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STUDIES ON THE PHYSICAL, CHEMICAL AND MICROBIOLOGICAL ANALYSIS OF WATER RESOURCE (SURFACE WATER) AT AMANGANJ TEHSIL, PANNA, MADHYA PRADESH

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ABSTRACT

Studies on the physical, chemical, and microbiological analysis of water sources are important to assess the quality of these resources and identify potential risks to human health and the environment due to cement plant activities. The main objectives of the research were to examined the physical, chemical and microbiological examination of water quality of Amanganj tehsil, Panna, Madhya Pradesh for the long-term evaluation of the proposed industrial development in terms of cement plants/ mining projects. Physical examination of surface water sources were provided information about water quality, temperature, color, and turbidity and other important parameters, which were indicated the presence of minor pollutants or contaminants. Chemical examination of water sources was provided information about pH, total dissolved solids, nutrient levels, and the presence of metals and minerals. Microbiological examination of water sources was providing information about the absent of bacteria such as coliform, which can cause illness in humans. Similarly, seasonal variations were impacted the quality of surface and groundwater

sources due to cement plant activities. This research can help to identify potential risks to human health and the environment and inform management practices to protect these resources.

Keywords: Cement industry; Water Quality; Impact; Analysis; Examination

INTRODUCTION

Cement is a critical building material used in the construction of buildings, roads, bridges, and other infrastructure projects, hence cement production businesses play a significant role in the construction sector. However, cement manufacture is a substantial source of carbon emissions and air pollution. In recent years, several cement makers have been utilising alternative fuels and renewable energy sources to lower their carbon footprint and make the production process more environmentally friendly. Cement making is regarded as one of the world's most environmentally destructive businesses **[1]**. India's Central Pollution Control Board puts it seventeenth in its database of polluting industries. Cement production may mobilise and spread potentially hazardous elements (PHEs) into the environment via many processes, including as emissions of particulate matter, dust, and gases during the manufacturing process and the release of cement dust and wastewater during transportation and storage. Mobilization and dispersion of potentially harmful materials into the atmosphere and human environment as a result of industrial and anthropogenic operations have been linked to severe health issues for humans **[2]**.

Due to discharge from local factories, residential garbage, and land and agricultural drainage, the water quality of village ponds, the primary supply of water for irrigation, washing, bathing, and drinking in rural India, has been reported to deteriorate. Less than one percent of the water in ponds, lakes, rivers, and dams is utilised for industrial, residential, and agricultural reasons. 70% of the water in these ponds is polluted, according on estimates, due to the discharge of effluents from industry, household trash, land and agricultural drainage. The Central Pollution Control Board (CPCB) has divided surface sources into five classes, namely A, B, C, D, and E, based on water quality for a number of specific quality uses. Class A, Class B, Class C, Class D, and Class E include surface sources for drinking water in addition to conventional treatment but with chlorination; organised outdoor bathing; drinking water with conventional treatment; industrial cooling; fisheries; wildlife propagation; irrigation; and controlled disposal, respectively **[3]**.

Amanganj is a town located in the Panna district of Madhya Pradesh, India. The region is home to several cement plants, which have both positive and negative impacts on the local economy and environment. Some of the positive impacts of cement plant activities in Amanganj include:

- Employment opportunities: Cement plants provide jobs for local residents, contributing to the economic development of the region.
- Revenue generation: Cement plants generate revenue for the government through taxes and royalties, which can be used to fund infrastructure development and other social programs.
- Infrastructure development: Cement plants require significant infrastructure, including roads, railways, and power supply, which can lead to improved infrastructure in the region.

  However, there are also negative impacts associated with cement plant activities in Amanganj, including:

- Air pollution: Cement plants are a significant source of air pollution, emitting particulate matter, sulfur dioxide, and other pollutants, which can have adverse health effects on local residents.
- Water pollution: Cement plants generate large amounts of wastewater, which can contain high levels of pollutants, including heavy metals and organic matter, and if not adequately treated, can lead to water pollution.
- Land degradation: Cement plants require large areas of land for mining, quarrying, and processing raw materials, which can lead to deforestation, soil erosion, and land degradation.
- Dust emissions: Cement plant activities generate dust emissions, which can settle on nearby agricultural fields, affecting crop yields and soil quality.

