INTRODUCTION
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Water is the elixir of life. Early life originated from water and many species and groups are still confined to aquatic eco-systems. (Trivedi, 2004). There is no need to discuss the need of water in our life, which we are all aware of. Water is basic necessity of our life. We cannot survive without water. Besides our need, water also plays a versatile role in the functioning of the biosphere.(Ghose, 2002).

Water is a vital element for the survival of life on our planet. It covers about three fourth of the earth’s surface.(Misra, 2008).

Surface water is a general term describing any water body which is found flowing or standing on the surface such as streams, rivers, ponds, lakes and reservoirs.(Gray, 2005). India is a country of rivers. Like network a number of river systems spreaded all over the country.(Ghose, 2002).Life, prosperity and civilization revolve around water in the Indian sub-continent (Black, 2005). Unfortunately, pollution of the environment is one of the most horrible ecological crises to which we are subjected today. The three basic amenities for living organisms are air, water, and soil or land. Some times in the past, these amenities were pure, virgin, undisturbed, uncontaminated and basically most hospitable for living organisms, but the situation is just the reverse today because progress in science and technology is also leading to pollution of environment and serious ecological imbalance which in the long run, may prove disastrous for mankind. The root cause of the environmental pollution has been the man’s misbehavior with the nature under the false ego that he is the master of nature. These undesirable
situations are created by man himself and other living biota on the earth (Mathur and Choudhary, 2004).

In comparison to stagnant water, flowing water is particularly a complex situation. Rivers differ not only through; cyclic, seasonal progression but also along their size, length, flow characteristics, gradients geology, salt concentration, turbidity etc. There are also considerable differences in the degree to which they have suffered degradation through pollution.

Uni-directional movement of water in the rivers has a considerable influence on the types of plants and animals that can live in running water. Because of higher water velocity and uni-directional flow in streams allow upstream processes to influence and in some cases determine down stream processes. All rivers in South Gujarat are characterized by high suspended load which often increased with increase in the current speed due to the dispersion of the bottom sediments into the water column. This is typical to the estuaries of South Gujarat region which are shallow and subjected to substantial tidal influence. (Zingde et al., 1987).

Pollution is any departure from purity. However, the term purity must be viewed in context because water is never found in a completely pure state. Even the most remote, untouched geographical locations on the earth now receive some type of contamination through atmospheric transport, water movement, directly or indirectly through the activities of man. (Schmitz, 1995).

Water is one of the most important commodities which man has exploited than any other resources for the sustenance of his life. Most of the
water on this planet is stored in oceans and ice caps which is difficult to be
recovered for our diverse needs. Most of our demand for water is fulfilled by
rain water which gets deposited in surface and ground water resources. The
quantity of this utilizable water is very much limited on the earth. Though,
water is continuously purified by evaporation and precipitation. Pollution of
water has emerged as one of the most significant environmental problems of
recent times (Goel, 1997). Water quality of the costal areas, estuaries and
major river around the world is getting rapidly degraded due to massive
discharge of industrial wastes of diverse origin, domestic sewage, mine
drainage, oil spills, extensive fishing techniques etc. (Zutshi and
Raghuprasad, 2008).

Water is a liquid of life. Pure water is an animating fluid while
polluted water is a real curse for living beings. Man during course of his
civilization has settled in places where plenty of water was available. But
with the increase of population and in exploitation of natural resources for
his own benefit, he has behaved in a wild manner by creating problem of
pollution, hazardous not only to aquatic life but also to his own life. While
western countries have become quite sensitive to this problem. India is still
continuing, because of irresponsible behaviour of its citizens, in rendering
water more polluted day by day and the situations is deteriorating
progressively (Tripathi and Pandey, 1995).

The water of rivers plays an important role in overall development
programmes of the country. They also serve as a source of water supply for
domestic and industrial purposes and also for agriculture, fisheries and
power generation. The same water resources are also utilized for the disposal
of industrial waste and sewage, leading to water pollution. The pollution of rivers and streams by industrial waste and domestic sewage has increased tremendously and producing the most unsanitary condition in the environmental sources of water (Kumar, 2002).

