

PETROL FILLING STATIONS' LOCATION AND MINIMUM ENVIRONMENTAL SAFETY REQUIREMENTS IN OBIO AKPOR LGA, NIGERIA

Samuel B. Arokoyu, Ogoro Mark and Amanoritsewo O. Jochebed

Department of Geography and Environmental Management,
University of Port Harcourt, Port Harcourt, Nigeria.

Abstract

The study examines the proliferation of petrol filling stations in relation to the minimum environmental safety requirements by the Department of Petroleum Resources (DPR) that 'distance from the edge of the road to the nearest pump and from the next petrol filling station should not be less than 15 and 400 meters respectively. The Global Positioning System (GPS) was used to acquire the coordinates of each filling station in the study area and then imported to the ArcGIS 9.3 software environment. Distances between filling stations from the road and from each other were determined using the ArcGIS 9.3 measurement tool alongside buffering analysis in respect to their coordinates. The Z ratio analytical technique was used to examine the conformity of petrol filling stations to the required distance of 400m and 15m from each other and from the road respectively as stipulated by DPR amendment decree 37 of 1997. Findings from the z ratio analysis at 152 degree of freedom and 95% confidence level reveals that the petrol filling stations in the study area neither conform to the required distance of 400m apart nor conform to the required distance of 15m from the road. Thus, the study recommends, among others, the need for the regulatory agency, DPR, to improve their capacity in enforcing the compliance of petrol filling stations with laid down regulations.

Keywords: Proliferation, regulatory agency, petroleum, filling stations, safety requirements,

Introduction

Nigeria is blessed with abundant natural resources and at present, she is the ninth world producer and sixth world exporter of crude oil (CBN, 2010). Despite this, population growth rate has continued to outpace the ability of Government to build essential infrastructures, enact and enforce legislation needed to make life in safe, rewarding and healthy (W.H.O, 2010). This rapid growth rate of most urban centres has increased the use of automobiles, generators and other petroleum demanding plants. The pathetic power situation in Nigeria has exacerbated the increasing demand for petroleum products, leading to the proliferation of petrol filling stations and consequently, with less consideration of the minimum environmental safety requirements for their operations (Afolabi, Olajide & Omotayo, 2011). Safety practices in locating petrol filling stations are of utmost importance in preventing hazards and reducing potential risks that could affect humans and their environment.

In most large urban areas of Nigeria, there is high demand for land for socio-economic services that are in high demand. This high land demand often results to land scramble and illegal conversion of land uses, leading to haphazard development and the deliberate location of petrol filling stations in unsuitable areas that are highly vulnerable to hazard (KASUPDA, 2009). Several problems have come to be associated with these poorly located filling stations. Today, this has become an important social issue requiring the attention of social critiques and researchers alike. For example, Samuel (2011) acknowledged the significant contributions of petrol filling stations' location to traffic congestion, pollution, and fire. The dimension and extent of the problems depend on the criteria or variable such as location, size and set back from the road. Thus, it is imperative to study spatial location of petrol filling stations in Obio Akpor Local Government Area in order to determine how they conform to the locational guidelines set by the regulatory bodies.

Study Area

The Study area is one of the 23 local governments of Rivers state, found in the south southern part of Nigeria, otherwise called the Niger Delta Region of Nigeria, located approximately between latitude $4^{\circ} 45''$ N through $4^{\circ} 56''$ N and longitude $6^{\circ} 52''$ E through $7^{\circ} 6''$ E. It has a general elevation of less than 15.24m above mean sea level (Oyegun & Adeyemo, 1999). It is bounded by Ikwerre LGA to the north, Port Harcourt LGA to the south, Oyigbo LGA to the east Emohua LGA to the west, as shown in figure 1.

