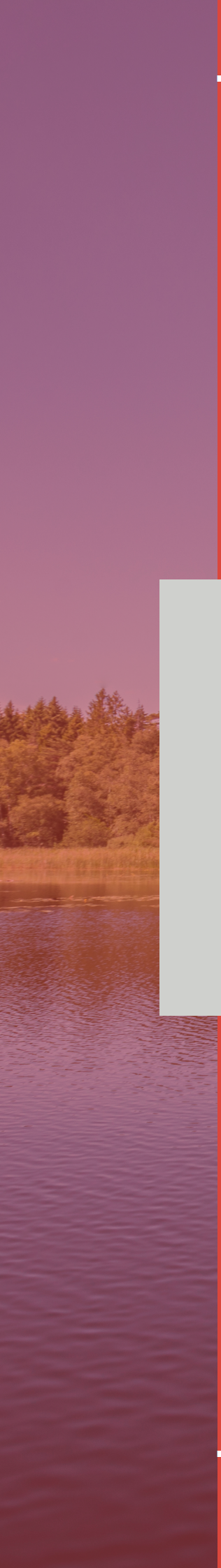

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CHAPTER -1
INTRODUCTION

1. HISTORICAL BACKGROUND

Bengaluru city, earlier known as Bangalore, was once aptly known as "The City of Lakes". The Kempe Gowdas, founder of Bengaluru, established several man made tanks and lakes to impound with the idea that its citizens would always have abundance of water for drinking, irrigation and other secondary usage and also enhance the beauty of the city.The first tank in Bengaluru was constructed way back in the later part of the 16th century named Ulsoor tank covering an area of 125 acres. The first instance of contamination of Ulsoor tank by domestic sewage was reported in 1883 after which the use of lake water for public consumption was prohibited. As per the earlier records of Bengaluru city, there were around 262 water bodies, however, today as per the recent figure, the number of lakes/tanks have declined and some of the lakes are disused. The reduction of water bodies over the period has been 35%, while in terms of water spread area, it records a decrease of 8.6%.

1.1 IMPORTANCE OF LAKES IN BENGALURU

The natural undulating topography of city with hills and valleys makes it apt for development of lakes to arrest and store rainwater. The lakes of Bengaluru city have a hydrological connectivity forming a chain of reservoirs in the existing three valleys namely Hebbal, Koramangala & Challaghatta and Vrishabhavati. Each valley at the ridge top gives birth to small streams and these cascades down to form major stream systems in three valleys. The water flows from North to South-East and in the South-West directions along the natural gradient of the land. During rainy season, the surplus water from the upstream lake flows down into the chain of lakes situated downstream. This connectivity prevents wastage of overflowing water from the lakes into the surrounding area. Bangalore and the lakes are interlinked to each other through a series of chains of lakes in series giving a cascading effect to the whole system. Today, Bengaluru city is partly dependent on Cauvery river, 140 km away from the city as a drinking water source apart from groundwater.

1.2 PRESENT SCENARIO OF BENGALURU LAKES

Since many years, lakes have been serving as the medium of water security to the lakhs of people of Bengaluru city especially during non-rainy season. The lakes have also favorably influenced microclimate of the Bengaluru city, and by adopting the concept of rainwater harvesting, the lakes are a source of groundwater recharge and also have increased the bio-diversity by evolving into wetland ecosystem. The Northern part of the city has 40% of the lakes and the Southern part has 60%. Groundwater is a major source of drinking water for the city, and therefore the lakes need to be preserved and protected for avoiding groundwater contamination due to polluted lakes. Rapid urbanization and developmental activities in the Bengaluru city have contaminated the lakes of the city. Illegal dumping, encroachment and discharge of industrial/wastewater and domestic sewage into the lakes, resulted in lakes being polluted, and also most of the lakes are reduced to cesspools.A division bench headed by Chief Justice A S Oka was hearing a batch of petitions seeking directions to the BBMP to ensure effective maintenance and monitoring of the storm water drains. In pursuance of the orders of Honourable High Court of Karnataka (W.P.No. 38401/2014 C/w. W.P.No. 11044/2018 dated 18.06.2019) wherein Honourable Court has directed to appoint CSIR-National Environmental Engineering Research Institute (CSIR-NEERI) for study of Bengaluru lakes. The Honorable High Court added that NEERI as an expert agency shall make an in depth study as per the terms of reference (ToR) and the state including other concerned authorities would have to implement the short-term and long-term measures as recommended by CSIR-NEERI.

Director, CSIR-NEERI and team of Scientists visited Bengaluru and held a meeting with Commissioner, Special Commissioner, BBMP and Additional Chief Secretary, Urban Development Department on July 16th, 2019. The officials briefed CSIR-NEERI about the status of lakes of the city. Based on the Honourable High Court order and subsequent discussions,

BBMP vide letter no. Comm/BBMP/Lakes/PR/PSR(G)/1743/19-20 dated 26th July 2019, approached CSIR-NEERI to undertake the study on lakes of Bengaluru city for the protection, restoration and rejuvenation of the deteriorating lakes. Accordingly, CSIR-NEERI submitted a proposal to BBMP with defined objectives and scope of work. Subsequently, CSIR-NEERI has initiated the study in association with other CSIR institutes having expertise in subject area keeping in view of the timelines and scope of work in two phases.

1.3 OBJECTIVES OF THE STUDY

- Study the causes of pollution of lakes in the city of Bengaluru.
- Ascertain the location of lakes which have disappeared with passage of time.
- Suggest short term and long term measures for the protection, restoration and rejuvenation of lakes.
- Preparation of master plan for rejuvenation and restoration of the existing lakes.

1.4 SCOPE OF WORK

Honorable High Court order dated 18.06.2019 and in accordance with the ToR of the study, the work is to be carried out in two phases as delineated here under:

Phase-I: Assessment status of the lakes and need for rejuvenation

- Reconnaissance survey of 210 lakes of Bengaluru city within the limits of BBMP area presented in Table 1.
- Ascertain the location of lakes which have disappeared with passage of time.
- Study the environmental status of the existing lakes.
- Ascertain the causes of pollution of the lakes.
- Suggest measures for restoration of the extinct lakes which have disappeared with the passage of time.
- Recommend short term and long-term measures for protection, restoration and rejuvenation of the existing lakes.

Table 1: Number of lakes in Bengaluru city

Government Agency	No. of lakes
Bruhath Bangalore Mahanagara Palike	168
Bangalore Development Authority	32
Karnataka Forest Department	9
BMRCL/Metro	1
Total	**210**

Phase-II: Master plan for rejuvenation of lakes

- **Prepare master plan for rejuvenation of the existing lakes as well as for the restoration of all the lakes.**
- **Update the existing rejuvenation master plan available with BBMP/BDA.**

As per the new Karnataka Government Order dated 11.12.2019, 27 lakes under the custody of Bengaluru Development Authority (BDA), 09 lakes under Karnataka Forest Department and 01 lake under BMRCL (Bangalore Metro Rail Corporation Limited) have been transferred to BBMP (Bruhat Bengaluru Mahanagara Palike). The revised details are given in Table 2.

Table 2: Revised number of lakes in Bengaluru city

Government Agency	No. of lakes
Bruhath Bangalore Mahanagara Palike	205
Bangalore Development Authority	05
Total	**210**

1.5 REPORT LAYOUT

Chapter 1: Introduction (this chapter)

- *This chapter outlines an introduction to the whole study carried out under Phase-I.*

Chapter 2: Background of the study

- *This chapter briefs the details of the study area, namely climate, geology, humidity, temperature etc. It also outlines the details of the lakes of Bengaluru city.*

Chapter 3: Prevailing baseline status of the lakes of Bengaluru city

- *This chapter focuses on the status of the existing lakes of Bengaluru city. It also details the pollution status of the lakes w.r.t water quality in terms of physico-chemical, bacteriological and biological parameters including sediment quality.*

Chapter 4: Short term and long-term measures

- *This chapter outlines the short term and long-term measures to be adopted by BBMP for the lake quality preservation etc.*

Chapter 5: Conclusion

- *This chapter outlines the summary of the pollution status of the lakes and delineates the necessary measures recommended for rejuvenation and restoration of the lakes.*

CHAPTER -2 BACKGROUND OF THE STUDY

2.0 INTRODUCTION

The study area is located in Bengaluru district and lies in between the latitudes N 12°51' 00" N to N 13°9' 00" and longitudes E 77° 29' 00" to E 77°47' 00" at an average elevation of about 900 m. The study area comprises of Bruhat Bengaluru Mahanagara Palike (BBMP) and Bengaluru Development Authority (BDA) (Fig. 2.1) of Bengaluru Metropolitan Area (BMA).

2.1 DESCRIPTION OF STUDY AREA

The Bengaluru district comprises of the BBMP and BDA areas. BBMP is further divided into 8 zones viz., Raja Rajeshwari Nagar Zone, Dasarahalli Zone, Mahadevpura Zone, Yelahanka Zone, Bommanahalli Zone, South Zone, East Zone and West Zone. The list of the lakes that fall under BBMP are presented in 3-Table 2.1. Out of total 210 lakes, BBMP has 205 lakes under its custody and remaining 5 lakes fall under BDA.

2.1.1 BBMP (BRUHAT BENGALURU MAHANAGARA PALIKE)

BBMP is fourth largest Municipal Corporation in India with an area of 762 km2 and population is 6.8 million (2011 census). BBMP has 198 wards within the Bengaluru Metropolitan City to regulate the zoning, building regulations, health, licensing, trade, education and infrastructure. The whole BBMP area is surrounded by the BDA area. Bengaluru is the fastest growing cities in India with growing IT industry. The city is called as Silicon Valley of India, IT Hub of Asia and also called as the Pensioners Paradise. .

2.1.2 BDA (BENGALURU DEVELOPMENT AUTHORITY)

BDA forms the circumference of the BBMP area. BDA is the planning authority which covers an area of 1307 km2 with 590 villages under its jurisdiction. BDA has been mapping the Urban growth Boundary (UGB) for Bengaluru city through comprehensive development plan (CDP) and the same is revised every year as per the Karnataka Town and Country Planning Act, 1961. BDA has the major lakes viz., Bellandur and Varthur under its jurisdiction.

2.1.3 CLIMATE

The city is situated at an altitude of 920m above mean sea level. The city experiences a tropical climate with dry and wet seasons. The city has pleasant weather throughout the year and has a maximum temperature of 36°C with a mean temperature of 27°C. The average rainfall in the study area is 900mm with average of 50 rainy days. The monthly humidity of the city is as low as 44% in the month of March and reaches to an extreme of 80 to 85% in the period during June to October. Surface winds have seasonal variations either east or west with eastern winds dominating the year and the general wind speed averages from 9 to 17 km/h.

2.1.4 GEOLOGY

The area is an upland plain, surrounded by undulating topography. Bengaluru is located in the centre of Mysore plateau, part of Precambrain Deccan Plateau with granites and gneisses, which are prominently exposed as a central ridge running NNE-SSW in Bengaluru North. Pegmatitic ad aplitic veins and basic xenolithic patches gently crisscross granitic gneisses. The rocks act as good aquifers and have considerable weathering. Granites and gneisses are intruded by a number of basic dykes that are oriented east-west and north-south. Dykes form a barrier to the movement of groundwater in the area.

At higher elevations, laterite is found with weathered gneisses showcasing various shades of clay. South Bengaluru has high granite genisses mounds raising to 30 to 70m. The southern and eastern areas have deep weathered zones in valleys and dissected terrain. The loamy sandy soil are also present in the study area with ranging depth of 2 to 5m with a below weathered zone of depth 5 to 20m. The topography is flat excluding a central ridge running from NNE to SSW.

2.1.5 HYDROMORPHOLOGY

The undulating topography of the area makes it favorable for the large water bodies creation, providing uses for irrigation, drinking and fishing etc. The water bodies in the past had helped the city in maintaining the water balance in the area and in the neighborhood. The city has a series of valleys, ridges and has major watersheds viz., Kormangala and Challaghatta valley, Hebbal valley, Vrishabhavathi valley which holds rain water and this water is utilized in dry periods of the city. All the lakes in the Bengaluru city form a hydrological chain. The reservoirs of the city are the lakes that constitute the major part for the water usage. Small stream originate from these three valleys which flow down from each valley to the other.

There is no major river in Bengaluru city. Arakavati river flows through Bengaluru North. Vrushabhavati river originates from Basavanagudi within the city and flows to join the river Arkavati as tributary near Muduvadidurga. At present, both the rivers carry sewage of Bengaluru city.

2.2 METHODOLOGY

As per the High Court Order for carrying out the pollution status of the lakes, CSIR-NEERI has carried out a reconnaissance survey of the lakes followed by a series of meeting with BBMP, BDA etc. The 210 lakes of Bengaluru city have been classified into the various categories viz., Developed lakes, Work in progress lakes, tender in progress lakes, undeveloped lakes and discussed lakes (encroached lakes). The methodology adopted for assessing the pollution status of the lakes is as follows: The step by step process of carrying out the study is presented in 1-Fig. 2. The study started off with the reconnaissance survey of the lakes and then with the collection of the secondary data, preparation of the thematic maps and finally sampling and then analysis, data interpretation. CSIR-NEERI team after having series of meeting BBMP has carried out a reconnaissance survey of the lakes. Every detail of the lakes viz., encroachment details, boundary of the lake, inlets and outlets of the lake and other relevant details were obtained from BBMP and accordingly, a field plan for the 210 lakes had been prepared in consultation with BBMP. The GPS location of every lake has been noted and the same has been plotted on the map. The secondary data has been collected from various departments viz., Karnataka Pollution Control Board (KSPCB), Karnataka Groundwater Board (KGWB), EMPRI (Environmental Management and Policy Research Institute), BBMP (Bruhat Bengaluru Mahanagara Palike), BDA (Bengaluru Development Authority), Karnataka Forest Department etc regarding the available information on the lakes.

The data has then been used for the interpretation of each lake data with the collected secondary data. After the reconnaissance survey of the lakes, the GPS location of each lake has been plotted on the Survey of India Toposheets 57G/8, 57G/12, 57H/5 and 57G/9 on 1:50,000 scale. The boundary of each existing zone of BBMP and BDA has been digitized and a thematic map depicting all the zones has been prepared. The figure shows the location of the all the categorized lakes in each zone. Each lake thematic map has been prepared that shows the boundary of the lake along with 30m buffer area round the lake that shows the settlements etc. that are present around the lake. The inventorisation of every lake has been carried out with BBMP where BBMP has helped CSIR-NEERI in demarcating the lake boundary and helped in locating the entering point of the lake. Accordingly, various features of the lake viz., status of the lake, inlet and outlet, presence of STP, presence of separate storm water drain etc have been noted down in the field note book during the site visit. Accordingly, the list has been prepared.

The disused/encroached lakes have been physically verified and the GPS location and photographs of the same have been taken in the field. The locations have been plotted in the GIS software. The details of the encroached lakes have been obtained from BBMP subsequently. A separate write up on the encroached lakes along with the restoration plan for Kamakshi Palya, Arehalli, Thavarakere lakes has been presented in the subsequent chapters of the report.

2.3 FIELD SAMPLING

CSIR-NEERI team had carried out sampling work during August 2019 - January 2020. Parallel teams have carried out the sampling of these lakes. A field schedule for the day has been prepared in consultation with BBMP and accordingly the sampling was started. At each lake, the team noted down the GPS location of the lake, check the boundary of the lake and other features pertaining to the lake. The samples were collected at the approachable places of the lake. The lake samples were also collected from the middle based on the status of the lake viz., weeding etc. The lake samples were collected at the surface, middle and bottom depending on the depth of the lake. The lake samples including lake water and sediment were analyzed for physico-chemical, biological (phytoplankton, zooplankton and benthos) and microbiological parameters. The microbiological samples were stored in ice boxes and transported to the laboratory for analysis.

