

## **EFFECT OF URBAN RUNOFF AND HUMAN ACTIVITIES ON SOME PHYSICOCHEMICAL PARAMETERS OF RIVER LANDZUN, BIDA, NIGER STATE, NIGERIA**

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### **Abstract**

Urban runoff and human activities have become a major source of surface water pollution in most developing nations. Urban runoff is the flow of water that occurs within an urban area when excess storm water, meltwater, or water from civil construction failure over the earth's surface. River Landzun one of the most prominent river in Bida located within latitude 9° and 9° North of the equator and longitude. 5° 56' and 04° east of Greenwich meridian. This study assessed the effects of urban runoff and human activities on some physicochemical parameters of river landzun in Bida Niger State, Nigeria. The result of physicochemical parameters indicated the variations which was observed from points to points. These variations were attributed to runoff and human activities. Water samples were collected from 3 randomly selected points and analyzed following standard protocol. Data was collected through the use of structured questionnaires, interview, observations, reconnaissance survey and laboratory analysis which was analyzed using frequencies and percentage. The study revealed that 96% of the respondents indicated that river Landzun possess a lot of potential socioeconomic impacts. Pollution source of river Landzun was non-point-source which resulted into many water related diseases when consumed such as diarrhea, dysentery, cholera and typhoid. Water pollution can be difficult to determine because it is not always visible, so scientist use a variety of techniques and tests to measure water quality and the level of contaminants. Therefore, there is need for environmental education, public awareness and credible law enforcement agencies saddle with responsibilities to check and control environmental degradation and pollutions.

**Keywords:** *Effect, Urban runoff, Human Activities, Physiochemical, parameters, rive Landzum, Niger State.*

### **INTRODUCTION**

Water quality refers to the chemical, physical, biological, and radiological characteristics of water (Okerenta et al, 2016). It is a measure of the conditions of water relative to the requirement of one or more biotic species, and or to any human need or purpose. It is most frequently used by reference to a set of standards against which compliance can be assessed. The most common standards used to access water quality relate to health of ecosystems, safety of human contact and consumption (USEPA, 2005).

Water is an indispensable natural resource on earth. All life including human being depends on water. Due to its unique properties water is of multiple uses for living organism (Majumder and Dutt, 2014, Singh, 2014). Thus, water is a natural resource with limited and uneven distribution in time and space. All forms of life and all human activities are dependent on water (El-morhit, and Mouhir, 2014). Water resources are of great importance to human life and economy and are the main source of meeting the demand for drinking water, for irrigation of lands and industries (Kepuska, 2013). Lack of water is considered as a limiting factor of socio-economic development of a country (N'Diaye et al, 2013).

Water is an essential requirement of human and industrial developments and it is one the most delicate part of the environment (Das and Acharya, 2003). Water resource frequently gets contaminated by anthropogenic activities and to lesser extent through natural effects. Some notable human activities leading to pollution of water resources especially surface water include wastes disposal (municipal, solid and effluents) from several domestic and industrial area, human activities in the water such as dredging oil, and gas activities (Elede, et al, 2017). Kumar (2011), reported that the pollution of a river could result to the spread of diseases like cholera, typhoid fever and diarrhea. Studies have shown that the consumption of highly contaminated water can cause injury to the human body. Toxins within water can harm or even kill aquatic and other animal that may have accidentally or ignorantly feed on the infected organisms. The accumulation of wastes like urea, animal manure and vegetable peelings in water may lead to the growth of algae and other aquatic plants, the consequences is increase rate of microbial activities. This situation may result in depletion of dissolved oxygen causing the death of aquatic animals (Utsev and Aho, 2012).

Water is the most essential resource to both man and other living organisms. And as such the importance of water cannot be over- emphasized. Historically, it has been an important factor in determining the settlements of people. Water is available in large quantity as can be seen in oceans, sea, rivers, springs, lakes, ponds. However, lack of quality precludes their uses for many purposes as a result of pollution. It is known as a universal solvent because it easily dissolves most solvent to form a solution. The unique property enables it to be used, in a wide range of important activities (Utsev and Aho, 2012).