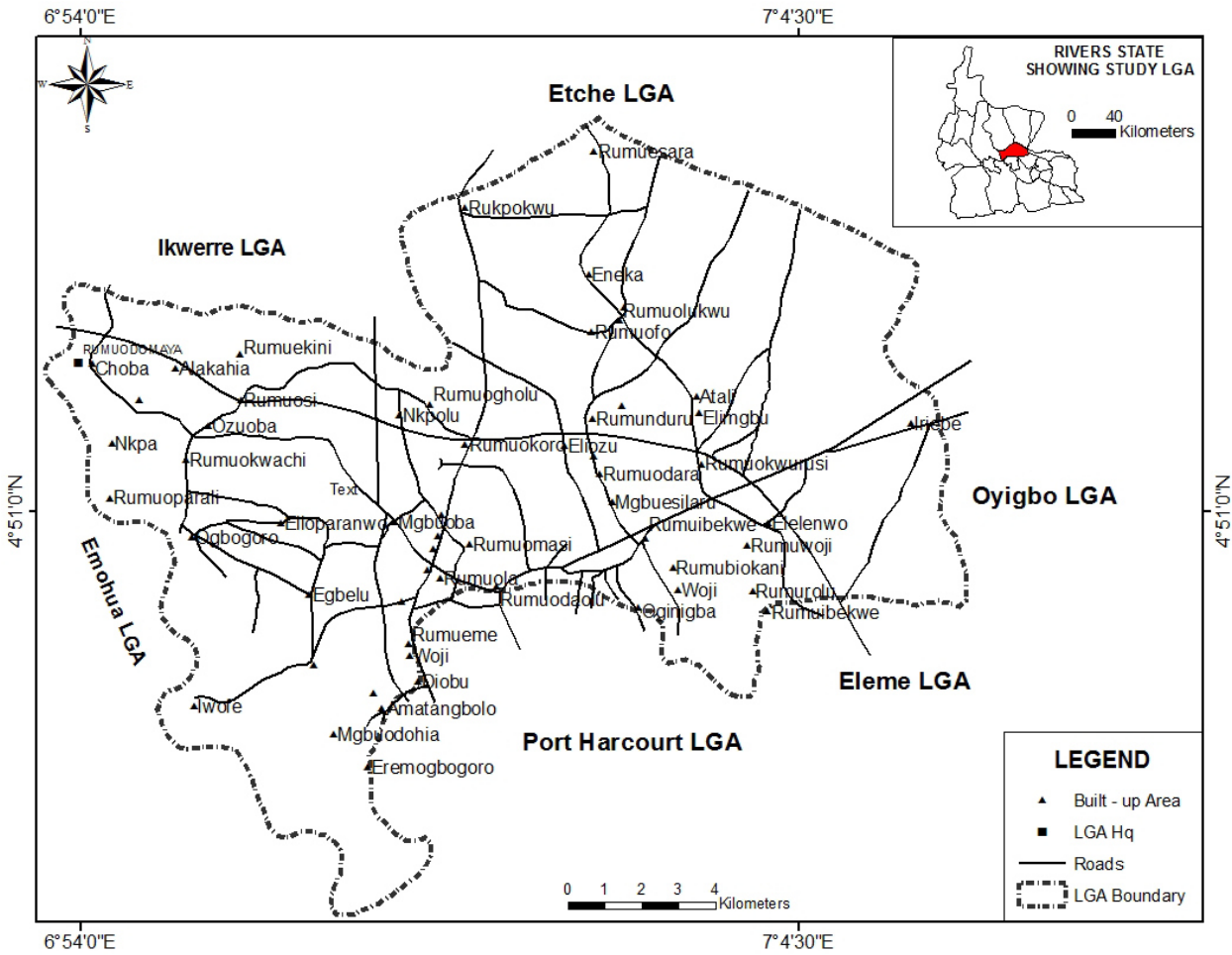
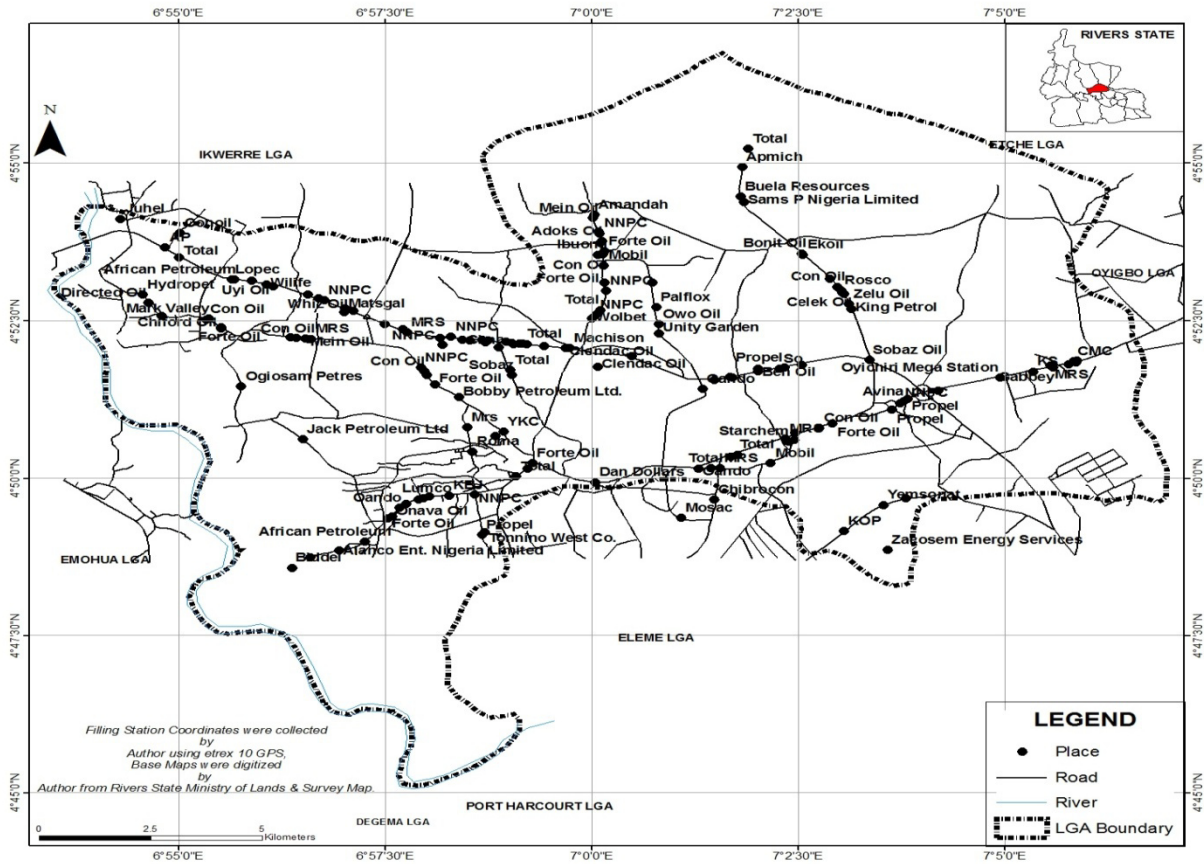


Figure 1. Obio Akpor LGA Showing Communities with insert Rivers State

Obio-Akpor LGA of Rivers State has a population of 283,294 persons, made up of 145,326 males and 137,968 females (N.P.C, 2006). From field work carried out by authors, there are about 153 filling stations in the study area which were considered as the target population as shown in figure 2.



Source: Authors' Fieldwork, 2014.

Figure 2 Obio Akpor LGA Showing the Location of Filling Stations

Materials and Methods

The acquisition of petrol filling station data in the study area was carried out using the global positioning system (GPS). The GPS was used to acquire the coordinates of each petrol filling stations, in respect to the first pump and the road edge. The GIS software (Arc GIS 9.3) enabled the determination of distances between the first pump from the road edge and one petrol filling station from another within the study area.

The Z ratio analytical technique was used to determine the level of conformity of petrol filling stations to the required distance from each other and from the road as stipulated by Department of Petroleum Resources (DPR) guidelines for approval to construct and operate petroleum products dispensing.

Data Analysis

The petroleum filling station amendment decree no. 37 of 1977 safety rules and regulations stipulate site inspection by DPR of proposed filling station, so as to among other things, issue report on the following basic requirements: -

- (i) Size of the proposed land site.
- (ii) Whether site lie within pipeline or electricity high tension cable Right Of Way (ROW).
- (iii) Distance from the edge of the road to the nearest pump (not less than 15 meters).
- (iv) The number of petrol stations within 2km stretch of the site on both sides of the road will not be more than four, including the one under consideration.
- (v) The distance between an existing station and the proposed one will not be less than 400 (four hundred) meters.
- (vi) The drainage from the site will not go into a stream or river.
- (vii) In some instances where site is along Federal Highway, a letter of consent from the Federal Highway is required.
- (viii) DPR guided/supervised EIA study of the site by DPR accredited consultant.

This study is concerned with regulation number iii & v which state that:

- a) The distance from the edge of the road to the nearest pump will not be less than 15 meters.
- b) The distance between an existing station and the proposed one will not be less than 400m (four hundred meters)

Buffering technique in the GIS environment was used to analyse the spatial conformity of petrol filling stations across the study area in relation to required standards.

