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Study of Water Quality in Terms of Physico-Chemical Parameter of Brahmani River

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Abstract

The current study is aimed at assessing the present water quality standard along the extend of the Brahmani river in conditions of Physico-chemical parameters. In this study area, Brahmani river is getting a substantial quantity of work wastes and witnessing a substantial quantity of creature and agricultural actions. Nine samples were together down the complete stretches of the river basin through the period from August 2014 to September 2015 on the opening working day of every month. A variety of Physico-chemical parameters like pH, Dissolved Oxygen (DO), Biochemical Oxygen Demand (BOD), and Conductivity were analyzed. The current study indicates that the water quality of the Brahmani river is healthy inside the charity boundary. It is also examined that the Physico-chemical parameters are suitable for considerations in this study.

Keywords: *Brahmani river; Physico-Chemical parameters; pH; DO; BOD; Conductivity.*

1. Introduction

Water is significant for life on earth. Water is one of the most well-known substances on earth covering over 70% of the outside of the earth. Billions of individuals are denied essential water accessibility. Among her nations on the planet, India is one of only a handful hardly any chose nations talented with sensibly great land just as water assets. Due to the spatial and of the time contrast in precipitations just as the quick development of populace and better living qualities, the interest for the give of water assets when all is said in done and freshwater in coming up next is expanding. Subsequently, the per capita accessibility of water is decreasing step by step. Regardless, surface water resources in the country are in much better volume when appeared differently with the groundwater resources. Ecological change is moving the river in conclusion impacts the measure of water available, of course, growing burdens from a point and non-point sources are shelling the idea of surface similarly as groundwater resources. As the reputation of the river in the country isn't enduring, groundwater bolsters an incredible piece of the people during the lean months. There is an exceptional assortment both in the sum and nature of discharge from zone to zone in these stream bowls. With two or three extraordinary cases, all the medium and minor conduit bowls start in the mountains, and along these lines show an ordinary component of brisk gushing and rainstorm dealt with the river in the inclining territories. At the point when they show up in the fields they are usually moved as a streaming river. The compensated or untreated discharges from such sources would reliably find a way into the conduits that swing like a pendulum because of the infrequent river nature of this river through the overwhelming storm when water gushes down the river the free in the toxic substances, the river rate, and river significance swing because of the tides in the streaming compasses.

The physicochemical nature of waterway water is significant from the wellbeing perspective. So consistent checking of stream water quality is needed to confirm any adjustment in quality and flare-up of wellbeing issues. Singkran et al. (2010) investigated picking water conditions in the Northeastern conductors of Thailand utilizing a period game-plan and water quality record models. Test results the mean watched estimations of the water quality restrictions of every conductor through season more than 14 years (1994-2007) were utilized to build up a set time game-plan model for foreseeing the estimation of the related furthest reaches of each stream in the going with multi-year length (2008-2012). Sahu et al. (2011) explored the longing for water quality records utilizing a neuro-fuzzy social affair structure. They proposed a competent technique, for example, a flexible framework fuzzy enlistment system (ANFIS) for the guess of water quality. Sharma et al. (2011) examined the assessment of the water nature of the Narmada waterway to physio-synthetic boundaries at Hoshangabad. They have completed a factual investigation on boundaries like pH, EC, Turbidity, Calcium Hardness, Nitrite, Sulfate, Chloride, phosphate, and Dissolve Oxygen. Akkaraboyina and Raju (2012) studied about the appraisal of water quality file of waterway Godavari at Rajahmundry. Examination of the water quality boundaries into a solitary number which would direct to a simple comprehension of a list, consequently giving a significant device to the board and dynamic purposes. Eneji et al. (2012) studied the spatial and fleeting variety like the quality of river Benue, Nigeria. Trial results the spatial variety among various stations and occasional changes, a multivariate examination of fluctuation was utilized to aggregate that information dependent on spatial variety among various stations and occasional changes, multivariate investigation of difference was as used to assemble this information dependent on spatial likenesses. Galavi et al. (2012) investigated neuro-fuzzy demonstrating and anticipating in water quality. The test utilized Artificial insight (AI), based models, in hydrological gauging. While the presentation was a common framework course of action among ANFIS models, there were no advantages to all ANFIS engineering for each case.