2.4 LAKE QUALITY PARAMETERS

2.4.1 PHYSICO-CHEMICAL AND MICROBIOLOGICAL PARAMETERS

The lake water samples were analyzed for the parameters viz., pH, temperature, Electrical Conductivity (EC), Total Dissolved Solids (TDS), Total Suspended Solids (TSS), Turbidity, Dissolved Oxygen (DO), Biological Oxygen Demand (BOD), TOC (Total Organic Carbon), Nitrate, Phosphate, Total Coliform, Fecal Coliform, chlorophyll, pheophytin. The parameters like pH, TDS, EC, temperature were measured on site. Dissolved Oxygen (DO) was fixed on site and later analysed in the lab. The depth of the lake was also measured. Sachi disk was used to check the transparency of the lake. All the other parameter were preserved using the respective chemicals. The list of parameters along with the units and the method of analysis are presented in the Table 2.1.

Table 2.1 List of parameters of lake water analysis

S.No.	Parameters	Unit	Methods: Reference: APHA 21st Edition Methods
1.	pH	–	4500 – H - Electrode
2.	Electrical Conductivity (EC)	µS/cm	2510 – C Conductivity meter
3.	Total Dissolved Solids (TDS)	mg/l	2540 – C Gravimetric Method
4.	Total Suspended Solids (TSS)	mg/l	2540 – D Gravimetric Method
5.	Turbidity	NTU	2130 – B Nephelometric Method
6.	DO	mg/l	4500 – o – C Azide Modification
7.	BOD	mg/l	5210 – B BOD test at 27^{0} c
8.	TOC	mg/l	TOC Analyzer (Catalytic Oxidation Combustion Method)
9.	NO_3	mg/l	4500 – B UV Spectrophotometric Method
10.	PO_4	mg/l	4500 – D Stannous Chloride Method
11.	TC	CFU/100ml	9222 - B Membrane Filtration Technique Method
12.	FC	CFU/100ml	9222 – D Membrane Filtration Technique Method
13.	Chlorophyll	mg/m^3	10200 H Spectrophotometric Method
14.	Pheophytine	mg/m^3	10200 H Spectrophotometric Method

2.4.2 BIOLOGICAL PARAMETERS

Phytoplankton

The group Phytoplankton is generally known as primary producers as they are the basal group of the food chain in the water body. The distribution of phytoplankton is important for the survival of aquatic life. Also, the richness of phytoplankton positively influences the richness of fishes and other aquatic life forms. The distribution and density of phytoplankton are influenced by climate, season, pH, water level, turbidity, nutrient flux, sunlight availability etc. Importantly, pollution or abiotic stress greatly affects the phytoplankton diversity in the aquatic body. Studying the diversity of phytoplankton will help to understand the health of water body. Thus, the phytoplankton distributions were analyzed in this study.

The phytoplankton diversity in the lake was studied by following a standard procedure. Briefly, 100 litres of water sample was filtered through plankton net with the mesh size of 20µm and collected in a sampling container. The collected sample was preserved by the addition of Lugol's iodine solution and 5% buffered formalin solution. All samples were labeled properly and transported to the laboratory for analysis. In the laboratory, the collected samples were briefly centrifuged at 3500rpm for 20 min and the concentrated sample was analyzed following Lackey drop method under Compound microscope. Further, the composition of phytoplankton (%) and Shannon-Weiner Diversity Index (SWDI) were calculated for each sample to evaluate the community structure and diversity of phytoplankton.

Zooplankton

Zooplanktons are generally known as Secondary producers or primary consumers. They mainly depend on the phytoplankton for their survival. The diversity of zooplankton also depends on climate, season, pH, water level, turbidity, nutrient flux, sunlight availability, pollution level, abiotic stress, etc. The richness of zooplankton is also important for the production of fish and other aquatic life form. Studying the zooplankton will indicate the health of water body.

The diversity of zooplankton was studied using the sample collected by filtering 100 l of water through plankton net with the mesh size of 200 µm and preserved by adding 10 % buffered formalin. All the samples were properly labeled and transported to the laboratory for analysis. The sample was analyzed microscopically and the morphological characteristics were used to identify the organisms. Further, the community composition (%) and Shannon-Weiner Diversity Index (SWDI) were estimated based on the diversity of the zooplankton to assess the community structure and diversity of zooplankton in the lake.

Benthic Fauna

Benthic fauna is generally known as the organisms that are living on the surface or within the sediment of lake floor. The diversity of benthic community is very important for the maintenance of Lake. The diversity of benthic community could be affected by biotic as well as abiotic factors. Thus, studying the diversity of benthic fauna could help to understand the heath of water body. With the above perspectives, the benthic community of the Lake was analyzed.

The diversity of benthic fauna was studied using the sediment samples collected with Van Veen grab sampler and sieved through 500 µm sieve. The sieved samples were collected in the sampling bottles and fixed with Rose Bengal-Mgcl2 and 5% buffered formalin solution. The samples were labeled properly and transported to the laboratory for analysis. The samples were analyzed using stereo microscope and the morphological features were used to identify the organisms. Further, the composition of benthos (%) and Shannon-Weiner Diversity Index (SWDI) were calculated for each sample to evaluate the community structure and diversity of Benthos Fauna.

Interpretation of diversity Index

The SWDI has been used to assess the pollution or stress level in the water body. The following criteria were used to determine the pollution level in the Lake based on SWDI values.

SWDI Value	Condition
Less than 1	Heavy pollution
1-2	Moderate pollution
2-3	Less pollution or moderately good condition
More than 3	Good quality

2.4.3 LAKE SEDIMENT

Sediment samples from lakes were collected as per the standard procedure using Van Veen Grab Sampler to evaluate the existing status of sediment quality of the lake. Sediment quality delineated through specific parameters, viz., pH, EC, total Kjeldahl Nitrogen (TKN), Total Phosphorus and Total organic carbon (TOC), Particle Size distribution, Texture and Heavy metals. Standard methods have been followed for the analysis of sediment samples.pH is an indicative of the alkaline or acidic nature of the sediments and greatly affects the microbial population, solubility of metal ions as also regulating nutrient availability. Most of the Aquatic organisms are affected by pH because most of their metabolic activities are pH dependent. Optimal pH range for sustainable aquatic life is pH 6.5 - 8.2. (Murdock et al.,2001). The electrical conductivity (EC) of soil and sediment, associated with salinity is measured as one of main soil characteristics in agricultural production and environmental protection. It is influenced by moisture content, salts, and amount and type of clays and other factors. The pH and EC of sediment samples were determined by preparing sediment extract in distilled water in ratio 1:2 (as per Jackson procedure, 1967)Sediment is the sink and source of nutrients in overlying water. The study of the total nitrogen (TKN), total phosphorus (TP) and TOC (TOC) in sediments is significant to understand their circulation in water-sediment interface. Organic carbon, present in sediments, influences its physical and chemical properties. TOC can have its origin either from organic matter from natural sources such as plant materials deposited on sediments or anthropogenic inputs to aquatic systems.

Depending on the environmental conditions, sediments can store and discharge nutrients, and therefore play an important role in the circulation of materials in the aquatic environment. Two of the principal nutrients, nitrogen and phosphorus in their various forms play an essential role in aquatic biological processes. Further, their concentrations can be significantly augmented by the activities of man, especially through point discharges of municipal and industrial wastes, and through runoff from modified watersheds. Total nitrogen was determined by Kjeldhal method and total phosphorus was determined by Ascorbic Acid Blue Colour method (spectrophotometric). Total organic carbon content was also determined by TOC analyzer following standard pretreatment. Particle size distribution, also known as gradation, refers to the proportions by dry mass of a soil distributed over specified particle-size ranges. The textural class of a soil is determined by its particle size distribution; namely sand, silt, and clay content. Texture refers to the general physical appearance of the sediment. The international pipette method (Black, 1965) was adopted for determination of particle size distribution and texture based on the United States Department of Agriculture (USDA).The heavy metals occur in the solution as cations and are adsorbed by the negatively charged soil particles. They are held strongly as complex on the surface of clay alumino silicates hydrated oxide and humus. In general, adsorption increases with pH. Heavy metal pollution needs serious attention because it can persist in the sediment for many decades. The heavy metals also create problems in the nutrient utilization by plant and also marked reduction in chlorophyll content. Heavy metals in sediment samples were determined by extracting sediment by Hydrochloric acid and Nitric acid mixture digestion and analysed on ICP-OES (SW-846-6010-B / EPA).

Table 2.2 Sediment Quality Guidelines

S.No.	Metals	Consensus based SQG*		Canadian SQG**	
		TEC	PEC	ISQG	PEL
1	As	9.8	33	5.9	17
2	B	-	-	-	-
3	Cd	0.99	5.00	0.6	3.5
4	Cr	43	110	37.3	90
5	Co	-	-	-	-
6	Cu	32	150	35.7	197
7	Fe	20000	40000	-	-
8	Hg	0.18	1.11	0.17	0.486
9	Mn	460	1100	-	-
10	Ni	23	36	-	-
11	Pb	36	130	35	91.3
12	Zn	120	460	123	315

TEC; Threshold Effect concentration (below which adverse effects are not expected to occur)

PEC : Probable effect Concentration above which adverse effects are expected to frequently occur

*MacDonald, D.D., C.G. Ingersoll, and T.A. Berger. 2000. Development and Evaluation of Consensus-based Sediment Quality Guidelines for Freshwater Ecosystems. Arch.Environ. Contam. Toxicol. 39, 20-31.

*Consensus based sediment quality Guidelines, Recommendations for use and application, December 2003, WiscosinDept of Natural Sources

** Canadian Sediment Quality Guidelines for the protection of aquatic life, CCME, 2001

ISQG : Interim Freshwater Sediment Quality Guidelines ,PEL : Probable effect level

US EPA (2002) recommended the following assessment categories for TOC in sediments:

Low impact: ≤ 1%

Intermediate impact: 1 to 3%

High impact: >3%

Ref : U.S. Environmental Protection Agency (EPA). 2002. Mid –Atlantic Integrated Assessment (MAIA) Estuaries 1997-98: Summary Report, EPA/620/R-02/003,115 pp

2.5 LAKE QUALITY INDEX

Various studies have been carried out for assessing the water quality based on the calculation of lake quality index. Lake Water Quality Index gives an indication of quality of lake water.

2.5.1 CALCULATION OF LAKE WATER QUALITY INDEX

The water quality index was prepared using the measured values of the lake quality. The parameters were selected based on their importance in the water quality. The standard values of drinking water of BIS were used in the study and the steps involved in the calculation of WQI are presented below:

a. Each parameter is assigned a weight (wi) base on their relative importance in the lake water quality. The highest value is assigned to parameters having major effects on the lake quality and the lowest value is assigned to parameters not considered harmful.

b. The relative weight of each parameter is calculated as per the following equation

$$Wi = \frac{wi}{\sum_{i=1}^{n} wi}$$

where, Wiis the relative weight of the parameter and wi is the weight of the each parameter

c. A quality rating scale for each parameter is computed by dividing its concentration in each water sample by its respective standard according to BIS standards and the result was multiplied by 100 where, qiis the quality rating for each parameter, Ci is the concentration of each parameter and Si is the BIS norm for each parameter

d. For computing the WQI, the water quality sub index (SIi) for each parameter is first determined and then the following equation is used to calculate the WQI of the lake

$$SIi = Wi\ qi$$

$$WQI = \sum_{i=1}^{n} SIi$$

where, Sliis the sub index of the ith parameter. The WQI index values are classified as per the Table 2.3.

Table 2.3 Water quality scale

S.No.	WQI	Water Quality Status	Usage
1.	0 – 25	Excellent	Drinking, irrigation and industrial
2.	26 – 50	Good	Domestic, irrigation and industrial
3.	51 – 75	Poor	Irrigation
4.	76 – 100	Very poor	Restricted use for irrigation
5.	> 100	Unsuitable for drinking	Proper treatment before use

Based on the above calculation, the lakes have been classified based on the WQI of the lake water

Bruhat Bengaluru Mahanagara Palike
Table 2.4 Raja Rajeshwari Zone (RRZ) – 37 lakes

Sl No	Name of Lake	Village Name & Sy No.	Survey Details		Status for lakes
			Total Area		
			Acres	Guntas	
1	2	3	4	5	6
DEVELOPED LAKES					
1	JP Park	Jallahalli - 32	47.00	26.00	Developed
		MathiKere - 59	18.00	4.00	
		Thanniranahalli - 01	20.00	39.00	
		Yeshwanthapura-114	16.00	36.00	
		Total	103.00	22.00	
2	Mallathalli	Mallathalli - 101	51.00	5.00	Developed
		Mallathalli - 26	1.00	9.00	
		Giddadakonehalli - 6	20.00	8.00	
		Total	72.00	22.00	
3	Halagevaderahalli Lake	Halagevaderahalli -01	17.00	10.00	Developed
4	Bheemanakatte	Bheemanakatte/ Halagevaderahalli - 138	1.00	23.00	Developed
5	Lingadheeranahalli (Handralli Lake)	Lingadheeranahalli-2	5.00	32.00	Developed
		Lingadheeranahalli -4	4.00	8.00	
		Total	10.00	0.00	
6	Handrahalli Lake	Handrahalli -8	16.00	6.00	Developed
7	Herohalli	Herohalii - 99	34.00	33.00	Developed
8	Vishwannedam	Herohalli - 50	4.00	30.00	Developed
9	Mangamanahalli Lake	Mangamanahalli - 43	6.00	22.00	Developed

10	Jogi Lake	Malasandra -30	3.00	2.00	Developed
11	H.Gollahalli Lake	Hemmigepura -25	7.00	25.00	Developed
		H.Gollahalli - 9	7.00	8.00	
		Varahasandra-9	4.00	33.00	
		Total	19.00	26.00	
12	Bayapanapalya kunte	Vajarahalli - 36	2.00	31.00	Developed
13	Chikkagowdana palya	Hemmigepura - 92	1.00	33.00	Developed
14	Sompura Lake	Sompura - 11 & 12	18.00	20.00	Developed
15	Ullala Lake	Ullala - 93	24.00	12.00	Developed
PARTIALLY DEVELOPED LAKES					
16	Dubasipalya Lake	Valagerahalli - 43	24.00	35.00	Partially Developed
17	HosaKerehalli	HosaKerehalli - 15	59.00	26.00	Partially Developed
18	Kengeri Lake	Kengeri - 15	27.00	3.00	Partially Developed
		Valagerahalli - 85	5.00	13.00	
		Total	32.00	16.00	
19	Konasandra Lake	Chowdenapura - 15	20.00	39.00	Partially Developed
		Hemmigepura-61	16.00	15.00	
		Total	37.00	14.00	
20	Gandhinagara Hosa Lake	Valagerahalli - 11,15 , Ramasandra - 16,17	43.00	30.00	Partially Developed
WORK IN PROGRESS					
21	Talaghattapura Lake	Talaghattapura - 73	19.00	16.00	Work in progress
22	Chikkabasthi (Ramasandra)	Ramasandra -6	7.00	2.70	Work in progress
UNDEVELOPED LAKES					
23	Nagarabhavi	Nagarabhavi-77	5.00	22.00	Undeveloped

24	Srigandakavalu	Srigandakavalu - 15	5.00	30.00	Undeveloped
25	Pattanagere / Kenchenahalli	Kenchenahalli - 33	3.00	39.00	Undeveloped
		Pattanagere - 43	0.00	31.00	
		Total	4.00	30.00	
26	Kodigehalli	Kodigehalli - 30	9.00	25.00	Undeveloped
27	Varahasandra Lake	Hemmigepura - 4	4.00	11.00	Undeveloped
		Varahasandra-24	13.00	9.00	
		Total	17.00	20.00	
28	Lingadheernahalli	Lingadheeranahalli - 13	6.00	36.00	Undeveloped
29	Gattigerepalya Lake (Sompura)	Sompura -27/53	0.00	37.00	Undeveloped
30	Mylasandra (Sunnakalupalya)	Kengeri - 58	6.00	2.00	Undeveloped
		Mylasandra-37	6.00	24.00	
		Total	12.00	26.00	
31	Busegowdana Lake	Kengeri -66	5.00	28.00	Undeveloped
		Mylasandra-27	10.00	14.00	
		Total	16.00	2.00	
32	Kannali	Kannali -5	48.00	31.00	Undeveloped
		Kodigehalli - 78	19.00	14.00	
		Total	68.00	5.00	
33	Kenchanapura	Kenchanapura -10	17.00	26.00	Undeveloped
34	Bheemanakuppe	Bheemanakuppe-180	39.00	24.00	Undeveloped
35	Sooli Lake	Maragondanahalli-12,26,27 , M Krishnasagara - 34,36,37	53.00	7.00	Undeveloped
DISUSED LAKES					
36	Bovimaranahalli	Halagevaderahalli -124	22.00	34.00	Disused
37	Gundopanth Lake	Pantharapalya-59	2.00	1.00	Disused