On an overall categories, the more important types of industries whose waste water contribute to pollution of water bodies in India are Pulp and Paper, textiles, tanneries, sugar, distilleries shellac, hydrogenated vegetable oils, coal’s washeries, petrochemicals and miscellaneous agriculture spread and diffuse the hazards of pollution through drainage to ponds, lakes and streams all over the country. And any other industrial wastage which include metals, acids, detergents, petroleum, alkalies, phenols, alcohols, carbamates, cyanides, chlorine and many organic and inorganic toxicants (Jhingran, 1997).

Water pollution may occur either naturally or by man made causes. For protection and control of water quality, however, the man made pollution is more significant. Natural pollution is chiefly derived from the surface runoff and ground water seepage. But, man made pollution the main concern in water pollution, may be said to be originated from Urban, Industrial and agricultural sources. (Rajvaidya and Markandey, 2005).

The material which causes pollution of environment is called pollutants (Trivedi, 2004).

Water collects it pollutants which may be in solid, liquid or gaseous state from various sources. Upon admixture with natural water, these impurities tend to induce undesirable changes in water quantity which results from characteristic interactions with water itself. The nature and
magnitude of the changes are directly related to the nature and quantity of water pollutants present in water. (Trivedi, 2004). These may be a vast number of pollutants present in a water body. For convenience, pollutants are classified as physical, chemical and biological pollutants. (Rajvaidya and Markandey, 2005).

As a consequence of rapidly expanding industrialization and excessive population growth, our rivers are being polluted. Water is regarded as "Pollute" when it is changed in its quality or composition directly or indirectly as a result of human activities, so that it becomes less suitable for drinking, domestic and agricultural or recreational purposes. Surface waters invariably contain a rich variety of micro-organisms. Analysis of the micro-organisms and other biota will give valuable insights into the quality of the water. Specific types present will depend on the environmental conditions of the water. (Gower, 1980). The quality of life is linked with the quality of environment; hence the biological components of the fresh water depend solely on physico-chemical condition of water. Analysis of physico-chemical parameter of water is therefore essential as it has great bearing on explanation of metabolism of the aquatic ecosystem. (Salodia, 1996).

Rivers are currently degraded by both natural and anthropogenic activities, which deteriorate their quality, and made it as sewage channel and push them to the brink of extinction in the process of unplanned development. Unfortunately, over the years, less attention has been given to river losses world over. The major anthropogenic activities noticed were disposal of dead bodies, cattle wading, bathing, open defecation in open
places, clothes washing, disposal of the wastes and ashes. (Verma and Saksena, 2010).

All water resources such as ponds, rivers, streams, estuaries and oceans serve as habitat for various aquatic fauna and flora. (Verma and Sharma, 2002). Among these all resources most fresh water streams flow to the ocean level and meet the sea. Under special condition the flow of freshwater to the ocean is partially enclosed and outlet to the sea restricted to a relatively narrow opening. These places are referred to as Estuaries. Within the estuary freshwater from the lands flows upon and meet the denser salt water of the ocean. (Yadav and Misra, 2004). An estuary is a semi enclosed coastal body of water which has a free connection with the open sea and within which the seawater is measurably diluted with freshwater derived from the land drainage. (Pritchard, 1967). The estuary may extend up to the river channel for a considerable distance and out into an ocean. Because of these resistances to sudden mixing, the nature of the environment and the two water bodies tend to be a great variation in the estuary and at the same location at different times. (Palmer, 1980).

Estuaries constitute a major interface between land and oceans and have been regarded as one of the most important aquatic ecosystems. Distribution of chemical constituents in estuarine environment are controlled by physical, chemical and biological processes, which govern the fate of the nutrients from the continents as major elements in riverine, and coastal regions. (Padmavathi and satyanarayana, 1999).