2. Study Area

Brahmani is the second biggest waterway in Odisha. Two significant waterways, the Sankh and Koel, begin from the Chhotangpur level and join at Vedavyasa close Rourkela in the Sundargeh locale of Odisha to shape a significant river called the Brahmani. Its course through Sundargarh, Keonjhar, Dhenkanal, Cuttack, and Jajpur areas in the seaside fields and goes into the Bay of Bengal at Dhamra. The Brahmani is 799 km long. There are 45 significant tributaries of the Brahmani, of which the significant ones are Sanka, Gohira, Chianti stream, Tikira, Singadajor, Bangaru river, Nandiranalla, Nigra river, Bangusinghanaalla, Baraha, Daunri, Kumaria, Kelua river, Birupa, Hansa, Kharsua. In the wake of accepting the name of the Brahmani, the waterway crosses the Tamra and Jharbera backwoods evading along National Highway 23. It at that point passes the town of Bonaigarh in the Sundargarh locale before being dammed at Rengali in the Anugul area. An enormous supply of a similar name is made accordingly. It at that point courses through the towns of Talcher and Dhenkanal before separating into two streams. The waterway at that point gets the Kharsuan, to its left side bank before converging with the Baitarani, a significant stream. A distributary canceled Maipara branches here to join the Bay of Bengal a short separation away while the standard continues toward the north for a couple of km more before at last gathering the ocean close Chandbali at Palmyras point.

Fig.1. Brahmani river in Odisha.

3. Methodology

Materials and method, test formats, Water Quality Index Development Procedure, Rating Scale for Calculation of Water Quality Index, Formulation of Water Quality Index and Calculation of Parts of Water Quality Parameter in River Water were used in this paper.

Materials and Method; Water tests were gathered each month from August 2014 to September 2015 from nine changed stations as referenced in the above table in clean waterless polythene bottles. The pH is one of the most notable water quality tests performed. Biological oxygen demand (BOD) is one of the most widely recognized proportions of toxin natural material in water.

Test Formats; Field-test techniques for chemical water quality checking fall into three classifications: (1) Test strips, (2) Color plate packs, (3) Hand-held advanced instruments.

WQI Development Procedure; The system for extending a WQI was trailed by the methods as appeared under: The water quality parameters of interest are known and were passed by the suitability for their future uses in a water body.

Rating Scale for Calculation of Water Quality Index; A rating level was set up as appeared in Table 1 for an assortment of standards of each boundary

Formulation of Water Quality Index; The scopes quality of parameters in drinking water as per its permit confines by CPCB values are given in Table 1. The quality of water rating qi for the ith water quality parameters is acquired starting the connection: qi= 100(vi/si).

Table 1 Permissible Limits for Drinking Water Quality (CPCB)

S. No	Water Quality Parameter	Permissible Ranges
1	pH	6.5-8.5
2	DO	4.0-6.0
3	BOD	2.0-3.0
4	Conductivity	0-1000

Calculation of Parts of Water Quality Parameter in River Water; From the above detailing, the expansion or reduction of the pieces of the parameters in the stream water was discovered at the chose station for example Brahmani down-stream, which was affected generally by enterprises and by different effluents. So, the whole of unit weight of 11 water quality parameters can be given as:

$$\sum_{i=1}^{11} Wi = 1 (1)$$

Table 2 Water Quality factors: ICMR/CPHEEO Standards assigned

S. No	Water Quality Factors	ICMR/CPHEEO Standards (xi)
1	pH	6.5-8.5
2	DO	>5
3	BOD	<5
4	Conductvity	<300

ICMR Standards (1975) CPHEEO Standards (1991)
The general WQI of River Brahmani is then determined by collecting these sub-indices (SI) straightly. In this way, WQI can be composed as:

WQI= $[\sum_{i-1}^{11} qiWi / \sum_{i=1}^{11} Wi] = \sum_{i=1}^{11} qiWi$
Where, $\sum_{i=1}^{11} Wi=1$

4. Results and Discussions

In this study various Physico-chemical parameters i.e., pH, DO, BOD, and Conductivity test was performed to check the water quality. Based on their results comparing with the standard values different graphical representation and tabulation are being done in this chapter. Further, each Physico-chemical parameter is being described according to their basic standard value are there is a comparison of results between the years 2014 and 2015. Different water quality measures are also performed which are also described.

pH Level; pH is the negative logarithm of the hydrogen particle convergence of an answer and it is hence a proportion of whether the liquid is acid or alkaline. The pH scale ranges from 0 to 14. The scope of common pH in freshwaters stretches out from around 4.5, for corrosive, peaty upland waters, to over 10.0. The most ordinarily experienced range is 6.5-8.0.