Table 1 Names and coordinates of Filling Stations in Obio Akpor LGA

S/N	Name	Eastings	Northings	S/N	Name	Eastings	Northings
1	Lopec	6.927306	4.885861	80	Con Oil	6.922167	4.875278
2	African Petroleum	6.927861	4.885833	81	Chiford Oil	6.92525	4.872972
3	Wilife	6.934361	4.884583	82	Ogiosam Petres	6.92925	4.857583
4	Perhoo Integrated Resources Ltd	6.935639	4.884111	83	Jack Petroleum Ltd	6.941694	4.843528
5	Matsgal	6.950022	4.877259	84	Cima Petrol Station	6.939194	4.870528
6	African Petroleum	6.951917	4.8775	85	Heiman's Oil	6.940417	4.870444
7	Salzaman Nigeria Ltd	6.958111	4.874	86	Mein Oil	6.942222	4.870167
8	MRS	6.962639	4.871861	87	Con Oil	6.942833	4.870139
9	Fidelity Oil	6.969811	4.868611	88	MRS	6.943361	4.870111
10	NNPC	6.969389	4.870417	89	NNPC	6.965472	4.8625
11	Cima	6.973917	4.869833	90	Forte Oil	6.968278	4.858111
12	Mobil	6.975333	4.869694	91	NNPC	6.976306	4.828889
13	Mac King Petroleum	6.978472	4.869306	92	Propel	6.977861	4.818222
14	Chiosa	6.98125	4.867917	93	Anele Oil	6.967111	4.828472
15	Sobaz	6.983861	4.860528	94	Rhodax Oil and Gas	6.9625	4.826389
16	Total	6.983528	4.861917	95	Oando	6.961222	4.825389
17	U.D. Uko	6.984139	4.868694	96	Forte Oil	6.958778	4.822556
18	Clendac Oil	7.001122	4.862722	97	African Petroleum	6.954167	4.816389
19	Geogal Chucks Associates	7.02475	4.859167	98	Alanco Ent. Nigeria Limited	6.948972	4.814111
20	Mikab Ventures	7.028333	4.859833	99	Dabatt	6.94325	4.812278
21	So	7.037778	4.862222	100	Biddel	6.939444	4.809472
22	Propel	7.038861	4.8625	101	Onava Oil	6.959694	4.823139
23	Dose Marine	7.042306	4.863306	102	Gamag Oil	6.964944	4.827583
24	King Petrol	7.052344	4.878003	103	Lumco	6.966	4.827889
25	Read Logistics	7.050831	4.882	104	KBJ	6.971111	4.828639
26	Celek Oil	7.050539	4.882431	105	Tonnino West Co.	6.978278	4.818861
27	Rosco	7.050281	4.882944	106	Roma	6.975917	4.840278
28	Sams P Nigeria	7.030639	4.906417	107	Mrs	6.974889	4.846667

	Limited						
29	Buela Resources	7.030083	4.907889	108	Stonefield	6.980528	4.844444
30	Total	7.031514	4.920531	109	Forte Oil	6.987944	4.837194
31	Apmich	7.030333	4.915722	110	Total	6.984694	4.833694
32	Bonit Oil	7.042333	4.892778	111	Sobaz Oil	6.987056	4.835778
33	Ekcoil	7.042556	4.892472	112	Dan Dollars	7.000639	4.832111
34	Eromo Energy Resources Ltd	7.048056	4.886111	113	YKC	6.982111	4.845583
35	Con Oil	7.049547	4.883944	114	Bobby Petroleum Ltd.	6.973194	4.854778
36	Zelu Oil	7.051861	4.879361	115	Jorax Oil Petroleum	6.966639	4.860583
37	Sobaz Oil	7.055944	4.8645	116	Con Oil	6.966139	4.861556
38	Ben Oil	7.033528	4.862194	117	Forte Oil	6.925222	4.873306
39	Johny Son Oil	7.033528	4.861583	118	Mark Valley	6.922611	4.875556
40	Palflox	7.027861	4.860139	119	Gamag Oil Nigeria Ltd.	6.91325	4.876278
41	Viv King Nigeria Ltd	7.012111	4.885056	120	Hydropet	6.909417	4.881917
42	Owo Oil	7.0135	4.874056	121	Con Oil	7.028083	4.838917
43	Palflox	7.012972	4.878528	122	Total	7.029306	4.839444
44	Unity Garden	7.013472	4.871583	123	MRS	7.038972	4.843694
45	Chieson Nigeria Ltd	7.008083	4.865528	124	Con Oil	7.045917	4.846556
46	Forte Oil	7.002472	4.885139	125	Forte Oil	7.048528	4.847722
47	Mobil	7.002389	4.889611	126	Propel	7.060556	4.851361
48	Forte Oil	7.002444	4.893333	127	Sobaz Oil	7.069778	4.856389
49	Adoks Oil	7.002056	4.896028	128	Oyichiri Mega Station	7.082361	4.859889
50	NNPC	7.001583	4.898139	129	KS	7.089	4.861472
51	Owoma Petroleum	7.001417	4.898528	130	Gabbey	7.093028	4.862556
52	Con Oil	7.001222	4.892317	131	Pinnacle	7.096111	4.863417
53	Amandah	7.0005	4.903083	132	Jezco Oil Nigeria Ltd.	7.097694	4.863861
54	Mein Oil	7.00025	4.902222	133	Mobil	7.097806	4.864444
55	Ronel Oil	7.001694	4.895639	134	CMC	7.097111	4.864222
56	Ibuomi	7.002194	4.892528	135	MRS	7.092528	4.863083
57	NNPC	7.002778	4.882833	136	Propel	7.063639	4.854222
59	Total	7.00175	4.877778	137	Avina	7.062833	4.853556