These proposed cement plants might potentially pollute the land and water quality in areas where cement enterprises are proposed to be located. A physical, chemical, and microbiological investigation of the water quality quality in the Amanganj Tehsil, Panna district, Madhya Pradesh, has not yet been published on Science Direct, web of science, or Google Scholar. The management of such a terrestrial ecosystem is primarily geared at the preservation of natural habitat and the accurate maintenance of the physicochemical and microbiological properties of soil and water within acceptable limits. In keeping with these considerations, the primary purpose of the present study is to assess the physical, chemical, and microbiological characteristics of the water quality in Amanganj, Panna, Madhya Pradesh, in order to evaluate the proposed cement plant's long-term impact.

MATERIALS AND METHODS

Study area

The mineral lime stone occurrence was established in villages Kakra, Kamtana, Saptai, Judi, Devri Purohit and Devra, Hardua Ken, Puraina, Sotipura, Madayyan, Devri in Tehsil: Amanganj, District: Panna (MP) and therefore cement manufacturing units was also covered above area. The proposed site and study area was covered within latitude 24°19'2.99"N-24°20'2.02"N and Longitude 79°57'30.02"E-79°58'42.25"E, whereas mining lease area covered withing latitude: 24^0 19’ 46.6” to 24^0 22’ 15.3” (Northing) and longitude: 79^0 56’ 15.5” to 79 ^{0} 59’ 38.2” (Easting).

Sample collection

For the purpose of the study, a total of 11 samples of surface water sources were evaluated, and the sampling was carried out **(Table 1 and 2)**.

Table 1: Sampling location for Surface water quality examination

Sr. No.	Sampling Code	Sampling Site	Co-ordinates
1	SW-1	Ken River Near Tighra Village	N 24°17’53.3” E 079°57’52.1”
2	SW-2	Ken River Near Singaura Village	N 24°24’13.3” E 079°56’05.0”
3	SW-3	Sonar River Near Village Santa	N 24°21’42.3” E 079°55’08.9”
4	SW-4	Nala Near Deora Village	N 24°20’49.7” E 079°58’19.0”
5	SW-5	Pond Near Chikhla Village	N 24°17’13.9” E 079°55’30.3”
6	SW-6	Pond Near Umri Village	N 24°15’40.8” E 079°56’04.2”
7	SW-7	Beteha Nala Near Surajpur	N 24°22’03.4” E 079°53’43.4”
8	SW-8	Pond Near Amanganj	N 24°25’47.9” E 080°02’38.7”
9	SW-9	Mirhasan River Near Amanganj	N 24°25’55.2” E 080°02’19.8”
10	SW-10	Berma River Near Gaisabad Village	N 24°14’39.0” E 079°50’37.0”
11	SW-11	Pond Near Pagra Village	N 24°21’10.7” E 080°00’09.8”

Analysis of collected samples

The samples that were taken from the various sample locations were analysed using a number of different physical, chemical, and microbiological characteristics, such as ambient temperature, colour, odour, taste, turbidity, pH, and electrical conductivity. Total Solids, Total Dissolved Solids, Total Suspended Solids, Total Alkalinity, Total Hardness, Calcium Hardness, Calcium, Magnesium, Sodium, Potassium, Chlorides, Sulphates, Nitrates, Fluoride, Dissolved Oxygen, Amonical Nitrogen, Nitrite Nitrogen as, Total Phosphate, Cyanide, Phenolic Compounds, Total Alkalinity, Total Hard Total Oil and Grease, BOD 3 days, COD, Pesticides, Poly Nuclear Hydrocarbon (PAH), Aluminum, Arsenic, Boron, Cadmium, Chromium, Copper, Iron, Lead, Manganese, Mercury, Selenium, Zinc, and Nickel were measured in accordance with the "Standard Methods for the Examination of Water and Wastewater" published by the American Public Health association (APHA) and the "Indian Standard" published by the Bureau of Indian Standards. The total coliform and fecal coliform were tested as per the Indian standard 1622: 1981.