Table 2.5 Dasarahalli Zone (DZ) – 10 lakes

Sl No	Name of Lake / Taluk	Village Name & Sy No.	Extent Details As Per RTC	
			Acre	Guntas
DEVELOPED LAKES				
1	Dasarahalli Lake (Chokkasandra)	Dasarahalli-24	3.00	29.00
		Chokkasandra-5	24.00	4.00
2	Kamgondanahalli Lake	Kamgondanahalli-18	15.00	26.00
		Shetty halli-67	5.00	32.00
		Medarahalli-26	1.00	32.00
3	Bagalgunte Lake	Bagalgunte -113	10.00	14.00
		Bagalgunte -83	2.00	38.00
		Bagalgunte -128	3.00	0.00
		Bagalgunte -129	2.00	23.00
		Bagalgunte -130	2.00	23.00
TO BE DEVELOPED LAKES				
4	Narasappanahalli Lake	Nellagadrenahalli-90	19.00	5.00
		Nellagadrenahalli-89	5.00	26.00
		Karivobanahalli-40	27.00	13.00
		Doddabidarakallu-24	1.00	20.00

5	Mallasandra Gudde Lake	Mallasandra-49	11.00	28.00
6	Doddabidarakallu Lake	Doddabidarakallu-125	23.00	21.00
		Nagasandra-6	16.00	36.00
7	Nelegedaranahalli Lake	Nelegedaranahalli -62	19.00	22.00
8	Abbigere Lake	Abbigere-75	26.00	6.00
		Singapura-93	21.00	7.00
9	Shivapura Lake	Nelegedaranahalli -59	6.00	26.00
10	Basappana katte	Leggere-121	6.00	29.00

Table 2.6 Mahadevpura Zone (MZ) – 51 lakes

S.no	Name of Lake	Taluk	Village Name & Sy. No	Survey Details	
				Total Area	
				Acres	Guntas
DEVELOPED LAKES					
1	Ambalipura Kelagina Lake	Bangalore East	Amblipura-41	4	9
2	Kaigondanahalli Lake	Bangalore East	Kaigondanalli-8	18	18
			Kasavanalli-70	30	5
			Total	48	23
3	Vijanapura Lake	Bangalore East	Kowdenahalli-85	10	30
4	Amblipura melina Lake	Bangalore East	Ambalipura-36	12	16
5	Sigehalli lake	Bangalore East	Sigehalli-32	31	13
6	Devsandra Lake	Bangalore East	Devsandra-31	16	8
7	Doddakanenahalli Lake	Bangalore East	Doddakannalli-109	18	14
8	Munnekolalu Lake	Bangalore East	Munnekolalu-25	15	38
9	Shilavanthana Lake	Bangalore East	White field-41	19	32
10	Kasavanahalli lake	Bangalore East	Kasavanalli-50	21	30
			Haralur-32	33	37
			Total	55	27
11	Chinnappanahalli	Bangalore East	Chinnappanahalli-15	11	33
12	Kowdenhalli lake	Bangalore East	Kowdenhalli lake-27	58	25
			K.R.Puram-97	2	34
			Total	61	19
13	Haraluru Lake	Bangalore East	Haraluru-95	27	13
14	Sowl Lake	Bangalore East	Bellandur-65	23	33
			Doddakannali-68	7	28
			Kaigondanalli-36	30	16
			Total	61	37
15	Challakere Lake	Bangalore East	Challakere -85	33	23
16	Mahadevapura Lake	Bangalore East	Mahadevapura-7	26	23

17	Kundalahalli Lake	Bangalore East	Kundalahalli-05	30	20
18	Devarabeesanahalli Lake	Bangalore East	Devarabeesanahalli - 18	13	31
19	Garudachar Palya Lake	Bangalore East	Mahadev pura-31	5	36
20	Vibhuthipura Lake	Bangalore East	Vibhuthipura-175	45	18
21	Doddanekundi lake	Bangalore East	Kaggadasapura-25	54	3
			Vibhuthipura-13	3	15
			Doddanekundi lake-200	56	39
			Total	114	17
22	Cikkabasavanapura Lake	Bangalore East	Basavanapura-14	14	7
23	Hormavu Agara Lake	Bangalore East	Hormavu Agara - 77	51	34
24	K R Puram (BEML)/ Benniganahalli Lake	Bangalore East	Benniganahalli-47	18	25
			Benniganahalli-55	27	14
			Total	45	39
25	Bhattarahalli Lake	Bangalore East	Bhattarahalli - 2	18	10
26	Sadaramangala Lake	Bangalore East	Sadaramangala kere-61	51	4
			Kodagehalli-8	1	17
			Total	52	21
27	Bhoganahalli Lake	Bangalore East	Bhoganahalli - 21	12	24
28	Panathur lake 1	Bangalore East	Panathur -38	25	17
29	Hoodi Lake	Bangalore East	Hoodi-79	15	10
30	Kalkere Lake	Bangalore East	Kalkere-45	67	25
			Kyalasanahalli-36	51	19
			Beelisivale-101	0	37
			Horamavu Agra-36	61	11
			Total	181	12
WORK IN PROGRESS					
31	Siddapura Lake	Bangalore East	Siddapura - 18	27	35
32	Hoodi Giddanakere	Bangalore East	Hoodi-138	28	31
33	Jimkenahalli Lake	Bangalore East	Varanasi - 47	8	35

34	Nagareshwara-Nagenahalli Lake	Bangalore East	Nagareshwara Nagenahalli-10	11	8
35	Mahadevapura Lake	Bangalore East	Mahadevapura-187	13	32
36	Nalluralli Lake	Bangalore East	Nalluralli-4	20	34
			Pattandur Agrahara-85	18	9
			Total	39	3
37	Gunjur Palya Lake	Bangalore East	Gunjur-83	36	37
UNDEVELOPED LAKES					
38	Gunjuru Karmelaram lake	Bangalore East	Gunjuru-95	9	17
39	Panthur lake 2	Bangalore East	Panthur lake-48	6	30
40	Gunjur mouji Lake	Bangalore East	Gunjur-301 (P)	59	13
			Kachamaranahalli-74	4	26
			Total	63	39
41	Junnasandra lake	Bangalore East	Junnasandra-32	24	33
42	Sitaram Palya Lake	Bangalore East	Sonnenalli-33	25	5
43	Garudachar Palya Lake (Goshala)	Bangalore East	Mahadevapura-86	5	14
44	B. Narayanapura Lake	Bangalore East	B. Narayanapura-109	15	6
45	Chikkabellandur Lake	Bangalore East	Chikkabelandur-9	67	14
46	Pattandur agrahara lake-1	Bangalore East	Pattandur agrahara - 124	16	35
47	Pattandur agrahara Lake-2	Bangalore East	Pattandur agrahara - 54	13	12
48	Vengaiahna Lake /K.R.Puram Tank	Bangalore East	Sonnathammanahalli-46	24	37
			K.R.Puram-9	38	12
			Total	63	9
49	Gangashetty Lake	Bangalore East	K R Puram-58	18	32
			Devasandra-46	2	35
			Total	21	27
50	Horamavu Lake	Bangalore East	Horamavu-83	37	14
DISUSED LAKES					
51	Vijanapura Lake	Bangalore East	Vijanapura-42	29	15

Table 2.7 Bangalore West Zone (WZ) – 05 lakes

Sl No	Name of Lake / Taluk	Village Name &Sy No.	Total Area	
			Ac	Gu
DEVELOPED LAKES				
1	Sankey tank / Bangalore Central	Vyalikaval-21	40.00	24.00
ENCROACHED LAKES				
2	Kamakshi playa	Sanegoruvanahalli-60	6.00	35.00
3	Ancheramanakere (Gangondanahalli)	Gangondana halli-8	2.00	15.00
4	Sanigoruvahalli	Sanigoruvahalli-120	15.00	24.00
5	Shivanahalli (Agrahara Dasarahalli)	Agraharadasarahalli-72	9.00	25.00

Table 2.8 Bangalore East Zone (EZ) – 10 lakes

Sl No	Name of Lake	Taluk	Village Name & Sy No.	Total Area	
				Ac	Gu
DEVELOPED LAKES					
1	Ulsoor Lake	CTS	Ulsoor	106	0
UNDEVELOPED LAKES					
2	Kaggadasapura Lake	Bangalore East	Kaggadasapura -141	32	16
			Bairasandra-5	14	24
			Total	47	0
3	Melina lake byrasandra (DRDO)	Bangalore East	Byrasandra-109	14	19
WORK IN PROGRESS LAKES					
4	Kelagina lake Byrasandra	Bangalore East	Byrasandra-112	12	21
LAKES YET TO BE HANDED OVER FROM BDA					
5	Channasandra Lake	Bangalore East	Banasawadi-211	40	20
6	B. Channasandra Lake	Bangalore East	Banasawadi-64	20	15
DISUSED LAKES					
7	Konena Agrahara lake	Bangalore East	Konena Agrahara -60	20	10
8	Byatagunte Palya Lake	Bangalore North	Byatagunte palya-14	5	25
9	Geddalahalli Lake	Bangalore North	Geddalahalli-03	21	18
10	Lingarajapura Lake	Bangalore North	Lingarajapura-49	16	14

Table 2.9 Bommanahalli Zone (BZ) – 48 lakes

Sl No	Name of Lake	Village Name & Sy No.	Survey Details		Status of lake
			Total Area		
			Acres	Guntas	
1	2	3	4	5	6
DEVELOPED LAKES					
1	Ibblur Lake	Ibbalur-36	18.00	6.00	Developed
2	Venkogirao Lake / Agara Lake	Agra-11	5.00	39.00	Developed
		Venkogirao Khane-11	136.00	30.00	
		Total	142.00	29.00	
3	Puttenahalli Lake (Next to Brigade Millenium)	Puttenahalli-42	13.00	25.00	Developed
4	Mangammana Palya Lake	Yalkunte -19	7.00	29.00	Developed
5	Uttarahalli Lake / Bandgalore South	Uttarahalli-111	15.00	16.00	Developed
6	Annappanakere / Yelchenahalli Lake	Yelachenahalli-6,	4.00	39.00	Developed
		Gopinayakanahalli-14	1.00	33.00	
		Total	6.00	32.00	
7	Nyanappanahalli Lake / Akshayanagara Lake	Begur-344	6.00	7.00	Developed
8	Kalena Agrahara Lake	Kalena Agrahara-43	7.00	30.00	Developed
9	Basapura Lake-1	Basapura-15	9.00	34.00	Developed
		Singasandra-52	1.00	8.00	
		Total	11.00	2.00	
10	Kothanuru Lake	Kottanuru - 54	18.00	9.00	Developed
11	Kalyanikunte (Near Saibaba Temple)	Vasanthapura-21	1.00	33.00	Developed

12	Kodige Singasandra Lake	Singasandra-69	10.00	23.00	Developed
13	Parappana Agrahara / Bangalore South	Parappana Agrahara-23	16.00	11.00	Developed
14	Singasandra Lake Bangalore South	Singasandra-99	10.00	14.00	Developed
		Singasandra-100			
		Total			
15	Anjanapura Lake / Alahalli	Alahalli-30	15.00	35.00	Developed
		Gollahalli-3	5.00	30.00	
		Total	21.00	25.00	
16	Kudlu Doddakere / Anekal Taluk and Bengaluru South Taluk	Kudlu-150	26.00	38.00	Developed
		Parappana Agrahara-37	17.00	1.00	
		Total	43.00	39.00	
17	Kudlu Chikka Lake / Anekal Taluk	Kudlu-70	13.00	5.00	Developed
WORK IN PROGRESS					
18	Sarakki Lake / Jaraganahalli / Puttenahalli Lake	Sarakki-26	38.00	0.00	Work in progress
		Puttenahalli -5	6.00	10.00	
		Jaraganahalli-7	38.00	14.00	
		Total	82.00	24.00	
19	Haralakunte Lake (Somasandra Palya Lake)	Haralakunte-51	16.00	29.00	Work in progress
20	Hulimavu Lake	Hulimavu-42,	124.00	25.00	Work in progress
		Kammanahalli-110	5.00	32.00	
		Total	130.00	17.00	
21	Gubbalalu Lake	Gubbalalu - 25	8.00	10.00	Work in progress
22	Dorekere	Vasanthapura-6	9.00	12.00	Work in progress
		Uttarahalli-22	19.00	11.00	
		Total	28.00	23.00	

23	Basapura Lake-2 / Bangalore South	Basapura-66	10.00	29.00	Work in progress
24	Basavanapura Lake	Basavanapura -14	7.00	34.00	Work in progress
25	Kammanahalli Lake (Meenakshi Lake)	Kammanahalli-38	18.00	37.00	Work in progress
26	Yelenahalli Lake	Yelenahalli - 55	4.00	39.00	Work in progress
27	Gottigere	Gottigere-71	37.00	13.00	Work in progress
28	Puttenahalli / Byraweshwara nagara Chunchaghatta Lake	Chunchaghatta-70	22.00	31.00	Work in progress
29	Vasanthapura Lake / Janardhana Lake	Vasanthapura 28	7.00	10.00	Work in progress
30	Devara Lake	Bikasipura-9	7.00	15.00	Work in progress
31	Doddakallasandra Lake	Doddakallasandra-27	21.00	16.00	Work in progress
32	Konappana Agrahara Lake	Naganathapura-81	5.00	17.00	Work in progress
PARTIALLY DEVELOPED LAKES					
33	Madivala Lake	Madivala-76	166.00	39.00	Partially developed
		Kodi Chikkanahalli-23	80.00	9.00	
		Roopena Agrahara-11	6.00	10.00	
		Bellakkanahalli-64	21.00	35.00	
		Total	275.00	13.00	
TO BE DEVELOPED LAKES					
34	Subedarana Lake	Begur-48	6.00	5.00	To be developed
35	Swarnakunte Gudda Lake	Chandrashekarapura-1	9.00	5.00	To be developed

UNDEVELOPED LAKES					
36	Garveybhavipalya Lake	Hongasandra-41	18.00	4.00	Undeveloped
37	Arekere Lake	Arekere-34	37.00	21.00	Undeveloped
38	Subramanyapura Lake	Uttarahalli-64,	18.00	6.00	Undeveloped
39	Arehalli 2 & 3 (Small tanks)	Arehalli -27	3.00	0.00	Undeveloped
		Arehalli -28/3	1.00	22.00	
		Total	4.00	22.00	
40	Begur Lake	Begur-94	137.00	24.00	Undeveloped
41	Chikka Begur Lake	Begur-168,	32.00	19.00	Undeveloped
		Singasandra-86	9.00	37.00	
		Total	42.00	16.00	
42	Chowdeshwari Layout Lake	Beratana Agrahara-18	11.00	18.00	Undeveloped
43	Subbarayana Lake	Gottigere-12	5.00	10.00	Undeveloped
44	Kembathahalli Lake	Kembathahalli-3	6.00	16.00	Undeveloped
45	Konanakunte Lake	Konanakunte - 2	9.00	18.00	Undeveloped
46	Chikkammanahalli Lake	Kammanahalli-22	5.00	19.00	Undeveloped
DISUSED LAKES					
47	Belakahalli (Lingannana Lake)	Belakahalli-172/2A	7.00	0.00	Disused lake
		Belakahalli-56/1	6.00	18.00	
		Total	13.00	18.00	
48	Doresani Palya	Belakahalli-167	56.00	37.00	Disused lake