60	NNPC	7.000778	4.876583	138	NNPC	7.062222	4.853139
61	Wolbet	6.999944	4.875528	139	Total	7.041083	4.845222
62	Machison	6.995444	4.867722	140	Oando	7.021583	4.835778
63	Clendac Oil	6.994639	4.86775	141	Mobil	7.036028	4.83725
64	Matebot	6.990333	4.868306	142	MRS	7.025806	4.835833
65	Gamag Oil	6.986778	4.868694	143	Total	7.023944	4.835861
66	Total	6.986	4.868833	144	Oando	7.022417	4.856861
67	Nna-Nosike Oil	6.985389	4.868944	145	Starchem	7.039722	4.842972
68	I.C. Ejezie	6.983806	4.869139	146	Yemsonat	7.058806	4.826139
69	Citizens	6.982639	4.869361	147	Chelsea Oil	7.063417	4.827972
70	Con Oil	6.977917	4.869833	148	KOP	7.050833	4.819194
71	Planet Oil	6.979028	4.86975	149	Zacosem Energy Services	7.059639	4.814167
72	NNPC	6.971583	4.870667	150	Tani Tobi	7.040917	4.843444
73	Pamel Resources	6.961889	4.872667	151	Juhel	6.904833	4.901972
74	Chieson Nigeria Ltd	6.95025	4.878222	152	AP	6.913917	4.894361
75	NNPC	6.945972	4.880361	153	Conoil	6.916944	4.898167
76	Kingsize Oil	6.944806	4.880944				
77	Whiz Oil	6.942722	4.881944				
78	Uyi Oil	6.931389	4.885528				
79	Directed Oil	6.910556	4.879667				

Source: Authors' Field Work, 2014

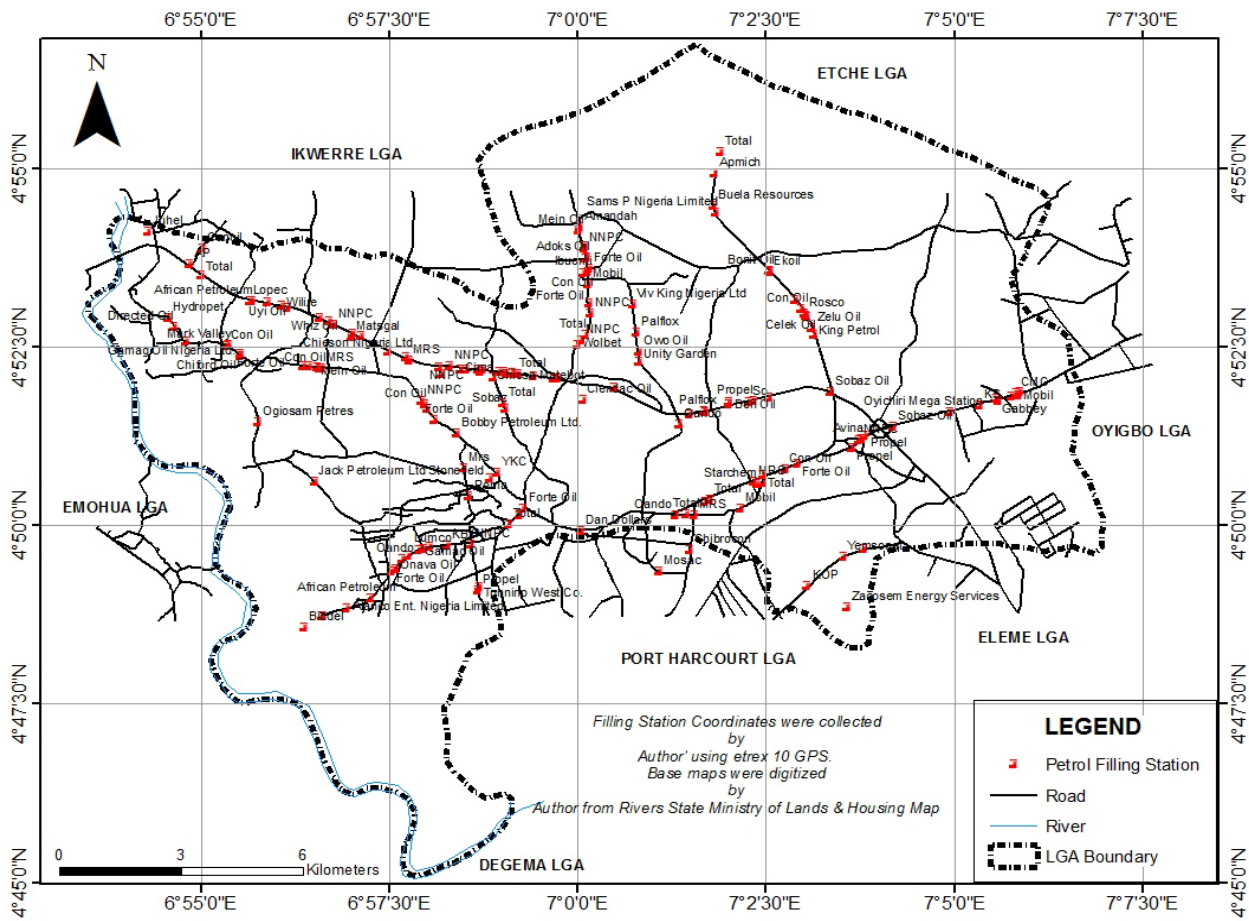


Figure 3 Spatial Distributions of Petrol Filling Stations in Obio Akpor LGA
Source: Authors' Field Analysis

The Z ratio analytical tools was used to determine the level of conformity of petrol filling stations to the required distance from each other as stipulated by DPR guidelines for approval to construct and operate petroleum products filling station amendment decree no. 37 of 1977.

Table 2 Measured Distances of Petrol Filling Station from another using their Coordinates in ArcGIS

9.3

S/N	Petrol Filling Station Distances from another (m)		Petrol Filling Station Distances another (m)
1	61.83	80	57.85
2	61.83	81	41.88
3	149.03	82	1741.48
4	151.51	83	2089.44
5	111.47	84	136.86
6	202.14	85	136.86
7	441.73	86	70.91
8	121.59	87	55.28
9	207.05	88	127.55
10	205.78	89	325
11	158.34	90	577.58
12	158.34	91	84.81
13	77.42	92	139.71
14	220.68	93	180.98
15	157.5	94	180.98
16	157.5	95	122.9
17	62.43	96	634.01
18	827.86	97	634.01
19	354.57	98	521.83
20	61.88	99	521.83
21	123.88	100	122.9
22	123.88	101	123.35
23	392.32	102	123.35
24	160.77	10	446.78
25	57.43	104	84.81
26	57.43	105	680.47
27	62.11	106	675.55
28	173.19	107	214.08
29	535.25	108	184.02
30	535.25	109	342.53
31	44.03	110	184.02
32	44.03	111	1508.56
33	287.48	112	214.08
34	137.59	113	662.35
35	160.77	114	119.51
36	1402.03	115	119.51
37	69.39	116	41.88
38	69.39	117	57.85
39	61.88	118	483.07
40	716.41	119	281.76
41	276.15	120	153.51