The river Tapi is one of the major west flowing rivers in the western part of India. Tapi originated from Satpura Mountain in Betul district of
Madhya Pradesh at an elevation of 752 m above sea level. Tapi runs 724 km from its origin though three states (Madhya Pradesh, Maharashtra, and Gujarat) before it joins the Arabian sea near Dumas, Surat.

There are four tributaries joining at right bank of the river (Vaki, Gomal, Amravati, Ane) and ten left bank tributaries (Vesu, Amravati, Bury, Panghara, Buri, Girna, Vaghar, Purna, Muna and Spina). The purna is the largest tributary draining approximately 29% of the basin area followed by Girna 15.4% and other tributaries are relatively small. In the last stretch of 145 km flow to the low lands of Surat district in Gujarat. Considerable fragmentation of the river had already taken place in the name of public and private interest of, agricultural irrigation, water supply, power generation and flood control. On this already fragmented ecosystem the construction of weir cum cause way at Rander is a seer scale human assault. Now Tapi River is divided in two by this barrier, upstream of the weir as fresh water, lacustrine ecosystem created by the impoundment of the river water and down stream of the weir as a marine inlet, which get filled during high tide and drain out along with low tide (C.P.C.B, 1994).

A number of drains loaded with sewage, domestic wastes and industrial effluents open directly into the Tapi river (Trivedy, 2000).

Most of the rivers receive effluents and a heavy load of domestic and city sewage. Domestic sewage is a composite like mixture of faeces, urine and sludge containing waste water, personal washing like clothes, floor, kitchen and others (Gupta et al., 2006). Due to domestic waste water organic and inorganic matter may be in the form of suspended, colloidal and dissolved or solid form concentration is increasing when wastes are organic
in nature. They contain carbon, nitrogen and phosphorus along with large population of micro-organisms and thus make such waters inhospitable for majority of organisms. Most of these are admixed with water other then organic. By and large the city sewage in most part of the world, especially in the developing and under developed countries water reach to rivers bodies in a completely untreated condition and if it is treated than in a partial manner. Addition of detergents and mineralization of organic matter will add to the nutrient budget in for an excessive manner than the natural levels.\cite{Gupta and Bhattachariya, 2002}.

Discharge of sewage into river water is a major environmental problem that adversely affects not only the aquatic and aesthetic values but also the flora and fauna.\cite{Kumar, 2002}. Discharging the waste waters containing organic matter and chemical detergent will increase these nutrients which in turn upsets the natural balance. Pollution brings changes in physico-chemical properties of aquatic ecosystem which ultimately disturb biological communities.

It is generally believed that every water body is capable of accepting certain minimum amount of pollution without any adverse effect on itself due to natural biological cycles and self purification capacity. This is possible as long as it was organic wastes such as fecal matter entering the waters that too in lower acceptable quantities but the situation has completely changed. These waters being subjected to pollution by a wide range of pollutants many toxic and highly persistent and resulted in reducing the capacity for self purification or it is totally lost.\cite{Gupta and Sharma, 2002}.
These undesired and hazardous changes in the natural state cause serious adverse effects on both the biotic and abiotic components of the environment. (Tripathi and Gupta, 2002).

Therefore, it is necessary to evaluate the water quality of Tapi with special reference to its Physico-Chemical property and Phytoplankton communities.