Table 2.10 Yelahanka Zone (YZ) – 32 lakes

Sl No	Name of Lake	Village Name & Sy No.	Extent Details	
			As Per RTC	
			Acre	Guntas
DEVELOPED LAKES				
1	Kattigenahalli Lake	Kattigenahalli-31	20.00	10.00
2	Thirumenahalli Lake	Thirumenahalli-63	7.00	10.00
3	Agrahara Lake	Agrahara-33	15.00	34.00
4	Kogilu Lake	Kogilu-84	40.00	4.00
		Kattigenahalli-117	38.00	24.00
5	Yelahanka Lake	Yelahanka-29	53.00	36.00
		Kenchenahalli-15	30.00	23.00
		Venkatala-39	199.00	31.00
		Manchenahalli-19	7.00	34.00
6	Veerasagara lake Bangalore North Additional	Veerasagara-26	17.00	24.00
		Attur-25	3.00	30.00
7	Attur Lake	Attur-81	56.00	29.00
		Ananthapura-92	6.00	15.00
		Ramagondana halli-39	7.00	22.00
		Kempanahalli-12	19.00	18.00
8	Narasipura Lake-20	Narasipura-20	15.00	30.00
9	Chokkanahalli lake-2	Chokkanahalli-2	8.00	2.00

10	Jakkur lake	Jakkur-15	39.00	21.00
		Jakkur-16	3.00	1.00
		Jakkur-17	3.00	14.00
		Jakkur-23	36.00	33.00
		Yelahanka amanikere - 55	58.00	16.00
		Sampigehalli-12	19.00	25.00
		Agrahara-13	3.00	17.00
11	Ramagondanahalli Lake	Ramagondanahalli-52	36.00	26.00
12	Allasandra Lake	Allalasandra-15	41.00	23.00
13	Avalahalli Lake	Avalahalli-10	11.00	1.00
		Singanayakanahalli- 64	2.00	10.00
14	Narasipura Lake-26	Narsipura-26	9.00	7.00
15	Doddabommasandra Lake	Tindlu-53	35.00	28.00
		DBSandra-56	39.00	10.00
		Kodigihally-175	49.00	21.00
16	Palanahalli Lake	Kattigenahalli-136	25.00	28.00

17	Rachenahalli Lake	Rachenahalli-69	18.00	16.00
		Dasarahalli -61	73.00	23.00
		Jakkur-82	76.00	6.00
18	Amruthahalli Lake	Amruthahalli -115	24.00	36.00
TO BE DEVELOPED LAKES				
19	Harohalli Lake	Harohalli-91	74.00	32.00
20	Singapura Lake	Singapura-102	66.00	18.00
21	Chikk Bettahalli Lake	Chikka Bettahalli-52	1.00	32.00
22	Bellahalli Lake	Bellahalli-68	18.00	32.00
23	Lakshmipura Lake	Lakshmipura-25	10.00	6.00
24	Srinivasapura Lake	Srinivasapura-2&3	3.00	39.00
25	Vaderahalli Lake	Vaderahalli-32	9.00	34.00
26	Venkateshpura Lake	Venkateshpura -12	6.00	35.00
27	Shivanahalli Lake	Shivanahalli-48	14.00	30.00
		Allalasandra-48	0.00	27.00
28	Medi Agrahara Lake	Medi Agrahara - 33	13.00	15.00
29	Chokkanahalli Lake	Chokkanahalli-68	0.00	20.00

TO BE HANDED OVER TO BBMP				
30	Hebbala Lake	Hebbala -38	92.00	26.00
		Kodigehalli-37	-	
31	Nagavara Lake	Nagavara 58 Vishwanathanaganahalli 12,13	56.00	21.00
RE-HANDED OVER FROM BBMP TO KARNATAKA FOREST DEPARTMENT				
32	Puttenahalli Lake	Puttenahalli -36,	29.00	14.00
		Attur- 49	7.00	26.00

Table 2.11 Bangalore South Zone (SZ) – 12 lakes

Sl No	Name of Lake	Village Name & Sy No.	Survey Details		Status of lake
			Total Area		
			Acres	Guntas	
1	2	3	4	5	6
DEVELOPED LAKES					
1	Mesthripalya lake	Jakkasandra-30	11.00	21.00	Developed
2	Kempambudhi Lake Bangalore North	Kempambudhi-2	47.00	7.00	Developed
3	Deepanjali Lake Bangalore South	Devatige Ramanahalli-32	7.00	22.00	Developed
4	Yediyur Lake Bangalore South	Dasarahalli-1	-	-	Developed
		Yediyur-59	-	-	
		Total	18.00	2.00	
WORK IN PROGRESS					
5	Byrasandra Lake / Chikkapete Lake	Byrasandra-56	15.00	11.00	Work in progress
6	Gowdana Palya Lake	Kadirenahalli-33	9.00	23.00	Work in progress
7	Malagala (Balaiahnalake) lake	Malagala-46	15.00	11.00	Work in progress
DISUSED LAKES					
8	Thavarekare	Thavarekere - 74	10.00	16.00	Disused
		Bairasandra-41	9.00	36.00	
		Total	20.00	12.00	
9	Karisandra Lake	Karisandra - 7	13.00	0.00	Disused
10	Nandi Shettappa Lake	Jaraganahalli-53	0.00	0.00	Disused
11	Chikkalsandra Lake	Chikkalasandra-76	12.00	26.00	Disused
12	Ittmadu	Ittamadu-17	4.00	0.00	Disused
		Chikkalasandra-83	6.00	23.00	
		Total	10.00	23.00	

Table 2.12 Bengaluru Development Authority (BDA)

S. No.	Name of Lake	Village Name and Survey No.	Extent	
			Acres	Guntas
1.	Bellandur Lake	Yamaluru-62 Amanikere Bellandur Kahne-1 Ibbalur-12 Kempapura-6 Beluru-2	916	17
2.	Varthur Lake	Varthur-319	439	39
3.	Kommaghatta Lake	Komaghatta-03 Ramasandra-46	9	4
4.	Ramasandra Lake	Ramasandra-159	7	6
5.	Chikkabanavara Lake	Chikka Banavara-3 Somashettyhalli-73 Keregullada halli-22 Ganigarahalli-11,15	105	15

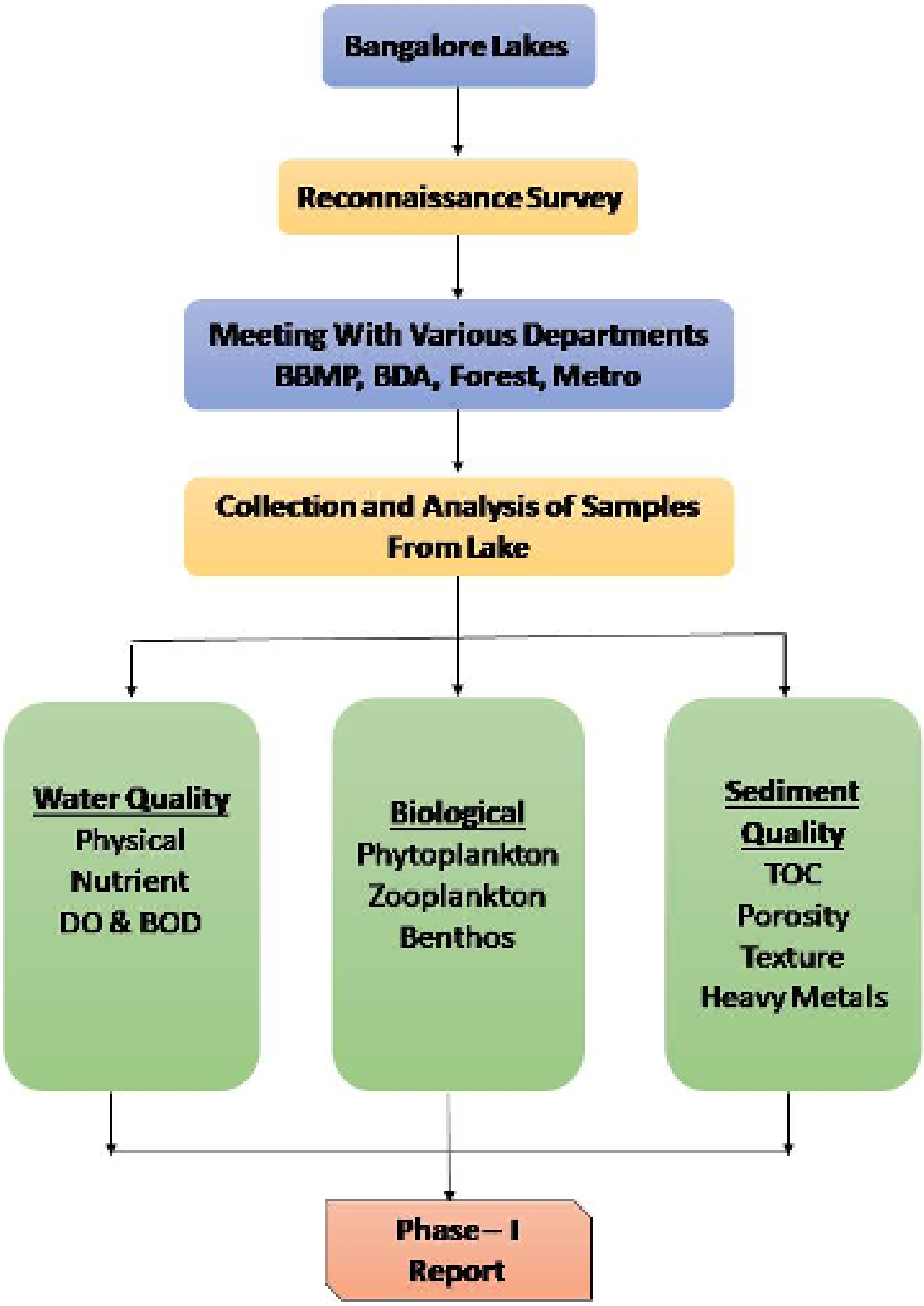

Fig. 2: Methodology of the Phase-I study

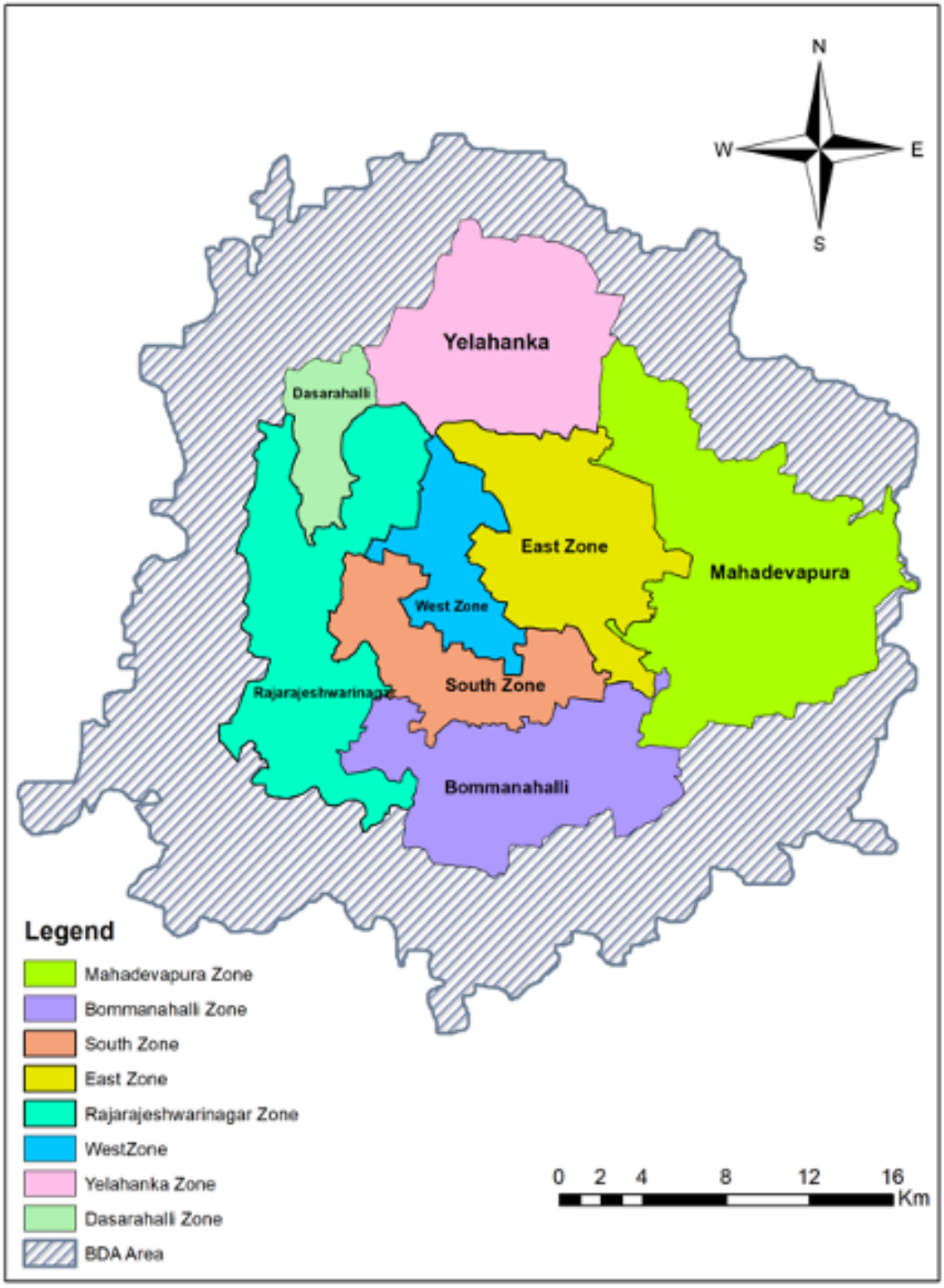

Fig. 2.1: Map showing various zones of Bengaluru city

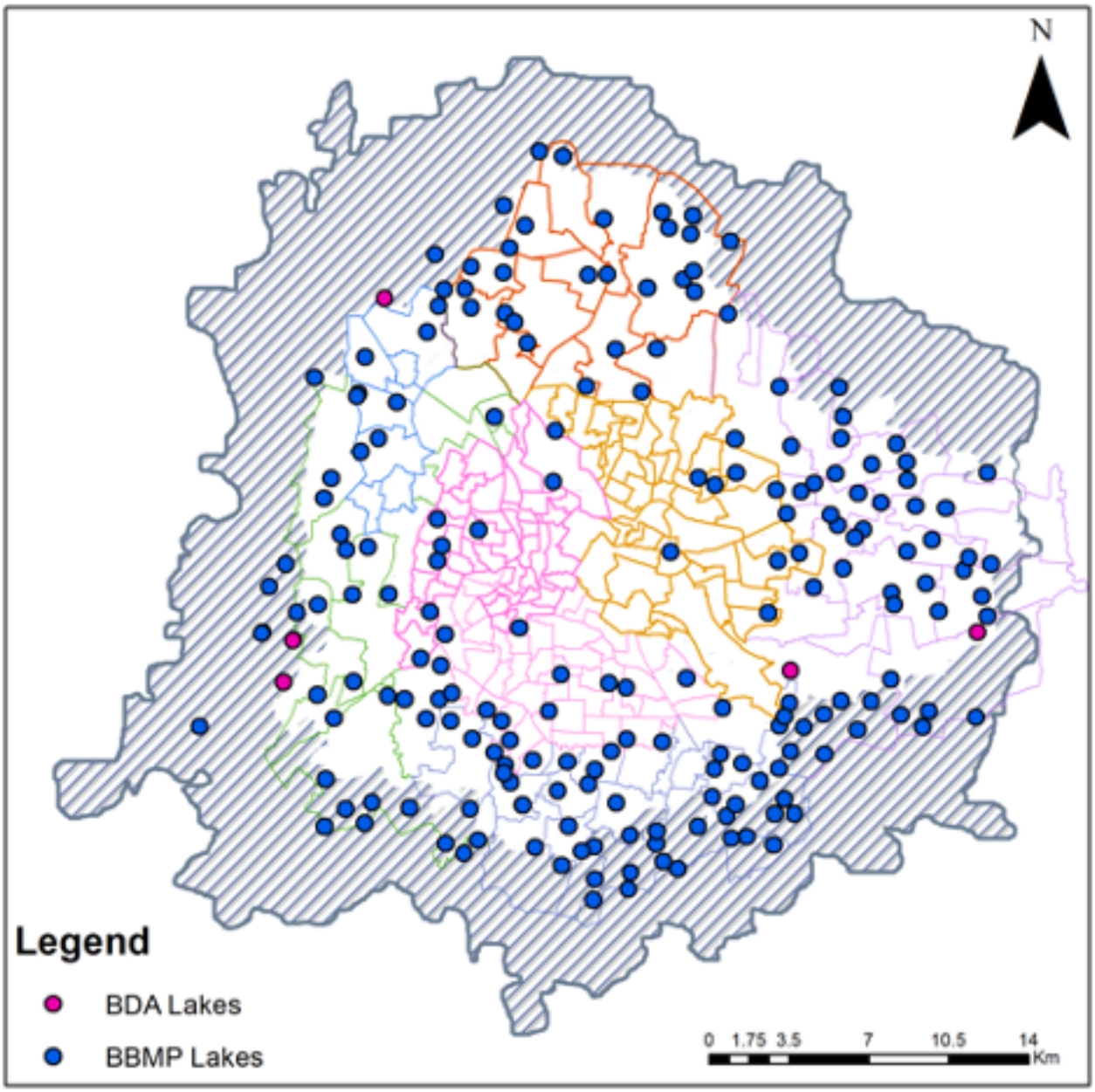

Fig. 2.2: Map showing BDA and BBMP Lakes of Bengaluru city

The following list shows the lakes that fall under various valleys namely, Hebbala/ Nagawar valley, Vrushabhavati valley, Arkavati valley, Koramangala/ Chalaghatta valley and lakes series