Statistical analysis

All data was expressed as means ± standard deviation (S.D.). The different experiments were performed by one-way analysis of variance (ANOVA) using SPSS version 20.0 software. A value of $p < 0.05$ was considered statistically significant.

RESULTS AND DISCUSSION

According to the findings in the Table 3, the average ambient temperature of all surface water sample locations ranged from 37 to 42 degrees Celsius. During the pre-monsoon season, the ambient temperature of the surface water sample sites SW-1, SW-2, SW-3, SW-4, SW-5, SW-6, SW-7, SW-8, SW-9, SW-10, and SW-11 was measured to be 37 degrees Celsius, 42 degrees Celsius, 40 degrees Celsius, 41 degrees Celsius, 39 degrees Celsius, 40 degrees Celsius, 41 degrees Celsius, 40 degrees Celsius, 39 degrees Celsius, and 38 degrees Celsius, respectively. In the pre-monsoon season (March-May 2022), the greatest temperature was recorded in SW-2 (42 degrees Celsius) and SW-3 (41 degrees Celsius). The lowest temperature was recorded in SW-1 (37 degrees Celsius), and SW-11 (38 degrees Celsius). During the pre-monsoon seasons (March to May 2022), the pH values of surface water samples varied from 7.6 to 8.0. The pH levels that were measured at the surface water sampling locations SW-1, SW-2, SW-3, SW-4, SW-5, SW-6, SW-7, SW-8, SW-9, SW-10, and SW-11 were 7.40, 8.00, 7.60, 7.70, 7.90, 7.70, 7.90, 7.70, 7.90, 7.70, 7.90, 7.70, 7.90, 7.90, 8.00, respectively. The pH levels that were measured during the pre-monsoon seasons (March to May 2022) fell within the acceptable range. The presence of these qualities, including colour, odour, and taste, provides some clues identifying the origin of the water sample. These characteristics were validated on location with the assistance of the appropriate sensing organs.

- The hue of two samples of surface water ranges from pale yellow to colourless, while the appearance of four samples is colourless.

- No foul odour was detected in any of the surface water samples that were collected for the purpose of conducting an odour test.

If there is a significant concentration of salts or metals in water samples, then those samples will have a taste that is either salty or metallic. All of the samples taken here, both of the surface water and the subsurface water, have a flavour that is pleasant. The presence of suspended debris or colour pigment in a sample of water can cause turbidity to develop. The presence of aberrant activity in the surrounding environment is indicated by turbidity readings that are high. The turbidity of all surface water samples has been between 0 to 5 NTU during the whole study. The readings of the samples' turbidity were all lower than the allowed limit of 5.0 NTU, which is specified in the standard IS 10500:2012.

