal site and that of numbers of dumpsters placed at the site within Calabar Metropolis. Waste collection can be carried out in varied forms: house to house, communal (dumpsters to waste truck) for onward transportation to final disposal site (Ogwuche, 2013). The communal system is the one practice in Calabar Metropolis. Solid waste micro disposal sites are location created by government as a facility (service) to enable her fulfills the responsibility of freeing the environment of fifth. The facility provides residents a place to deposit waste generated by them. Residents are required to evacuate waste generated by them and deposit same at such designated sites where the management process by government is expected to begin. According to Emri, Upuji and Ayambem (2022), Solid waste micro disposal sites are location/space designated by government for waste to be deposited temporally by residents, for onward lifting to the final dumpsite. They are small space where dumpsters are placed to enable residents deposit waste generated from activities carried out by them. Waste generated from human daily activities, are required to be evacuated regularly from the dumpsters to prevent any nuisance. The distribution of the micro disposal site in space, the availability, the appropriateness in terms of space allocated for it, their proximity to users are vital as it contributes to the exactness of the location. Micro disposal site can best support the idea of preserving the serenity of our environment in the face of increase in waste generated by our ever increasing urban population if the right space and the right numbers of dumpsters are placed on each site.

2. MATERIAL AND METOD

The Study Area

Calabar is the state capital of Cross River State. It is administratively divided into two local government areas, Calabar Municipality and Calabar South Local Government Area. Calabar Urban Area comprises of Calabar Municipality and Calabar South L.G.A, politically, it is situated in the Southern Senatorial district. The study area lies approximately in between Longitudes 8°18'25''E and 8° 22' 29.04''E of the Greenwich meridian and latitudes 5° 06'10.56''N and 4° 54' 43.21''N of the Equator. Calabar Urban Area shares boundaries with Odukpani Local Government Area in the north, in the South by the estuaries, Great Kwa River in the East, Akpabuyo Local Government Area in the East and Calabar River in the West. The city is about 48km from the estuary where Cross River and Calabar Rivers meet before joining the Atlantic Ocean. It has an area of 331.551 square kilometers.

The population of Calabar has been rising steadily over the years. In the 1963 census the population was 99,350 by the census figures of 1991 the population of Calabar had astronomically risen to 328,876 (NPC, 1991). According to the census figure 2006, Calabar has a population of 371,022 (NPC), but when projected to 2023 with a growth rate of 3.0 percent put the population at 613,232 persons.

The ancient city of Calabar has a long history and a fascinating heritage. Nearly after a century of contact with European sailors, Calabar gained recognition as an International Sea Port in the 16th century. From 17th to 19th century, Calabar became a major slave trade port in West Africa. Calabar accounted for approximately 30 percent of Africans carted away to the new world (America) as slaves from Africa. This represented the largest exit of slaves from a single point in Africa (Ojikpong, Agbor and Emri, 2016). The study area is inhabited by the Efiks, the Quas and Efuts. The people speak Efik and English fluently. See Figures 1 and 2. The study area is comprised of twenty two political wards, with Calabar Municipality having ten (10) political wards and Calabar South having twelve (12) political wards See figure 3..

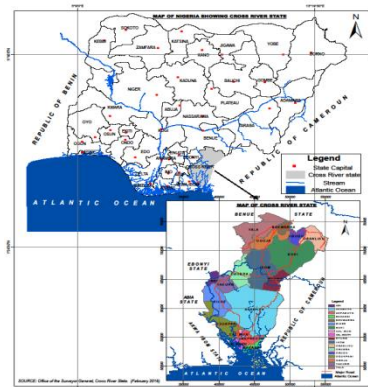


Fig 1: Map of Nigeria showing location of Cross River State.
Source: CRS Geographic Agency

