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EFFECT OF WASTE DUMPS ON STREAM WATER QUALITY: A CASE STUDY OF UBEYI STREAM, UNWANA

Onyekachi Samuel Ezeali and Emmanuel Ogbonnia Elechi
Department of Civil Engineering Technology
Akanu Ibiam Federal Polytechnic, Unwana
ezealisamuel26@gmail.com

Abstract

This research is aimed at investigating the effect of Waste Dumps on Stream Water Quality in Unwana, (A Case Study of Ubeyi Stream). Water Samples were collected and analyzed weekly from six (6) sampling points along the stream from September to December 2023. This process accommodated variations in time and frequency of waste dumping and dilution effect of precipitation. Sixteen water quality parameters (Physico-chemical, microbiological and metals) were analyzed, viz: pH, TSS, TDS, DO, BOD, COD, Nitrate, Phosphorus, Potassium, Mercury, Lead, Arsenic, Aluminum, Cadmium, Total Coliform Count and E-Coli. The mean values of the parameters at all stations were as follow: pH = 8.60, TSS = 2.76mg/l, TDS = 2.10mg/l, DO = 6.30mg/l, BOD = 68.40mg/l, COD = 280mg/l, Nitrate = 25.707mg/l Potassium = 1.211PPM, Mercury = 1.699PPM, Lead = 0.159PPM, Arsenic = 0.878PPM, Aluminum = 0.351PPM, Cadmium = 1.139PPM, Total coliform count = 28MPN/100mg/l, E-coli = 56MPN/100mg/l. Statistical packages and t --test were used for analyzing data. From the findings, it was discovered that most physico-chemical concentrations of the stream were within permissible limits of WHO and NSDWQ guidelines for drinking water. But Heavy metals (Hg, Pb, Al, Cd, As) and biological parameters (BOD, COD, Total coliform count and E-coli) were far above the stipulated limits of WHO and NSDWQ standards and were the critical pollutants of Ubeyi Stream. This implies that the discharge of solid waste dumps into Ubeyi stream contributed to large scale biological and Heavy metals pollution of the stream. Thus the water should be treated before use and government should ban indiscriminate disposal of waste within stream environment and provide effective waste management system in Unwana Community.

Keywords: Stream, Waste e-dumps, Water-quality, heavy metals, biological pollutants, water pollution, environmental-impact

Introduction

Water is absolutely essential not only for survival of human beings but also for animals, plants and all other living being. It is necessary that the water required for their needs must be good and it should not contain unwanted impurities or harmful chemical compounds or bacteria in it. Water is used for drinking, cooking, bathing, washing, irrigation, fountains display, navigation etc. But the world is confronted with a global water quality crisis resulting from inadequate waste management. The continuing growth of population and urbanization, rapid industrialization and expanding and intensifying food production are putting pressure on water resources and increasing the unregulated or illegal disposal of waste into water bodies. The natural decomposition of solid waste produced carbon (iv) oxide and methane while improper controls can result in severe climate effects, such as greenhouse gas (GHG) emissions, (Liu et al, 2024) For instance, during the waste treatment, landfills emits the most GHG compared to anaerobic digestion AD) (Liuet al, 2024). Hoang and Fogarassy (2020) highlighted the inadequate waste treatment has given rise to a range of unexpected consequences, including the contamination of rivers, stream, drains, the occurrence of floods and the transmission of infections through the breeding of vectors. This situation poses risks not only to the environment but also to the living organism (Liu and Hung, 2023), as the pollution of air, water and nearby soils is directly linked to improper waste treatment practices (Mor & Ravindra, 2023). Many low and middle – income cities grapple with solid waste accumulation due to inadequate collection and transportation systems (Alam et al 2022).

The self-purification of natural water systems is a complex process that often involves physical, chemical and biological processes working simultaneously. The amount of dissolved oxygen (DO) in water is one of the most commonly used indicators of a stream/river health. However, with the increasing industrialization, urbanization and population growth rates, the hazards of pollution exceed the self-purification capacity of some streams and rivers, thereby polluting them.

Methodology

Sampling Points

Six sampling points at 25m interval from the upstream dumpsite along the stream were chosen for analyses of the stream characterization while ten sampling points from the upstream dumpsite (i.e extension of four sampling points) were chosen for modeling.

Sampling Techniques

For reliable and satisfactory results, several samples were collected and tested for some months. The collections were done on every Monday of every week between 8am and 11am from September to December, 2023 to take care of changes in time, frequency of waste dumps and intensity of leachate movement.

Sampling

With the help of well labeled 500ml transparent sterile sampling bottles, water samples from the stream along the six designated points at 25m interval were collected for analyses. Also, another sets of samples were collected in similar sterile labeled bottles for analyses of modeling parameters in ten stations. These were tightly covered, stored in a cool ice chest and hurriedly transported to home water research laboratory in Abakaliki Ebonyi State, according to the standard method of American Public Health Association (APHA, 1992, 1998 and 2012) for analyses.

Chemical Parameter Analyzed:

pH Determination

pH is a measure of the H+ concentration. It is expressed mathematically as pH=Log(H^+). PH value ranges from acidic (1-6.8) through neutral (6.8-7.8) to basic (7.9-14). Therefore PH determines the acidic or alkalinity (basicity) of water.

Method:

The method used to determine pH value is the electrometrically using glass electrons.

Procedure:

1. A pH meter was warmed for 15-20 minutes. The electrode was removed from the distilled water and wiped dry.
2. The pH meter was standardized using the buffer solution at a temperature of between 20°C to 25C.
3. The pH knob was switched off on the electrode from the second buffer. removed and rinsed thoroughly and then wiped with tissue paper.
4. The electrode was inserted into the sample and the power restored, then the reading of the scale was taken.
5. The electrode was finally rinsed and stored, immersed in distilled water.

DO and BOD Determination

The biological oxygen demand is an empirical test in which standardized laboratory procedures are used to determine the relative oxygen requirement of waste water. The test measure the oxygen required for the bio-chemical degradation or biological degradation of organic materials and the oxygen used to oxidize inorganic materials such as sulfide and ferrous iron while the dissolved oxygen (DO) serves as a means of water control. The level of DO in water determines the microbiological plant and animal contents and also its ability for sustaining the life of fishes and other aquatic organisms.