Lakes Under Hebbala/Nagawar Valley

Sl No	Name of Lake / Taluk	Village Name & Sy No.	Lake Series	Lake valley
1.	B. Channasandra Lake	Banasawadi-64	Yellemallappa Chetty Series	Hebbala/ Nagawar valley
2.	Channasandra Lake	Banasawadi-211	Yellemallappa Chetty Series	Hebbala/ Nagawar valley
3.	Sitaram Palya	Sonnenalli-33	Yellemallappa Chetty Series	Hebbala/ Nagawar valley
4.	Sadaramangala Lake	Sadaramangala kere-61 Kodagehalli-8	Yellemallappa Chetty Series	Hebbala/ Nagawar valley
5.	Hoodi kere	Hoodi-79	Yellemallappa Chetty Series	Hebbala/ Nagawar valley
6.	Hoodi Giddanakere	Hoodi-138	Yellemallappa Chetty Series	Hebbala/ Nagawar valley
7.	Jimkenahalli Lake	Varanasi - 47	Yellemallappa Chetty Series	Hebbala/ Nagawar valley
8.	Vijanapura kere / Bangalore East	Kowdenahalli-85	Yellemallappa Chetty Series	Hebbala/ Nagawar valley
9.	Sigehalli / Bangalore East	Sigehalli-32	Yellemallappa Chetty Series	Hebbala/ Nagawar valley
10.	Devsandra kere / Bangalore East	Devsandra-31	Yellemallappa Chetty Series	Hebbala/ Nagawar valley
11.	Kowdenhalli lake / Bangalore East	Kowdenhalli lake-27 K.R.Puram-97	Yellemallappa Chetty Series	Hebbala/ Nagawar valley
12.	Challakere Lake /East taluk	Challakere -85	Yellemallappa Chetty Series	Hebbala/ Nagawar valley
13.	Kalkere / Bangalore East taluk	Kalkere-45 Kyalasanahalli-36	Yellemallappa Chetty Series	Hebbala/ Nagawar valley

		Beelisivale-101		
		Horamavu Agra-36		
14.	Horamavu Lake	Horamavu-83	Yellemallappa Chetty Series	Hebbala/ Nagawar valley
15.	Hormavu Agara Lake	Hormavu Agara - 77	Yellemallappa Chetty Series	Hebbala/ Nagawar valley
16.	Nagareshwara-Nagenahalli Lake	Nagareshwara Nagenahalli-10	Yellemallappa Chetty Series	Hebbala/ Nagawar valley
17.	Rampura kere	Kalkere-162	Yellemallappa Chetty Series	Hebbala/ Nagawar valley
		Rampura-22		
		Maragondanahalli-71		
		Huvineane-86		
18.	Bhattarahalli Lake	Bhattarahalli - 2	Yellemallappa Chetty Series	Hebbala/ Nagawar valley
19.	Vengaihna kere /K.R.Puram Tank	Sonnathammanahalli-46	Yellemallappa Chetty Series	Hebbala/ Nagawar valley
		K.R.Puram-9		
20.	Gangashetty Lake	K R Puram-58	Yellemallappa Chetty Series	Hebbala/ Nagawar valley
		Devasandra-46		
21.	B. Narayanapura Lake	B. Narayanapura-109	Yellemallappa Chetty Series	Hebbala/ Nagawar valley
22.	Cikkabasavana pura Lake	Basavanapura-14	Yellemallappa Chetty Series	Hebbala/ Nagawar valley
23.	Kattigenahalli Kere-31 Bangalore North Addl	Kattigenahalli-31	Yellemallappa Chetty Series	Hebbala/ Nagawar valley
24.	Thirumenahalli Bangalore North Addl	Thirumenahalli-63,68to 78, 84 to 86, 105 to 107	Yellemallappa Chetty Series	Hebbala/ Nagawar valley
25.	Agrahara Lake / Bangalore North Addl	Agrahara-33	Yellemallappa Chetty Series	Hebbala/ Nagawar valley
26.	Kogilu lake Bangalore North Addl	Kogilu-84	Yellemallappa Chetty Series	Hebbala/ Nagawar valley
		Kattigenahalli-117		

27.	Narasipura-20 Bangalore North Addl	Narasipura-20 Bangalore North Addl	Yellemallappa Chetty Series	Hebbala/ Nagawar valley
28.	Chokkanahalli lake	Chokkanahalli-2	Yellemallappa Chetty Series	Hebbala/ Nagawar valley
29.	Jakkur lake (Sampigehalli Lake)	Jakkur-15	Yellemallappa Chetty Series	Hebbala/ Nagawar valley
		Jakkur-16		
		Jakkur-17		
		Jakkur-23		
		Yelahanka amanikere - 55		
		Sampigehalli-12		
		Agrahara-13		
30.	Narasipura-26 Bangalore North Addl	Narsipura-26	Yellemallappa Chetty Series	Hebbala/ Nagawar valley
31.	Doddabommasandra lake / Bangalore North Additional	Tindlu-53	Yellemallappa Chetty Series	Hebbala/ Nagawar valley
		DBSandra-56		
		Kodigihally-175		
32.	Kattigenahalli Kere-136 (Palanahalli lake) /Bangalore North Addl	Kattigenahalli-136	Yellemallappa Chetty Series	Hebbala/ Nagawar valley
33.	Rachenahalli lake/ Bangalore North Additional	Rachenahalli-69	Yellemallappa Chetty Series	Hebbala/ Nagawar valley
		Dasarahalli -61		
		Jakkur-82		
34.	Srinivasapura Kere	Srinivasapura-2	Yellemallappa Chetty Series	Hebbala/ Nagawar valley
35.	Venkatehpura Lake	Venkateshpura 12	Yellemallappa Chetty Series	Hebbala/ Nagawar valley
		Sampigehalli 37		
36.	Amruthahalli lake	Amruthahalli-115	Yellemallappa Chetty Series	Hebbala/ Nagawar valley

37.	Hebbala lake	Hebbala-38	Yellemallappa Chetty Series	Hebbala/ Nagawar valley
38.	Nagavara	Nagavara-58	Yellemallappa Chetty Series	Hebbala/ Nagawar valley
39.	Yelahanka kere / Bangalore North Additional	Yelahanka-29	Yellemallappa Chetty Series	Hebbala/ Nagawar valley
		Kenchenahalli-15		
		Venkatala-39		
		Manchenahalli-19		
40.	Veerasagara lake Bangalore North Addl	Veerasagara-26	Yellemallappa Chetty Series	Hebbala/ Nagawar valley
		Attur-25		
41.	Attur Lake / Bangalore North Additional	Attur-81	Yellemallappa Chetty Series	Hebbala/ Nagawar valley
		Ananthapura-92		
		Ramagondana halli-39		
		Kempanahalli-12		
42.	Ramagondanahalli Bangalore North Addl	Ramagondanahalli-52	Yellemallappa Chetty Series	Hebbala/ Nagawar valley
43.	Allasandra lake / Bangalore North Additional	Allalasandra-15	Yellemallappa Chetty Series	Hebbala/ Nagawar valley
44.	Avalahalli / Bangalore North Addi	Avalahalli-10	Yellemallappa Chetty Series	Hebbala/ Nagawar valley
		Singanayakanahalli- 64		
45.	Harohalli lake Bangalore North Addl	Harohalli-91	Yellemallappa Chetty Series	Hebbala/ Nagawar valley
46.	Vaderahalli	Vaderahalli-32	Yellemallappa Chetty Series	Hebbala/ Nagawar valley
47.	Shivanahalli Lake	Shivanahalli-48	Yellemallappa Chetty Series	Hebbala/ Nagawar valley
48.		Allalasandra-38		

49.	Puttenahalli lake	Puttenahalli-36 Attur-49	Yellemallappa Chetty Series	Hebbala/ Nagawar valley
50.	Bellahalli	Bellahalli-68	Yellemallappa Chetty Series	Hebbala/ Nagawar valley
51.	Kannur		Yellemallappa Chetty Series	Hebbala/ Nagawar valley
52.	Chikkagubbi		Yellemallappa Chetty Series	Hebbala/ Nagawar valley
53.	Doddagubbi		Yellemallappa Chetty Series	Hebbala/ Nagawar valley
54.	Yarappanahalli		Yellemallappa Chetty Series	Hebbala/ Nagawar valley
55.	Kadusonnappanahalli		Yellemallappa Chetty Series	Hebbala/ Nagawar valley

Lakes Under Vrushabavathi Valley

Sl No	Name of Lake / Taluk	Village Name & Sy No.	Lake Series	Lake valley
1.	Malagala (Balaiahna Lake) Bangalore North	Malagala -46	Byramangala Lake series	Vrushabhavati valley
2.	Nayadahalli Lake Bangalore South	Nayadahalli-31	Byramangala Lake series	Vrushabhavati valley
3.	Sankey tank / Bangalore Central	Vyalikaval-21	Byramangala Lake series	Vrushabhavati valley
4.	Deepanjali lake Bangalore South	Devatige Ramanahalli-32	Byramangala Lake series	Vrushabhavati valley
5.	Halage vaderahalli Lake Bangalore South	Halage vaderahalli-1	Byramangala Lake series	Vrushabhavati valley
6.	J.P Park / *Bangalore* North	Jalahalli-32	Byramangala Lake series	Vrushabhavati valley
		Mathikere-59		
		Thanniranahalli-1		
		Yeshwanthpur-114		
7.	Mallathahalli lake / Bangalore North	Mallathahalli-101	Byramangala Lake series	Vrushabhavati valley
		Mallathahalli-26		
		Giddadakonehalli-6		
8.	Pattanagere/ Kenchenhalli lake	Kenchenhalli-33	Byramangala Lake series	Vrushabhavati valley
		Pattanagere-43		
9.	Srigandadakaval	Srigandadakaval-15	Byramangala Lake series	Vrushabhavati valley
10.	Nagarabhavi Lake	Nagarabhavi - 77	Byramangala Lake series	Vrushabhavati valley
11.	Hosakerehalli lake	Hosakerehalli-15	Byramangala Lake series	Vrushabhavati valley
12.	Herohalli Lake Bangalore North	Herohalli -99	Byramangala Lake series	Vrushabhavati valley

13.	Jogi kere / Bangalore South	Malasandra-30	Byramangala Lake series	Vrushabhavati valley
14.	Ullala lake / Bangalore North	Ullala-93	Byramangala Lake series	Vrushabhavati valley
15.	H Gollahalli kere/ Bangalore South	Hemmagipura-25	Byramangala Lake series	Vrushabhavati valley
		H. Gollahalli-09		
		varahasandra-09		
16.	Bayyapanapalya Kunte/ Bangalore South	Vajarahalli-36	Byramangala Lake series	Vrushabhavati valley
17.	Vishwaneedum Lake	Herohalli - 50	Byramangala Lake series	Vrushabhavati valley
18.	Talghatapura Lake	Talghatapura - 73	Byramangala Lake series	Vrushabhavati valley
19.	Varahasandra Lake	Hemmigepura-004,	Byramangala Lake series	Vrushabhavati valley
		Varahasandra-0024		
20.	Gandhinagar Hosakerehalli	Valagerahalli - 11& 15, Ramasandra-16 &17	Byramangala Lake series	Vrushabhavati valley
21.	Lingadeeranahalli	Lingadeeranahalli-13	Byramangala Lake series	Vrushabhavati valley
22.	Konasandra Lake	Chowdenapura- 15, hemmigepura- 61	Byramangala Lake series	Vrushabhavati valley
23.	Dubasipalay lake (Valagerahalli)	Valagerahalli-43	Byramangala Lake series	Vrushabhavati valley
24.	Mylasandra (Sunnakallu palya) lake	Kengeri-58	Byramangala Lake series	Vrushabhavati valley
		Mylasandra-37		
25.	Busegowdana lake	Kengeri-66	Byramangala Lake series	Vrushabhavati valley
		Mylasandra-27		
26.	Kengeri Lake	Kengeri-0015,	Byramangala Lake series	Vrushabhavati valley

		Valagerahalli-0085		
27.	Dorekere	Vasanthapura-0006, Uttarahalli-0022	Byramangala Lake series	Vrushabhavati valley
28.	Uttarahalli Lake / Bandgalore South	Uttarahalli-0111	Byramangala Lake series	Vrushabhavati valley
29.	Annappanakere / Yelchenahalli Lake	Yelachenahalli -06,	Byramangala Lake series	Vrushabhavati valley
		Gopinayakanahalli-14		
30.	Subramanyapura lake	Uttarahalli-0064,	Byramangala Lake series	Vrushabhavati valley
31.	Gattigerepalya (Sompura) lake	Sompura-11, 12	Byramangala Lake series	Vrushabhavati valley
32.	Soolikere	Maragondanahalli-12, 26,27, M. Krishna Sagara--34, 36, 37	Byramangala Lake series	Vrushabhavati valley
33.	Kannali lake	Kannali-5 Kodigehalli-78	Byramangala Lake series	Vrushabhavati valley
34.	Kenchanapura lake	Kenchanapura -10	Byramangala Lake series	Vrushabhavati valley
35.	Sompura Lake	Sompura 11, 12	Byramangala Lake series	Vrushabhavati valley
36.	Mangammanahalli lake	Mangammanahalli -43	Byramangala Lake series	Vrushabhavati valley
37.	Bhimana kuppe	Bhimana kuppe-180	Byramangala Lake series	Vrushabhavati valley

Lakes Under Arkavati Valley

Sl No	Name of Lake / Taluk	Village Name & Sy No.	Lake Series	Lake valley
1.	Dasarahalli (Chokkasandra) Lake Bangalore North	Dasarahalli-24	Madavara Series	Arkavati valley
		Chokkasandra-5		
2.	Kamgondanahalli Kere Bangalore North	Kamgondanahalli-18	Madavara Series	Arkavati valley
		Shetty halli-67		
		Medarahalli-26		
3.	Bagalgunte Lake	Bagalgunte -113	Madavara Series	Arkavati valley
4.	Narasappanahalli Kere	Nellagadrenahalli-90	Madavara Series	Arkavati valley
		Nellagadrenahalli-89		
		Karivobanahalli-40		
		Doddabidarakallu-24		
5.	**Abbigere Kere**	Abbigere-75	Madavara Series	Arkavati valley
		Singapura-93		
6.	Nelagedaranahalli lake	Nelagedaranahalli -62	Madavara Series	Arkavati valley
7.	Mallasandra gudde lake	Mallasandra gudde-49	Madavara Series	Arkavati valley
		Mallasandra gudde- 50		
8.	Lingadeeranahalli (handrahalli) Lake Bangalore North	Lingadeeranahalli -2,	Madavara Series	Arkavati valley
9.		Lingaderanhalli -4		
10.	Handrahalli kere Bangalore North	Andrahalli-8	Madavara Series	Arkavati valley