42	500.34	121	153.51
43	281.54	122	112.21
44	827.86	123	317.44
45	258.37	124	317.44
46	326.95	125	268.74
47	91.18	126	723.03
48	61.28	127	766.92
49	45.23	128	430
50	45.23	129	82.51
51	113.06	130	139.3
52	96.23	131	63.93
53	96.23	132	63.93
54	61.28	133	78.76
55	113.06	134	82.51
56	258.37	135	115.52
57	172.35	136	83.71
58	147.36	137	83.71
59	147.36	138	119.59
60	90.63	139	264.19
61	90.63	140	756.5
62	483.06	141	206.22
63	87.02	142	206.22
64	69.77	143	366.31
65	69.77	144	112.21
66	62.43	145	551.59
67	131.88	146	551.59
68	123.67	147	1179.61
69	77.42	148	1114.39
70	244.76	149	114.28
71	77.42	150	1313.89
72	244.76	151	430.04
73	121.59	152	545.97
74	111.47	153	173.19
75	145.53		
76	145.53		
77	258.23		
78	343.3		
79	281.76		
		Σx	43602.84

Source: Authors' Field Analysis, 2014

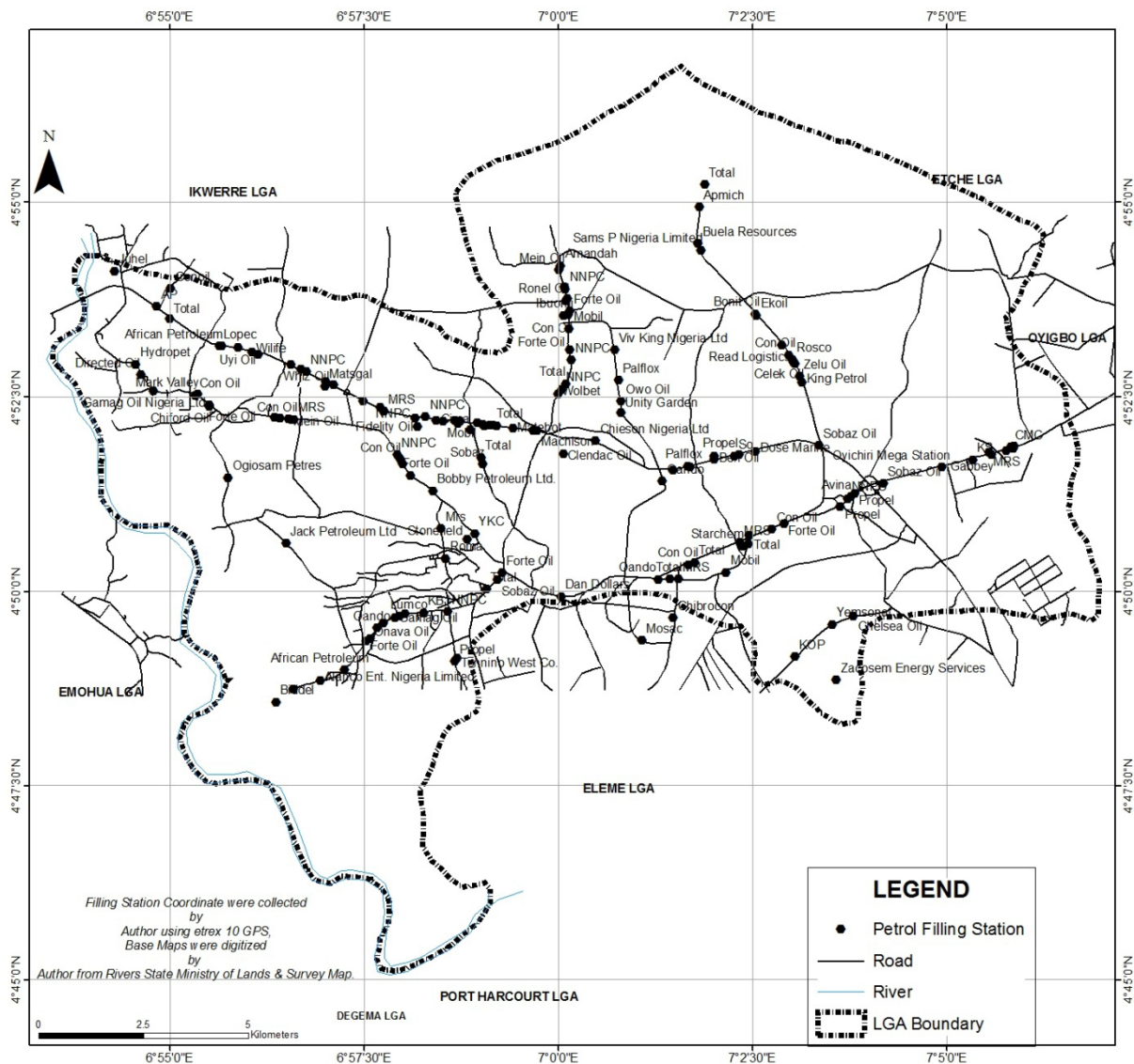
Z Calculated = 0.41

Degree of freedom = N-1= 153-1=152

Z critical = 1.65

Z calculated = 0.41

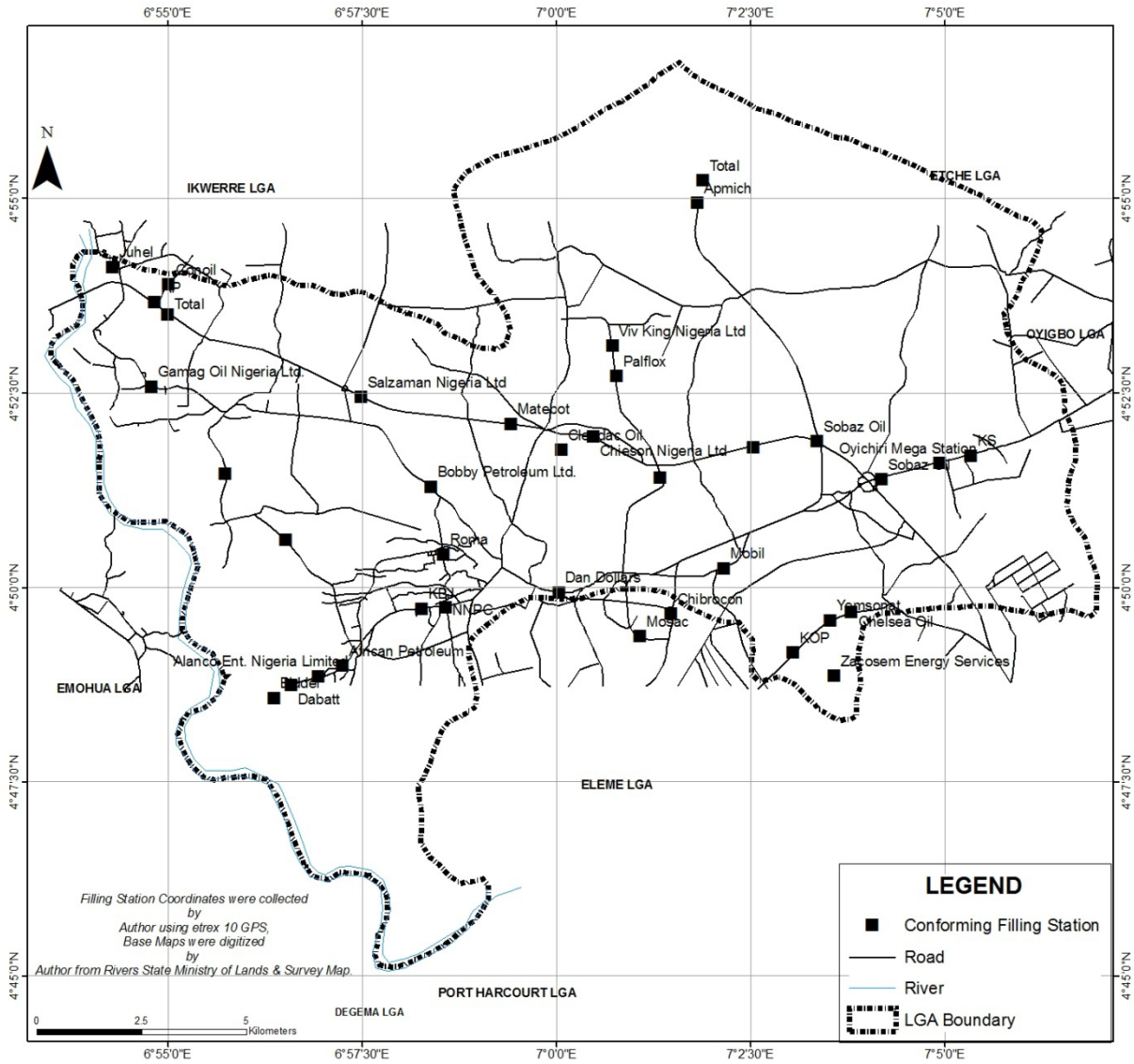
Since z critical is greater than z calculated at 152 degree of freedom at 95% confidence level, hence, the distance among petrol filling stations in Obio Akpor Local Government Area does not conform to the required standard.



Source: Authors' Field Analysis, 2014

Figure 4 Petrol filling stations in Obio Akpor Local Government Area

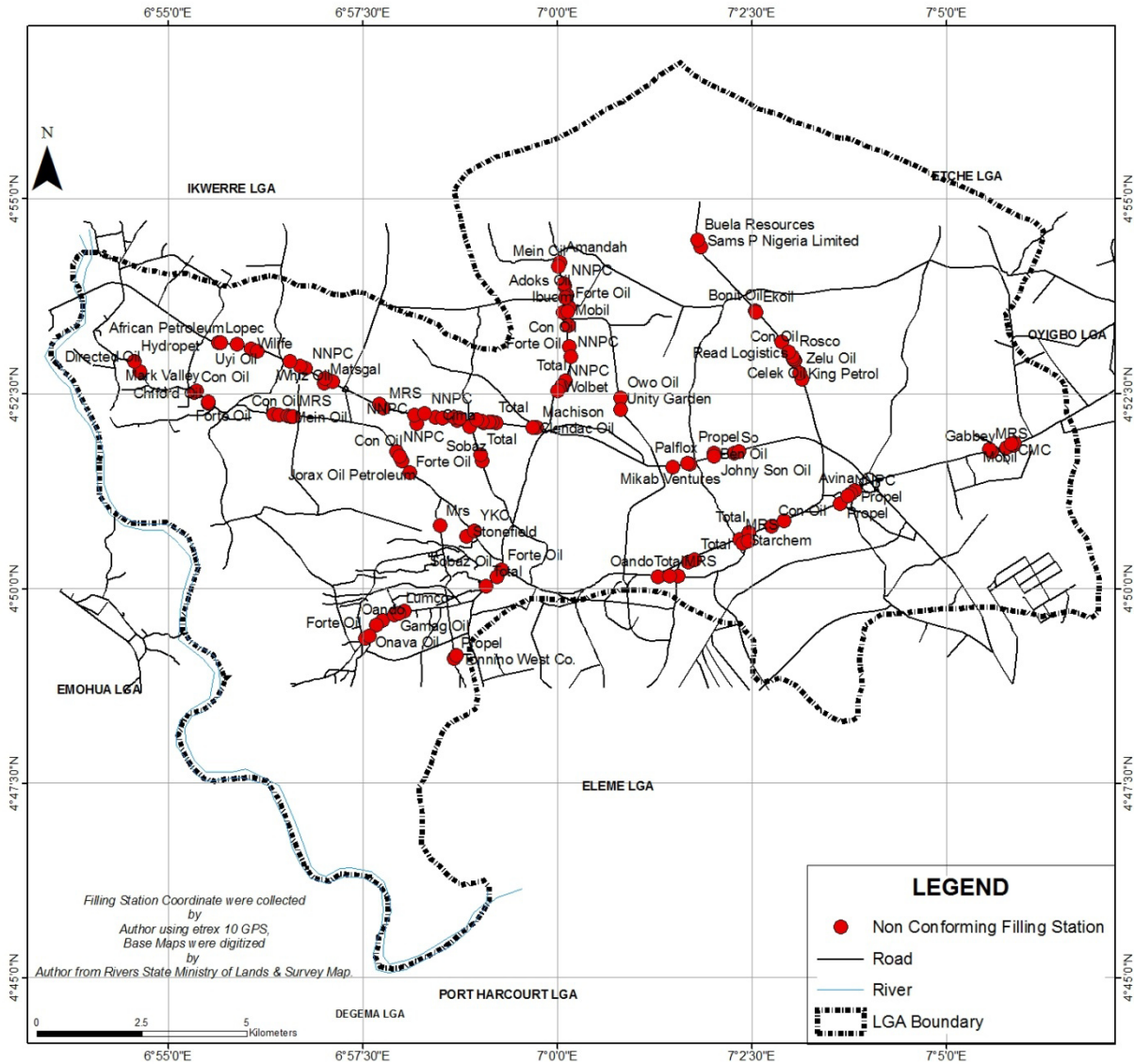
Figure 4 shows the location of Filling Stations in Obio Akpor LGA. The locations so derived aided in classifying the petrol stations as conforming or non-conforming.