Water is the most valuable natural resource available to man, without which no life can survive. Therefore, adequate and safe water supply is a pre-requisite for significant socio-economic development of any community (Algaon-odot, 2012). Water bodies' pollution is the introduction of contaminants into water bodies. Water pollutants are directly or indirectly discharged into water bodies without adequate treatment to remove harmful substances (Okerenta, Obia and Wegwu, 2016). Water pollution affects plants and animals living in these water bodies, and also, affects other aquatic biota. Globally, the most prevalent water quality problem is eutrophication -the introduction of nutrients (mainly phosphates and nitrates) into water bodies. Eutrophication substantially impairs beneficial uses of water (UNDESA, 2005). Water quality refers to the chemical, physical, biological, and radiological characteristics of water (Okerenta et al, 2016). It is a measure of the conditions of water relative to the requirement of one or more biotic species, and or to any human need or purpose. It is most frequently used by reference to a set of standards against which compliance can be assessed. The most common standards used to access water quality relate to health of ecosystems, safety of human contact and consumption (USEPA, 2005).

Agriculture, which accounts for 70 percent of water abstractions or withdrawals worldwide, plays a major role in water pollution. Farms discharge large quantities if agrochemicals, organic matter, drug residues, sediments and saline drainage into water bodies. The resultant water pollution possessed demonstrated risks to aquatic ecosystems, human health and productive activities (UNEP, 2016).

All over the world, fresh water resources have been subjected to an increasing pollution load from contaminated runoff water originated from manmade activities like domestic and industrial (Banetti and Garrido, 2010). The adverse effects of human impacts on the aquatics include water – borne diseases, alteration of aquatic biota composition, eutrophication and reduction or destruction of ecosystem integrity (Mustapha, 2008).

Human settlements, industries and agriculture are the major sources of water pollution. Globally, 80 percent of municipal wastewater is discharged into water bodies untreated, and

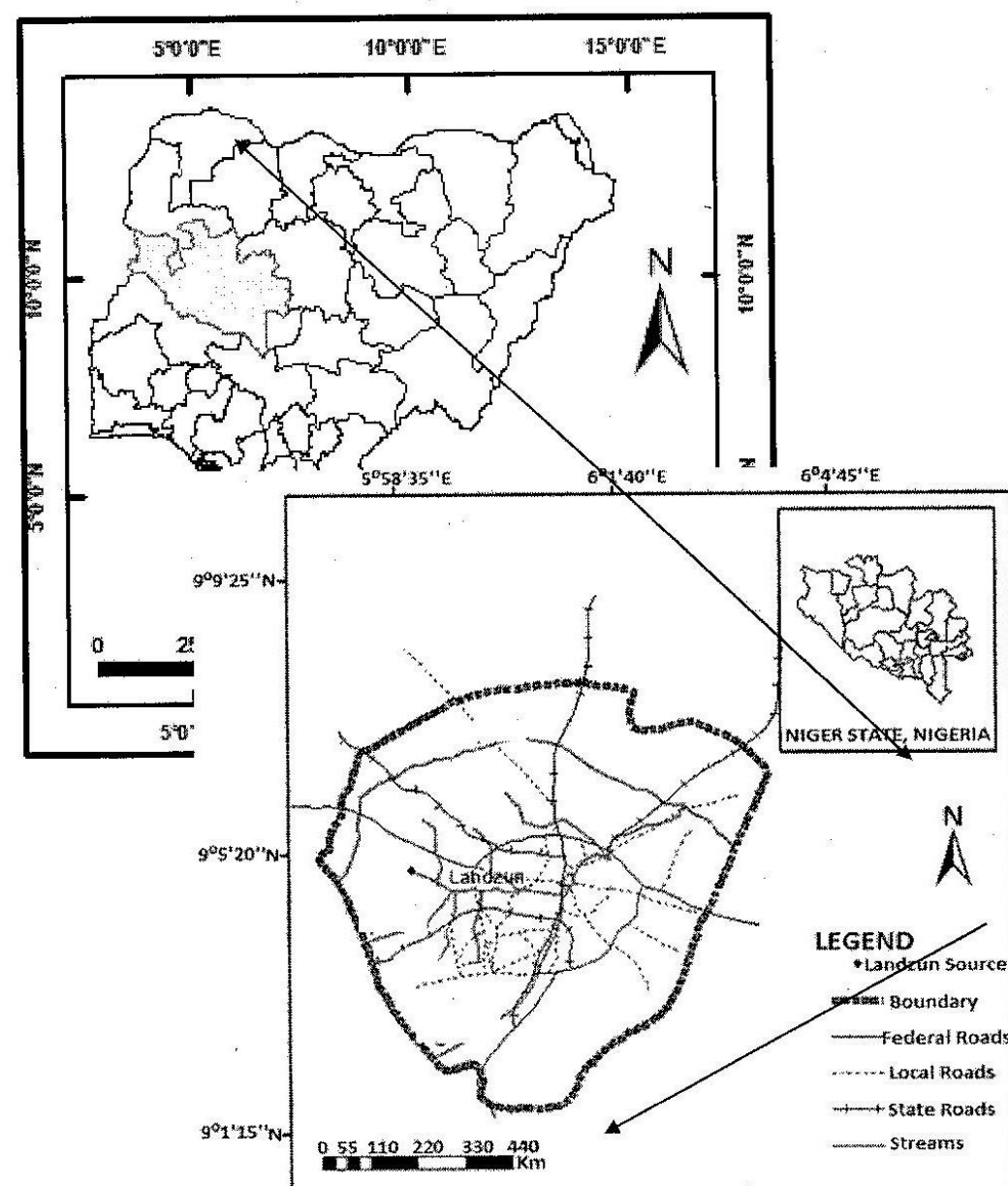
industry is responsible for dumping millions of tons of heavy metals, solvents, toxic sludge and other wastes into water bodies each year (WWAP, 2017)

