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CHANGING WATER QUALITY OF BASNA DRAIN, PHAPHAMAU, ALLAHABAD, UP, INDIA

Bechan Yadav (Research Scholar-S.R.F.)
Department of Geography
University of Allahabad
Allahabad-211002

ABSTRACT

Water is very important for human life. Without water man cannot alive. Due to human interference the water quality is decreasing rapidly. The study area extends from 25° 25' N to 25° 35' N latitude and 81°50' E longitude to 81°57' E longitude. The B.O.D. should be less than 3mg/liter in any water body. In Basna drain the B.O.D. is 7.3 mg/liter, which is not favorable for living organism of the drain. The Dissolved oxygen (D.O.) should be 5.0mg/liter. In Basna Drain it is 2.97 mg/liter that also indicates the mark of danger for the living organism in the drain. The C.O.D. is helpful in creation of oxygen. The C.O.D. should be less than 6mg/liter but it is 37.03 mg/liter in Basna Drain that is not good for water. A water having 250mg/liter C.O.D. is not allowed for dump in any surface water source. Like above description pH analysis is also the subject of my study. By the table number 3, the average pH value should be 6.5 to 8.5 in water. In Basna drain the pH value is 5.9, indicates the basic condition of the drain's water.

Keyword- Basna drain, water, value.

INTRODUCTION

India is rich in water resources, being endowed with a network of rivers and blessed with snow cover in the Himalayan range that can meet a variety of water requirements of the country. However, with the rapid increase in the population of the country and the need to meet the increasing demands of irrigation, human and industrial consumption, the available water resources in many parts of the country are getting the depleted and the water quality has deteriorated. Indian rivers are polluted due to the discharge of untreated sewage and industrial effluents. The Central Pollution Control Board (CPCB) has established the network of monitoring stations on rivers across the country. The present network comprises of 870 stations in 29 states and seven union territories spread over the country. The monitoring is done on monthly or quarterly basis in surface water and half yearly basis in case of ground water.

BACKGROUND

The Central Pollution Control Board (CPCB) is responsible for restoration and maintaining the wholesomeness of aquatic resources under water (Prevention and Control of Pollution) Act 1974 passed by Indian Parliament. To ensure that the water quality being maintained or restored at desire level it is important that it is monitoring on regular basis. Water quality monitoring helps in evaluating the nature and extend of pollution control required and effectiveness of pollution control measures already in existence. It also helps in drawing the water quality trends and prioritizing pollution control efforts.

WATER RESOURCES IN INDIA AT A GLANCE

The geographical area of India is 3287263 sq km. The length of its coastline is about to 7500 km. The climate of India varies from tropical monsoon in south to temperate in north. Its terrain have upland plain (Deccan Plateau) in south, flat to rolling plain along the Ganges, deserts in west, Himalayas in north. India is enviably endowed in respect of water resources. The country is literally criss-cross with river and blessed with high precipitation mainly due to the southwest monsoon, which accounts for 75% of the annual rainfall. There are thirteen major river basins (area more than 20,000 square kilometer) in the country, which occupy 82.4% of total drainage basins, contribute eighty five percent of total surface flow and house eighty percent of the country's population. Major river basins are Brahmaputra, Ganga (including Yamuna Sub Basin), Indus (including Satluj and Beas Sub Basin), Godavari, Krishna, Mahanadi, Narmada, Cauvery, Brahmini (including Baitarni Sub Basin), Tapi, Mahi, Pennar and Sabarmati. The classification of river basin based on catchment area is given in following Table. There are few desert rivers, which flow for some distance and get lost in deserts. There are complete arid areas where evaporation equals rainfall and hence no surface-flow. The medium and minor river basins are mainly in coastal area. On the east coast and part of Kerala State, the width of land between mountain and sea is about 100 km, and hence the riverine length is also about 100 km. whereas, the rivers in the west coast are much shorter as the width of the land between sea and mountains is less than 10 to 40 km. Yet, in spite of the nature's bounty, paucity of water is an issue of national concern resulting in deterioration of water quality in aquatic resources.