Procedure: The dissolved oxygen (DO) of the sample was tested for the day the samples were collected. The samples were initially used to rinse the BOD bottles and were filled up by ensuring no air bubbles remained in the bottle. 2ml of alkali diodide-acid reagent was also added. The bottle was capped and shaken, the sample then formed brownish to whitish precipitate which was allowed to settle until it made up 100ml. 2ml sulphuric acid(H_2SO_4) was also added.200ml of the samples were measured into a conical flask and titrated with sodium thiosulphate (0.025N) until a pale yellow color was formed, titration continued until the sample becomes colorless. The volume of the sodium thiosulphate used for the titration was noted. BOD difference between DO, on the first day and DO_5 after 5 days. Therefore BOD=DO1-D05× volume of BOD bottle ml of sample used

Chemical Oxygen Demand (COD) Determination

Procedure: 400mg of sulphuric acid (H_2SO_4) was measured and placed in a reflux flask.20ml of the sample and 20ml of distilled water was added and mixed, the 10ml of standard potassium dicro-mate ($K_2Cr_2O_7$) solution and glass beads are already treated to 600°C for an hour. The flask was then attached to the reflux condenser and 300ml of concentrated H_2SO_4 was added, mixing thoroughly while adding the acid. The mixture was refluxed for an hour, cooled and the condenser was washed with distilled water. The mixture was distilled for about 15 minutes with distilled water and cooled to a room temperature. Three (3) drops of ferri on indicator was added and the mixture was titrated with Fe(NH) to a color change from blue-green to a reddish brown. A blank consisting of 20ml of distilled water was refluxed in the same manner together with the reagent.

Therefore the COD was calculated a COD=(a-b) N×8000ml of sample

Where, N= Normality of titrate

A= ml titrant for blank

B= ml titrant for sample

Total Dissolved Solids (TDS)

Procedure: 250mls of water sample was filtered and then evaporated to dryness in a conical flask using the oven. After the evaporation, the residue in the beaker was then measured to get the total dissolved solids (TDS) in ml/l.

This was done by subtracting the difference in the weight of the flask before and after the oven drying.

Nitrate Determination

Procedure:

A known volume (50ml) of the sample was pipetted into a porcelain dish and evaporated to dryness on a hot water bath. 2ml of phenol disulphuric acid was added to dissolve the residue by constant stirring with a glass rod. Concentrated solution of sodium hydroxide and distilled water was added with stirring to make it alkaline. This was filtered into a Nessler's tube and made up to 50ml with distilled water. The absorbance was read at 410nm using UV-spectrophotometer Apel-Japan, Model No: PD-3000 UV after the development of color.

Nitrate' concentration =Absorbance of sample x concentration of standard Absorbance of standard

Procedure used for Biological Analysis

Total coliform MPN Test and Escherichia Coil (E. Coli) Determination.

The total coliform MPN(Most Probable Number) test is a statistical estimation of the concentration of coliform organisms present in 100ml of the sample. Coliform organisms comprise of the entire aerobic, anaerobic, facultative, gramnegative, non-spore forming rod shaped bacteria which ferment lactose with gas formation within 48hrs at 35°C.

Methods for Calculation of MPN:

The MPN model or Thomas approximate method.

Procedure:

Specified volumes of water sample are added to sterile fermentation tubes or bottles containing lauryl tryptose broth, and stored at 35± 0.5°C in an incubator for 24 hours. Each tube is gently swirled and examined for heavy growth, gas production in a submerged inverted tube within the test vessel, or acid production indicated by formation of a yellow color when bromocresol purple has been added to the medium. If there is no evidence of growth, gas or acid production, the sample are observed again after another 24hours of incubation. A positive presumptive reaction is established if there is gas production or acidic growth in the tubes within 48 hours.

In order to classify the coliform into those of faecal origin and those derived from non-faecal sources, the confirmatory test is performed. All the tubes which show evidence of-gas formation or acid production are regarded as positive tubes. These positive tubes are sub-cultured into an E.coli medium at $44^{O}C$ for 24hours.The E.coli medium is used to encourage the growth of E.coli while the growth of other coliform bacteria is suppressed.

Determination of Metals

Digestion of water sample:

The water samples were thoroughly mixed by shaking. 50ml of the sample was transferred into a glass beaker and 5.0ml of concentrated nitrate acid was added. The beaker with the content was placed on a hot plate and evaporated down to about 20ml. On cooling, the sample was filtered through using whatman no.42 filter paper to remove some insoluble material that could clog the atomizer. The water sample was stored separately in a reagent bottle for elemental analysis using Varian Spectra AA 55B Atomic Absorption Spectrometer air-acetylene and Nitrous oxide flame.

Atomic Absorption Spectrophotometer Technique

AAS is a technique which makes use of absorption spectrometry to assess the concentration of an analytic in sample. It requires standard solutions to establish the relationship between measured absorbance and the analytic concentration, and relies on Beer-Lambert law. It is commonly used for determining the concentration of a particular metal element in a sample. In their element form, metals will absorb ultraviolet light and get excited. Each metal has a characteristic wavelength that will be absorbed. The AAS instrument look for a particular metal of focusing a beam of UV light at a specific wavelength through a flame and into a detector. The sample of interest is aspirated into the flame. If that metal is present in the sample, it will absorb some of the light, thus reduce its intensity. The instrument measures the change in intensity. A computer data system converts the change in intensity into an absorbance.

Results and Discussions

Results

Table 3.1: Mean concentration of physico-chemical, microbial and heavy metals parameters of Ubeyi stream on different points for the period (September to December, 2023).