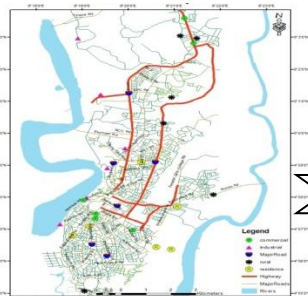


Fig. 2: Map of Calabar Metropolis
Source: CRS Geographic Agency

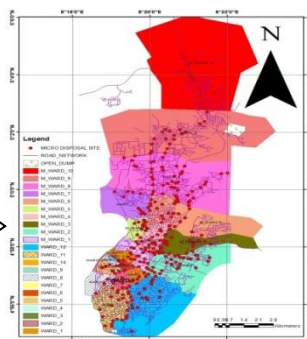


Figure 3.1: Political wards in Calabar Metropolis
Source: CRS Geographic Agency

3. METHOD OF DATA COLLECTION

The study sample size was statistically determined using “Taro Yamane” (1967) formula:

$$n = \frac{N}{1 + N(e)^2}$$

Where:

n is the sample size;

N is the finite population,

e is the level of significance (limit of tolerable error), that is 0.05(5%) and

I is unity (a constant)

Using the sampling frame formula with a projected population of 613,232 respondents (approximately 400) were sampled randomly and administered with questionnaire.

Research data was gathered from primary and secondary sources. Data were gathered through Ground-Truthing Observation (GTOs) in the field, identification and location of micro disposal sites, in Calabar Municipality with Garmin 76CSX hand held GPS to obtain the coordinates of the micro disposal sites, Arc GIS 9.3 software handles multiple tables and relate them to each other.

Secondary sources of data were obtained from existing literature on primary waste management from textbooks, internet, journals and magazines. Information was also sourced from the Quick Bird Imagery of Calabar Auto Photo Map, Ministry of Lands and Surveys Calabar, Ministry of Environment Calabar, Cross River Waste Management Agency, Calabar office of the National Population Commission (NPC) and the office of the State Statistician General where demographic data were collected.

4. DATA ANALYSIS

Table 1: Method of Waste Disposal by Residents:

S/N	Ward	Dumpster	Nearby Bush	Into Drain	Burning	Burying	Others	Total
1.	M1	9	-	7	-	2	-	18
2.	M2	9	-	8		1		18
3.	M3	11	-	6	-	1	-	18
4.	M4	11	-	6		1		18
5.	M5	12	-	4	-	2	-	18
6.	M6	13	1	3	-	1		18
7.	M7	14	1	3	-	-		18
8.	M8	10	3	5	-			18
9.	M9	8	7	-	-	3	-	18
10.	M10	6	10	-	-	2	-	18
11.	S1	5	2	9	-	2		18
12.	S2	3	3	8	-	4	-	18
13.	S3	10	-	5	-	3		18
14.	S4	12	-	4	-	2	-	18
15.	S5	14	-	3	-	1	-	18
16.	S6	8	-	7	-	3	-	18
17.	S7	8	2	6	-	2	-	18
18.	S8	9	3	4	-	2	-	18
19.	S9	9	3	5	-	1	-	18
20.	S10	7	4	4	-	3	-	18

21.	S11	7	4	5	-	2	-	18
22.	S12	9	3	2	-	4	-	18
Total		203	47	104	0	42	-	396
Percent		51.24	11.85	26.17	0	10.74	0	100

Source: Field Survey 2022

Respondents views were sought as regards how they dispose waste, as presented in Table 1, those who dispose their waste into dumpsters (at micro disposal site) are 51.24%, 11.85% dispose their waste in nearby bush, 26.17% dump theirs into the drainage, the practice of burning waste is not practiced in the study area, however 10.74 % do dispose of their waste by burying it.

Table 2: Distance Trekked by Residents to Dispose Waste:

Ward	0-100M	101-200M	201-300M	301-400M	Above 400M	Total
M1	4	5	4	3	2	18
M2	5	5	3	2	3	18
M3	3	6	2	4	3	18
M4	4	6	4	2	2	18
M5	5	4	3	2	4	18
M6	7	4	4	3	-	18
M7	3	4	3	4	4	18
M8	4	5	2	4	3	18
M9	3	6	2	2	5	18
M10	3	5	3	3	4	18
S1	5	6	4	3	-	18
S2	-	1	3	6	8	18
S3	6	6	4	2	-	18
S4	5	7	3	3	-	18
S5	4	5	5	4	-	18
S6	6	5	3	3	1	18
S7	2	4	5	4	3	18
S8	5	7	2	3	1	18
S9	7	5	4	2	-	18
S10	4	5	3	4	2	18
S11	7	4	3	1	3	18
S12	3	4	5	2	4	18
Total	95	109	74	66	52	396
Percentage	23.97	27.55	18.73	16.53	13.22	100

Source: Field Survey

The distance respondents trekked to dispose their refuse as presented in Table 2 reveal that respondents who trekked up to 100m to enable them dispose refuse make up 23.97%, respondents who trekked between 101m to 200m form 27.55%, those who have to move 201m to 300m constitute 18.73%, respondents who cover 301m to 400m comprise 16.53% and

respondents who have to cover a distance above 400m to enable them thrust aside their waste constitute 13.22%.