## Material and Methods

### Study Area

The study was conducted in Bida, Niger State, north central Nigeria (Latitude  $9^{\circ}4'60''$  North of the equator and longitude  $6^{\circ}1.0''$  east of the Greenwich meridian) Bida located at elevation 151 meters above sea levels and has projected population of 283,400 (NPC, 2019). (Figure 1) depict the map of Landzun River, Bida, Niger State Nigeria. The Landzun river stream is 8.86km long, and about 5km lies within the city of Bida, with an overall west to east flow pattern and estimated the flow rate of 22.21m<sup>3</sup>s between 2010 and 2018 (Daramola *et al* 2019).

Three locations were chosen; such as Dokodza, Tako Landzun as Wangi areas respectively.



## Map of Landzun River Bida, Niger State Nigeria

### Methodology

**Sample Collection:** water samples were collected in three different sampling locations along the river Landzun using one litre of container for each sample, the sample containers were tightly covered and were immediately sent to the laboratory for analysis. The sample locations were Tako Landzun, Wanigi and Dokodza.

### Data Collection:

Three hundred and ninety nine questionnaires were administered to the communities along river landzun and to eleven health facilities structural interviews was also conducted observations and also reconnaissance survey was carried out to collect data which was used to assess and examine the socioeconomic impact, pollution source and health implications of consuming contaminated water from river landzun.

### Analysis of Water Samples:

Standard analytical procedures were used in the determination of selected physicochemical parameters, the result of water samples after triplicate determination in the three sampling locations of river landzun are presented in Table 3.

### Result and Discussion

Socioeconomic impact of river landzun however, river landzun generates a large socioeconomic impacts which was assessed in both negative and positive ways, these impacts enhanced employment opportunities, improvement in economic development, growth of individual and community, some of the positive impacts as it was discovered from retrieved questionnaire and interview were numerous such as domestic uses, recreational, sand extraction, irrigation, education, local industrial uses, fishing, cultural and spiritual uses, and powerful vehicle for poverty alleviation (agriculture) which absorbed many people who could not have access to white collar job and that enhanced improvement in the standard of living.

While, some negative impacts of Landzun river at it was felt by the residents were loss of properties, loss of lives, displacement and replacement of people, soil erosion, loss of economic trees such as palm tree around Bangaie, Laruta, and some other places within Bida metropolis, migration which affected most of the people using the mentioned economic trees. The Table 1 and 2 represents both positive and negative impacts of river landzun as it was revealed by this study.

**Table 1 Respondents Rating of Human Activities Supported by River Landzun**

S/No	Respondents Opinion	Frequency	Percentage
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1	Farming	222	65
2	Industries	82	24.1
3	Domestic	30	8.8
4	Fishing	6	2.1
	<b>Total</b>	<b>340</b>	<b>100</b>

Table 2. The nature of environmental problem occurred as result of heavy rainfall

S/No	Respondents Opinion	Frequency	Percentage
1	Loss of properties	134	39.4
2	Displacement of people	96	29.7
3	Loss of lives	09	2.6
4	Loss of live and properties	101	28.2
	<b>Total</b>	<b>340</b>	<b>100</b>