The amounts of dissolved oxygen in every surface water sample fall somewhere in the range of 6.1 to 7.8 mg/l. This is something that should be expected from surface waters because they are frequently exposed to the atmosphere. The levels of dissolved oxygen that were measured at the surface water sampling locations SW-1, SW-2, SW-3, SW-4, SW-5, SW-6, SW-7, SW-8, SW-9, SW-10, and SW-11 were as follows: 7.2, 6.8, 7.6, 7.1, 7.8, 8.0, 7.1, 7.5, 7.6, 6.8, and 6.1 The results of the biochemical oxygen demand, or BOD, in every surface water sample were determined to be less than 2.0 mg/l. Based on these findings, there was no evidence of any organic pollutant load mixing with the surface water. The values of Chemical Oxygen Demand (COD) in every sample of surface water were less than 4.0. No organic pollution load, measured in terms of chemical oxygen demand, was found in any of the water samples. The maximum amount of dissolved solids that were found in any of the surface water samples was 389 mg/l, which is much less than the acceptable limit of 500 mg/l. In every surface water sample tested, the level of dissolved solid was shown to be significantly lower than the limit considered safe for drinking water. When there is a high concentration of total suspended particles in a water sample, the clarity of the water is impaired. The total suspended solids readings for every surface sample fell between 8 and 34 mg/l across the board. All of the measured values for suspended solids are lower than the permissible limit of 100 mg/l. All of the surface water samples had chloride concentrations that were within the range of 4.0 to 27.8 mg/l, which is a significant distance below the ideal limit of 250 mg/l. All of the surface water samples had chloride concentrations that varied from 15 to 40 mg/l, which is much below the desired limit of 250 mg/l that is specified in IS 10500: 2012. Sulfate concentrations in all surface water samples were found to be below the desired level of 200 mg/l, ranging from 34 to 128.2 mg/l. This contrasts with the maximum amount of sulphate that should be present, which is 400 mg/l. The hardness of all of the surface water samples was discovered to be in a range that was between 102 and 241 mg/l, which is lower than the ideal limit of 300 mg/l. The presence of certain characteristics results in water samples having a flavour that is disagreeable and an odour that is offensive. In spite of this, it is encouraging that none of the surface water samples were discovered to contain oil or grease, phenolic compounds, ammonia, or any of the other contaminants that might alter the flavour and smell of water. According to the IS 10500:2012 standard, the fluoride level of all of the surface water samples was determined to be between 0.2 to 0.4 mg/l, which was determined to be much lower than the desired limit of 1.0 mg/l. The iron concentration of every surface and ground water sample fell somewhere in the range of 0.05 to 0.2 mg/l. Iron concentrations in every surface water sample came in at levels that were either lower than the ideal limit of 0.3 mg/l or lower than the allowed maximum of 1.0 mg/l. Nitrate contents in every surface water sample were found to be rather low, ranging from 0.7 to 0.8 mg/l, which is a significant distance below the ideal limit of 45 mg/l. According to the values, it appears that the region uses very little nitrogenous fertiliser. Dangerous water is water in which the concentration of toxic metals exceeds the levels considered safe, and drinking such water can be harmful to a person's health. Toxic heavy metals such as cadmium, selenium, lead, arsenic, hexavalent chromium, mercury, etc. were either below their respective detectable levels or, when they were detected, were below or equal to the allowed limits. This was the case for all of the samples. The results of testing on every surface water sample showed that neither Total Coliforms nor faecal coliform as MPN/100 ml were present. As a result, the samples of water taken from the surface were clean. These waters are suitable for consumption, so utilise them as such.

Recent industrial growth, chemical usage intensification, amount of mining/smelting waste, industrial waste, and traffic in many metropolitan areas have all contributed to environmental risks for terrestrial and aquatic ecosystems as well as problems with food quality and socioeconomic concerns. The general quality of the food supply has suffered as a result. The soil on the planet contains trace elements, which plants absorb. All living things, including people, plants, and animals, need these components to flourish. Higher levels of toxic substances are frequently produced by both natural processes (like weathering and the alteration of rocks and raw materials) and human activities (like mining, smelting, industrial, and agricultural operations), which can be considered potential sources of soil and groundwater contamination (Cr, Cu, Hg, Pb, Zn, Sb, Co, Ni, Cd, and As) **[4]**.

The physico-chemical characteristics of water, including pH, temperature, organic matter content, dissolved oxygen level, electric conductivity, turbidity, NH3 content, metal content, and other chemical components, all have an impact on the quality of drinking water, and some of these characteristics may have an immediate impact on consumers' health. Water's physico-chemical characteristics include: (Pitter, 2009). These characteristics may also have an impact on the survival of possible disease-causing microorganisms as well as the effectiveness of disinfection. Using the pH scale, you can determine how acidic or alkaline water is. The biological activities occurring in the water have an impact on it. Several of these compounds, such chlorides, P-substances, and N-chemicals, however, also serve as markers of faecal contamination. However, several of these drugs have a reputation for having detrimental impacts on human health. The COD, commonly referred to as the chemical oxygen demand, is a crucial sign of the water's quality. Greater levels of COD in surface water indicate a higher concentration of oxidizable organic material, which leads to lower levels of dissolved oxygen (DO). A decrease in DO can result in the development of anaerobic conditions, which are hazardous to aquatic life. It is expected that the production of trihalomethane byproducts will arise from the treatment of water with active chlorine since COD is present in groundwater. By-products (BPs) of chlorine disinfectants have the potential to affect human health or to elicit a variety of reactions in those who ingest treated water. The duration, quantity, and frequency of an impact are only a few examples of the many variables that might affect how strong an effect is. One of the pollutants of groundwater that is most frequently observed in rural regions is nitrate. The main factors that cause nitrate to be present in groundwater include fertilisers, septic systems, and manure storage or spreading operations. Since nitrate compounds are soluble, nitrate ions do not persist in soil. The nitrogen species most vulnerable to the loss brought on by leaching is nitrate. Because infants' digestive systems are still developing, excessive levels of nitrate in their drinking water can cause methemoglobinemia because nitrate can be converted to nitrite, which can then cause methemoglobinemia. The range of nitrate-N at which the health of the general population starts to be affected (443-885 NO3) is 100-200 mg/l; however, the effect on an individual varies substantially depending on a number of various variables. Yet, they are not thought to be signs of the potential existence of other, more dangerous pollutants, such bacteria or pesticides, in residential or agricultural contexts **[5]**.