Parameters	Units	Stream sampling points								
		Station A upstream (control) Ometre	Station B Point of solid waste dump at the bank of the stream	Station C	Station D	Station E	Station F	WHO 2017 standard	NSDWQ 2007	Remark
		0m	25m	50m	75m	100m	125m			
pH		7.90	7.60	8.10	8.30	8.10	8.60	6.5-8.5	6.5-8.5	Expect station F was not ok. Others were within the limit
Total suspended solid (TSS)	Mg/l	0.88	2.38	1.66	1.90	1.46	2.76	500	500	Ok
Total dissolved solid (TDS)	mg/l	0.68	1.60	2.10	0.72	0.94	1.88	500	500	Ok
Dissolved oxygen (DO)	mg/l	6.30	5.50	5.80	3.00	1.00	5.30	Atleast 5	Atleast 5	Station D and E were not okey while others were okey
BOD	Mg/l	16.40	68.40	30.80	20.80	18.80	11.20	0-5	0-5	Not Ok
COD	Mg/l	229.33	210.67	120.00	149.33	168.00	10.00	10.00		Not Ok
Nitrate	Mg/l	22.899	20.456	17.876	23.904	25.707	25.296	50	50	Ok within limit

Potassium (K)	PPM	0.433	0.302	1.044	1.046	1.211	1.056	10		Ok
Phosphorus (P)	mg/l	59.085	47.660	60.501	61.534	71.055	80.413	5		Not Ok
Mercury (Hg)	PPM	0.004	0.203	0.109	0.022	1.699	1.034	0.006	0.001	Not ok except the control station A
Lead (Pb)	PPM	0.077	0.118	0.159	0.037	0.012	0.070	0.01	0.01	Not ok
Arsenic (As)	PPM	0.878	0.453	0.064	0.112	0.402	0.134	0.01	0.01	Not ok
Aluminum(Al)	PPM	0.103	0.204	0.046	0.331	0.348	0.351	0.2	0.2	Not ok except the control station A
Cadmium (Cd)	PPM	0.112	0.002	0.036	0.139	0.124	0.133	0.003	0.003	Not ok except the control station A
Total coliform count	CFU ML	5	10	16	9	13	28	0.2	10	Not Ok
E-coli	CFU 100 ML	10	20	32	18	26	56	0	0	Not ok

Number of samples per station = 17

Discussion

Mean pH levels of all samples ranged from 7.60 to 8.60. The mean pH values of water samples from the upstream (control) station A to downstream station E were within the WHO guideline value of 6.50-8.50 (WHO 2017) and NSDWQ 6.50-8.50 (NSDWQ 2017). However, mean value of station F was above the WHO and NSDWQ guideline values. pH is an important parameter in the evaluation of water quality. Figure 3.1 showed the mean pH values of all the stations.

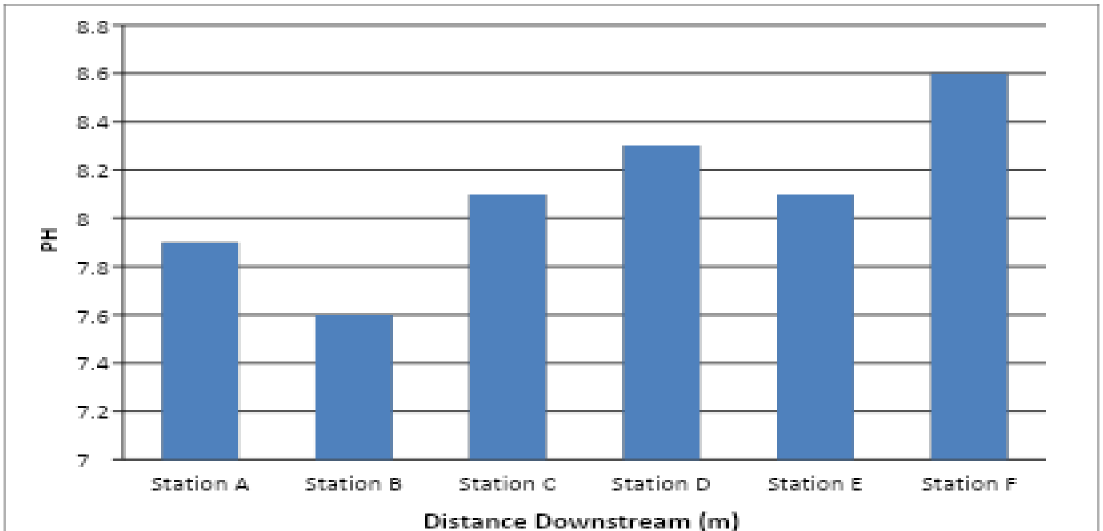


Fig 3.1: PH Values for September to December 2023

Dissolved Oxygen (DO)

Mean Dissolved Oxygen of all the stations for September to December, 2023 ranged from 1.00mg/L to 6.30mg/L. The mean values recorded at all the stations were below WHO guideline for drinking water of 9mg/l-11mg/l. In general, DO levels less than 5mg/L are stressful to most aquatic organisms. Dissolved oxygen (DO) is fundamental to survival of aquatic organisms. Without DO, water bodies become inhospitable to gill-breathing aquatic organisms. The low dissolved oxygen recorded in all the station in November to December could be traced to the low level of water during the dry season with low self-purification of the contaminants. Continuous dumping of waste into the stream will support the growth of aquatic weeds and hence reduced dissolved oxygen of the stream. This is in agreement with Pau (2011) that noted the deflection of dissolved oxygen in a water body could be attributed to dumping of wastes in stream which resulted in increase in plant and algal growth. The mean values of Dissolved Oxygen (DO) were illustrated in figure 3.2.

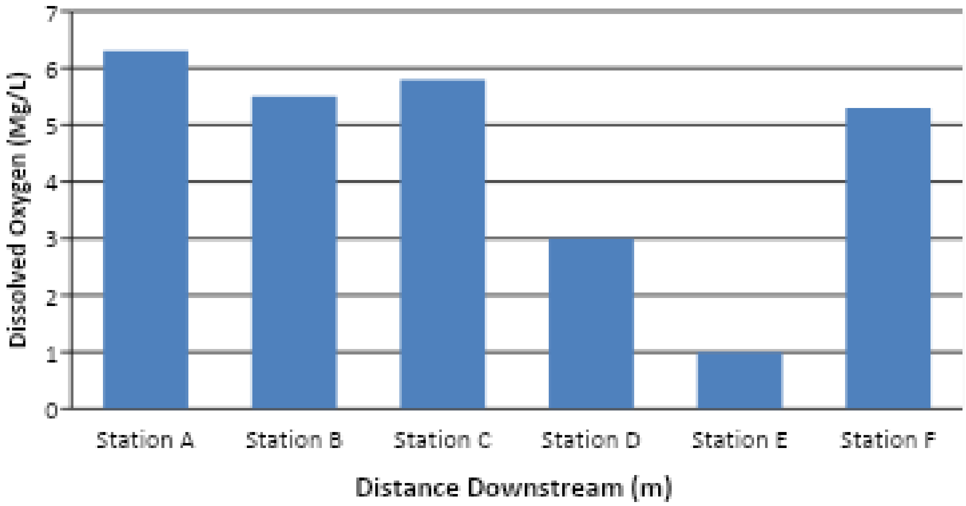


Fig 3.2: Dissolved Oxygen (DO) Values for September to December 2023

Total Dissolved Solid (TDS)

All the sampled water in all the stations recorded low mean total dissolved solid. The mean TDS is shown in table 3.1. The mean TDS ranged from 0.68mg/L to 2.10mg/L and was below WHO guideline value of 250mg/l (WHO, 2017) and NSDWQ value of 500mg/l (NSDWQ, 2007). Figure 3.3 showed the mean values of total dissolved solid for all the stations. Zobaidul et al., (2021) noted that higher level of T.D.S can make water taste bitter or salty or brackish.