Table 3: Distance (Metre) Respondents wished to trek to Disposed Waste:

Ward	0-100M	101-200M	201-300M	301-400M	400M+	Total
M1	9	7	2	-	-	18
M2	9	8	1	-	-	18
M3	7	8	3	-	-	18
M4	9	8	1	-	-	18
M5	8	8	2	-	-	18
M6	13	5	-	-	-	18
M7	10	6	2	-	-	18
M8	8	8	2	-	-	18
M9	10	7	1	-	-	18
M10	8	8	2	-	-	18
S1	10	7	1	-	-	18
S2	9	7	2	-	-	18
S3	8	8	2	-	-	18
S4	7	9	2	-	-	18
S5	9	8	1	-	-	18
S6	9	8	1	-	-	18
S7	8	8	2	-	-	18
S8	8	7	3	-	-	18
S9	7	9	2	-	-	18
S10	9	7	2	-	-	18
S11	9	8	1	-	-	18
S12	8	8	2	-	-	18
Total	192	167	37	0	0	396
Percentage	48.49	42.15	9.36	0	0	100

Source: Field Survey

Table 3 shows that 48.49% consider a maximum distance of 100m as being appropriate for residents to trekked to discard their waste, 42.15% consider 200m as an ideal distance to trekked to the nearest micro disposal site, 9.36% of the respondents are of the opinion that maximum distance of 300m is ideal. However, none of the respondents considered distance of above 300m as an ideal walking distance to discard waste.

Table 4: Population per ward:

SN	Ward	Projected Population to 2023/Ward	Percentage of projected Pop/Ward	Percentage of projected Pop/LGA
1	CAL M1	91,310	14.89	49.5% (303,549 pop)
2	CAL M2	3,986	0.65	
3	CAL M3	51,389	8.38	
4	CAL M4	4,292	0.70	
5	CAL M5	19,930	3.25	
6	CAL M6	51,389	8.38	
7	CAL M7	8,217	1.34	
8	CAL M8	29,926	4.88	
9	CAL M9	10,977	1.79	
10	CAL M10	32,133	5.24	
11	CAL S1	16,986	2.77	50.5% (309,683 pop)
12	CAL S2	21,586	3.52	
13	CAL S3	27,779	4.53	
14	CAL S4	23,119	3.77	
15	CAL S5	24,591	4.01	
16	CAL S6	30,846	5.03	
17	CAL S7	18,520	3.02	
18	CAL S8	14,043	2.29	
19	CAL S9	45,870	7.48	
20	CAL S10	15,453	2.52	
21	CAL S11	26,185	4.27	
22	CAL S12	44,705	7.29	
	Total	613,232	100	100

Source: Field Survey

Table 4 shows that a total population of the study area is six hundred and thirteen thousand two hundred and thirty two. Calabar Municipality population is 303,549 (49.5 percent) while, Calabar South LGA population is 309,683 (50.5percent) residents. It is further deduce from the table that, ward 1 in Calabar Municipality has the highest population (91,310) and least populated is ward 2 (3,986) also in Calabar Municipality.

Table 5: Number of Municipal solid waste micro disposal sites per ward:

SN	Ward	Number of Site/Ward	Percentage of Site/Ward	Percentage of Site/LGA
1	CAL M1	13	4.70	75.62% (208 sites)
2	CAL M2	32	11.70	
3	CAL M3	21	7.60	
4	CAL M4	21	7.60	
5	CAL M5	10	3.70	
6	CAL M6	28	10.20	
7	CAL M7	10	3.70	
8	CAL M8	42	15.30	
9	CAL M9	19	6.90	
10	CAL M10	12	4.30	
11	CAL S1	6	2.10	24.38% (65 sites)
12	CAL S2	0	0.00	
13	CAL S3	1	0.37	
14	CAL S4	1	0.37	
15	CAL S5	3	1.00	
16	CAL S6	2	0.70	
17	CAL S7	1	0.37	
18	CAL S8	3	1.00	
19	CAL S9	3	1.00	
20	CAL S10	5	1.80	
21	CAL S11	14	5.10	
22	CAL S12	26	9.50	
	Total	273	100	100