Source: Authors' Field Analysis, 2014

Figure 5 Conforming petrol filling stations in Obio Akpor Local Government Area

The figure 5 above shows that only 35 filling stations conform to the DPR guideline of 400m distance from one another.



Source: Authors' Field Analysis, 2014

Figure 6 Non conforming petrol filling stations in Obio Akpor Local Government Area

The figure 6 above shows that 118 filling stations did not conform to the DPR guideline of 400m distance from one another.

The Z ratio analytical tools was used to determine the level of conformity of petrol filling stations to the required distance from the road as stipulated by DPR guidelines for approval to construct and operate petroleum products petrol filling station amendment decree no. 37 of 1977 safety rules and regulations iii stated that: The distance from the edge of the road to the nearest pump will not be less than 15 meters.

Table 3 Measured Distances of Petrol Filling Stations from the Road

X	Actual Distance from Road (m)		Actual Distance from Road (m)
1	9.7	79	8
2	8.94	80	4.85
3	9.03	81	4.21
4	31	82	5.45
5	10	83	16.98
6	9	84	8.89
7	7.05	85	7
8	15.39	86	12.72
9	15.64	87	10.1
10	15.72	88	3
11	20.61	89	18.3
12	18.64	90	8
13	17.96	91	7
14	6.16	92	5
15	15.48	93	6
16	23.3	94	19.1
17	9.54	95	12.2
18	8	96	6
19	17.64	97	12.18
20	22.73	98	4.49
21	12.25	99	8
22	10.03	100	15.9
23	15.92	101	5
24	10	102	15.7
25	5	10	5
26	8	104	7
27	7	105	15.1
28	10	106	5
29	6.85	107	17
30	13	108	6.7
31	8	109	8.7
32	14.74	110	4.2
33	11.9	111	12.4
34	21.92	112	13.8
35	5	113	3
36	3.09	114	2.4
37	16.17	115	2
38	15	116	7.6

39	6.96	117	7.2
40	9.41	118	4
41	15.81	119	3
42	8.71	120	18.7
43	15.1	121	20.3
44	9.82	122	9
45	15.48	123	18.1
46	5	124	21.1
47	8	125	15.8
48	12	126	24.5
49	15.53	127	4.1
50	15.75	128	23.6
51	15.6	129	10
52	15	130	7
53	6.94	131	7.1
54	9.45	132	10.5
55	9.71	133	12.1
56	4.29	134	8
57	19.57	135	8
58	7	136	12
59	2	137	15
60	11.5	138	22
61	15.2	139	18.4
62	8	140	11.2
63	6.7	141	15.8
64	8	142	8
65	7	143	6.9
66	12.13	144	6
67	12.48	145	8.9
68	13.3	146	15.7
69	15	147	6
70	19.1	148	6.6
71	16	149	9
72	17	150	20
73	4.39	151	6
74	15.6	152	28
75	15.3	153	4
76	15		
77	4.57		
78	7.19	Σx	1721.56