The term indicator organisms can be used for any member of the flora or fauna of a habitat and any species may be considered as potential indicator organism. Bioindicators including both plants and animals species in which some are more sensitive to pollution while others are more tolerant (Egge and Aksnes, 1992). Some species of organisms have specific pre-requisites for their survival and hence fluctuations in their requirements result in an ecological imbalance. Occurrence of such species in a particular area indicates special conditions of habitat and such species are referred as bioindicators. A bioindicator is an organism or biological response that reveals the presence of the pollutants by the occurrence of typical symptoms or measurable responses, and is therefore more qualitative. So, Biological indicators are species used to monitor the health of an environment or ecosystem. They are biological species or group of species whose function, population, or status can be used to determine ecosystem or environmental integrity. Such organisms are monitored for changes (biochemical, physiological or behavioural) that may indicate a problem with their ecosystem. Physical and chemical testing cannot tell us about the cumulative effects of different pollutants in the ecosystem and about how long a problem may have been present the bioindicators tell us. Therefore, a good
The biomonitor will indicate the presence of the pollutant and also attempt to provide additional information about the amount and intensity of the exposure. These organisms (or communities of organisms) deliver information on alterations in the environment or the quantity of environmental pollutants by changing in one of the following ways: Biochemically, Physiologically or Behaviourally. (http://en.Wikipedia.org/wiki/Bioindicator). Since they indicate marked conditions of the environment. ‘Indicator organisms’ are present within the water bodies and wastes naturally, except in highly contaminated environments. Absence of multiple species of different orders with similar tolerance levels that were present previously at the same site is more indicative of pollution than absence of a single species. It is clearly necessary to know that which species should be found at the site or in the system. (Jamil, 2001). Land plants evolved from green algae about 500 million years ago. The algae are a paraphyletic group, meaning they did not descend from a common ancestor. Algal group have independently evolved several times in life on earth, representing a beneficial strategy adopted by parallel evolutionary paths. (http://www.wisegeek.com/whatis.algae.htm).

Algae are a large and diverse group of eukaryotic photosynthetic organisms. Most algae use the energy of sunlight to make their own food, a process called photosynthesis. Algae are the most important photosynthesizing organisms on earth. They capture sun’s energy and produce oxygen in maximum amount (a by product of photosynthesis) than all plants combined. Algae form the foundation of most aquatic food webs, which support an abundance of animals. Algae vary greatly in size and grow
in many diverse habitats. Microscopic algae called phytoplankton which float or swim in water bodies. ([http://tuberose.com/algae.html](http://tuberose.com/algae.html)).

Algae are natural inhabitants of water. It serves as the basic food within an aquatic ecosystem. Algae are involved in water pollution in different ways but the selective algae, in polluted water are also being used as indicators of pollution.

Many organisms may be suitable as indicator species for biomonitoring programmes. The following are major groups of organisms which could be used as indicator organisms viz, micro-organisms, Protozoa, Phytoplankton, Phyto-benthos, Meio-benthos, Macro-benthos, Nekton, Birds and mammals (Trivedi, 2004).

The plankton is the indicator of ecological conditions and chemical nature show recent conditions. If the environmental conditions are altered then the change in the plankton population is inevitable which is replaced by species to species. The utility of plankton as direct or indirect food for fishes and their utility in assessing the water quality have now-been well established. (Salodia, 1996).

Algae are potential pollution indicators because of their quick response to the toxicants and other chemicals. It has long been recognized that the algae are sensitive indicators of water quality.

Periphytic and benthic algae seen to be rather suitable for bio-monitoring work. Diatoms form the bulk of benthic population. The algae (particularly the Chlorophyceae) are very similar to the higher plants in terms of their cell structure, metabolism and nutrient requirement. So, they would obviously be appropriate indicators of soil fertility. Bluegreen algae
and Euglenophyceae are found in greater number at organically polluted sites. (Trivedi, 2004).

When an Ecosystem received any pollutant, changes will occur in its Physico-Chemical nature and that cause a change in the biota of that region. Some biota which is sensitive to the pollutant will disappear from the place and those capable of being tolerant to that type of pollution are able to withstand. In the identification of the organisms of different/similar type of ecosystem, we can predict the degree of pollution.(Trivedi, 2004).

Some algal forms are more valuable as biological indicators because of their acute presence and easy to identify. They also show quick response to environmental changes then other living organisms. Phytoplankton responds rapidly to changes in the aquatic environment particularly in relation to nutrients like nitrate, phosphate and silicate. Most of the phytoplankton in the marine and estuarine ecosystems are nutrient limited, meaning that their production is held below maximum levels by low concentration of one or more essential nutrients of which silicate is the most important nutrient for diatoms.(Eggs and aksnes, 1992).

The higher concentration of nutrients; in particular nitrogen and phosphorous are naturally to be expected in polluted rivers.(Munawar, 1970). The increase of phosphorus as a result of sewage contamination because of Detergent containing phosphate.(Ganapati, 1960).