The pH value of the different stations for the year 2014 and 2015 data is mentioned in Table 3 and the respective pH values are represented graphically in Figures 2 and 3. It is observed from Figure 2 the pH value is maximum at Gomlai and minimum at Tilga station in the Brahmani river. Figure 5.2 shows that the pH values are maximum at Gomlai, Jaraikala, Jenapur, and Talcher and minimum value at Tilga station of the Brahmani river. All the water samples are found to have pH value well within the tolerance limit.

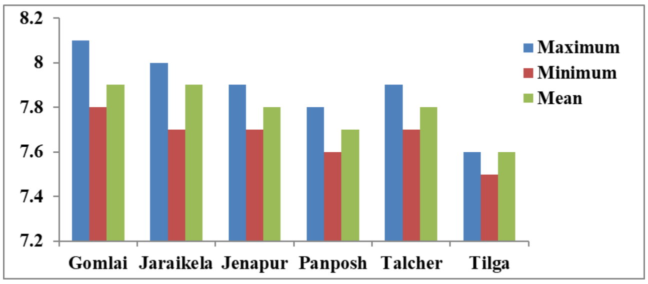

Fig.2. pH value of 2014

Table 3pH Level

S. No.	Name of the sampling Station	Standard pH value	pH value (2014)	pH value (2015)	pH value (2015)
1	Gomlai	6.5-8.0	7.9	7.73	7.73
2	Jaraikela	6.5-8.0	7.9	7.73	7.73
3	Jenapur	6.5-8.0	7.8	7.76	7.76
4	Panposh	6.5-8.0	7.7	7.6	7.6
5	Talcher	6.5-8.0	7.8	7.73	7.73
6	Tilga	6.5-8.0	7.6	7.43	7.43

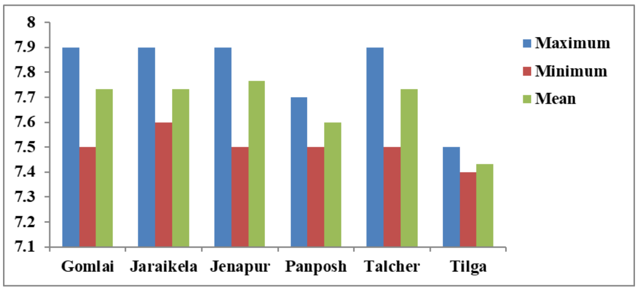

Fig.3. pH value of 2015

Dissolved Oxygen; (DO) The significance of dissolved oxygen (DO) has just been addressed in the conversation of BOD above. The result is that the genuine convergences of DO in a stream will be most reduced in the mid-year when it is normally the situation that the danger of harm to water flexibly source or natural contamination is most prominent, particularly in regions created as places of interest or where such cultivating. The levels around zero persevere then septic conditions will set in and any staying natural issue will experience septic deterioration to yield items, for example, methane and ammonia. The DO of most raw water sources lies within a range of 4.0-6.0.

The DO value of the different stations for the year 2014 and 2015 data is mentioned in Table 3 and the respective DO values are represented graphically in Figures 4 and 5. It is observed from Figure 4 the DO value is maximum at Talcher and minimum at Gomlai station in the Brahmani river. Figure 5 shows that the DO value is maximum at Tilga and minimum value at Panposh station of the Brahmani river. All the water samples are found to have to DO value well within the tolerance limit.