CONCLUSIONS

Studies on the physical, chemical, and microbiological analysis of water sources are important to assess the quality of these resources and identify potential pollutants or contaminants. The results of these studies can inform decisions about the safe use and management of water resources. The physical examination of surface sources can provide information about water quality, temperature, color, and turbidity, which can indicate the presence of pollutants or contaminants. The chemical examination of water sources can provide information about pH, total dissolved solids, nutrient levels, and the presence of metals and minerals. The microbiological examination of water sources can provide information about the presence of bacteria such as coliforms, which can cause illness in humans. Overall, the results of physical, chemical, and microbiological examinations of soil and water sources can help to identify potential risks to human health and the environment. Appropriate management practices can then be implemented to protect these resources and ensure their safe use.

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Table 2: Surface water quality status of the study area

Sr. No.	Parameters	Units	SW-1	SW-2	SW-3	SW-4	SW-5	SW-6	SW-7	SW-8	SW-9	SW-10	SW-11	As Per IS 10500 of 2012	
														Acceptable	Permissible
Physical Parameters															
1	Ambient Temperature	˚C	37	42	41	40	41	39	40	41	40	39	38	-	-
2	Colour	Hazen	Clear	Clear	Clear	Clear	Clear	Clear	Clear	Clear	Clear	Clear	Clear	5	25
3	Odour	-	UO	UO	UO	UO	UO	UO	UO	UO	UO	UO	UO	UO	UO
4	Taste	-	AG	AG	AG	AG	AG	AG	AG	AG	AG	AG	AG	AG	AG
5	Turbidity	NTU	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	1	5
6	pH at 25 °C	-	7.40	8.00	7.60	7.70	7.90	7.70	7.90	7.70	7.90	7.90	8.00	6.5 – 8.5	NR
Inorganic Parameters														-	-
7	Electrical Conductivity	µS/cm	586	576	626	621	245	373	468	567	455	549	596	-	-
8	Total Solids	mg/l	363	405	402	406	253	221	382	377	316	392	302	-	-
9	Total Dissolved Solids	mg/l	346	389	381	383	245	211	354	349	286	371	268	500	2000
10	Total Suspended Solids	mg/l	17	16	21	23	8	10	28	28	30	21	34	-	-
11	Total Alkalinity as $CaCO_3$	mg/l	319	236	276	252	143	109	248	235	266	231	273	200	600
12	Total Hardness as $CaCO_3$	mg/l	189	211	241	238	122	102	218	201	189	201	224	300	600
13	Calcium Hardness as $CaCO_3$	mg/l	124	118	125	120	89	76	98	103	79	88	149	-	-
14	Calcium as Ca^{++}	mg/l	52.3	55.6	49.4	44.2	34.5	41.9	50.2	48.6	54.8	59.8	47.6	75	200
15	Magnesium as Mg^{++}	mg/l	31.2	33.5	34.8	32.1	26.5	13.8	21.5	26.5	26.8	25.9	26.6	30	100
16	Sodium as Na	mg/l	63	51	67	62	36	35	57	52	52	68	46	-	-
17	Potassium as K	mg/l	21	17	16	12	8	15	20	22	19	27	23	-	-
18	Chlorides as Cl	mg/l	31	30	34	31	16	15	32	30	36	38	40	250	1000
19	Sulphates as SO_4	mg/l	89	108.8	128.2	120.4	59	34	72	70	39	41	101.8	200	400
20	Nitrates as NO_3	mg/l	BDL	0.80	0.70	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	45	NR
21	Fluoride as F	mg/l	0.2	0.3	0.4	0.3	0.5	0.3	0.3	0.4	0.5	0.2	0.3	1	1.5
22	Dissolved Oxygen	mg/l	7.2	6.8	7.6	7.1	7.8	8.0	7.1	7.5	7.6	6.8	6.1	-	-
Pollutants															
23	Amonical Nitrogen as NH_3-N	mg/l	0.1	0.1	0.3	0.3	0.2	0.3	BDL	BDL	BDL	0.2	BDL	-	-
24	Nitrite Nitrogen as NO_2-N	mg/l	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	-	-
25	H_2S	mg/l	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	-	-
26	Total Phosphate as PO_4-P	mg/l	0.8	2.1	1.3	1.3	1.5	BDL	0.9	0.7	1.4	1.6	1.8	-	-
27	Cyanide as CN	mg/l	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.05	NR
28	Phenolic Compounds	mg/l	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.001	0.002
29	Total Oil & Grease	mg/l	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.01	0.03
30	BOD_3 days at 27 °C	mg/l	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	-	-
31	COD	mg/l	< 4.0	< 4.0	< 4.0	< 4.0	< 4.0	< 4.0	< 4.0	< 4.0	< 4.0	< 4.0	< 4.0	-	-
32	Pesticides	mg/l	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	0.001
33	Poly Nuclear Hydrocarbon (PAH)	mg/l	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	-	-
Trace Metals															
34	Aluminium as Al	mg/l	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.03	0.2