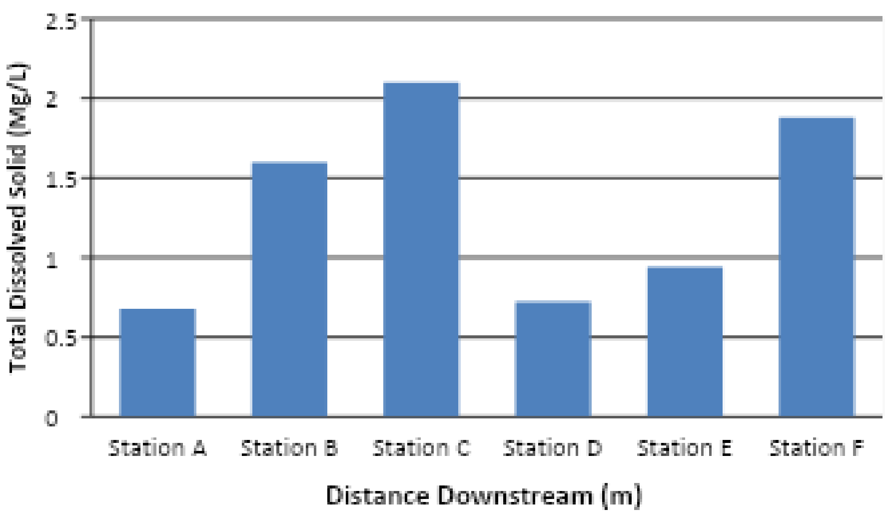


Fig 3.3: Total Dissolved Solid (TDS) Values for September to December 2023

Dissolved Oxygen (DO)

Mean Dissolved Oxygen of all the stations for September to December, 2023 ranged from 1.00mg/L to 6.30mg/L. The mean values recorded at all the stations were below WHO guideline for drinking water of 9mg/l-11mg/l. In general, DO levels less than 5mg/L are stressful to most aquatic organisms. Dissolved oxygen (DO) is fundamental to survival of aquatic organisms. Without DO, water bodies become inhospitable to gill-breathing aquatic organisms. The low dissolved oxygen recorded in all the station in November to December could be traced to the low level of water during the dry season with low self-purification of the contaminants. Continuous dumping of waste into the stream will support the growth of aquatic weeds and hence reduced dissolved oxygen of the stream. This is in agreement with Paul (2011) that noted the deflection of dissolved oxygen in a water body could be attributed to dumping of wastes in stream which resulted in increase in plant and algal growth. The mean values of Dissolved Oxygen (DO) were illustrated in figure 3.4.

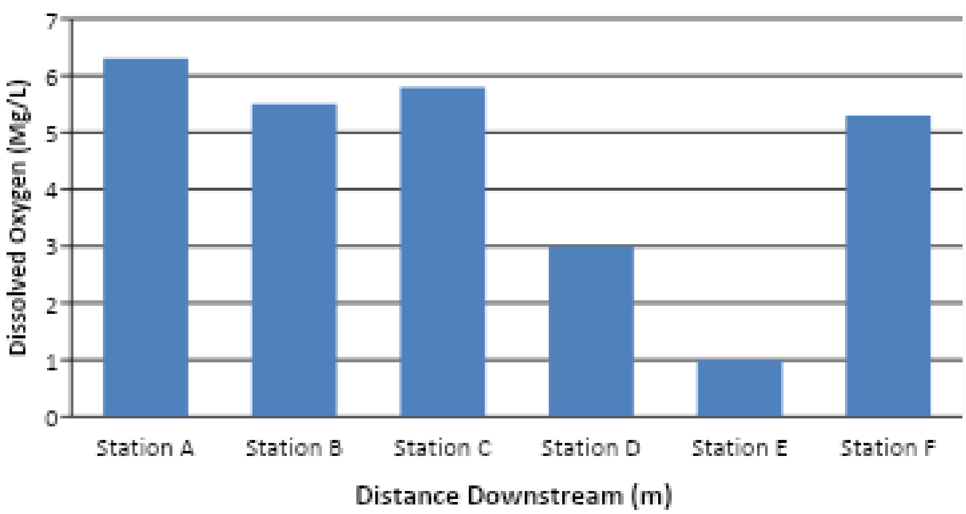


Fig 3.4: Dissolved Oxygen (DO) Values for September to December 2023

Dilution effect on Biochemical Oxygen Demand (BOD)

Biochemical oxygen demand gives an estimate of organic pollution in water High levels of BOD can cause harm to aquatic life especially fish. Low level of BOD in stream systems indicate good water quality, while high levels indicate polluted water. The result of Biochemical oxygen demand measured for all water sampled is presented in table 3.1. The mean BOD of all stations for September to December 2023 ranged from 11.20mg/l to 68.40mg/l. The result revealed that the mean values at all the stations were higher than WHO guideline value of less than 5mg/l for drinking water (WHO, 2017). It was observed that the rice hustle and leachate from the waste dumps impacted negatively on the biochemical and biological quality of Ubeyi stream.

However, the mean values of BOD in wet season (September to October) were lower than that of dry season (November to December). The dry season had higher BOD results. This is justified by the high dilution activity resulted from heavy rainfall of September and October, 2023. The wet season results indicated and confirmed the significant role of precipitation activities on dilution of BOD. Figure 3.5 showed mean values of the Biochemical Oxygen demand of all the stations.