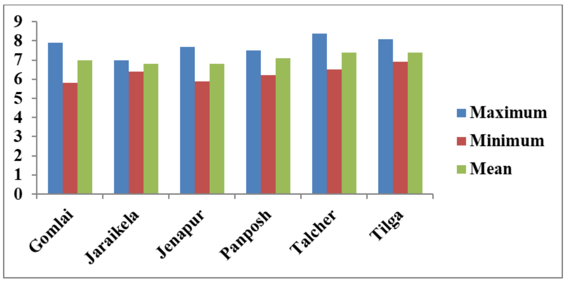

Fig.4. DO in mg/L 2014

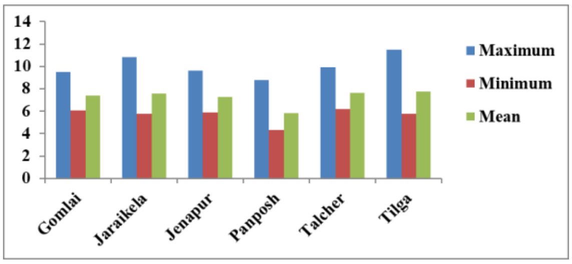

Fig.5. DO in mg/L 2015

Biochemical Oxygen Demand (BOD); At the point when a characteristic issue is discharged into a conduit it fills in as a food hotspot for the microorganisms present there. These will later start the breakdown of this issue to less confusing regular substances and finally too clear blends, for instance, carbon dioxide and water. The measure of the waste present is sufficiently enormous, the pace of bacterial take-up of oxygen will overpower that at which the DO is revived from the air and photosynthesis, and finally, the getting water will get anaerobic. The BOD of most crude water sources exists in the scope of 2.0-3.0.

The BOD value of the different stations for the year 2014 and 2015 data is mentioned in Table 4 and the respective BOD values are represented graphically in Figures 6 and 7. It is observed from Figure 6 the BDO value is maximum at Gomlai and minimum at Jaraikela station in the Brahmani river. Figure 7 shows that the BOD value is maximum at Panposh and minimum value at Tilga station of the Brahmani river. All the water samples are found to have to BOD value well within the tolerance limit.

Table 4 BOD mg/L

s. No.	Name of the sampling Station	Standard BOD value	BOD value (2014)	BOD value (2015)
1	Gomlai	2.0-3.0	0.7	1.16
2	Jaraikela	2.0-3.0	0.5	1.03
3	Jenapur	2.0-3.0	0.5	0.466
4	Panposh	2.0-3.0	0.5	1.73
5	Talcher	2.0-3.0	0.5	0.86
6	Tilga	2.0-3.0	0.3	0.26

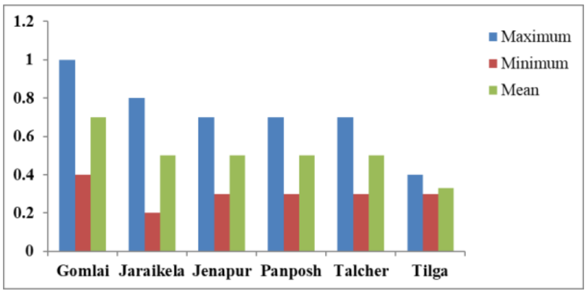

Fig.6. BOD in mg /L 2014

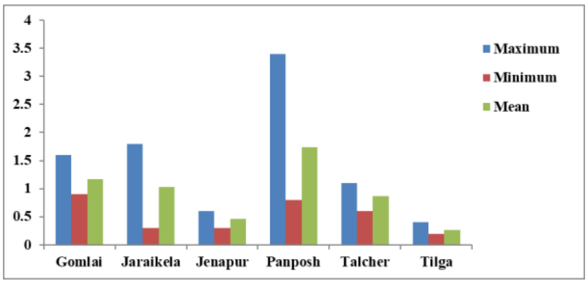

Fig.7. BOD in mg /L 2015

Conductivity; It is electrical conductivity and, not absolutely, as unequivocal conductance, the conductivity of water is an announcement of its ability to coordinate an electric back and forth movement. As this property is related to the ionic substance of the model which is accordingly a segment of the center of the separated solid, the essentialness of successfully performed conductivity estimations is clear. In itself, conductivity is a property of little eagerness to a water specialist anyway it is a critical marker of the range into which hardness and alkalinity regard are most likely going to fall, and of the solicitation for the split up solids substance of the water. The Conductivity of most crude water sources exists in anger of 0-1000. Conductivity (μS/cm) x 2/3 = Total Dissolved Solids (mg/l).

The Conductivity value of the different stations for the year 2014 and 2015 data is mentioned in Table 5 and the respective Conductivity values are represented graphically in Figures 8 and 9. It is observed from Figure 8 the Conductivity value is maximum at Panposh and minimum at the Tilga station in the Brahmani river. Figure 9 shows that the Conductivity value is maximum at Gomlai and minimum value at Tilga station of the Brahmani river. All the water samples are found to have to Conductivity value well within the tolerance limit.