Table

Classification of river Basin in India

River basin	Catchment area (in sq km and in %)	No. of Basin
Major	More than 20,000 (82.4)	13
Medium	Between 2000 – 20,000 (8)	48
Minor	Less than 2,000 (9.6)	52

OBJECTIVE

To address water-related environmental problems, it is must to have accurate information and to know precisely what the problem is, where it is occurring, how serious it is, and what is causing it. Such information is necessary for determining cost-effective and lasting solutions to water-related problems. The goal is to provide appropriate picture of current water-quality conditions and trends in water quality and water uses, and to facilitate the identification of emerging issues and future priorities. The water quality monitoring is performed with following objectives.

- For rational planning of pollution control strategies and their prioritization;
- To assess nature and extent of pollution control needed in Basna drain;
- To evaluate effectiveness of pollution control measures already is existence;
- To evaluate water quality trend over a period of time;
- To assess assimilative capacity of a water body thereby reducing cost on pollution control;
- To understand the environmental fate of different pollutants.
- To assess the fitness of water for different uses.

DATA SOURCES AND METHODOLOGY

The present study includes two data sources primary and secondary. The primary data is based on observation, questionnaire, schedule method and interview method. The secondary data have two methods of data sources published and unpublished data. On the basis of primary and secondary data the following methods have been used in the present study:

Firstly, the location map of the study area is based on toposheet no. 63G/14.

Secondly, the primary data is field-survey conducted and questionnaire based data collected.

Thirdly, reference book and related study-area research consulted.

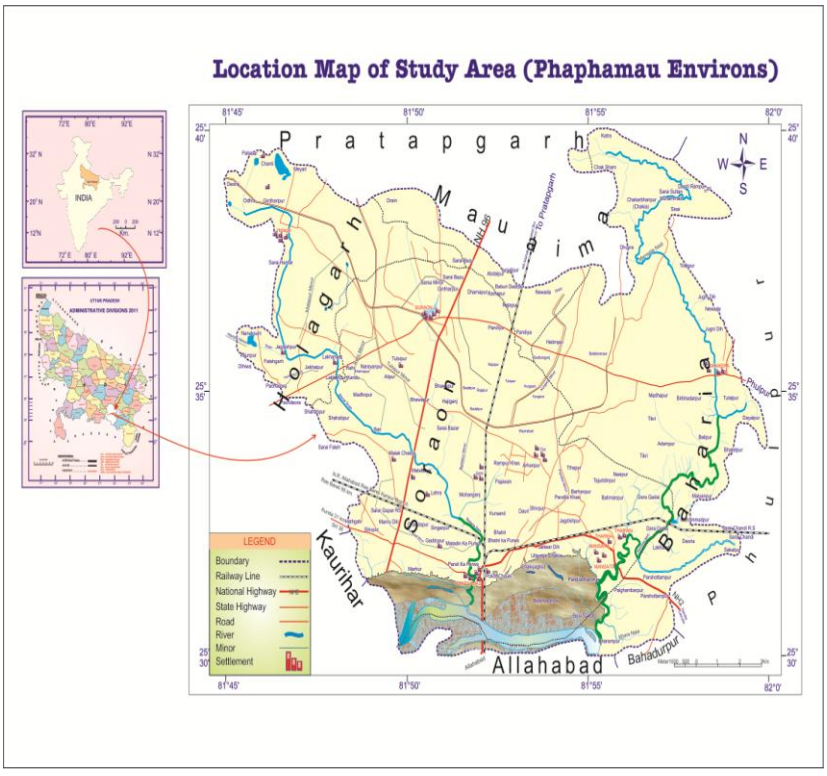
Fourth, researcher has taken help of IFFCO water analysis center Phulpur for water analysis of the drain.

STUDY-AREA

The study-area extends from 25˚ 25'N to 25˚ 35' N latitude and 81˚ 50'E to 81 57'E longitude. River Ganga and its tributary river Mansaita and Basna drain pass through this region. This region spreads over 31.45 km^2geographical area. Geomorphologically, the region is a segment of "Upper Ganga Plain" and particularly is known as a part of "Avadh Plain"(Lucknow Plain), which is one of the most important micro-physiographic units of "Great Plains" of North India. Geologically, the region is filled up with younger and older alluvial deposits. These deposits are comprised of caliches formation, buried soil layers and current soil layers in sequential order from bottom to top ranging from upper Pleistocene to Holocene periods. The main constituents of litho logy in the area are "Khather" and "Bhangar".

The alluvial soil of the area are still largely immature and are of little pedogenic evolution, but have encouraged geomorphic agent 'man' to establish a close relationship with nature, which is the earnest necessity of the present geological era 'anthropocene'.