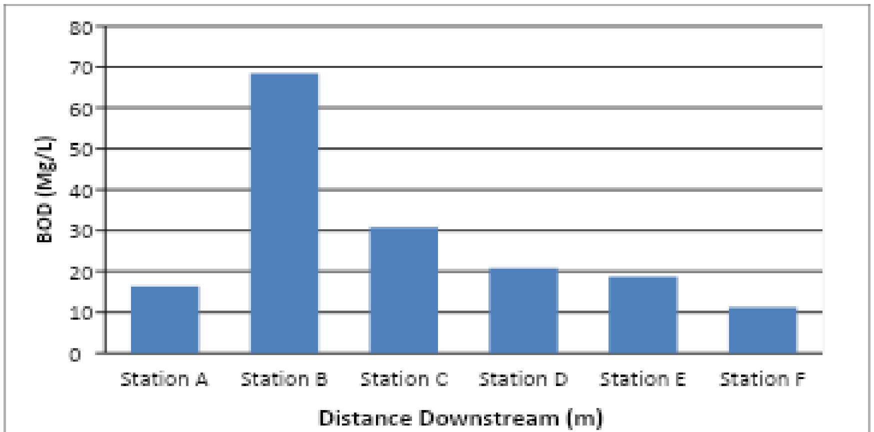


Fig 3.5: BOD Values for September to December 2023

Chemical Oxygen Demand (COD)

Chemical oxygen demand is the amount of oxygen consumed under specific conditions in the oxidation of organic and oxidizable inorganic compounds. COD content could also indicate water pollution which originates from many sources, such as domestic, industrial wastewater, agricultural and animal activities. The mean chemical oxygen demand measured for all water sampled along the stream is presented in table 3.1. The mean COD of all the stations for September to December, 2023, ranged from 120.00mg/l to 280.00mg/l. The result showed that the mean values at all the stations were higher than WHO guideline value of 10,mg/l for drinking water (WHO, 2017). The high COD values of 120.000mg/l 280.00mg/l in the samples recorded revealed that the stream water had high organic load. COD values generally are higher than BOD values because the proportion of the substances which can be oxidized chemical exceeds the biologically oxidized (Bartram & Balancem 1996). Figure 3.6 showed the mean values of Chemical Oxygen Demand (COD) of all the stations.

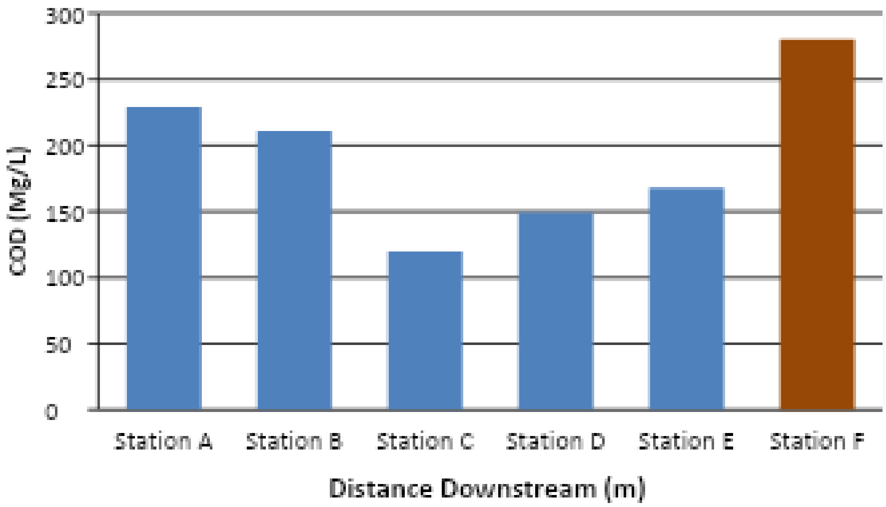


Fig 3.6: COD Values for September to December 2023

Nitrate

High level of nitrate is capable of inducing eutrophication. The mean nitrate of all sampled water is summarized in table 3.1. The mean nitrate of all the stations for September to December 2023 ranged from 17.876mg/l to 25.707mg/l. The result revealed that the mean values of all the station were within the WHO guideline value of 50mg/l (WHO, 2017) and NSDWQ value of 50mg/l (NSDWQ, 2007). This means that there were no abnormal values exceeding the guidelines and the values were satisfactory. This is in agreement with WHO guideline values of 50mg/l as nitrate and 3mg/l as nitrite ion were retained in 2017 convention to protect against methaemoglobinaemia in bottle-fed infants following short-term exposure. The mean values of Nitrate were illustrated in figure 3.7.

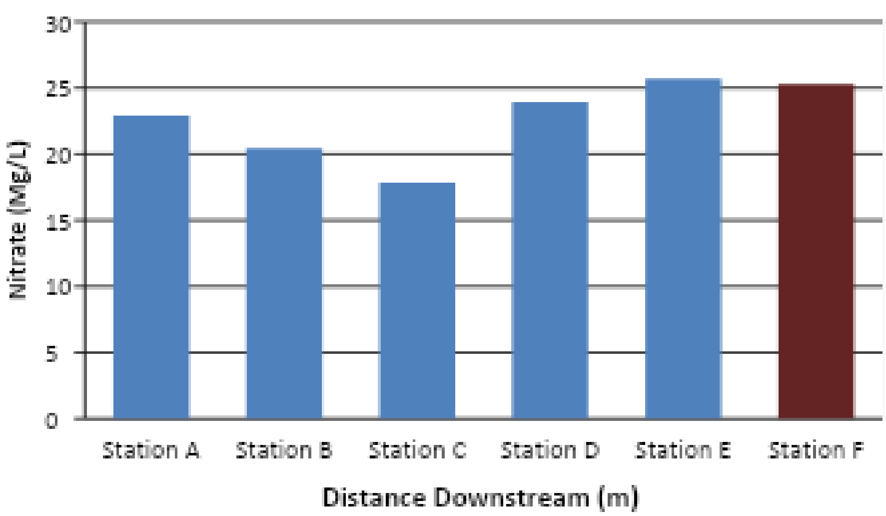
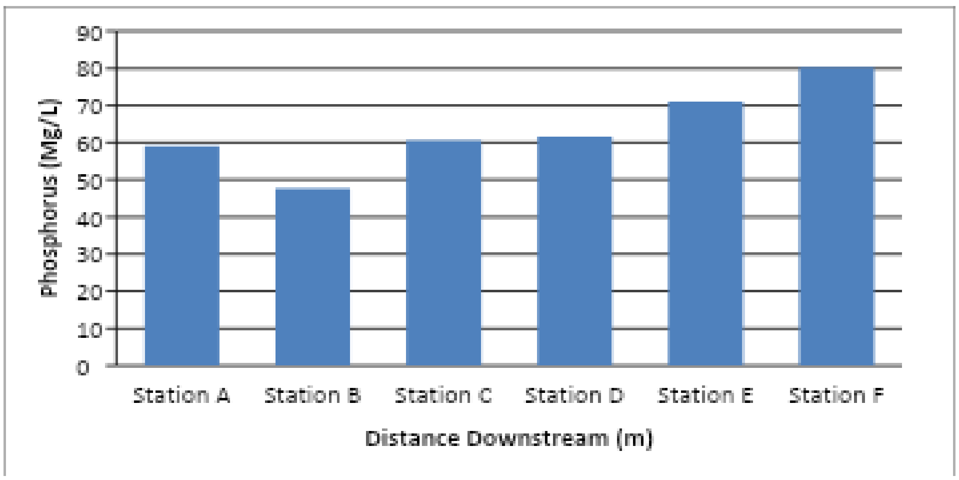