Source: Field Survey

Table 5, shows that a total of two hundred and seventy three (273) solid waste disposal sites are located in Calabar Metropolis. Calabar Municipality has two hundred and eight (75.62%), while, Calabar South Local Government has sixty five designated sites (24.38%). Ward 8 in Calabar Municipality has the highest number of 42 sites (15.3%). Wards 3, 4 and 7 all in Calabar South has one (1) site each, ward 2 also in Calabar South has no disposal site located in it.

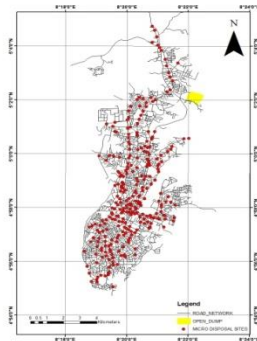


Figure 4: Distribution of municipal solid waste micro disposal sites and the final disposal site.

Given the distribution in figure 4, the inadequacies of micro disposal sites has resulted in the development of illegal micro dump sites created by residents, which is either as a result of distance to the nearest micro disposal site of more than 300M walking distance or total absent of micro site within the neighbourhood. The illegal micro site or flash points are shown in figure 5.

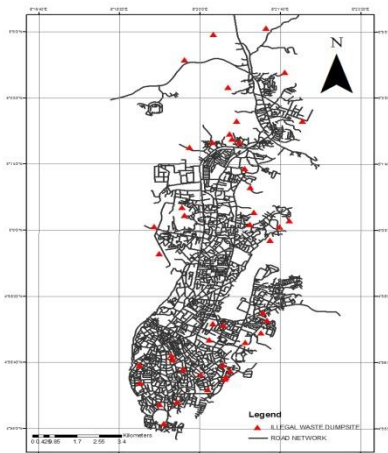


Figure 5: Illegal waste dump in the study area.

Test of Hypothesis

Ho: There is no significant relationship between population and the number of municipal solid waste micro disposal site.

Data for the testing of this hypothesis is found in tables 4 (Percentage of projected Pop/Ward) and 5 (Number of Site/Ward).

The Pearson’s-Moment Correlation Coefficient (r) is used to test for the variation in concentration as regards the number of municipal solid waste micro disposal sites and the population per ward see table 6

Table 6: Hypothesis testing

SN	Population (Y)	Bin (X)	Y-Y Mean	(Y-Y) ²	X-X Mean	(X-X) ²	(Y-Y)(X-X)
1	14.89	13	10.34	106.92	0.59	0.35	6.10
2	0.65	32	-3.90	15.21	20.59	423.95	-80.30
3	8.38	21	3.83	14.67	8.59	73.79	32.90
4	0.70	21	-3.85	14.82	8.59	73.79	-33.07
5	3.25	10	-1.30	1.69	-2.41	5.81	3.13
6	8.38	28	3.83	14.67	15.59	243.05	59.71
7	1.34	10	-3.21	10.30	-2.41	5.81	7.74
8	4.88	42	0.33	0.11	29.59	875.57	9.76
9	1.79	19	-2.76	7.62	6.59	43.43	-18.19
10	5.24	12	0.69	0.48	-0.41	0.17	-0.28
11	2.77	6	-1.78	3.17	-6.41	41.09	11.41
12	3.52	0	-1.03	1.06	-12.41	154.01	12.78
13	4.53	1	-0.02	0.00	-11.41	130.19	0.23
14	3.77	1	-0.78	0.61	-11.41	130.19	8.90