The region enjoy mild monsoon climate with long hot summer (maximum temperature 41.82˚C and minimum temperature 24.91˚ C in May), medium rainfall generally from mid-June to mid-October (55.28 mm in June, 177.44 mm in July, 231.78 mm in August, 197.82 mm in September and 24.88 mm in October) and dry winter (maximum temperature 23.50˚C and minimum temperature 7.90˚C.



Map-1

PROPERTIES OF THE STREAM

Name of Stream	Length (In Region)	Average Width	Average Depth	Average Flow	Average Discharge Rate
River Ganga	12.95 Km	850 M	23 M	0.77 M/S	
River Mansaita	29.00 Km	25.8 M	6.5 M	0.62m/S	0.72m/Week
Basna Drain	25.00 Km	15.5 M	2.97 M	0.65 M/S	0.82m/Week

RESULT AND DISCUSSION:

WATER QUALITY OF BASNA DRAIN IN PHAPHAMAU SUBURBAN AREA

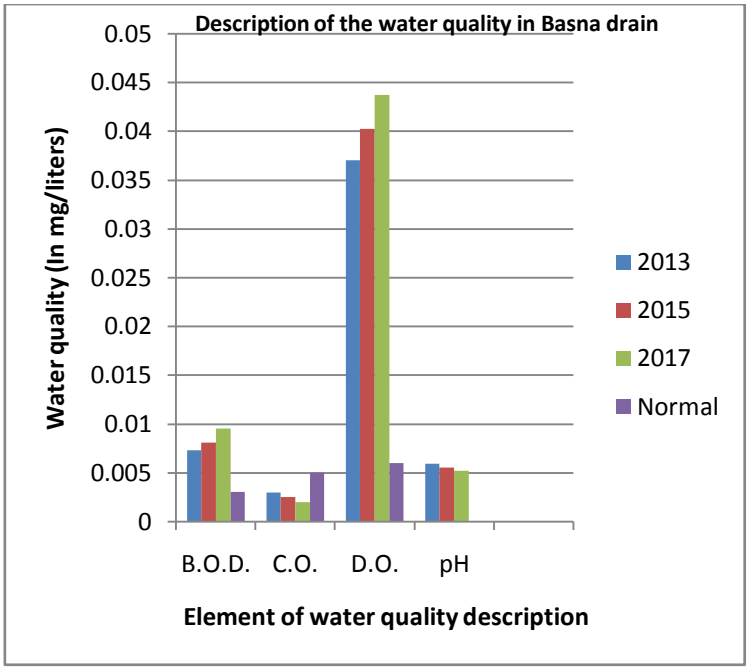
The water quality of any water is very important for flora and fauna in the water and for surroundings. The present study is based on the description and analysis of the water quality of Basna drain. The water quality of Basna drain is decreasing, due to high growth of population, urbanization, uses of chemical and pesticides in agriculture area. The four important elements; Biological Oxygen Demand (B.O.D.), Dissolved Oxygen (D.O.), Chemical Oxygen Density (C.O.D.) and pH value are necessary in the balance water. The sample testing of water of Basna drain is helpful to know the level of water quality in the drain. The testing centre IFFCO in Phulpur is helpful in the testing of water quality of the Basna drain. After that the water quality of the drain is decreasing very fast. The following table shows the imbalance in the water quality of the Basna drain.

Table

Description of the Water Quality in Basna Drain:

S.N.	Element of water Analysis	Quantity (in mg/liters)			Normal condition (In mg/liters)
		2013	2015	2017	
1.	B.O.D.	7.3	8.1	9.5	3.0
2.	D.O.	2.97	2.5	2.0	5.0
3.	C.O.D.	37.03	40.2	43.7	6.0
4.	pH	5.9	5.5	5.2	6.5-8.5

Sources-Water Analysis Center IFFCO (Phulpur).



The above table shows the description of water quality in Basna drain. In this study the four elements (i.e. B.O.D, D.O., C.O.D., and pH value) are responsible in the study of water quality of the drain. The temporal sample water testing year is 2013, 2015 and 2017 with interval of two year. The normal condition of the element of water analysis is shown in the table. The normal condition for B.O.D., D.O., C.O.D., and pH value is 3.0, 5.0, 6.0, 6.5 to 8.5 mg/liters respectively.