Fig 3.7: Nitrate Values for September to December 2023

Phosphorus

Phosphorus determinations are extremely important in assessing the potential biological productivity of surface waters. Phosphorus determinations are routine in the operation of waste water treatment plants and in stream pollution studies in many areas. The mean concentrations value of phosphorus for September to December, 2023 are shown in table 3.1. The values ranged from 47.660mg/l to 80.413mg/l. Station F downstream recorded the highest mean value of 80.413mg/l. The result shows that the mean values of all the stations were within the WHO guideline value of 250mg/l (WHO, 2017) and NSDWQ value of 100mg/l. Figure 3.8 illustrated the mean values of phosphorus of all the stations.



Metals/Heavy Metals

Potassium

Table 3.1 shows the mean values of potassium at all the stations. The mean values ranged from 0.302PPM to 1.211PPM. Station E recorded the highest mean value of 1.211PM. The result obtained is lower than the stipulated WHO limit of 10PPM. This means that potassium concentration in the stream was satisfactory. Figure 3.9 illustrated the mean values of Potassium.

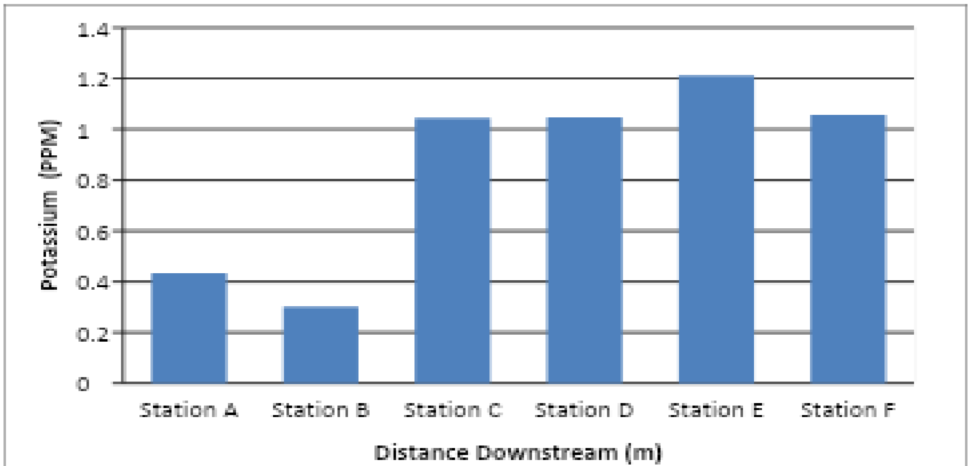


Fig 3.9: Potassium (K) Values for September to December 2023

Mercury

Table 3.1 shows the mean values of Mercury for the period under study. The mean value ranged from 0.004PPM to 0.203PPM. Station B recorded the highest value of 0.203PPM while station A recorded the least value. Station B to station F were higher than WHO limit value of 0.006PPM and NSDWQ value of 0.001PPM. Only station A value of 0.004PM was within WHO guideline for drinking water. This means that the stream at many locations are polluted. Meththyl Mercury, a highly toxic substance that causes neurological damage, produces chromosomal aberrations, and has terotogenic effects, when drinking water contaminated by Mercury. Figure 3.10 showed the mean values of Mercury of Ubeyi Stream.

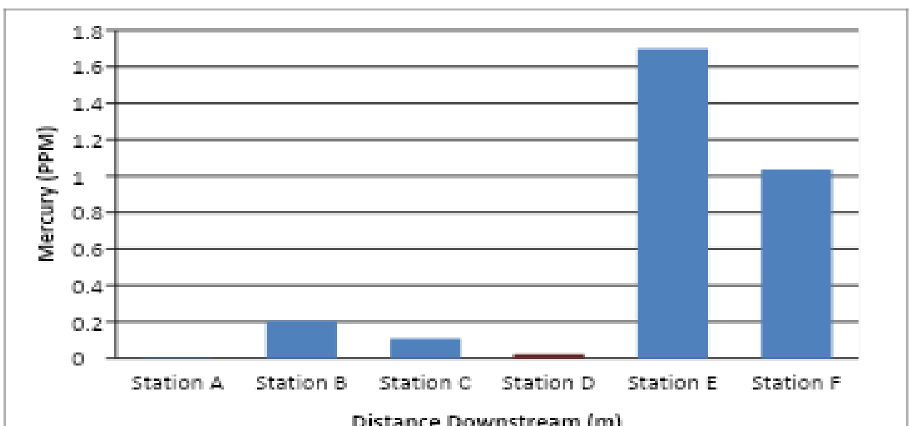


Fig. 3.10: Mercury (Hg) Values for September to December 2023

Lead

The mean recorded values of lead, for the period of September to December, 2023 ranged from 0.070PPM to 0.159PPM. The mean values of lead at all the station are shown in Table 3.1. The values were generally above the limit of 0.01PPM stipulated by WHO and NSDWQ guidelines.

Stations C recorded the highest value of 0.159PPM, which motor, vehicles and mills could be attributed to Lead emission released by the smoked into the stream since station C, is by the cluster of Rice Mills. This implies that the stream is polluted and not suitable for drinking. Danger of consuming stream polluted by Lead include severe headaches, loss of co-ordination, convulsion and serious damage to kidney, liver, brain, reproductive and central nervous system. The result revealed that the water needs treatment before consumption. Figure 3.11 illustrated the values of Lead.