15	4.01	3	-0.54	0.29	-9.41	88.55	5.08
16	5.03	2	0.48	0.23	-10.41	108.37	-5.00
17	3.02	1	-1.53	2.34	-11.41	130.19	17.46
18	2.29	3	-2.26	5.11	-9.41	88.55	21.27
19	7.48	3	2.93	8.58	-9.41	88.55	-27.57
20	2.52	5	-2.03	4.12	-7.41	54.91	15.04
21	4.27	14	-0.28	0.08	1.59	2.53	-0.45
22	7.29	26	2.74	7.51	13.59	184.69	37.24
TOTAL	Y=100 Y MEAN = 4.55	273 X MEAN = 12.41		219.59		2,870.75	83.89

$$\begin{aligned} \text{Standard deviation of X (S}_x) &= \sqrt{n \sum (X-X)^2/n} \\ &= \sqrt{2,870.75/22} \\ &= \sqrt{130.49} \\ &= 11.42 \end{aligned}$$

$$\begin{aligned} \text{Standard deviation of Y (S}_y) &= \sqrt{n \sum (Y-Y)^2/n} \\ &= \sqrt{219.59/22} \\ &= \sqrt{9.98} \\ &= 3.16 \end{aligned}$$

$$\begin{aligned} r &= 1/n \sum_{n=1}^{\infty} \left(\frac{(x-x)}{S_x} \frac{(y-y)}{S_y} \right) \\ &= 1/22 (83.89)/11.42 \times 3.16 \\ &= 3.81/36.09 \\ &= 0.11 \text{ Low (weak) relationship} \end{aligned}$$

The correlation coefficient of 0.11 indicated that there is a low (weak) relationship between population of the various wards and the numbers of locations designated as solid waste micro disposal sites. The implication is that population is not the focal point in the consideration of designation of site for solid waste micro disposal sites in the study area.

5. FINDINGS

During the period (2019-2023) of the research it was observed that dumpsters placed at most of the micro disposal site decreased by a half especially at locations where they used to be two dumpsters, one is found and at locations with one dumpsters, were left with none. This has resulted in residents to dump waste on the ground see plate 1. The micro disposal site are over stretched resulting to waste sprawl see plate 2 and 3. The issues of disappearing dumpsters were attributed to illicit activity of Scraps Metal Regulatory Agency that mangle and sell it to scrap men as well as dilapidation of dumpsters, see plate 4. In response to the act of the Scraps Metal Regulatory Agency, the governor of Cross River State scrapped the Agency on the 18/04/2023. He was quoted as saying “let me use this responsibility to announce that the Scraps Metal

Regulatory Agency is hereby scrapped". Presently, most micro disposal sites are without dumpster.



Plate 1: Waste on floor at Ekpo Abasi Street Calabar South



Plate 2: Over stretched dumpsters at Palm Street by Abatim on Culvert, Calabar South



Plate 3: Waste sprawl at a micro disposal site by Marian (Ika Ika Oqua) Market Calabar Municipality



Plate 4: Dilapidated dumpsters by White House Street Calabar South

Street waste baskets that used to be placed by the edge of the road or at the median strip to enable residents/passersby to drop/discarded waste materials are no longer there due to negligence on the part of authority saddled with the allocation/location of the street waste baskets. This explained the appearance of illegal waste dumps found on median strip along Mary Slessor Avenue at Bogobiri, Etta Agbor Road etc, the disappearance of these street waste baskets is due to poor handling by the waste pickers, who hauled the baskets into the vehicle and throw it down in an unprofessional manner.

6. CONCLUSION

The study examined solid waste micro disposal sites distribution in Calabar Metropolis and it is established that there is no correlation between population and the distribution of micro disposal site, the pattern of distribution is irregular. The spates of incessant illegal waste dumps around and within the city as well as the spate of waste sprawl at micro disposal site is an indication of inadequacies in terms of number of dumpsters placed at the site and lopsided distribution pattern and it has affected the aesthetics of the environment negatively. It is an indication of an unplanned, not well integrated waste evacuation system. Residents will be comfortable to dispose their waste at designated disposal sites, if the trekking distance is at maximum of 300M from their homes.

It could be established based on analysis that waste management in Calabar as regards the collection through municipal solid waste micro disposal sites is yet to attain the goal of keeping the environment clean and green.

7. RECOMMENDATION

It is disturbing that the State Ministry of Environment saddled with the responsibility to managed Cross River State environment has not been able to coordinate Calabar Urban Development Authority and Cross River State Waste Management Agency to manage waste in Calabar Metropolis, to promote a pleasing living environment for residents of Calabar. The following recommendations have been made to improve the deplorable condition of the environment due to poor waste management in Calabar Metropolis, Cross River State.

