5. WORK PLAN AND METHODOLOGY

Bhavan’s College established in 1946 is one of the oldest colleges of western suburb of Mumbai. The college is built upon 45 acres (180,000 m²) of land and has a botanical garden and a beautiful lake. Climate is subtropical, with mild winters and warm summers. The weather is typical coastal sultry and humid. The average rainfall of records from 1500 mm to 2000 mm. The place experiences the onset of the monsoon in the month of June and experiences monsoon till the end of September. The average temperature recorded in varies from 25 to 37 degrees. The raw sewage as well as waste water effluent from the laboratories of nearby Chemistry Department finds their way in the lake water due to seepage. The laboratory and sewage waste water contributes the largest source of heavy metal concentration in the lake, so it is expected that this reservoir can serve as a model for studying heavy metal concentration. The discharge of heavy metals in the environment has much obvious impact on aquatic systems. The increase in residue levels of heavy metal content in water, sediments and biota, will result in decreased productivity and increase in exposure of humans to harmful substances, [38]. The environments of land and water bodies are interdependent, linked by complex atmospheric, geological, physical, chemical and biological interactions.

The study on pollution status along the Bhavan’s College campus of Andheri, Mumbai, will be performed to study the level of pollution in water, sediment, fishes and plants. The sampling will be done daily in morning and evening sessions along different locations of the college campus. The grab samples collected in two sessions for a month will be mixed separately to give gross sample. Such gross samples will be drawn and preserved for analysis to give the pollution data for the period of twelve months.

5.1 Sediment sampling and preservation:

For sampling of soil and sediments plastic-made implements will be used to avoid contamination. Samples will be kept in polythene bags which are free from heavy metals and organics and well covered while transporting from field to the laboratory to avoid contamination from the environment. The samples will be air dried ground using agate mortar and sieved with a 0.5 mm mesh size sieve to uniform particle size. Samples were mixed thoroughly, packed in polythene bags and kept in a dry place until analyses.

5.2 Water Sampling and preservation:
The water samples collected from different sampling stations will be filtered using Whatman No. 41 (0.45 µm pore size) filter paper to remove suspended particles. Filtrate will be preserved in polythene bottles. In order to prevent the precipitation of metals 2 mL nitric acid will be added to the filtrate.

5.3 Vegetation and biota (Fish) sampling:
The vegetation (mangroves); and biota (fishes and crabs) samples will be collected randomly from different sampling locations. Surface contaminants of the samples will be removed by washing with deionized water twice and then with deionized double distilled water.

5.4 Sample Preparation:
The water samples will be concentrated to tenfold on a water bath and subjected to nitric acid digestion. Well-mixed soil/sediment/vegetation/ biota samples will be digested separately with aqua regia on a sand bath for 2 h. After evaporation to near dryness, the samples were dissolved in 2% nitric acid, filtered and then diluted to 50 mL with distilled water [39, 40].

Vegetation samples will be thoroughly washed to remove all adhered soil particles. Samples will be cut into small pieces, air-dried for 2 days and finally dried at 100 ± 1°C in a hot-air oven for 3 h. The samples will be ground in warm condition and passed through 1 mm sieve. The samples will be initially digested with nitric acid and further with aqua regia on a sand bath [40]. After evaporation to a lesser volume, the samples will be filtered and diluted to 50 mL with deionized water. The fish samples will be shucked to remove soft tissue; then freeze-dried for 72 h and finely ground to a homogenous powder. The freeze-dried tissue will be subjected to nitric acid digestion in a Teflon polytetrafluoroacetate closed digestion vessel [41]. After digestion, the vessels will be cooled to room temperature and then diluted to 10 mL with deionized water. Digests will be stored between 0–5 °C until analysis.

5.5 Analysis:
The analysis for the majority of the toxic metals like cadmium (Cd), copper (Cu), Nickel (Ni), chromium (Cr), cobalt (Co), iron (Fe), lead (Pb) mercury (Hg), arsenic (As) and zinc (Zn), will be done by Flame Atomic Absorption Spectrophotometer. For estimation of As and Hg, hydride generation coupled with an atomic fluorescence detector and cold-vapor techniques will be used [42]. The standard solutions will be prepared by using A.R. grade chemicals in acidified metal free deionised water. The calibration curves will be prepared separately for all the metals by running different
concentrations of standard solutions. A reagent blank will be used during the analysis and subtracted from the samples to correct for reagent impurities and other sources of errors from the environment. Average values of three replicates will be taken for each determination.