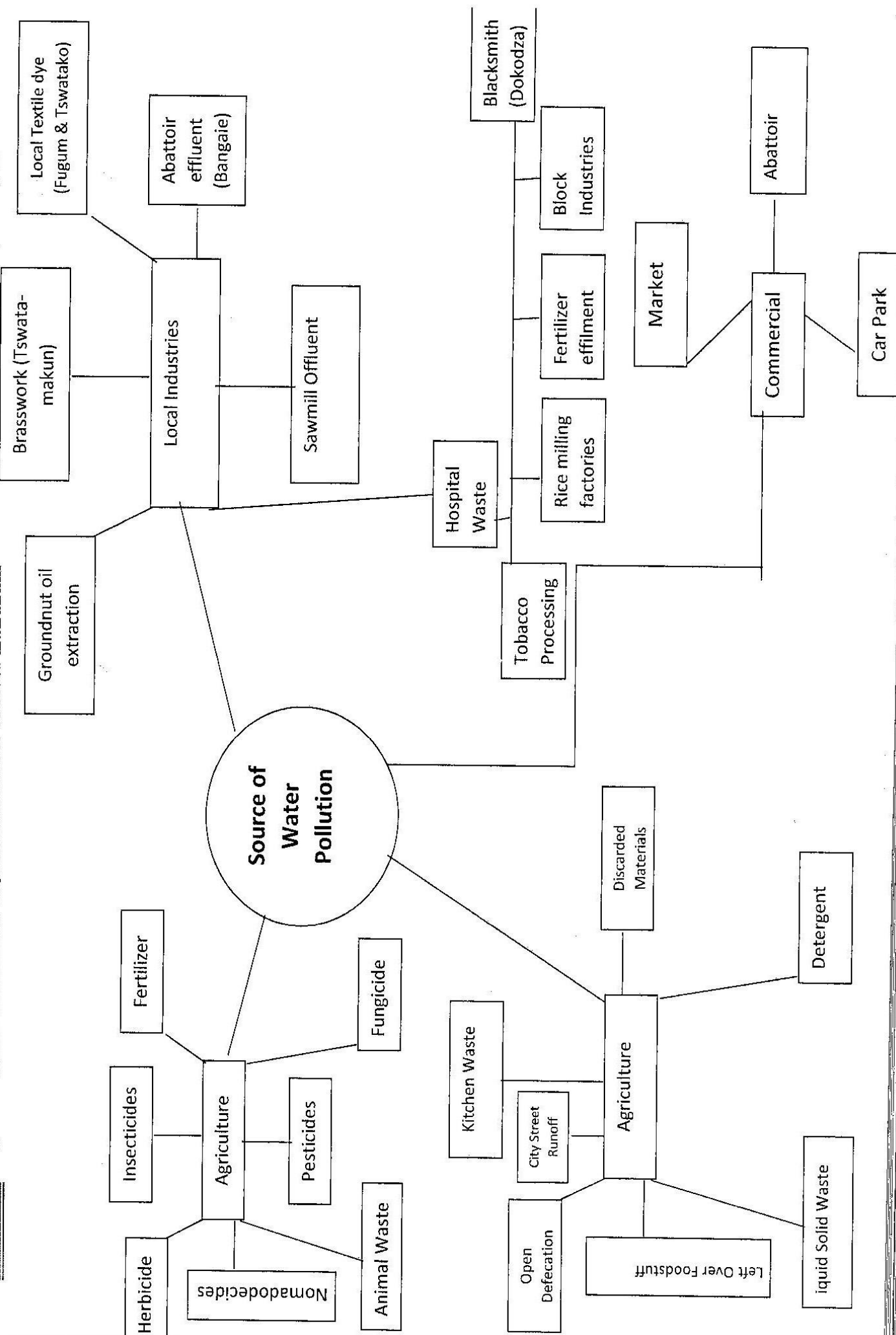
#### Pollution sources of river Landzun

Contamination of water bodies usually caused due to human activities and natural processes or forces. Water pollution is any change in the physical, chemical or biological properties of water that will have a detrimental consequence of any living organism. Some of the water pollution that is caused by direct sources, such as factories, waste management facilities, refineries etc. that directly release waste and harmful bye-products into the nearest water source without treating them. Indirect sources include pollutants that enter the water bodies via groundwater or soil or via the atmosphere as acid rain.

Water pollution can be grouped into surface water pollution, marine pollution and nutrient pollution are subsets of water pollution. Source of water pollution one either point sources and non-point source. Point source have one identifiable cause of the pollution. The pollution source of river landzun was non-point source which was seen as diffuse contamination that does originate from a single discrete source which include agricultural runoff, industrial waste effluent, discharges from residential and commercials areas as represented in the figure 2 below.

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Figure 2 typical illustration of pollution source of river Landzun



### Physicochemical Parameters of river Landzun

The values of different physiochemical parameters recorded from the three sampling points from the river Landzun are summarized in table 3.