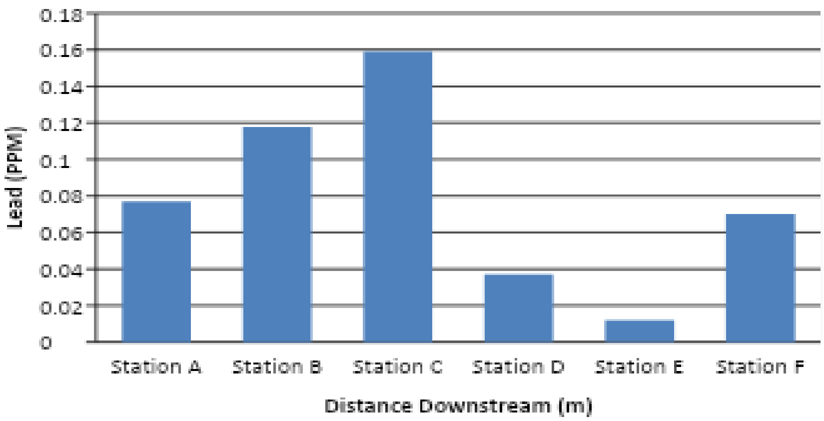


Fig. 3.11: Lead (Pb) Values for September to December 2023

Arsenic

The potential hazards of Arsenic to humans and animals are due to inhalation or ingestion, usually from drinking water containing high concentration of inorganic arsenic compounds. Arsenic causes mesothelioma, cancer of pulmonary lining and damage to many organs. The mean values recorded ranged from 0.064PPM to 0.878PPM for the period under study. The mean values are shown in Table 3.1. Station A recorded the highest value of 0.878PPM. The values generally were above the limit of 0.01PPM stipulated by WHO and NSDWQ (2017 and 2018) respectively. This means that the water is not safe for drinking. It requires proper treatment. Figure 3.12 illustrated the mean values of Arsenic. Han et al., (2019) noted Arsenic pollution of sediments in China.

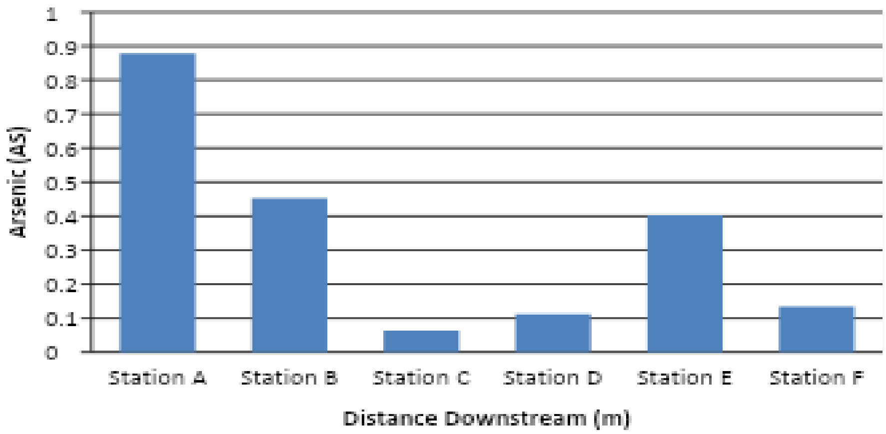


Fig. 3.12: Arsenic (AS) Values for September to December 2023

Aluminum

High concentration of Aluminum causes brain damage, bone diseases and severe anaemia. Table 3.1 shows the mean values of Aluminum for the period under study. The mean values ranged from 0.046PPM to 0.351PPM. Station F recorded the highest value of 0.351PPM while station C recorded the least value of 0.046PPM. The values of station A and Station C were within the WHO guideline value of 0.2PPM (WHO, 2017) and NSDWQ value of 0.2PPM. However, mean values stations, B,D,E and F were above the WHO and NSDWQ guidelines values for drinking water. Figure 3.13 illustrated the mean values of Aluminum.

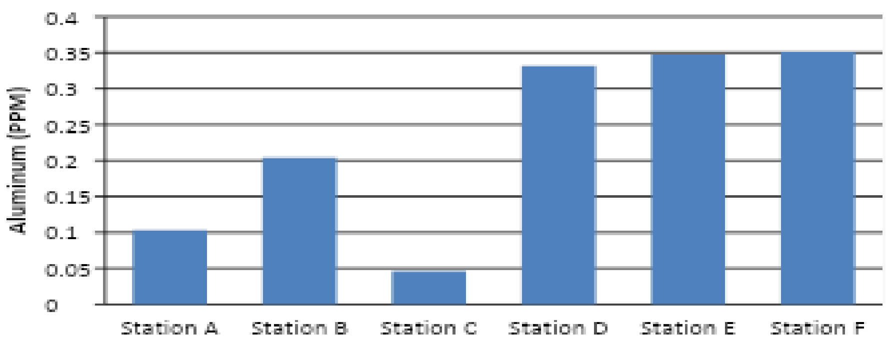


Fig. 3.13: Aluminium (AL) Values for September to December 2023

Cadmium

Table 3.1 shows the mean concentration values of cadmium for the period under study. The mean values ranged from 0.002PPM to 1.139PPM. Station D recorded the highest value of 1.139PPM while station B recorded the least value of 0.002PPM. The values of the stations were higher than WHO guideline value of 0.003PPM (WHO 2017) and NSDWQ value of 0.003PPM except the value of station B which was within the WHO and NSDWQ guideline for drinking water.

Consuming water contained cadmium is a potential health hazard due to its presence in urban atmosphere due to cigarette smoking. Cadmium can cause emphysema when inhaled and is known to be present at levels of about 1.00PPM in cigarette smoke. Cadmium could cause severe liver and kidney damage, pulmonary disease and death. The mean values of Cadmium were illustrated in figure 3.14.