Proposed municipal solid waste micro disposal site

It was observed in the field that some residential areas (Akima Nsa, Esuk Otu, Ikot Eneobong, Ikot Uduak, Ikot Nkebre, Jonathan Bye Pass, Nasarawa, Water Intake etc) that developed recently are without designated sites for temporally waste storage, this has made resident to dump waste on undeveloped plots, natural drainage, ravines etc. To curb this menace, a proposal for designation of new sites is presented in figure 6

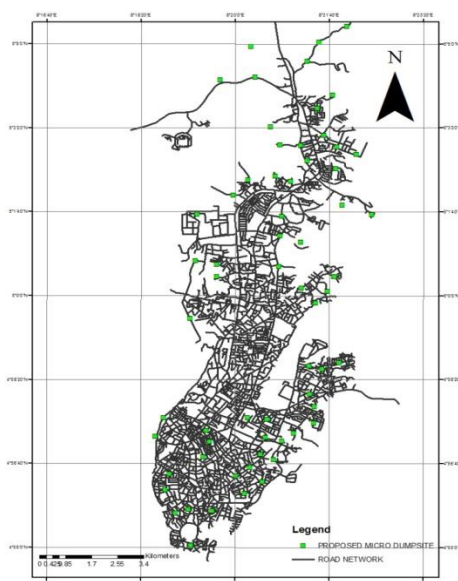


Figure 6: Proposed Locations for Municipal Solid Waste Micro Disposal Sites

A proposal is made for an additional sixty five (65) location for municipal solid waste micro disposal sites (See figure 6), bringing the total to three hundred and thirty eight (273 +65 =338) micro disposal sites in Calabar. This number will contribute towards achieving/sustaining the aim of keeping Calabar city clean and green.

Creation of refuse bay

Dumpsters are being placed on the “carriage way” of “access road” at designated solid waste micro disposal sites. This is unhealthy due to the width of the carriage way (8M). It will be better to reduce the time wasted by motorists at these points to the barest minimum. Time wasted will be reduced through the creation of refuse bay on the right of way. The Refuse Bay should be placed on the building line (distance between the property line and the edge of the carriage way).

Provision of More Standard Dumpsters

Apparently, absence of standard dumpsters (quantity and quality) in some parts of the city

especially residential areas, Central Business District (CBD) and other commercial areas with high population density is responsible for the accumulation of wastes on undeveloped lots, drainages, along the road and on median strip in the city. It therefore becomes expedient that standard dumpsters be procured and placed at various proposed locations within the metropolis. In a more synergic form, individual homes should be encouraged to procure waste storage bins and pay for house to house waste collection service or transfer the waste to nearby dumpsters by themselves.

Proper Implementation of Environmental Policies

Strict environmental policies will definitely address the cases of indiscriminate dumping in the city. Strict implementation of these laws will not only help in prosecuting the environmental law defaulters but will also serve as deterrent to several others. There is need to establish a mobile court to handle cases on environmental issues.

Improved Awareness and Campaign against Indiscriminate Dumping

Sensitization need to be made on adverse effects inherent in the abuse of our environment through indiscriminate refuse disposal system. Different avenues like media, workshops, seminars, school, and symposia should be explored by the government in order to create public awareness on the dangers of indiscriminate refuse dumping. Participation of public in the planning and implementation of solid waste management should also be encouraged through creating awareness.

Establishment of Research Department

It was discovered that CRSWMA lacks data, publications and researches on waste management. It is therefore pertinent to establish research centers and departments in order to make data on waste composition, characteristics, volume of waste generation as well as spatial characteristic of the city; this will enable the Agency function efficiently.

Relocation of micro dumpsite

Dumpsite located along “Channel 1 Drainage” at Mary Slessor by Botanical Garden, Palm Street by Abatim, Mayne Avenue by Atakpa and Mt Zion streets are direct invitation to the public to dump waste directly into the drainage especially when the dumpsters are fill to the brim. The location of micro dumpsite at this site not only promotes wrong doing, the location of it on the bridge/culverts narrow the right of way. It was observed that motorist have to apply caution when plying that portion of road at evacuation time, and at some times during evacuation vehicles have to park and wait for the lifting to be completed before continuing with their movement.

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