Phosphate, Nitrite, Nitrate and Ammonia are together referred as nutrients. They are most important for the growth of aquatic life in ecosystem. The presence of phosphate in an estuary can be taken as an index of potential fertility of the ecosystem. Nitrate is the main nutrient which limits the growth of phytoplankton. Nitrate is the highest oxidized form of
nitrogen. Domestic sewage, natural run off and agricultural wastes are the important sources of nitrate and nitrite in the aquatic ecosystem. (Saxsena, 1987).

Algae show distinct distribution and diversity, due to the discharge of domestic sewage, agricultural run off, industrial effluents etc. (Pandey et al., 1999).

Phytoplankton play a key role in maintaining proper equilibrium between abiotic and biotic components of the ecosystems. They have been regarded as the chief primary producers of natural ecosystem.

Phytoplankton productivity is often the primary source of all the organic matter in an ecosystem. Being an index of trophic status phytoplankton reflect the overall environmental condition of the system and its potentiality. Their density has been reported to be affected by the quality of water. (Trivedy, 2000).

This “algal biodiversity” plays an important role along with the physico-chemical characteristics of aquatic environment and its ecology.

When any water body turns up their colour, due to heavy growth of different species of algae, the water is being unpotable and such type of heavy algal growth are called "Algal blooms" or "Water blooms". The water blooms may be constituted by a single species or by a number of species and may be temporary and disappear within a few days only or may be permanent and persist for a longer period. (Tripathi and Pandey, 1995).

Algal blooms are very unsightly and react with recreational persuits. When algae die and decompose, foul odour and tastes are developed in
waters. The scum of algae may act as a barrier of the oxygen penetration into water which is resulting in killing of fish.

Algae respond to organic pollution by complete elimination of the original species. Very heavily polluted areas are almost devoid of algal species. Moderately polluted areas remain often rich in the cyanophyceae species such as Oscillatoria sp. and Spirullina sp. (Goel, 1997).

The other members commonly encountered in organically polluted areas may belong to the groups Bacilllariophyceae (Nitzschia sp., Navicla sp., Synedra sp.) and Chlorophyceae include (Stigeoclonium sp., Cosmarium sp., Scenedesmus sp. and Chlorella sp.) (Goel, 1997).

Algae in water may be considered as generally microscopic organisms that subsist on inorganic nutrients and produce organic matter from carbon dioxide by photosynthesis. The general nutrient requirements of algae are carbon, nitrogen, phosphate, sulfur and some trace elements. (Manhan, 1997).

Algae have recently attracted attention, as indicators of pollution and their use in removal of toxicants from waste water and as a bioassay organism for testing toxicity of chemicals (Becker, 1994). The algae are very similar to the higher plants in terms of their cell structure, metabolisms and nutrient requirements, so they could obviously be appropriate indicators of water quality. Blue green algae and euglenophyceae are in greater numbers at organically polluted sites. (Subha and Chandra, 2005).

In recent years, the number of studies are increasing on the amounts and types of organisms, in case of river phytoplankton. The interest has arisen because of the need for information on water quality played by phytoplankton as biological indicators of pollution.
(Palmer, 1969) observed that the size, shape, amount and rate of precipitation, sunlight and the quality of water greatly influence the growth of algae in water.

Algae are common and normal inhabitants of the surface layers in water bodies exposed to sunlight. Myxophyceae and Bacillariophyceae were shown to be correlated with the intensity of pollution by (Palharya and Malviya, 1988). According to (Mahajan, 2005) Spirogyra sp., Anabaena sp., Navicula sp., Synedra sp. and Oscillatoria sp. can be considered as pollution tolerant forms. Spirogyra sp. and Oscillatoria sp. form abundant growth in the summer season.