The first element of the study is Biological Oxygen Demand (B.O.D.). The Biological Oxygen Demand is known with another name of Biochemical Oxygen Demand. It is the amount of dissolved oxygen needed (i.e. demanded) by aerobic biological organisms to break down organic material present in the given water sample at certain temperature over a specific time. The normal condition of B.O.D. is 3.0 mg/liters. The rate of B.O.D. in Basna drain in year 2013, 2015 and 2017 is 7.3, 8.1, and 9.5mg/liters respectively. The growth of B.O.D. with the difference of two year from 2015 to 2013 is 0.8 and 2017 to 2015 is 1.4mg/liters. The B.O.D. in year 2013, 2015 and 2017 is 4.3, 5.1 and 6.5mg/liters higher than the normal level (i.e. 3.0 mg/liters). Thus the level of B.O.D. is very high and growing very fast. It's very big Challenge for the aquatic environment of Basna drain in Phaphamau region.

The second element of the study is Dissolved Oxygen (D.O.). It is the amount of gaseous oxygen dissolved in the water. Oxygen enters in the waters by direct absorption from the atmosphere, by rapid movement or as a waste product of plant photosynthesis. Water temperature and the volume of moving water can affect dissolved oxygen levels. The normal level of Dissolved Oxygen is 5.0mg/liters. The present level of D.O. in year 2013, 2015 and 2017 is 2.97, 2.5 and 2.0 respectively. It's very low than the normal level. The difference in the level of D.O. from the normal level in year 2013, 2015 and 2017 is 2.03, 2.5 and 3.0. It is very low from the normal level. Hence, it is bad news for the flora and fauna in the drain and its surroundings.

The third element is Chemical Oxygen Demand (C.O.D.). It is a measure of the capacity of water to consume oxygen during the decomposition of organic matter and the oxygen of inorganic chemicals such as Ammonia and nitrite. The normal level of C.O.D. is 6.0mg/ liters. The current scenario of the level of C.O.D. in the drain in year 2013, 2015 and 2017 is 37.03, 40.2 and 43.7mg/liters respectively. It is very high than the normal level. The raise

value of C.O.D. from the normal level in year 2013, 2015 and 2017 is 31.03, 34.2 and 37.5 in Basna drain. Its shows the critical conditions of the aquatic environment of Basna drain.

Finally, the last element of the study is pH value. The total pH scale ranges from 1 to 14, with 7 considered to be neutral. A pH less than 7 is said to be acidic and solutions with a pH greater than 7 are basic are alkaline. The normal value of pH is 6.5 to 8.5. The current year 2013, 2015 and 2017 pH value is 5.9, 5.5 and 5.2 in Basna Drain. The pH value of Basna drain is acidic. The value goes down from the normal level make the water acidic. Thus the above value of Basna Drain shows the acidic condition. This acidic condition is harmful for the flora and fauna of the Basna drain.

CAUSES OF SURFACE WATER POLLUTION IN BASNA DRAIN

When pollutants enter a stream, river or lake these gives rise to surface water pollution. The surface water pollution has a number of sources. These can categorize as:

- Natural and *Anthropogenic* Sources
- Point and Non-point Sources

POINT AND NON-POINT SOURCES

The well-defined source that emits pollutants or effluents directly into different water bodies of fresh water is called point sources. Domestic and industrial waste is examples of this type. The point sources of pollution can be effectively checked. On the other hand, the non-point sources of water pollution are scattered or spread over large areas. This type of sources delivers pollutants indirectly through environmental changes and account for majority of the contaminants in streams and lakes. For example, the contaminated water that runs off from agriculture farms, construction sites, abandoned mines, enters streams and lakes. It is quite difficult to control non-point sources.

NATURAL AND ANTHROPOGENIC SOURCES

As mentioned earlier, an increase in the concentration of naturally occurring substances is also termed pollution. The sources of such an increase are called natural sources. Siltation (which includes soil, sand and mineral particles) is one such natural source. It is a common natural phenomenon, which occurs in most water bodies. Indiscriminate deforestation makes soil loose and flood waters bring silt from mountains into streams, rivers and lakes. On the other hand, the human activities that result into the pollution of water are called anthropogenic or manmade sources of water pollution. For example, domestic (sewage and waste water), industrial and agricultural wastes that goes into the rivers, lakes, streams and seas are anthropogenic sources. Certain materials that are leached from the land by run-off water and enter the various water bodies also belong to this category. The anthropogenic sources of water pollution are shown in Fig. 34.2. Fig. 34.2 : Anthropogenic Sources of water pollution Precipitation Sewer Septic tank or cesspool Leakage Discharge Percolation Water table Imigation Land fill dump or refuse pile Pumping well Stream Leakage Aquifer (fresh) Leakage Discharge or injection Aquifer (fresh) Intentional input Unintentional input Direction of ground water movement Aquifer (saline)