35	Arsenic as As	mg/l	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.01	NR
36	Boron as B	mg/l	0.2	0.2	BDL	BDL	BDL	0.3	BDL	BDL	BDL	BDL	0.2	1	5
37	Cadmium as Cd	mg/l	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.01	NR
38	Chromium as Cr^{6+}	mg/l	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.05	NR
39	Copper as Cu	mg/l	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.05	1.5
40	Iron as Fe	mg/l	0.2	0.3	0.2	BDL	0.2	BDL	BDL	0.2	0.3	0.3	0.2	0.3	1
41	Lead as Pb	mg/l	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.05	NR
42	Manganese as Mn	mg/l	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.1	0.3
43	Mercury as Hg	mg/l	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.001	NR
44	Selenium as Se	mg/l	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.01	NR
45	Zinc as Zn	mg/l	0.07	BDL	BDL	BDL	0.06	0.07	0.07	0.06	BDL	0.07	BDL	5	15
46	Nickel as Ni	mg/l	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.02	NR
Microbiology															
47	Total Coliform	MPN/100 ml	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	SBA	SBA
48	Fecal Coliform	MPN/100 ml	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	SBA	SBA

Note:- BDL is Below Detectable Limit ; Minimum Detectable Limit For parameters tested are as Under (NO2-0.01, PO4-0.01,Oil & Grease-2.0, BOD-2.0, COD-4.0,Al-0.01, As-0.05, B-0.1, Cd-0.05, Cr^{+6}-0.01, Cu-0.03, Fe-0.05, Pb-0.05, Mn-0.03, Hg-0.01, Zn-0.05, Se =0.05) (Unit mg/l); NTU - nephalometery turbidity unit; NR - no relaxation; MPN - most probable number; UO – unobjectionable; AG - agreeable; NA- not applicable; SBA: Should be Absent

SW-1: Ken River Near Tighra Village; SW-2: Ken River Near Singaura Village, SW-3: Sonar River Near Village Santa, SW-4: Nala Near Deora Village, SW-5: Pond Near Chikhla Village, SW-6: Pond Near Umri Village, SW-7: Beteha Nala Near Surajpur, SW-8: Pond Near Amanganj, SW-9: Mirhasan River Near Amanganj, SW-10: Berma River Near Gaisabad Village, SW-11: Pond Near Pagra Villag