The pollution tolerant algae such as Spirogyra sp., Oscillatoria sp., Scenedesmus sp., Pinnularia sp., Gomphonema sp. and Euglena sp. were used as bio-indicator of pollution

Nitzschia acicularis, Nitzschia palea, Navicula pupula, Pandorina morum, Euglena acus, and Euglena polymorpha algal species thrived to extreme polluted site of the rivers. (Palmer, 1969).

(Palmer, 1959) demonstrated that algal assemblages could be used as indicators of clean water or polluted water. Palmer published a composite rating of organisms such as Euglena sp., Oscillatoria sp., chlamydomonas sp., Scenedesmus sp., Chlorella sp., Stigeoclonium sp., Nitzschia sp. and Navicula sp. which could be used to indicate that the water was polluted. On the other hand some other organisms such as Pinnularia sp., Meridion sp., Staurastrum sp. and Surirella sp. indicate that the water body could be considered clean.

Determination of pH is one of the important step to access the water quality. The waste discharges into the river are responsible for including alkalinity or acidity in the water. Majority of flowing waters are neutral to
alkaline in nature. The pH depends on rainfall, photosynthetic activity and discharge of industrial and domestic effluents. (Habib, 2002).

Water temperature plays an important role in influencing the periodicity, occurrence and abundance of phytoplankton. (Tripathi and Pandey, 1995).

Dissolved oxygen is an important factor for aquatic life. Dissolved oxygen values fluctuate due to seasonal variation, stream morphology, temperature and biological characters. The raised values of dissolved oxygen may be due to high photosynthetic rate by phytoplankton during which more carbon dioxide is utilized and oxygen is released. (George and Koshy, 2008). As dissolved oxygen content is important for direct need of many organisms and affects the solubility and availability of many nutrients and therefore, the productivity of aquatic ecosystem. Good quality non polluted surface water are saturated with dissolved oxygen but polluted water tends to lower the dissolved oxygen content which proves to be harmful to the organisms dwelling in the water. (Koshey and Nayar, 2000).

Measurement of Biochemical Oxygen Demand is crucial for assessment of organic pollution on natural water courses and is the amount of oxygen utilized by micro-organisms in stabilizing the organic matter. Biochemical Oxygen Demand values approximate the amount of oxidisable organic matter present in the solution and can be used as a measure of water or waste water strength. (Koshey and Nayar, 2000).

Chloride particularly occurs in all waters and waste water is usually a major constituent. Discharge of agricultural, industrial and domestic waste water can contribute to the presence of chloride in natural water. The most important sources of chloride in water is the discharge of
domestic sewage. So, chloride concentration serves as an indicator of sewage (Gupta et al., 2006). The chloride content increases with degree of eutrophication. The high value of chloride can be due to the Sea water intrusion also (George and Koshy, 2008).

The important natural sources of metals in the atmosphere are surface waters, soils and vegetation, volcanic activity and forest fires (Trivedi, 2004).

Metal pollution in estuarine, harbar and coastal environment is usually caused by land runoff, mining activities, shipping and dumping activities and anthropogenic inputs (Iyer, 1997).

Heavy metals pollution of aquatic environment has been studied in many countries. The choice of metals, Cu, Cd, Pb, Zn and Ni selected for the study because these metals are having importance in nutritional, biochemical and a pollution view point. Copper and Zinc are considered to be essential for plant growth in trace level and toxic at greater amount. Whereas, lead and cadmium are not essential and act purely as toxicants.

Heavy metals have received much attention in ecotoxicology research because of their increasing input extended persistence, wide spread toxicity to biota and their tendency to accumulate and also have biological magnification.