**Table 3. Physicochemical Parameters of river Landzun**

PARAMETERS	PH	TP (°C)	TB (NTU)	EC (µs/cm)	TH (MG/L)	TDS (MG/L)	TSS (MG/L)	TS (MG/L)	DO (MG/L)	BOD (MG/L)
Sampling Points										
TKL	8.72±0.01 <sup>a</sup>	11.07±0.01 <sup>a</sup>	4.91±0.01 <sup>a</sup>	80.01±0.01 <sup>a</sup>	270.01±0.02 <sup>c</sup>	53.61±0.01 <sup>a</sup>	30.42±0.01 <sup>a</sup>	84.02±0.01 <sup>a</sup>	3.81±0.01 <sup>a</sup>	1.70±0.01 <sup>b</sup>
WNG	8.88±0.01 <sup>c</sup>	14.02±0.01 <sup>b</sup>	4.97±0.01 <sup>b</sup>	110.02±0.01 <sup>b</sup>	140.02±0.01 <sup>b</sup>	73.71±0.01 <sup>c</sup>	34.87±0.01 <sup>c</sup>	108.51±0.01 <sup>c</sup>	3.67±0.01 <sup>a</sup>	1.87±0.01 <sup>c</sup>
DKZ	8.46±0.01 <sup>a</sup>	15.02±0.01 <sup>c</sup>	3.24±0.01 <sup>a</sup>	40.02±0.01 <sup>a</sup>	100.02±0.01 <sup>a</sup>	26.81±0.01 <sup>a</sup>	20.81±0.01 <sup>a</sup>	47.61±0.01 <sup>a</sup>	3.92±0.01 <sup>c</sup>	1.32±0.01 <sup>a</sup>
NIS Standard	6.5- 8.5	AMBIENT	5.00	1000	150	500			5.0	10

Results represent mean ± standard error of mean in triplicate determination. Values with the same superscript in the same column are not significantly different at p<0.05. River is a vital resource that is necessary for the sustenance of life and ecological health. The variation in water quality in a given environment is often influenced by geological formations and anthropogenic activities (Badmus et al, 2014). The results indicate that the quality of river water for the study area varies from location to location. Which accounted for the variations in values obtained from the three sampling points.

However, 283 (83.2%) constituted the majority of respondents from collective (11) health facilities comprising the public and the privates indicated that the most prevalent water related diseases often reported to their facilities was due to consumption of contaminated water was diarrhea, while, from the respondents 39(11.5%), 12(3.5%) dysentery and 6(1.8%) cholera respectively, these represent the opinions of people mostly health personnel. It was widely recognized that infectious diarrhea is a major world leading cause of morbidity and mortality especially children in developing countries (Nwaoha et al, 2016). This was also in line with the work of Omelonye (2015) conducted in Nsukka which revealed that diarrhea is one of the top causes of childhood mortality in sub-Saharan Africa. Also related to a work of Praveen (2016) opined that adverse alteration of water quality presently produces large scale illness and deaths of humans and aquatic life.

**Table 4. Prevalent Water Related Disease (WRD) in the study area.**

S/No	Rating	Frequency	Percentage
1	Diarrhea	283	83.2
2	Typhoid	39	11.5
3	Dysentery	12	3.5
4	Cholera	6	1.8

Total	340	100
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### Conclusion

Water quality information is used to protect human health, and restore healthy ecological conditions and to sustain a viable economy.

- Landzun generates a large socioeconomic impact either through runoff to the immediate environment such as displacement, resettlement, migration, loss of ecosystem, education and other impacts which could either be positive or negative.
- Agricultural runoff, urban runoff, urban industrial waste, waste discharge from commercial centres, domestic waste, plant and animal waste were major contributing sources of pollution of river Landzun.
- Water quality parameters can vary in values significantly due to the variations in environmental condition and geological settings (Igusi; 2010).
- The variations observed were probably due to various factors referred to as non-point source.
- The findings show that the poor water quality is responsible for most of the human health concerns which lead to waterborne diseases such as diarrhea, dysentery, typhoid and other diseases which also destroy aquatic organisms (Iduwo, 2015).

### Recommendations

The observation based on the findings from available data of this research, the following recommendations are made:

- Right-sizing applications of fertilizer using techniques like biodynamic farming, setting ponds can help keep polluted runoff from entering the river.
- Waste minimization techniques.
- Proper urban planning and implementations should be seriously considered to avoid urban flooding.
- Public enlightenment campaign should be intensified to educate the people on the dangers inherent in taking water from the river without any form of treatment.
- Provision of pollution prevention and control bills at relevant quarters and enhanced monitoring.
- The Federal Government should enact water pollution control programmes which should be directed towards greatest effort towards municipal waste treatment.

- Regular water assessment should be carried out as a routine and the treatment method modified accordingly to ensure safe water at the tap.
- Therefore, there is a serious need for environmental education and proper public awareness on management of urban waste disposal.

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