11.	Kodigehalli lake / Bangalore North	Kodigihally-30	Madavara Series	Arkavati valley
12.	Doddabidarakallu /Nagasandra kere	Nagasandra-6	Madavara Series	Arkavati valley
		Doddabidarakallu-125		
13.	Lakshmipura lake	Lakshmipura-25	Madavara Series	Arkavati valley
14.	Medi agrahara lake	Medi agrahara-33	Madavara Series	Arkavati valley
15.	Madavara lake		Madavara Series	Arkavati valley

Lakes Under Kormangala/Chalaghatta Valley

Sl No	Name of Lake / Taluk	Village Name & Sy No.	Lake Series	Lake valley
1.	Ulsoor / Bangalore Central	Ulsoor	Varthur Series	Koramangala/ Chalaghatta valley
2.	Kelagina kere / Byrasnadra	Byrasandra-112	Varthur Series	Koramangala/ Chalaghatta valley
3.	Kaggadasapura Lake	Kaggadasapura -141	Varthur Series	Koramangala/ Chalaghatta valley
		Bairasandra-5		
4.	Melina kere byrasandra (DRDO)	Byrasandra-109	Varthur Series	Koramangala/ Chalaghatta valley
5.	Gowdana Palya Lake	Kadirenahalli-0033	Puttenhalli Series	Koramangala/ Chalaghatta valley
6.	Yediyur Lake Bangalore south	Dasarahalli-0001, Yediyur-0059	Puttenhalli Series	Koramangala/ Chalaghatta valley
7.	Kempambudhi Lake Bangalore North	Kempambudhi-0002	Puttenhalli Series	Koramangala/ Chalaghatta valley
8.	Mesthripalya lake	Jakkasandra-30, 31	varthur series	Koramangala/ Chalaghatta valley

9.	Byrasandra lake / Chikkapete lake	Byrasandra-56	Puttenhalli Series	Koramangala/ Chalaghatta valley
10.	Gubbalalu Lake	Gubbalalu - 25	Puttenhalli Series	Koramangala/ Chalaghatta valley
11.	Chikkagowdanapaly lake	Hemigepura-92	Puttenhalli Series	Koramangala/ Chalaghatta valley
12.	Singasandra / Bangalore South	Singasandra-99	Varthur Series	Koramangala/ Chalaghatta valley
13.	Parappana Agrahara / Bangalore south	Parappana Agrahara-23	Varthur Series	Koramangala/ Chalaghatta valley
14.	Kudlu Chikka kere / Anekal taluk	Kudlu-70	Varthur Series	Koramangala/ Chalaghatta valley
15.	Kudlu doddakere / Anekal	Kudlu-150 Parappana Agrahara-37	Varthur Series	Koramangala/ Chalaghatta valley
16.	Kodige Singasandra Lake	Singasandra-69	Varthur Series	Koramangala/ Chalaghatta valley
17.	Basapura Lake-1/ Bangalore South	Basapura-0015 Singasandra-52	Varthur Series	Koramangala/ Chalaghatta valley
18.	Kalena Agrahara Lake	Kalena Agrahara-0043	Hulimavu series	Koramangala/ Chalaghatta valley
19.	Bheemana Katte	Bheemana katte Halagevaderahalli As per RTC survey-138	Puttenhalli Series	Koramangala/ Chalaghatta valley
20.	Begur Lake	Begur-94	Varthur Series	Koramangala/ Chalaghatta valley
21.	Gottigere	Gottigere-0071	Hulimavu series	Koramangala/ Chalaghatta valley
22.	Anjanapura Lake / Alahalli	Alahalli-0030 Gollahalli-0003	Hulimavu series	Koramangala/ Chalaghatta valley
23.	Puttenahalli/ Byraweshwara nagara Chunchaghatta kere	Chunchaghatta-0070	Puttenhalli Series	Koramangala/ Chalaghatta valley

24.	Kothanuru lake	Kottanuru - 54	Puttenhalli Series	Koramangala/ Chalaghatta valley
25.	Basapura Lake-2/ Bangalore South	Basapura-66	Varthur Series	Koramangala/ Chalaghatta valley
26.	Basavanapura Lake	Basavanapura -0014	Hulimavu series	Koramangala/ Chalaghatta valley
27.	Chikka Begur Lake	Begur-168,	Varthur Series	Koramangala/ Chalaghatta valley
		Singasandra-86		
28.	Hulimavu Lake	Hulimavu-42, Kammanahalli 110	Hulimavu series	Koramangala/ Chalaghatta valley
29.	Konappana Agrahara lake	Naganathapura-81	Varthur Series	Koramangala/ Chalaghatta valley
30.	Kammanahalli Lake (Meenakshi Lake)	Kammanahalli-0038	Varthur Series	Koramangala/ Chalaghatta valley
31.	Vasanthapura kere	Vasanthapura 28	Puttenhalli Series	Koramangala/ Chalaghatta valley
32.	Devarakere	Bikasipura-9	Puttenhalli Series	Koramangala/ Chalaghatta valley
33.	Yelenahalli Lake	Yelenahalli - 55	Hulimavu series	Koramangala/ Chalaghatta valley
34.	Doddakallasandra Lake	Doddakallasandra-27	Puttenhalli Series	Koramangala/ Chalaghatta valley
35.	Chowdeshwari layout Lake	Beratana agrahara-0018	Varthur Series	Koramangala/ Chalaghatta valley
36.	Nyanappanahalli Lake	Begur-0344	Hulimavu series	Koramangala/ Chalaghatta valley
37.	Subedaranakere	Begur-0048	Hulimavu series	Koramangala/ Chalaghatta valley
38.	Chikkammanahalli Lake	Kammanahalli-0022	Hulimavu series	Koramangala/ Chalaghatta valley

39.	Konanakunte Lake	Konanakunte - 2	Puttenhalli Series	Koramangala/ Chalaghatta valley
40.	Swarnakunte gudda kere	Chandrashekarapura-0001	Hulimavu series	Koramangala/ Chalaghatta valley
41.	Kembathahalli lake	Kembathahalli-3	Hulimavu Series	Koramangala/ Chalaghatta valley
42.	Arekere lake	Arekere-34	Hulimavu series	Koramangala/ Chalaghatta valley
43.	Subbarayana lake	Gottigere-12	Puttenhalli Series	Koramangala/ Chalaghatta valley
44.	Kalyanikunte (Near Saibaba Temple)	Vasanthapura-21	Puttenhalli Series	Koramangala/ Chalaghatta valley
45.	Puttenahalli Lake (Next to Brigade Millenium) Bangalore South	Puttenahalli-42	Puttenhalli Series	Koramangala/ Chalaghatta valley
46.	Mangammana Palya Kaere	Yalkunte -19	Varthur Series	Koramangala/ Chalaghatta valley
47.	Ibblur Lake	Ibbalur-0036	Varthur Series	Koramangala/ Chalaghatta valley
48.	Sarakki/Jaraganahalli/Puttenahalli Lake	Sarakki-26	Puttenhalli Series	Koramangala/ Chalaghatta valley
		Puttenahalli -5		
		Jaraganahalli-7		
49.	Haralakunte Lake (Somasandrakere)	Haralakunte-0051	Varthur Series	Koramangala/ Chalaghatta valley
50.	Venkogirao kere	Agra-11, venkogirao lake-11	Varthur Series	Koramangala/ Chalaghatta valley
51.	Garveybhavipalya Lake	Hongasandra-41	Varthur Series	Koramangala/ Chalaghatta valley
52.	Madivala lake	Madivala-76	Puttenhalli Series	Koramangala/ Chalaghatta valley
		Kodi chikkanahalli-23		

		Roopena agrahara-11 Bellakkanahalli-64		
53.	Ambalipura Kelagina kere	Amblipura-41	Varthur Series	Koramangala/ Chalaghatta valley
54.	Amblipura melina kere / Bangalore East	Ambalipura-36	Varthur Series	Koramangala/ Chalaghatta valley
55.	Kaigondanahalli Lake / Bangalore East	Kaigondanalli-8 Kasavanalli-70	Varthur Series	Koramangala/ Chalaghatta valley
56.	Doddakanenahalli kere / Bangalore East	Doddakannalli-109	Varthur Series	Koramangala/ Chalaghatta valley
57.	Kasavanahalli lake / Bangalore East	Kasavanalli-50 Haralur-32	Varthur Series	Koramangala/ Chalaghatta valley
58.	Haraluru kere / Bangalore East	Haraluru-95	Varthur Series	Koramangala/ Chalaghatta valley
59.	Sowl kere / Bangalore East	Bellandur-65 Doddakannali-68 Kaigondanalli-36	Varthur Series	Koramangala/ Chalaghatta valley
60.	Devarabeesanahalli Lake	Devarabeesanahalli - 18	Varthur Series	Koramangala/ Chalaghatta valley
61.	Junnasandra lake	Junnasandra-32	Varthur Series	Koramangala/ Chalaghatta valley
62.	Bhoganahalli Lake	Bhoganahalli - 21	Varthur Series	Koramangala/ Chalaghatta valley
63.	Gunjur Palya kere	Gunjur-83	Varthur Series	Koramangala/ Chalaghatta valley
64.	Gunjur mouji kere	Gunjur-301 (P) Kachamaranahalli-74	Varthur Series	Koramangala/ Chalaghatta valley

65.	Panathur lake	Panathur -38	Varthur Series	Koramangala/ Chalaghatta valley
66.	Chikkabelandur Lake	Chikkabelandur-9	Varthur Series	Koramangala/ Chalaghatta valley
		Mullur-78		
67.	Gunjuru Karmelaram lake	Gunjuru-95	Varthur Series	Koramangala/ Chalaghatta valley
68.	Panthur lake	Panthur lake-48	Varthur Series	Koramangala/ Chalaghatta valley
69.	Munnekolalu kere / Bangalore East	Munnekolalu-25	Varthur Series	Koramangala/ Chalaghatta valley
70.	Chinnappanahalli/ Bangalore East	Chinnappanahalli-15	Varthur Series	Koramangala/ Chalaghatta valley
71.	Kundalahalli Lake	Kundalahalli-05	Varthur Series	Koramangala/ Chalaghatta valley
72.	Doddanekundi lake	Kaggadasapura-25	Varthur Series	Koramangala/ Chalaghatta valley
		Vibhuthipura-13		
		Doddanekundi lake-200		
73.	Shilavanthana kere / Bangalore East	White field-41	Varthur Series	Koramangala/ Chalaghatta valley
74.	Siddapura Lake	Siddapura - 18	Varthur Series	Koramangala/ Chalaghatta valley
75.	Nalluralli tank	Nalluralli-4	Varthur Series	Koramangala/ Chalaghatta valley
		Pattandur Agrahara-85		
76.	Pattandur agrahara lake	Pattandur agrahara - 124	Varthur Series	Koramangala/ Chalaghatta valley
77.	Pattandur agrahara	Pattandur agrahara - 54	Varthur Series	Koramangala/ Chalaghatta valley
78.	Mahadevapura Lake	Mahadevapura-187	Varthur Series	Koramangala/ Chalaghatta valley

79.	Mahadevapura Lake /East taluk	Mahadevapura-7	Varthur Series	Koramangala/ Chalaghatta valley
80.	Vibhuthipura kere	Vibhuthipura-175	Varthur Series	Koramangala/ Chalaghatta valley
81.	Sitaram Palya	Sonnenalli-33	Yellemallappa Chetty Series	Hebbala/ Nagawar valley
82.	Garudachar Palya (Goshala)	Mahadevapura-86	Varthur Series	Koramangala/ Chalaghatta valley
83.	Garudachar Palya Lake	Mahadev pura-31	Varthur Series	Koramangala/ Chalaghatta valley
84.	K R Puram (BEML)	Benniganahalli-47	Varthur Series	Koramangala/ Chalaghatta valley
		Benniganahalli-55		

CHAPTER -3

PREVAILING ENVIRONMENTAL STATUS OF THE BENGALURU LAKES

3. INTRODUCTION

The number of lakes of Bengaluru city under the jurisdiction of BBMP and BDA are 205 and 5, respectively. Each of these lakes have been divided based on the stage of development viz., developed lake, undeveloped lakes, lakes whose tender is in progress and lakes for which tender is yet to be prepared for development. The details of all the 210 lakes are described lake wise, zone wise of BDA and BBMP.

3.1 BENGALURU DEVELOPMENT AUTHORITY (BDA)

Bengaluru Development Authority has 5 lakes under its jurisdiction and they are Bellandur, Varthur, Kommaghatta, Ramasandra and Chikkabanavara lakes. To assess the lake water quality, samples from the lake were collected from the periphery and centre of the lake at 30cm below the surface and 30cm above the bottom of the water column. The collected water samples were analyzed for various physico-chemical and microbiological parameters, biological parameters and sediment quality. The analytical results of each lake are presented in the following sections.

Table 3.1 Details of BDA Zone lakes

S. No.	Name of Lake	Village Name and Survey No.	Extent		Sampling Date
			Acres	Guntas	
1.	Bellandur Lake	Yamaluru-62 Amanikere Bellandur Kahne-1 Ibbalur-12 Kempapura-6 Beluru-2	916	17	9-10-2019 26-12-2019
2.	Varthur Lake	Varthur-319	439	39	10-10-2019 26-12-2019
3.	Kommaghatta Lake	Komaghatta-03 Ramasandra-46	9	4	09-10-2019 24-12-2019
4.	Ramasandra Lake	Ramasandra-159	7	6	14-09-2019 09-10-2019
5.	Chikkabanavara Lake	Chikka Banavara-3 Somashettyhalli-73 Keregullada halli-22 Ganigarahalli-11,15	105	15	12-10-2019 23-12-2019

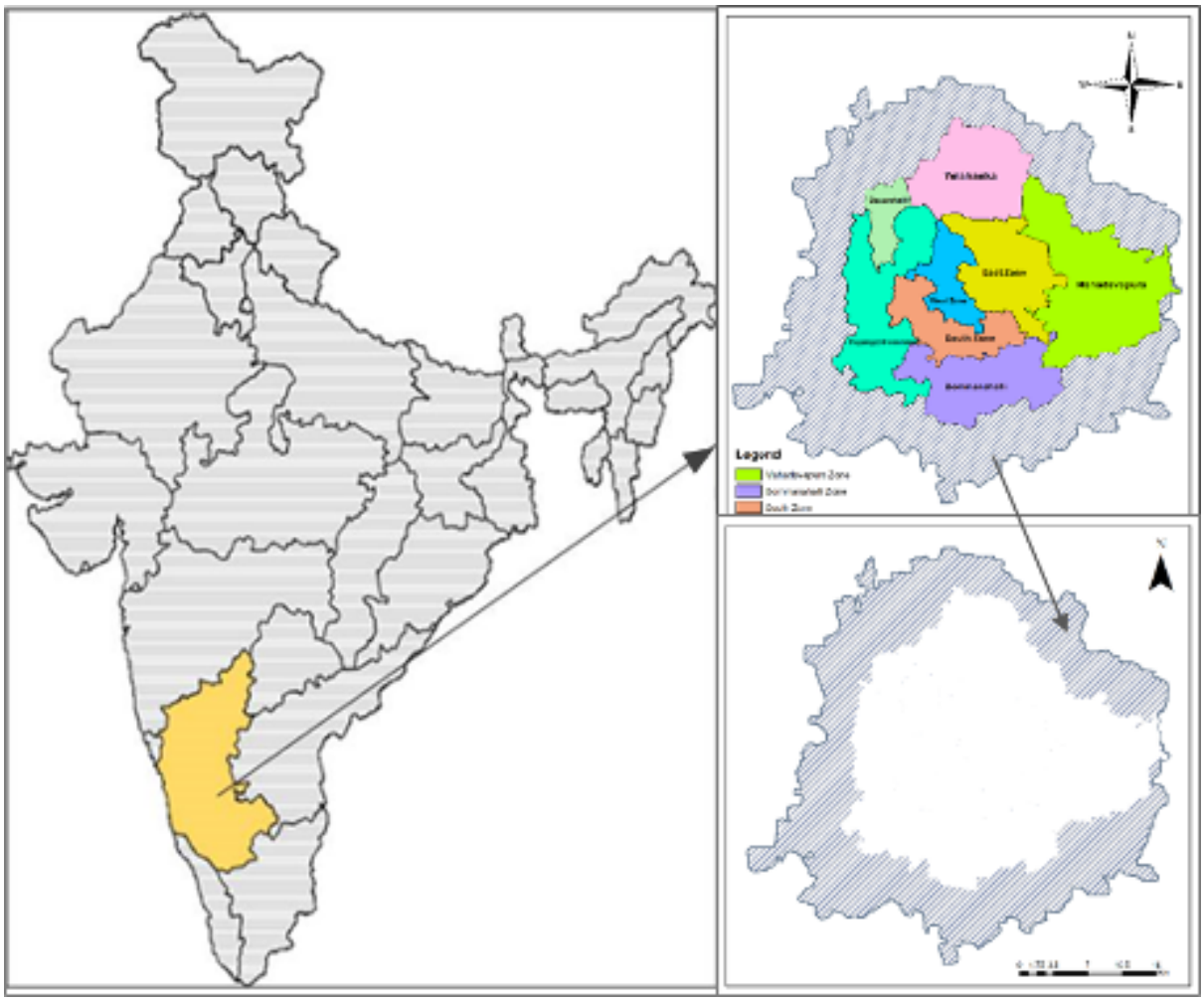

Fig. BDA: Map showing the location of the BDA area

BELLANDUR LAKE
(BENGALURU DEVELOPMENT AUTHORITY)

SALIENT FEATURES

Village Name & Syno	:	Yamaluru-62, Amanikere Bellandur Kahne-1, Ibbalur-12, Kempapura-6, Beluru-2
Latitude Longitude	:	12°56'6.44"N 77°40'1.94"E
Total Area	:	916 Acres 17 Guntas

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3.1.1 BDA-1: BELLANDUR LAKE

Bellandur Lake located in the suburb of Bellandur in the southeast of Bengaluru and is the largest lake in the city. It was used for landing amphibious aircraft during British rule. It is a part of Bellandur drainage system that drains the southern and the south-eastern parts of the city. The lake is a receptor from three chains of lakes upstream, and has a catchment area of about 148 square kilometres (37,000 acres). Water from this lake flows further east to the Varthur Lake, from where it flows down the plateau and eventually into the Pinakani river basin. At present, it is highly polluted with sewage, and in May 2015 the foam covering the water surface caught fire and burned for hours. The lake caught fire again in January 2018.