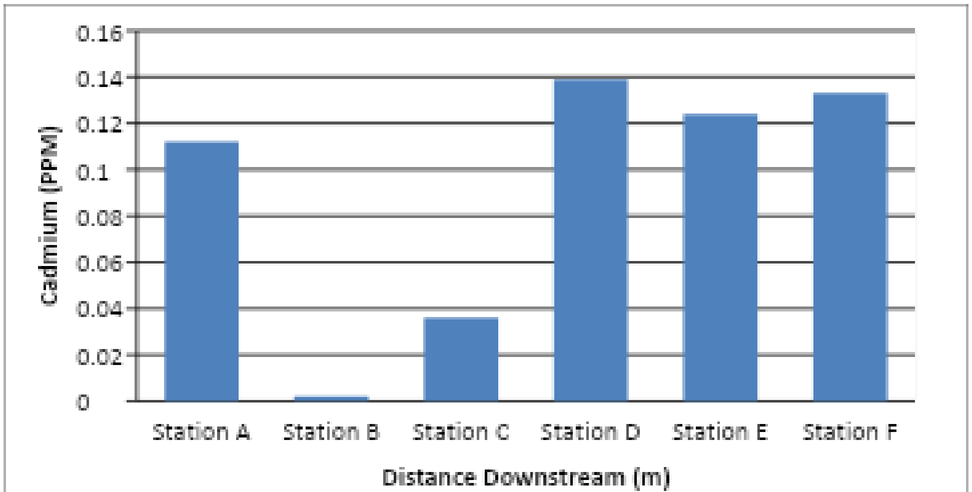


Fig 3.14: Cadmium (CD) Values for September to December 2023

Microbial Parameters

Total Coliform Count

Mean total coliform count from September to December, 2023 is shown in Table 3.1. The mean values ranged from 5 to 28 MPN/100mg/l as against the WHO standard limit of 0.2 MPN/100mg/l and NSDWQ value of 10MPN/100mg/l. Station F recorded the highest value of 28MPN/100mg/l while station A recorded the least value of 5 MPN/100mg/l/ The values of all the stations were higher than WHO guideline (WHO 2017) except station A and station B were within the NSDWQ value of 10MPN/100mg/l. This means that the stream at many locations are polluted and not suitable for drinking. The contamination is an indicator that a health risk exists for individuals who consume the polluted stream water. Figure 3.15 illustrated the mean values of Total Coliform Count of the stream.

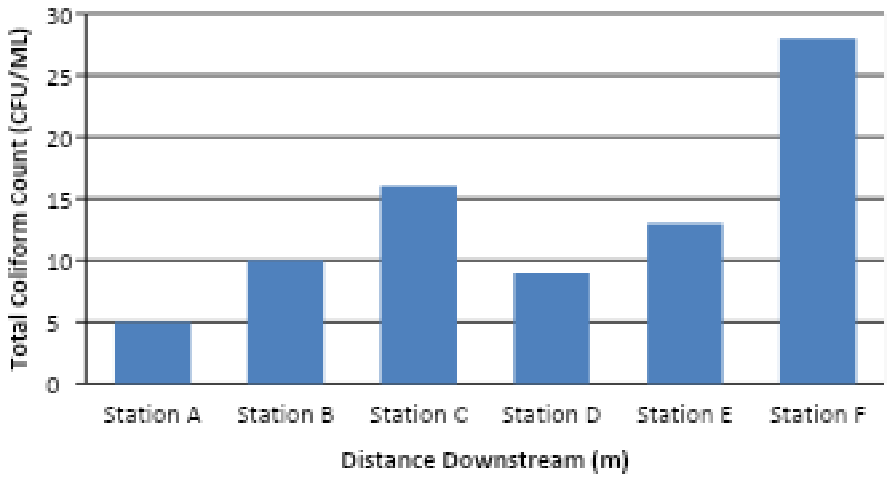


Fig. 3.15: Total Coliform Count Values for September to December 2023

Escherichia Coli

Table 3.1 shows the mean values of Escherichia coli for the period under study. The mean values ranged from 10MPN/100mg/l to 58MPN/100mg/l. Station F recorded the highest value while station A recorded the least value. The values of all the stations were very high against the standard limit of 0.0MPN/100mg/l (WHO, 2017) and NSDWQ 2018) value of 0.0MPN/100mg/l for drinking water. This implies that the stream has indication of faecal materials of men or other animals.

Consuming the stream water untreated portends danger from water-borne diseases such as urinary track infections, bacteraemia, meningitis, diarrhea (one of the main cause of morbidity and mortality among children), acute renal failure and haemolytic anaemia. The detection of Escherichia coli provided a clear evidence of pollution and therefore highlighted the danger which the people face from the use of the stream. Figure 3.16 illustrated the mean values of Escherichia Coli.

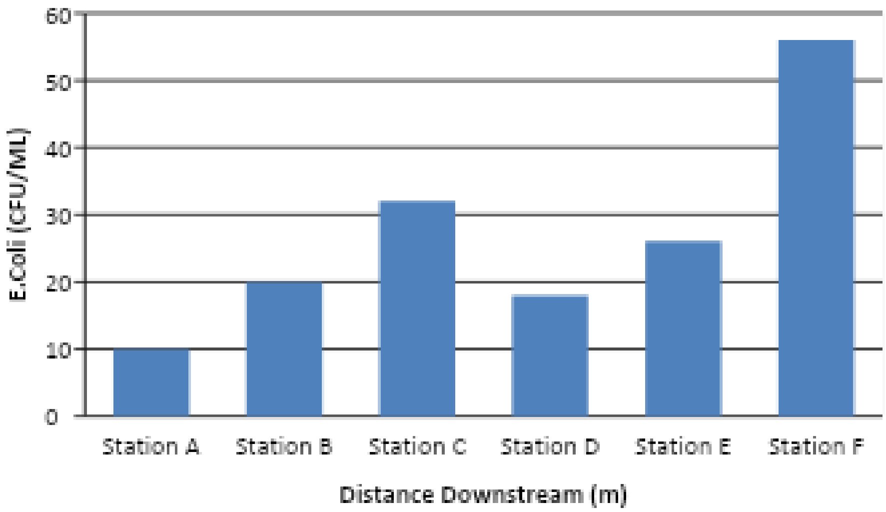


Fig. 3.16: E-Coli Values for September to December 2023

Conclusion and Recommendations

Based on the findings from this study, it is clear waste dumps in the stream have a negative impact on the water quality. The negative impacts are more pronounced in dry season. This study concludes that water quality of Ubeyi stream has deteriorated as a result of solid waste that is improperly disposed there. Furthermore, its water is not suitable for human consumption and thus there is a need to strength regulations against improper waste handling especially along water bodies.

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