Table 5 Conductivity in μ mho/cm

s. No.	Name of the sampling Station	Standard Conductivity value	Conductivity value (2014)	Conductivity value (2015)
1	Gomlai	0-1000	177.3	264.6667
2	Jaraikela	0-1000	164.0	244
3	Jenapur	0-1000	131.3	184.3333
4	Panposh	0-1000	185.7	282
5	Talcher	0-1000	119.3	166
6	Tilga	0-1000	84.0	137

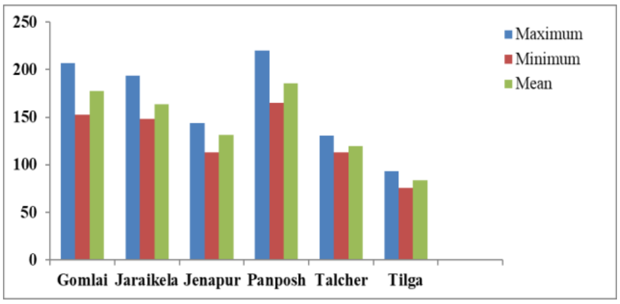

Fig.7. Conductivity in µ mho/cm 2014

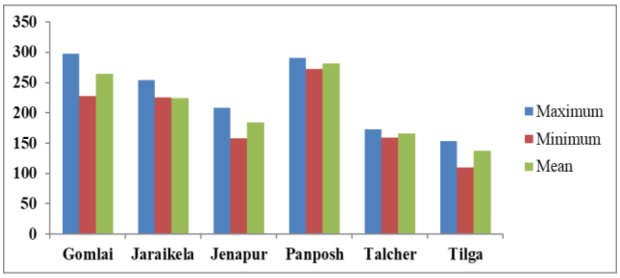

Fig.8. Conductivity in µ mho/cm 2015

Comparison of Physico-chemical Parameters for Different Years (2013-2015)

pH Level: The pH means values of 2013, 2014, and 2015 are presented in Figure 9. It is observed that the pH value is maximum at Gomlai and Jaraikela in 2014 and minimum pH values at Tilga in 2015 as compared to all three years. The following Figure shows that in the year 2013 the average minimum pH value 7.9 observed in Panposh. In the year 2014, the average maximum pH value 8.1 observed in Gomlai and a minimum value of 7.5 in Tilga. In the year 2015, the average minimum pH value of 7.4 and the maximum value 7.7 observed in Tilga. The average maximum mean comparing all three years was found 7.9 and the average minimum mean was 7.4.

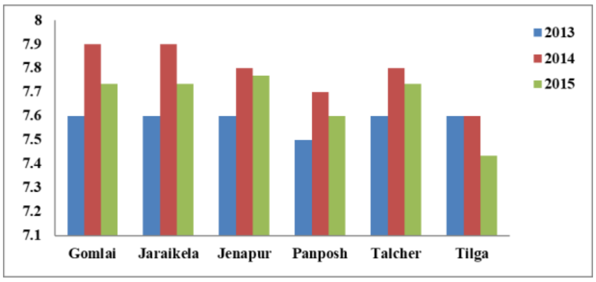

Fig.9. Comparison of the pH mean values

Dissolved Oxygen: DO means values of 2013, 2014, and 2015 are presented in Figure 10. It is observed that the DO value is maximum at Jaraikela, Talcher, and Tilga in 2015 and minimum DO values at Panposh in 2015 as compared to all three years.

The following Figures show that in the year 2013 the average minimum DO value 6.8 observed in Gomlai and Panposh. In the year 2014, the average maximum DO value 7.4 observed in Talcher and a minimum value of 6.8 in Jenapur. In the year 2015, the average minimum DO value of 5.8 observed in Panposh and the maximum value 7.8 observed in Tilga. The average maximum mean comparing all three years was found 7.8 and the average minimum mean was 5.8.