5.6 Physico-Chemical study:
The water samples collected will be analyzed for temperature, pH, conductivity, suspended solids, dissolved solids, alkalinity, salinity, hardness, Chemical Oxygen Demand (C.O.D), Dissolved Oxygen (D.O), Biochemical Oxygen Demand (B.O.D), cyanide, fluoride and phosphate content. The techniques and methods followed for analysis and interpretation will be according to the standard procedures [33-38].

5.7 Microbiological Assay:
The microbiological study for Escherichia Coliform (E.coli) and total bacteria will be performed by usual methods [1].

5.8 Air Pollution Tolerance Index (APTI):
The study was carried out to understand air pollution impact on different plant species grown in Bhavan’s College campus. Leaf samples were obtained from 08 plants species of different locations in the campus area. The Air Pollution Tolerance Index (APTI) was determined by calculating the ascorbic acid, chlorophyll, pH and relative water contents in leaf samples. Ascorbic acid was estimated by 2, 6 - dichlorophenol indophenol dye following the usual method [43]. Chlorophyll was calculated by spectrophotometer and pH was determined by digital pH meter. Relative water content of leaf material was estimated by taking the initial weight and dry weight of leaf material. The APTI was calculated by using the following formula [44]

\[ \text{APTI} = \frac{A (T+P) + R}{10} \]

Where, 
A= Ascorbic acid (mg/g dry wt.)
T= Total Chlorophyll (mg/g dry wt.)
P= pH of leaf extract.
R= Relative water content of leaf tissue (%).

The entire sum was divided by 10 to obtain a small manageable figure.
6. SCOPE OF THE STUDY
The study on pollution status along of the is proposed to be carried out for tenure of one year. The sampling of water and sediment samples will be done daily in morning and evening sessions along different locations of the creek. The samples collected in two sessions for a month will be mixed separately to give gross sample. Such gross samples will be drawn for twelve months. The gross samples collected for twelve months will be analyzed for their physico-chemical properties, heavy metal contents, and organic pesticide content as well as for microbiological content. It is expected that the results of samples collected for twelve months will provide fluctuations in level of pollutants released during different working days of the college.
7. UTILITY OF THE STUDY

Although the Central Pollution Control Board (CPCB) is responsible for restoration and maintaining the wholesomeness of aquatic resources under Water (Prevention & Control of Pollution) Act 1974 passed by Indian Parliament, it is expected that to maintained or restored the water quality at desired level it is important to have monitoring on regular basis. Such regular water quality monitoring helps in evaluating the nature and extent 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. 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 study on pollution status along the Vasai creek will be useful to satisfy following objectives.

• For rational planning of pollution control strategies and their prioritization;
• To assess nature and extent of pollution control needed;
• To evaluate effectiveness of pollution control measures already 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.
8. LIMITATIONS
In view of limited resources, limited numbers of physico-chemical parameters, organic pollution related parameters, major inorganic ions and micro pollutants (Toxic Metals) will be monitored and analyzed monthly to keep a track of water quality over large period of one year. It is expected that prolonged preservation of samples particularly in warm weather conditions might bring variations in the results. To get a concrete and consistent pollution level data it is felt that analytical results needs in depth validation. There is also a possibility of low flow conditions of lake water prevailing during summer months. The quality control of chemicals used in analysis is also a cause of concern which can be tackled by using analytical grade chemicals. Limited availability of software to analyze the data for trend analyses and data validation will also reduce the speed of the research work.

9. TIME SCHEDULE

<table>
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<tr>
<th>Activity</th>
<th>Duration</th>
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<td>Sampling</td>
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<td>Physico-Chemical analysis</td>
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<td>APTI Analysis</td>
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<td>Compilation of analytical results</td>
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