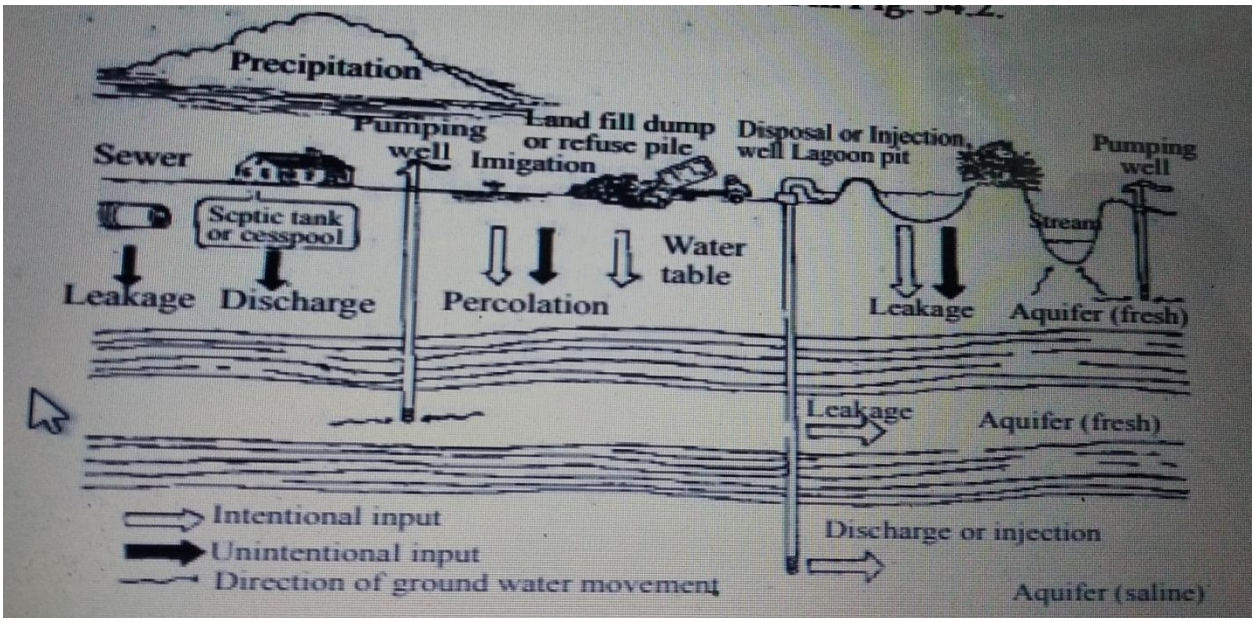


Fig- Anthropogenic sources of water pollution

WATER POLLUTANTS

You have read the various sources from where pollutants enter the water bodies. Let us now learn about the various types of pollutants arising out of these sources. These can be broadly put under the following types.

- Sewage Pollutants (Domestic and Municipal Waste)
- Industrial Pollutants
- Agricultural Pollutants
- Radioactive and Thermal Pollutants

DOMESTIC AND MUNICIPAL POLLUTANTS: The sewage contains garbage, soaps, detergents, waste food and human excreta and is the single largest sources of water pollution. Pathogenic (disease causing) microorganisms (bacteria, fungi, protozoa, algae) enter the water system through sewage making it infected. Typhoid, cholera, gastroenteritis and dysentery are commonly caused by drinking infected water. Water polluted by sewage may carry certain other bacteria and viruses cannot grow by themselves, but reproduce in the cells of host organisms. They cause a number of diseases, such as, polio, viral hepatitis and may be cancer which are resistant to like the organic matter is oxygen demanding substances. They are responsible for deoxygenating of water-bodies which is harmful for aquatic life. Other ingredients which enter the various water bodies are the plant nutrients, i.e., nitrates and phosphates. They support growth of algae, commonly called algal bloom (blue-green species). This process is called eutrophication and is discussed in details in the next section.