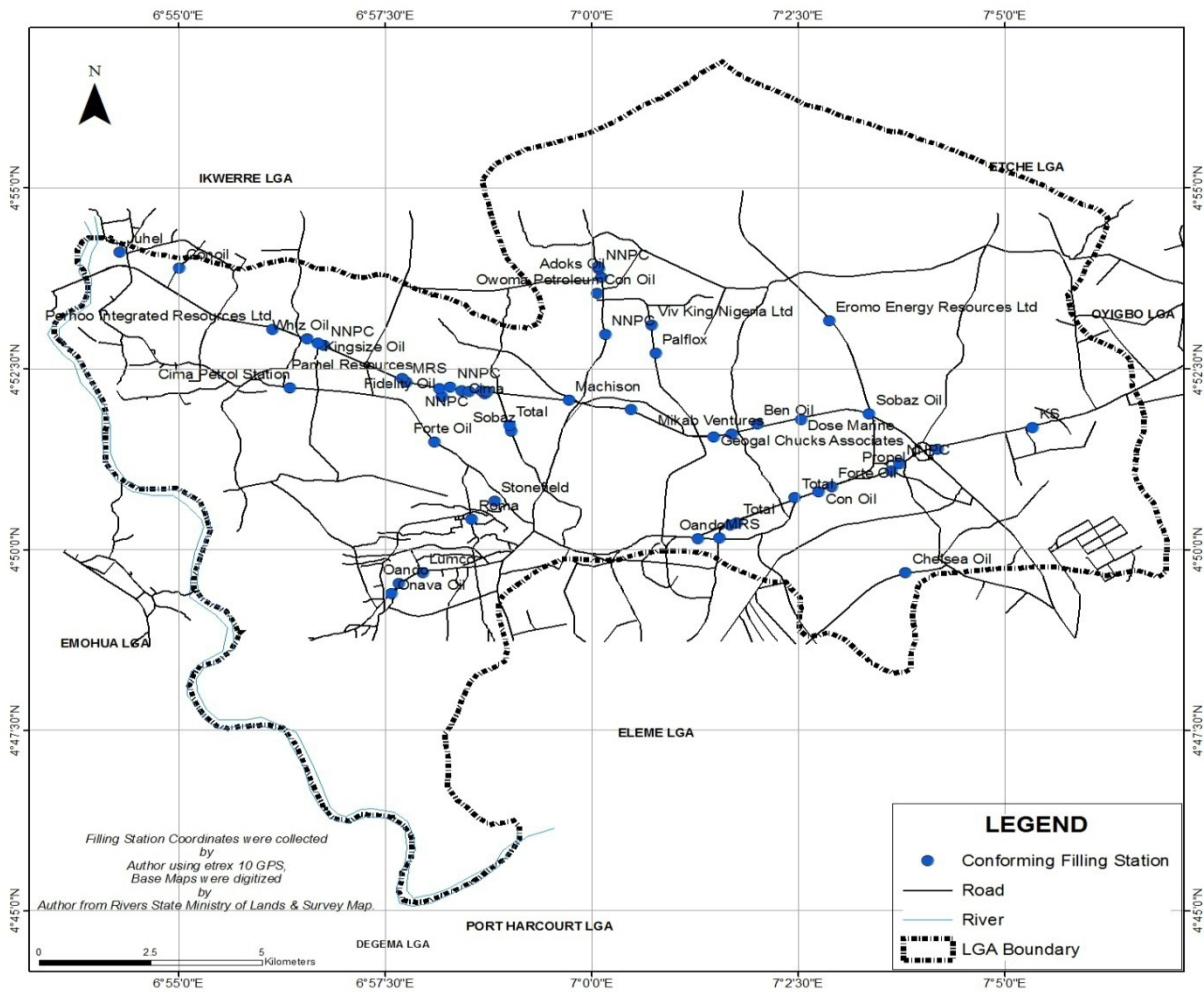
Source: Authors' Field Analysis, 2014

Degree of freedom = $N-1 = 153-1=152$

Z critical = 1.65

Z calculated = 0.33

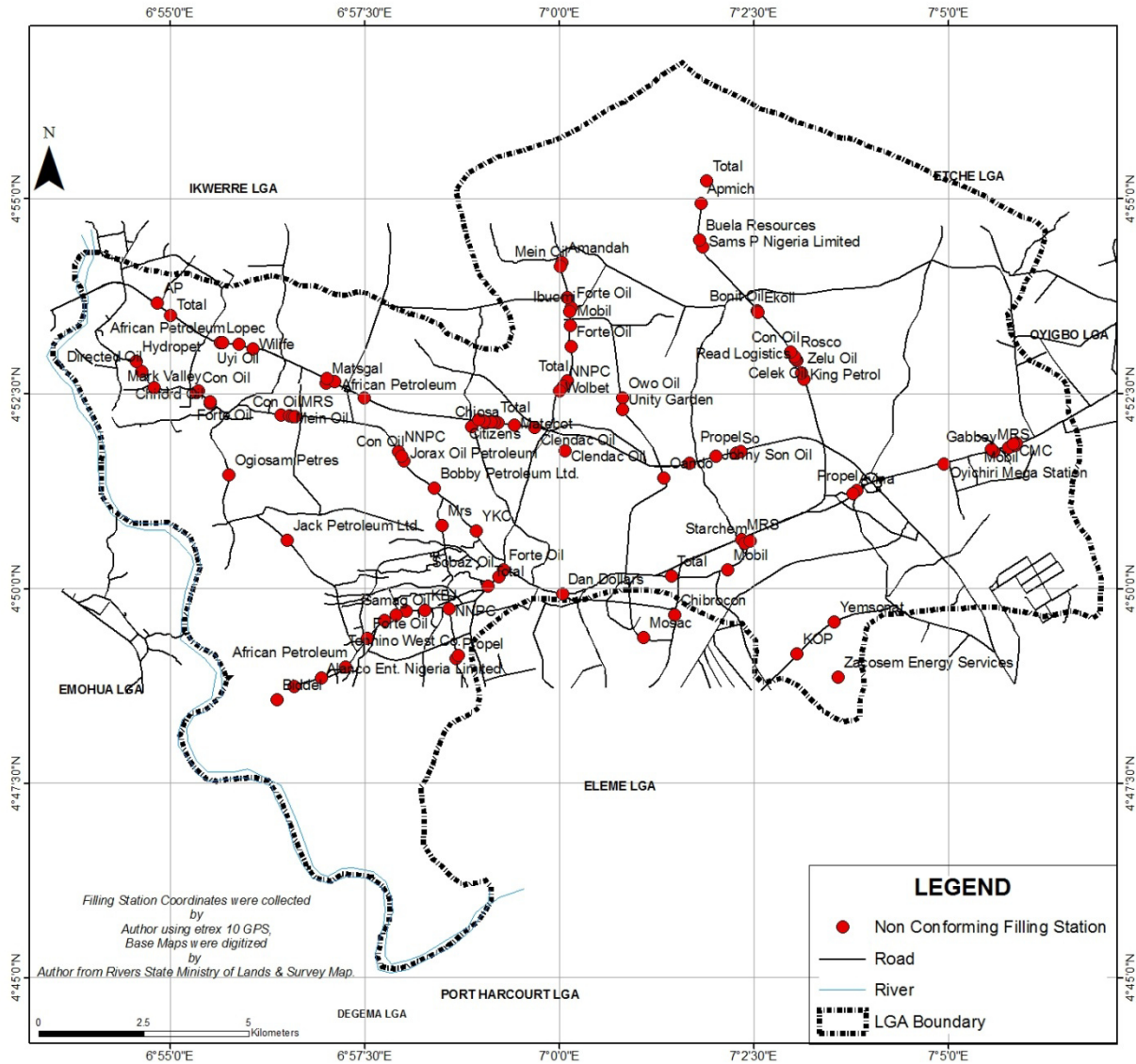
Since z critical is greater than z calculated at 152 degree of freedom, at 95% confidence level, hence the distance from the road among petrol filling stations in Obio Akpor Local Government Area do not conform to the required standard.



Source: Authors' Field Analysis, 2014

Figure 7 Conforming petrol filling stations in Obio Akpor Local Government Area to distance from the road

The above shows the conforming petrol filling stations in the area to required distance from the road.



Source: Authors' Field Analysis, 2014

Figure 8 Non conforming petrol filling stations in Obio Akpor Local Government Area to distance from the road

The above shows the non conforming oil petrol filling stations in Obio Akpor LGA in relation to required distance from the road by regulation.

Conclusion

The analysis of the spatial distribution of filling stations in the study area reveals that conformity to 400m required distance from one another was met by only 35(23%) out of the 153 petrol filling stations in the region, while the remaining 118(77%) did not conform. Also, the analysis of petrol filling stations' conformity to the required 15m distance from the road shows that only 50(33%) petrol filling stations conformed while 103(67%) petrol filling stations did not.

Recommendations

This study therefore make the following recommendations to ensure public safety in the light of the findings: improved public participation in environmental monitoring and auditing of hazardous public facilities; improved project screening techniques and tools to reduce risks; improved enforcement of all applicable legislations and procedure for locating petrol filling stations.

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