The greater part of the dissolved heavy metals transported by natural water system under normal physico-chemical condition rapidly absorbed on to particulate materials. However, heavy metals immobilized in bottom sediments do not necessarily stay in that condition but may be released as a result of chemical changes in the aquatic ecosystem.
The important natural sources of metals in the atmosphere are surface waters, soils and vegetation, volcanic activity and forest fires.\textit{(Trivedi, 2004).} Chemical properties of heavy metals with respect to their interaction with suspended particles, sediments, aquatic organisms and plants are greatly affected by the dissolved metals exit in natural waters.\textit{(Salomons and Forster, 1984).}

The toxicity of heavy metals in the natural environment, particularly in the aquatic environment is currently of major concern. The problem is compounded by their accumulation at first trophic level of food chain of which phytoplankton, are a major part. Therefore, the contaminants are efficiently passed on to other trophic levels causing a number of disastrous effects.\textit{(Trivedi, 2004).}

The main source for heavy metals is untreated waste water from industries. Cd and Pb may be discharged from metal processing industries, electric equipments, batteries, plastics, chemical industries, dye works etc. Cu and Zn including above sources may come from industries, automobiles, mechanical equipment etc.\textit{(Kabata and Pendias, 1984).}

The main uses of cadmium in industry are as protective plating on steel, nickel-cadmium batteries and in certain pigments and stabilizers used in plastics. Cadmium will be emitted to air and water by miners, metal smelteries, cadmium containing pesticides and both during the manufacturing and their disposal.

The major industrial wastes contributing to zinc, are galvanizing wastes, zinc plating wastes, dye manufacturing wastes. Industries
manufacturing paints and pigments, pharmaceutical industries and cosmetics also contribute to zinc in aquatic habitat.

Copper has been mined and used by man in a variety of products since pre-historic times. Uses for copper include electrical products, coin and metal plating. Oxides and Sulphate of copper are used for pesticides, algicides and fungicides.

Phytoplankton responds rapidly to changes in the aquatic environment particularly in relation to nutrients like nitrate, phosphate and silicate. Most of the phytoplankton in the marine and estuarine ecosystem are nutrient limited, meaning that their production is held below maximum levels by low concentrations of one or more essential nutrients of which silicate is the most important nutrient for diatoms. (Eggs and Aksnes, 1992).

Phosphate phosphorus plays an important role on algal population and acts as primary limiting factors. Phosphate and nitrate in natural water may be derived through allochthonous input, through rainwater, leaching of soil and weathering of rocks. (George and Koshy, 2008).

Algae have been known to produce antibiotic metabolites and there is continuing search for identifying new compounds with antimicrobial activity. Algae are important to humans in the form of food and medicine. Algal species are very much valued for nutritional benefits. Algae have been used in traditional systems of medicine such as in traditional Chinese medicine and Indian medicines and Ayurveda. Agar-agar, carrageenans and alginates are important drugs obtained from algae. Phytochemical and Pharmacological investigations have discovered medicinal and remedial utility of compounds produced by algae like *Spirulina sp.* and *Chlorella sp.*
Investigations have demonstrated antimicrobial and antioxidant activity of several algal species. ([http://dl.begelhouse.com/journals/](http://dl.begelhouse.com/journals/)).

Algae supplements provide the body with Protein, Carbohydrates, Carotenoids, Aminoacids, Vitamins and Trace minerals. It is especially beneficial for vegetarians or individual suffering from malnutrition. Many algal forms are used for medicinal and nutritional purposes e.g. *Spirulina sp.*, *Chlorella sp.* and *Scenedesmus sp.* Algae like *Hydrodictyon recticum*, *Chlorella vulgaris* and *Oscillatoria princes* can be also used for extraction of antibiotics. ([http://onlinelibray.wiley.com/doi/10.1002/bit.260180809](http://onlinelibray.wiley.com/doi/10.1002/bit.260180809)).

Algae stimulate the immune system, increase white blood cells count. Algae supplements are ideal for improving overall health. Algae is also beneficial for treating anemia, infections, fatigue, obesity and toxicity. ([http://www.1001beautysecrets.com/nutrition/algae/index.html](http://www.1001beautysecrets.com/nutrition/algae/index.html)).
Aims and Objectives:-

It is generally believed that every water body is capable of accepting certain minimum amount of pollution without any adverse effect on itself, due to natural biological cycles and self purification capacity.

This was possible as long as it was organic wastes such as fecal matter entering the waters that too in lower acceptable quantities, but the situation has completely revered with these waters as they are subjected to pollution by a wide range of pollutants. Many of them are toxic and highly persistent and resulted in reducing the capacity for self purification. Pollution brings changes in physico-chemical properties of aquatic ecosystem which ultimately disturb biological communities.