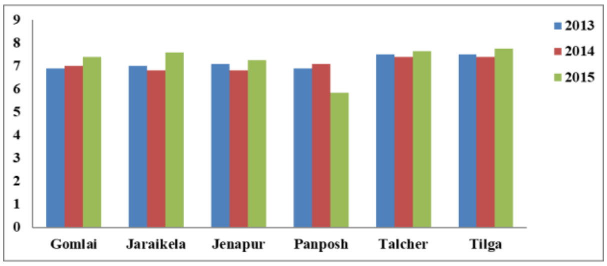

Fig.10. Comparison of the DO mean values

Biochemical oxygen demand: The BOD means values of 2013, 2014, and 2015 are presented in Figure 11. It is observed that the BOD value is maximum at Panposh in 2015 and minimum DO values at Tilga in 2015 as compared to all three years.

The following Figure shows that in the year 2013 the average minimum BOD value 0.5 observed in Jaraikela. In the year 2014, the average maximum BOD value 0.33 observed in Gomlai and a minimum value of 0.3 in Tilga. In the year 2015, the average minimum BOD value of 0.03 observed in Tilga and the maximum value 1.7 observed in Panposh. The average maximum mean comparing all three years was found 1.7 and the average minimum mean was 0.03.

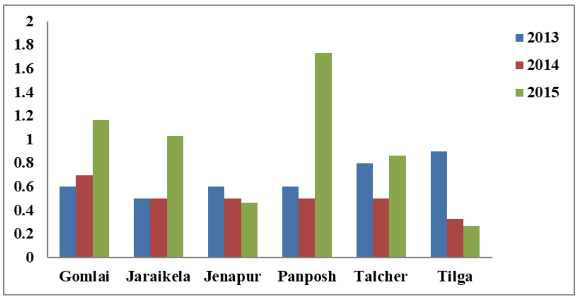

Fig.11. Comparison of the B.O.D mean values

Conductivity: The Conductivity mean values of 2013, 2014, and 2015 are presented in Figure 12. It is observed that the Conductivity value is maximum at Panposh in 2015 and minimum Conductivity values at Tilga in 2014 as compared to all three years. The following Figure shows that in the year 2013 the average minimum Conductivity value 104 observed in Tilga. In the year 2014, the average maximum Conductivity value 177.3 observed in Panposh and a minimum value of 84 in Tilga. In the year 2015, the average minimum Conductivity value of 137 observed in Tilga and the maximum value 264 observed in Panposh. The average maximum mean comparing all three years was found 264 and the average minimum mean was 84.

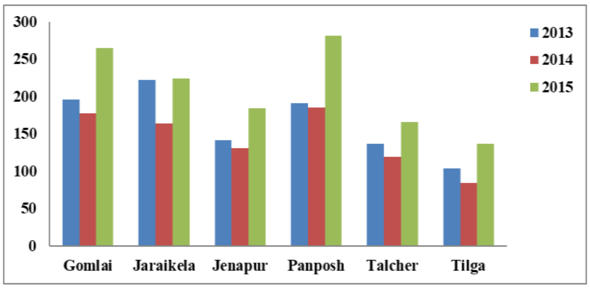

Fig. 12. Comparison Conductivity in µ mho/cm mean values

Conclusions

1) The study of the water quality test of Brahmani River is done by using different techniques like pH, DO, BOD, and Conductivity calculation of different Parts of water quality specification also overall Water Quality Index (WQI). The Error calculation and performance analysis of these models were carried out in this study. The summary from the present research work is being done and it is listed below:
2) Beginning the computation of the parameter in Brahmani river water, it very well may be expressed that the amount of water specification in three back-to-back season follows the equivalent patterns. It reasoned because the inflow of effluents to the Brahmani river is consistent annually.
3) WQI result for the measuring stations differs from fantastic to great in storm seasons and from great to poor while summer, as well as winter seasons the scope of the quality index of water boundaries, is taken the particular area suggested by the ICMR. The water should be used as residential.
4) Notwithstanding, important action should take to keep up the great water nature of the Brahmani river basin should be taking granted to save the significant asset to the people in the future. The quality index might be utilized as a device to pass on helpful data for the nature of water effectively and justifiable to the general population and policymaker.
5) The current examination unfolds the water quality of the river Brahmani is very protected when contrasted with the physicochemical parameter's perspective. Be that as it may, because of expands mechanical and human exercise along its bank consistent checking of the water nature of the waterway is an absolute necessity to keep up the water quality of the river.

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