Lake Water Quality

The analytical results are presented in Table BDA-1.1. The pH of the lake water was normal and ranged from 6.9 to 7.5. The DO values varied in the range of Nil– 3.1 mg/l. The presence of very high BOD (62-122 mg/l) levels in lake water attributed to the increased biological activity, high nitrate content and decaying plants and animals etc. The nitrate-nitrogen ranged from 1.5 to 4.9 mg/l. The water quality index of the lake is determined as 181 indicate that the water is unfit for drinking and requires immediate restoration. The Bellandur lake mainly receives effluents from Industries around. Most of the effluents disposal is being diverted but still some industries discharge effluents to Bellandur.

Table BDA-1.1: Water quality of Bellandur lake

(Physico-chemical and microbiological parameters)

S.No.	Parameter	Concentration
1.	pH	6.9 – 7.5
2.	TDS	278 – 597
3.	TSS	11 – 165
4.	Turbidity	0.3 – 4.5
5.	Chlorophyll-a	0.032
6.	Pheophytin	0.003
7.	DO	Nil – 3.1
8.	BOD	62 – 122
9.	TOC	8.56 – 21.58
10.	NO_3^-	1.5 – 4.9
11.	NH_3-N	5.0 – 49.2
12.	P-PO_4	0.18 – 0.56
13.	TC	1200 – 2120
14.	FC	200 – 1160

*All units in mg/l except for pH, Turbidity (NTU), TC & FC(CFU/100ml)

Biological Parameters (Phytoplankton, Zooplankton, Benthos)

The phytoplanktons such as Oscillatoria sp. (32.89%), Navicula sp. (20.36%) and Merismopedia sp. (13.98%) were the most abundant in the lake (Table BDA-1.2). The SWDI varied from 1.477 to 1.959 indicating moderate level of contamination in the lake water. The zooplankton diversity in the lake identified Rotifer (22.22%), Ostracod (20%) and Cladocera (18.89%) to be the dominant groups. Further, the SWDI (1.011-2.030) values suggests moderate to slightly high level of contamination. The benthic organisms in the lake sediment were dominated by Gastropod (79.31%) and three groups were recorded.

Table BDA-1.2: Water Quality of Bellandur Lake: Biological Parameters (Phytoplankton, Zooplankton, Benthos fauna).

Parameters	Phytoplankton		Zooplankton		Benthos fauna
Genus/ Group	*Anabaena* sp, *Chlorella* sp, *Closterium* sp, *Crucigenia* sp, *Eudorina* sp, *Euglena* sp, ***Merismopedia* sp**, ***Navicula* sp**, *Nitzschia* sp, *Oedogonium* sp, ***Oscillatoria* sp**, *Pediastrum* sp, *Spirogyra* sp, *Synedra* sp		**Cladocera**, Coleoptera, Copepod, Diptera, Hemiptera, Nauplius Larva, Odonata, **Ostracod, Rotifer**, Trombidiformes		Diptera, **Gastropod**, Hemiptera
No. of Genus/ Groups	**Min.**	**Max.**	**Min.**	**Max.**	3
	5	9	3	10	
Abundance*	121000	192000	6000	78000	116
SWDI	1.4771	1.9594	1.0114	2.0305	0.6532

*The units of abundance for phytoplankton, zooplankton, Benthos fauna are L^{-1}, per m^3, per m^2, respectively.

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Lake Sediment

The lake Sediments were analysed for specific parameters and the analytical results are presented in Table BDA-1.3. The pH and EC of the lake sediment was observed as 6.83 and 0.83 mS/cm respectively. The nutrient parameters viz., total nitrogen and total phosphorus were found to be 0.31 % and 0.098 % respectively. TOC (11.95 %) of the sediment sample was found to be rich and in high impact range (more than 3%) as per USEPA 2002 Standards. The sediment texture is observed to be sandy loam, with fine sand (0.02-0.2 mm) dominating with content of 53.56 % followed by silt (0.002 to .02 mm) content of 30.57 % and clay (<0.002 mm) content of 10.88 %. Concentration of metals like cadmium (1.39 mg/kg), chromium (58.08 mg/kg), nickel (28.23 mg/kg) and lead (53.64 mg/kg) were observed to be above Threshold Effect concentration. Furthermore, concentrations of copper (331 mg/kg), mercury (2.05 mg/kg) and zinc (984.46 mg/kg) were observed to be above SQL levels. The metal enrichment in the lake sediments may be attributed to disposal of sewage, use of manure and fertilizers etc.

Table BDA-1.3: Sediment Analysis of Bellandur Lake

Sl.No	pH	EC (mS/cm)	Total N (%)	Total P (%)	TOC (%)
1	6.83	0.83	0.31	0.098	11.95

Particle size distribution					
Sl.No	Coarse sand (0.2-2 mm)	Fine sand (0.02 - 0.2 mm)	Silt (0.002-0.02 mm)	Clay (<0.002 mm)	Texture
2	4.99	53.56	30.57	10.88	Sandy Loam (SL)

Heavy Metals (mg/kg)												
Sl.No	As	B	Cd	Cr	Co	Cu	Fe	Hg	Mn	Ni	Pb	Zn
3	1.137	22.61	29.28	58.08	3.46	331	12736	2.05	187	28.23	53.64	984.46

VARTHUR LAKE
(BENGALURU DEVELOPMENT AUTHORITY)

SALIENT FEATURES

Village Name & Syno	:	Varthur-319
Latitude Longitude	:	12°57'0.57"N 77°44'27.17"E
Total Area	:	439 Acres 39 Guntas

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3.1.2 BDA-2: VARTHUR LAKE

Varthur lake, which is a man-made lake, built by Ganga kings over thousands of years ago for agriculture and domestic uses. It has an area of 180.40 hectares and is the second largest lake in Bangalore city, after Bellandur. The lake receives 40% of the sewage water from Bangalore city from Bellandur Lake, further upstream.

Lake Water Quality

The pH of the lake water was normal and ranged from 7.0 to 7.4 (Table BDA-2.1). The DO values varied from Nil to 3.6mg/l. Low DO levels indicate increased biological activity in the lake. The presence of very high BOD concentration (67-130 mg/l) in lake water indicates decomposable matter in the lake and also high rate of decaying plants and animals in the lake water. The nitrate-nitrogen ranged from 2.9 to 20.6mg/l. The presence of coliform organism in the lake water indicates sewage inflow in to the lake. The water quality index of the lake is determined as 114 indicate that the water is unfit for drinking and requires immediate restoration.

Table BDA-2.1: Water quality of Varthur lake

(Physico-chemical and microbiological parameters)

S.No.	Parameter	Concentration
1.	pH	7.0 – 7.4
2.	TDS	396 – 652
3.	TSS	14 – 157
4.	Turbidity	1.5 – 5.5
5.	Chlorophyll-a	0.031
6.	Pheophytin	BDL
7.	DO	Nil – 3.6
8.	BOD	67 – 130
9.	TOC	7.94 – 12.05
10.	NO_3^-	2.9 – 20.6
11.	NH_3-N	10.1 – 18.5
12.	P-PO_4	0.034 – 0.349
13.	TC	2240 – 2920
14.	FC	1320 – 1820

*All units in mg/l except for pH, Turbidity (NTU), TC & FC(CFU/100ml)

Biological Parameters (Phytoplankton, Zooplankton, Benthos)

The number of phytoplankton genera in the lake varies from 4 to 19 and the dominant species were Oscillatoria sp. (30.62%), Eudorina sp. (12.6%) and Closterium sp. (10.03%) (Table BDA-2.2). The SWDI (1.128-2.793) values indicate moderate to slightly high level of contamination in the lake water. Zooplankton diversity in the lake showed Copepod (25.23%), Rotifer (19.82%) and Ostracod (13.51%) to be the dominant groups. The SWDI (0.861-1.859) values indicate moderate to high level of contamination. Four groups of benthic organisms were recorded in lake sediments. Gastropod (67.57%) was found to be the dominant group and the analysis of SWDI (0.864) indicates high level of contamination in the lake.

Table BDA-2.2: Water Quality of Varthur Lake: Biological Parameters (Phytoplankton, Zooplankton, Benthos fauna)

Parameters	Phytoplankton		Zooplankton		Benthos fauna
Genus/ Group	*Anabaena* sp, *Chlorella* sp, ***Closterium*** sp, *Crucigenia* sp, *Cyclotella* sp, *Diatoma* sp, *Euastridium* sp, ***Eudorina* sp**, *Euglena* sp, *Merismopedia* sp, *Microcystis* sp, *Navicula* sp, *Nitzschia* sp, *Nodularia* sp, *Nostoc* sp, *Oedogonium* sp, ***Oscillatoria* sp**, *Pediastrum* sp, *Rivularia* sp, *Spirogyra* sp, *Surirella* sp, *Synedra* sp		Cladocera, Coleoptera, **Copepod,** Decapod, Diptera, Fish larva , Hemiptera, **Ostracod, Rotifer,** Trombidiformes		Diptera, **Gastropod**, Hemiptera, Tricoptera
No. of Genus/ Groups	**Min.**	**Max.**	**Min.**	**Max.**	
	4	19	3	8	4
Abundance*	63000	202000	15000	48000	148
SWDI	1.1278	2.7929	0.8609	1.8594	0.8641
Evenness Index	0.7906	0.9541	0.7836	0.9232	0.6233

*The units of abundance for phytoplankton, zooplankton, Benthos fauna are L^{-1}, per m^3, per m^2, respectively.

Lake Sediment

The pH and EC of the lake sediment was observed as 6.98 and 0.15 mS/cm, respectively (Table BDA-2.3). The result showed that the sediment sample is neutral in nature. The nutrient parameters viz. total nitrogen and total phosphorus were found to be 1.12 % and 0.072% respectively. TOC (0.02%) of the sediment sample was found to be in low impact range (less than1%) as per USEPA 2002 Standards. The sediment texture is observed to be sandy clay loam, with fine sand (0.02-0.2 mm) dominating with content of 70.07 % followed by clay (<0.002 mm) content of 23.35 %.

Table BDA- 2.3: Sediment Analysis of Varthur Lake

Sl.No	pH	EC (mS/cm)	Total N (%)	Total P (%)	TOC (%)
1	6.98	0.15	1.12	0.072	0.02

Particle size distribution					
Sl.No	Coarse sand (0.2-2 mm)	Fine sand (0.02 - 0.2 mm)	Silt (0.002-0.02 mm)	Clay (<0.002 mm)	Texture
2	3.16	70.07	3.43	23.35	Sandy Clay Loam (SCL)

Heavy Metals (mg/kg)												
Sl.No	As	B	Cd	Cr	Co	Cu	Fe	Hg	Mn	Ni	Pb	Zn
3	BDL	3.59	0.38	4.17	1.03	4.93	3196	0.05	27.01	2.48	2.19	9.61

KOMMAGHATTA LAKE
(BENGALURU DEVELOPMENT AUTHORITY)

SALIENT **FEATURES**

Village Name & Syno	:	Komaghatta-03, Ramasandra-46
Latitude	:	12°55'50.08"N
Longitude		77°28'2.35"E
Total Area	:	9 Acres 4 Guntas

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3.1.3 BDA-3: KOMMAGHATTA LAKE

Kommaghatta Lake situated in the villages Kommaghatta and Ramasandra has an area of 9 Acres and 4 Guntas.

Lake Water Quality

The pH of the lake water ranged from 7.9 to 8.7 (Table BDA-3.1). The DO values varied in the range 1.2-5.6mg/l and low DO levels indicate increased biological activity in certain pockets of the lake. The presence of moderate BOD concentration 12-15mg/l indicates the increasing growth of plants in the lake, increasing nitrate content which increases the algal growth. The nitrate-nitrogen ranged from 1.3 to 14.2mg/l. The presence of coliform organism in the lake water indicates sewage inflow in to the lake. The water quality index of the lake is determined as 107 indicate that the water is unfit for drinking and requires immediate restoration.

Table BDA-3.1: Water quality of Kommaghatta lake

(Physico-chemical and microbiological parameters)

S.No.	Parameter	Concentration
1.	pH	7.9 – 8.7
2.	TDS	480 – 568
3.	TSS	2.8 – 22
4.	Turbidity	0.8 – 1.5
5.	Transparency	0.2
6.	DO	1.2 – 5.6
7.	BOD	12– 15
8.	TOC	9.1 – 9.48
9.	NO_3^-	1.3 – 14.2
10.	NH_3-N	2.8 – 6.7
11.	P-PO_4	BDL – 0.112
12.	TC	1040 – 2200
13.	FC	460 – 760

*All units in mg/l except for pH, Turbidity (NTU), TC & FC(CFU/100ml) and transparency (m)

Biological Parameters (Phytoplankton, Zooplankton, Benthos)

More than ten genera of phytoplankton were recorded in lake water and the phytoplankton such as Oscillatoriasp. (29.3 %), Closterium sp. (10.55 %) and Surirella sp. (10.16%) were abundant in the lake (Table BDA-3.2). The SWDI values ranged from 1.256to 2.391 indicating moderate to slightly high level of pollution in the lake water. Among zooplanktons, Copepod (55.47%), Diptera (17.97%) and Rotifer (10.94%) were the dominant groups. The SWDI (1.2783 to 1.187) values based on zooplankton diversity indicate moderate to slightly high level of contamination in the lake water. Benthos could not be collected as the bed was hard due to clay.