One of the most horrible ecological crisis to which we are subjected today is the Environmental Pollution. In the past, three basic amenities air, land or soil and water were pure, virgin, undisturbed, uncontaminated and basically most hospitable for living organisms but the situation is totally reversed now.

The urban, industrial technological revolution and speedy exploitation of every bit of natural resources resulted in environmental pollution.

Surat district is having various small and large scale industries of pharmaceuticals, textiles, chemical, paper and pulp, refiners etc. which contribute in industrial development of Gujarat but at the same time polluting the aquatic ecosystems by the discharge of effluents along with domestic sewage.
As soon as pollutant is added to the water it becomes part of the environment as well as the organisms that live there, it affects the ecosystem. Thus directly or indirectly causing a change in the characteristics of flora and fauna along with physico-chemical characteristics of water. Moreover pollution, both from industrial and domestic waste appear to be real threat to organisms.

Therefore, the investigation has been conducted to assess the impact of pollution through the evaluation of physico-chemical as well as biological parameters of Tapi riverine ecosystem.

Tapi is divided into upper freshwater zone and down stream saline water zone by the weir cum causeway constructed across the river at Rander. Salinity fluctuation in the down stream is depending on the tidal inputs and amount of freshwater released occasionally from weir cum causeway. So, here is the meeting of two water masses i.e. Sea and fresh water indicating a range of different temperature, water levels, current and levels of dissolved, organic and inorganic substances. This is obviously creating a stressful environment and few species of algae can actually tolerate the continuous fluctuations.

Three location were selected on the Tapi on the basis of freshwater and seawater intrusion, anthropogenic and domestic sewage inlets.

Site-1 is Ashwani kumar which is the freshwater zone of the river and the cremation ground is located on the bank of the river thus the drainage of cremation ground, flowers, burnt ash and coal are drained into the river water. This site is also getting polluted by the local people as they wash their clothes on the bank of river.
Site-2 is Nanpura which is intermediate zone of the Tapi. This site is mostly getting polluted due to inlet of the domestic and industrial sewage, and anthropogenic activities.

Site-3 is Umara which is the estuarine zone of the Tapi. Here domestic sewage, anthropogenic pollution and cremation ground waste is drained.

To, evaluate the water quality of Tapi is one of the great advantages for showing the amount of contaminant present in the water and its impact on the physico-chemical and biological components of the water column and it can be used to assess what the organisms are likely to be exposed to, as well as for calculation of the amount transported in and out of the system.

During present investigation the physico-chemical parameters selected to evaluate the water quality were pH, Temperature, chloride, Dissolved oxygen, Carbon dioxide, Hydrogen Sulphide, COD, BOD, Ammonical nitrogen, Nitrate, Nitrite, Silica, Phosphate, and Heavy metals like Copper, Zinc, Nickel, Lead and Cadmium. Biological parameters are strongly affected by variation in water quality, as they serve as good indicator species. So Phytoplankton were also collected and studied.

Tapi has been studied in detail with respect to physico-chemical and its biological communities with special reference to Phytoplankton community.

Phytoplankton were studied because,

- Phytoplankton are used as the indicator species of aquatic environment.
- Phytoplankton are potential pollution indicators because of their quick response to the pollutants.
- Phytoplankton are primary producers and occupy No.1 position in food chain; they fix the solar/radiant energy and convert it into
chemical energy which is transferred from one level to another level of food chain.

- Phytoplankton serve as very good bioindicator in assessing the quality of water.
- Certain algal forms grow in the special types of polluted waters and these species are characteristics features for the particular environment.

**To fulfill the aim following objectives were selected:**

- Quantitative and Qualitative analysis of Phytoplankton with Reference to Physico-Chemical Parameters.
- Biological Succession of Phytoplankton with respect to Season.
- Pigment estimation (Chlorophyll-a) with reference to primary productivity.