***INDUSTRIAL POLLUTANTS*:** Many industries are located near rivers or fresh water streams. These are responsible for discharging their untreated effluents into rivers like highly toxic heavy metals such as chromium, arsenic, lead, mercury, etc. along with hazardous organic and inorganic wastes (e.g., acids, alkalis, cyanides, chlorides, etc.). River Ganges receives wastes from textile, sugar, paper and pulp mills, tanneries, rubber and pesticide industries. Most of these pollutants are resistant to breakdown by microorganisms (called no biodegradable), therefore damage the growth of crops and the polluted water is unsafe for

drinking purposes. Factories manufacturing plastic, caustic soda and some fungicides and pesticides release mercury (a heavy metal) along with other effluents in nearby water body. Mercury enters the food chain through bacteria, algae, fish and finally into the human body. The toxicity of mercury became evident by the Minimata Bay tragedy in Japan during the period 1953-60. Fish died due to mercury consumption and those who ate fish were affected by mercury poisoning and quite a few died. The milder symptoms of mercury poisoning are depression and irritability but acute toxic effects can cause paralysis, blindness, insanity, birth defects and even death. The high concentration of mercury in water and in fish tissues results from formation of soluble monomethylmercury ion, (CH3, Hg+) and volatile dimethylmercuty [(CH3) 2 Hg] by anaerobic bacteria in sediments.

***AGRICULTURAL WASTE*:** Manure, fertilizers, pesticides, and wastes from farms, slaughterhouse, poultry farms, salts and silt are drained as run-off from agricultural lands. The water body receiving large quantities of fertilizers (phosphates and nitrates or manures becomes rich in nutrients which leads to eutrophication and consequent depletion of dissolved oxygen. Consumption of water rich in nitrates is bad for human health especially for small children. Pesticides (DDT, dihedron, aldrin, Malathion, carboryl etc.) are used to kill insect and rodent pests. Toxic pesticide residues enter the human body through drinking water or through food chain (biomagnifications). These compounds have low solubility in water but are highly soluble in fats. For example, the concentration of DDT in river water may be very low but some fish over a period of time accumulate so much of DDT that they become unfit for human consumption. The use of pesticides in our country is increasing very rapidly. Some of these chemicals which are highly toxic become metabolized by animals that graze on fields. Therefore, these poisonous chemicals have been often observed in the human food chain. The presence of these chemicals in humans even in minute amounts can cause hormonal imbalance and may lead to cancer.

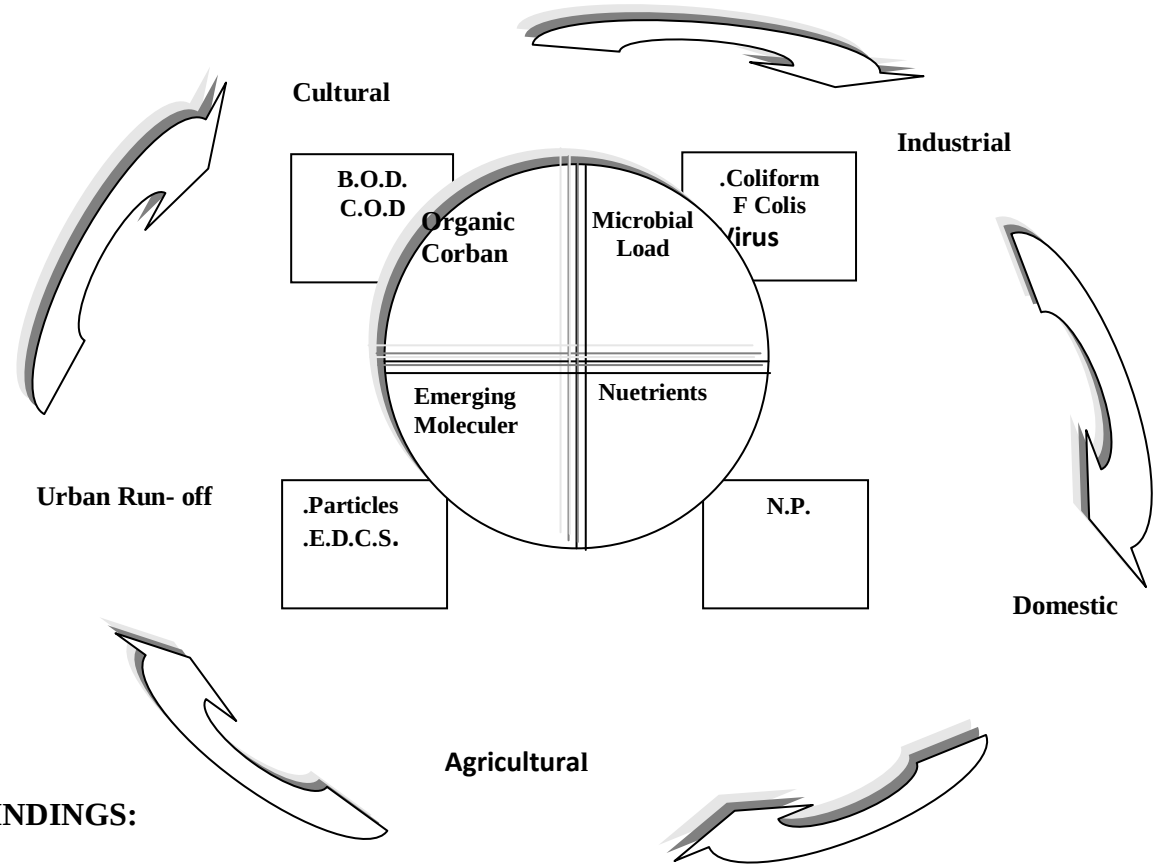
***PHYSICAL POLLUTANTS*:** Physical pollutants can be of different types. Some of them are discussed below:

(a) Radioactive Wastes: Radionuclide found in water is radium and potassium-40. These isotopes originate from natural sources due to leaching from minerals. Water bodies are also polluted by accidental leakage of waste material from uranium and thorium mines, nuclear power plants and industries, research laboratories and hospitals which use radioisotopes. Radioactive materials enter human body through water and food, and may be accumulated in blood and certain vital organs. They cause tumors and cancer.

(b) Thermal Sources: Various industries, nuclear power plants and thermal plants require water for cooling and the resultant hot water is often discharged into rivers or lakes. These results in thermal pollution lead to the imbalance in the ecology of the water body. Higher temperature lowers the dissolved oxygen level (which is very essential for marine life) by decreasing the solubility of oxygen in water. Fish and other aquatic organism can get affected by a sudden change in water temperatures.

(c) Sediments: Soil particles carried to streams, lakes or oceans form the sediments. The sediment becomes polluting due to their large amount. Soil erosion defined as the soil carried by flood water from crop land, is responsible for sedimentation. The sediments may damage the water body by introducing a large amount of nutrient matter.

PATHWAY OF POLLUTANT GENERATION IN BASNA DRAIN



FINDINGS:

- Water pollution refers to any physical, chemical or biological change that has anλ undesirable affect on living organisms.
- Sewage, industrial, agricultural pollution and physical pollutants are the variousλ sources of water pollution. These sources may be limited to a point sources or spread over large areas (non-point sources).
- Sewage, fertilizers, detergents, toxic wastes released by industries is some of the sources of groundwater pollution.
- Phosphatic and nitrogenous fertilizers cause algal bloom and severe oxygen depletion in water body. The water body is said to be eutrophied.
- The quantity of oxygen needed by micro-organisms in degrading organic wastes in a water body is defined in terms of its biological oxygen demand (BOD).
- Biological magnification of toxic materials released into water bodies poses a serious threat to aquatic life and eventually to human life.
- Polluted water may be made useful for human consumption by subjecting it to various treatments.
- Legislative measures have been enacted in our country to restrict the pollution of various water bodies.

SUGGESSITIONS:

By conserving and rejuvenating natural habitats, we can improve the quality of water in our streams. There are many steps we can take to improve the water quality of Basna drain in Phaphamau region, such as:

- Control farm contaminants by applying migration tools.

- Plant trees on hills and near streams to reduce land run-off.
- Remove or mitigate possible limiting factors, which will prevent natural recovery of the area in the short and long term e.g. by fencing off streams to reduce direct water contamination.
- Take care when applying fertilizers and pesticides.
- Be aware of water table depth and avoid overusing in dry seasons.
- Retire land from unsuitable uses or change land uses (e.g. pasture to forest).
- Careful planning of urban growth and subdivisions so that they have minimal impact on neighboring waterways.
- Continued control or removal of invasive or pests.

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