Table BDA-3.2: Water Quality of Kommaghatta Lake: Biological Parameters (Phytoplankton, Zooplankton)

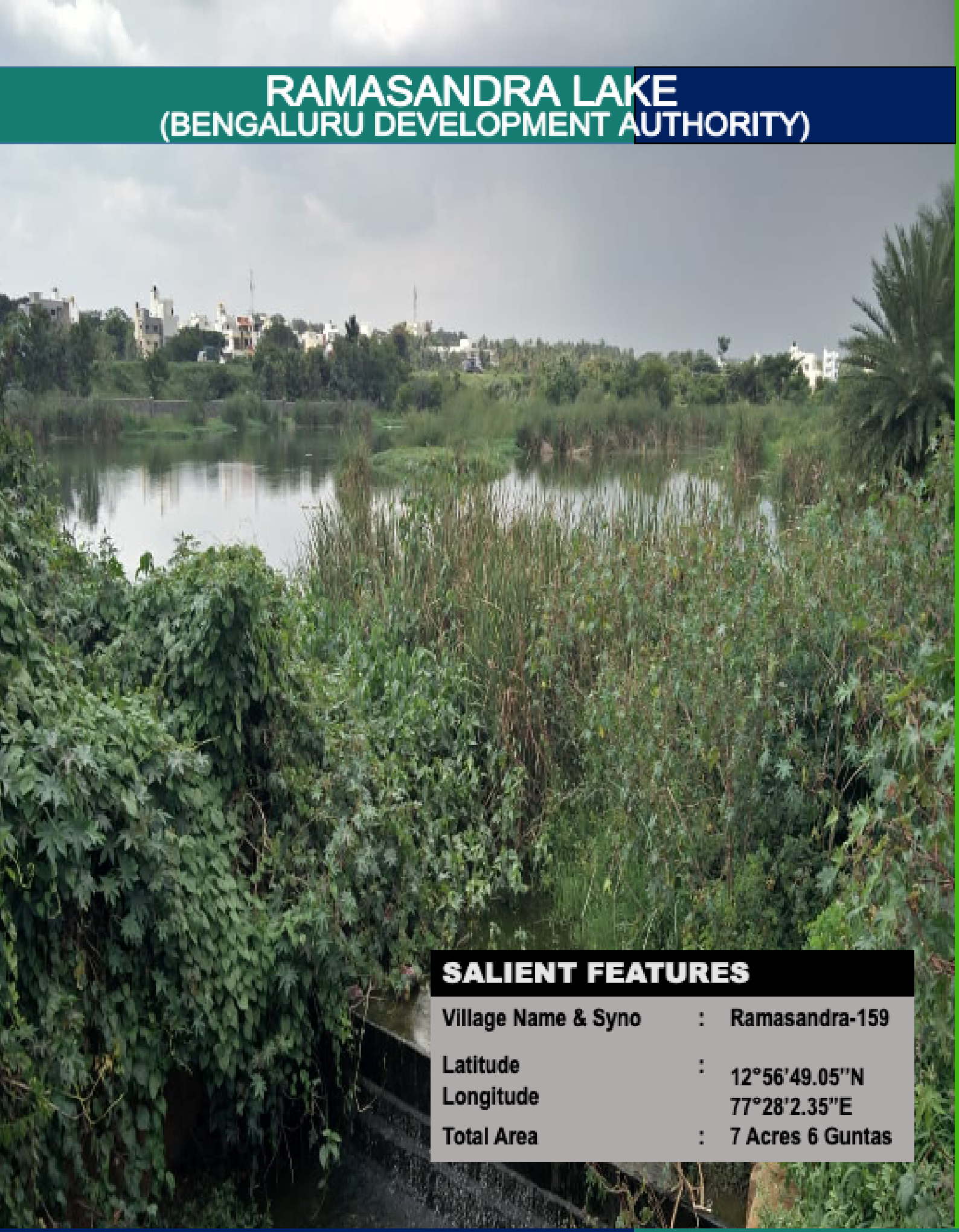
Parameters	Phytoplankton		Zooplankton	
Genus/ Group	*Chlorella* sp, ***Closterium* sp**, *Cyclotella* sp, *Diatoma* sp, *Eudorina* sp, *Euglena* sp, *Fragilaria* sp, *Nitzschia* sp, *Nodularia* sp, ***Oscillatoria* sp**, *Rivularia* sp, *Skeletonema* sp, Spirulina sp, ***Surirella* sp**, *Synedra* sp		Cladocera, **Copepod,** Decapod, **Diptera**, Ostracod, **Rotifer**, Trombidiformes	
No. of Genus/ Groups	13	6	4	7
Abundance*	383000	129000	28000	100000
SWDI	2.391	1.256	1.187	1.273

*The units of abundance for phytoplankton and zooplankton are L^{-1} and per m^3, respectively.

Lake Sediment

Sediment samples could not be collected due to presence of rocks and hardened clay mass at the bottom. Due to this hardened clay mass, the sediment grab was not able to grab any sediment from the bottom

RAMASANDRA LAKE
(BENGALURU DEVELOPMENT AUTHORITY)



SALIENT FEATURES

Village Name & Syno	:	Ramasandra-159
Latitude	:	12°56'49.05"N
Longitude		77°28'2.35"E
Total Area	:	7 Acres 6 Guntas

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3.1.4 BDA-4: RAMASANDRA LAKE

Ramasandra Lake situated in the village Ramasandra and has an area of 7 Acres and 6 Guntas.

Lake Water Quality

The pH of the lake water was normal and found to be 7.6 (Table BDA-4.1). The DO level in the lake was good and found to be 7.1 mg/l. The presence of moderate BOD (14 mg/l) level in lake water indicates decomposable matter in the lake. The nitrate-nitrogen ranged was 0.7mg/l. The water quality index of the lake is determined as 81 indicate that the water is can be used for irrigation purposes but with restricted usage.

Table BDA-4.1: Water quality of Ramasandra lake

(Physico-chemical and microbiological parameters)

S.No.	Parameter	Concentration
1.	pH	7.6
2.	TDS	309
3.	TSS	19
4.	Turbidity	1.5
5.	Transparency	0.2
6.	DO	7.1
7.	BOD	14
8.	TOC	12.9
9.	NO_3^-	0.7
10.	NH_3-N	8.9
11.	P-PO_4	0.328
12.	TC	1280
13.	FC	920

*All units in mg/l except for pH, Turbidity (NTU), TC & FC(CFU/100ml and transparency (m)

Biological Parameters (Phytoplankton, Zooplankton, Benthos)

The phytoplankton diversity analysis found Oscillatoria sp. (15.94%), Closterium sp. (15.94 %) and Rivularia sp. (14.49 %) to be the dominant phytoplanktons in the lake (Table BDA-4.2). The SWDI values ranged from 1.905 to 2.625 suggest moderate level of contamination in the lake water. Among zooplanktons, Copepod (25.33%), Rotifer (20.67%) and Ostracod (14.67%) were most abundant groups. The SWDI (1.011 to 2.023) values suggest moderate to slightly high level of pollution in the lake water. Benthos could not be collected as the lake was completely covered with weeds.

Table BDA-4.2: Water Quality of Ramasandra Lake: Biological Parameters (Phytoplankton, Zooplankton)

Parameters	Phytoplankton		Zooplankton	
Genus/ Group	*Anabaena* sp, *Chlorella* sp, ***Closterium* sp**, *Cosmarium* sp, *Crucigenia* sp, *Cyclotella* sp, *Diatoma* sp, *Eudorina* sp, *Euglena* sp, *Fragilaria* sp, *Navicula* sp, *Nitzschia* sp, *Nodularia* sp, *Oedogonium* sp, ***Oscillatoria* sp**, *Pediastrum* sp, ***Rivularia* sp**, *Spirogyra* sp, *Spirulina* sp, *Surirella* sp		Cladocera, Coleoptera, **Copepod**, Diptera, Fish larva , Hemiptera, Nauplius Larva, Odonata, **Ostracod**, **Rotifer**	
No. of Genus/ Groups	16	8	10	3
Abundance*	45000	162000	144000	6000
SWDI	2.6252	1.9048	2.0226	1.0114

*The units of abundance for phytoplankton, zooplankton, Benthos fauna are L^{-1}, per m^3, per m^2, respectively.

Lake Sediment

Sediment could not be collected from the lake as the whole lake was completely filled with weeds and water hyacinth.

CHIKKABANAVARA LAKE
(BENGALURU DEVELOPMENT AUTHORITY)

SALIENT FEATURES

Village Name & Syno	:	Chikka Banavara-3, Somashettyhalli-73, Keregullada halli-22, Ganigarahalli-11,15
Latitude Longitude	:	13°04'55.09"N 77°30'25.17"E
Total Area	:	105 Acres 15 Guntas

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3.1.5 BDA-5: CHIKKABANAVARA LAKE

Chikkabanavara Lake situated in the villages Chikka Banavara, Somashettyhalli, Keregullada halli, Ganigarahalliand has an area of 105 Acres and 15 Guntas.

Lake Water Quality

The pH of the lake water was normal and ranged from 7.1 to 8.1 (Table BDA-5.1). The DO values were satisfactory and varied in the range of 2.8 – 7.3mg/l. The presence of moderate BOD (8-14 mg/l) levels in lake water indicates decomposable matter in the lake. The nitrate-nitrogen ranged from 0.2 to 2.2mg/l and low nitrate concentrations at some pockets of the lake indicate utilization of nitrate by phytoplankton and periphyton. Presence of coliform organisms in lake indicates sewage inflow in to the lake. The water quality index of the lake is determined as 107 indicate that the water is unfit for drinking and requires immediate restoration.

Table BDA-5.1: Water quality of Chikkabanavara lake

(Physico-chemical and microbiological parameters)

S.No.	Parameter	Concentration
1.	pH	7.1 – 8.1
2.	TDS	613 – 692
3.	TSS	22-23
4.	Turbidity	1.0 – 2.5
5.	Transparency	0.2
6.	DO	1.2 – 5.1
7.	BOD	8 – 13
8.	TOC	9.53 – 13.09
9.	NO_3^-	7.5 – 27.7
10.	NH_3-N	3.4 – 5.0
11.	P-PO_4	0.795 – 0.856
12.	TC	1360 – 1840
13.	FC	520 – 660

*All units in mg/l except for pH, Turbidity (NTU), TC & FC(CFU/100ml) and transparency (m)

Biological Parameters (Phytoplankton, Zooplankton, Benthos)

The phytoplankton diversity identified Oscillatoria sp. (36.65%), Closterium sp. (21.71%) and Eudorina sp. (16.73%) were the dominant genera in the lake (Table BDA-5.2). The diversity analysis uncovered the SWDI to be in the range of 1.469 to 1.649 indicating moderate level of contamination in the lake water. Zooplankton groups such as Copepod (59.09%) and Ostracod (26.86%) were prevalent in the lake. The SWDI (0.796 -1.402) values suggest moderate to high level of pollution in the lake. No samples were collected for the analysis of Benthos fauna as the lake surface was filled with dense weeds on surface.

Table BDA-5.2: Water Quality of Chikkabanavara Lake: Biological Parameters (Phytoplankton, Zooplankton, Benthos fauna)

Parameters	Phytoplankton		Zooplankton	
Genus/ Group	*Chlorella* sp, ***Closterium* sp,***Diatoma* sp, ***Eudorina* sp**, *Nitzschia* sp, *Oedogonium* sp, ***Oscillatoria* sp**, *Surirella* sp		Cladocera, **Copepod**, Decapod, Diptera, Hemiptera, Nauplius Larva, **Ostracod**, Rotifer, Trombidiformes	
No. of Genus/ Groups	7	5	4	8
Abundance* ($x10^3$)	148	133	124	118
SWDI	1.6496	1.4698	0.7957	1.402
Evenness Index	0.8477	0.9132	0.574	0.6742

*The units of abundance for phytoplankton and zooplankton are L^{-1} and per m^3, respectively

Lake Sediment

Sediment could not be collected as the lake surface was filled with dense weed on surface.

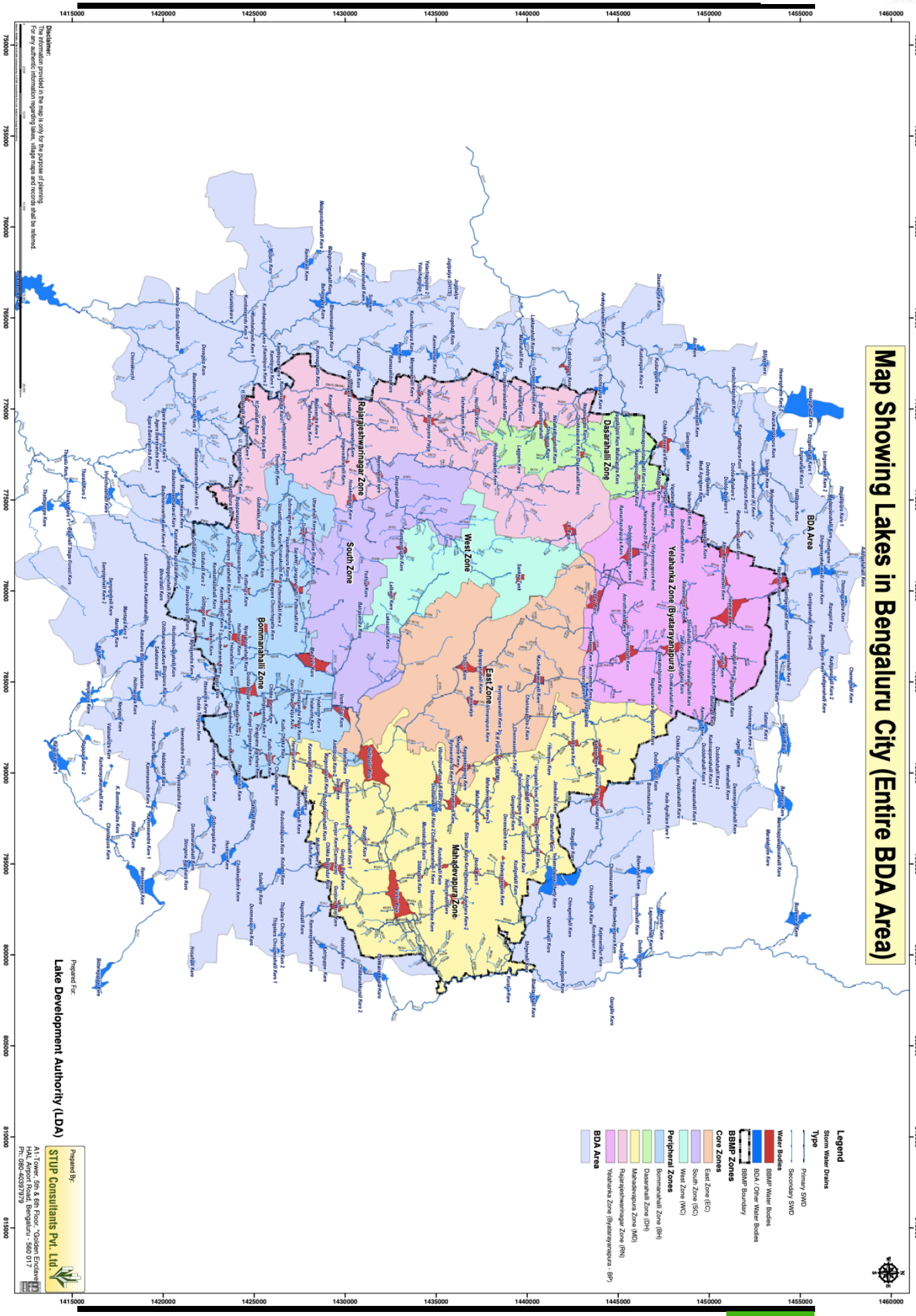
3.1.6 CONCLUSION

The lake quality in terms of physico-chemical, biological and microbiological characteristics of lake water and sediment has been assessed for all the 5 lakes of BDA. The analysis results revealed that out of 5 lakes, 4 lakes have very poor-quality water which means that the water cannot be used for any purpose. Only one lake has poor quality water that can be used for irrigation purpose but with a restricted usage.

Table BDA-5.4: Lake Quality Index of BDA lakes

S.No.	Name of Lake	WQI	Water Quality Status	Source of contamination
1.	Bellandur Lake	181	Unfit for drinking	Domestic sewage and industrial effluents
2.	Varthur Lake	114	Unfit for drinking	Domestic sewage and industrial effluents
3.	Kommaghatta Lake	107	Unfit for drinking	Domestic sewage and industrial effluents
4.	Ramasandra Lake	81	Restricted usage for irrigation	Domestic sewage
5.	Chikkabanavara Lake	107	Unfit for drinking	Domestic sewage and industrial effluents

MAPS SHOWING LAKES IN BENGALURU CITY



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