|| JAI SRI GURUDEV||

S.J.C INSTITUTE OF TECHNOLOGY

DEPARTMENT OF CIVIL ENGINEERING

CHICKBALLAPUR – 562101

CERTIFICATE

This is to certify that the project work entitled **"SUITABILITY OF HEBBAL-NAGAWARA VALLEY WASTEWATER FOR IRRIGATION IN CHICKBALLAPURA DISTRICT"** carried out by **SHAIK NOOR MOHAMMED (1SJ16CV099), PRAVALIKA A (1SJ17CV052), PRIYANKA S B (1SJ17CV053), K DEVARAJ GOWD (1SJ18CV416)** bond full for the award of Bachelor of Engineering in **Visvesvaraya Technological University, Belgaum** during the year 2020-21. It is certified that all corrections/ suggestions indicated for internal assessment have been incorporated in the report deposited in departmental library. The project has been approved as it satisfies the academic requirement in respect of project work prescribed for the said Degree.

Signature of Guide	Signature of HOD	Signature of Principal
Mr. Ravindra M V	Dr. G Narayana	Dr. G T RAJU
Associate Professor	HOD Dept. of Civil Engg.	Principal
Dept. of Civil Engg.	Dept. of Civil Engg	SJCIT

EXTERNAL VIVA:

Name of the Examiners:	Signature and Date
1. _____	_____
2. _____	_____

VISVESVARAYA TECHNOLOGICAL UNIVERSITY

JNANA SANGAMA, BELAGAVI – 590018

PROJECT REPORT ON

"SUITABILITY OF HEBBAL-NAGAWARA VALLEY WASTEWATER FOR IRRIGATION IN CHICKBALLAPUR DISTRICT"

Submitted in partial fulfilment of the requirement for the Eighth semester

BACHELOR OF ENGINEERING IN
CIVIL ENGINEERING

Submitted by:

SHAIK NOOR MOHAMMED	**1SJ16CV099**
PRAVALIKA A	**1SJ17CV052**
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Under the guidance of:

Mr. RAVINDRA M V
Associate Professor
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Karnataka State Council for Science and Technology
(An autonomous organisation under the Dept. of Science & Technology, Govt. of Karnataka)
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Mr. H. Hemanth Kumar
Executive Secretary

24th April 2021

Ref: 7.1.01/SPP/10

The Principal
S.J.C. Institute of Technology
P.B. No. 20 B.B. Road
Chikkaballapura - 562 101

Dear Sir/Madam,

Sub : Sanction of Student Project - 44th Series: Year 2020-2021
Your Project Proposal Reference No. : ***44S_BE_3402***
Ref : Your Project Proposal entitled " ***SUITABILITY OF HEBBAL-NAGAVARA VALLEY TREATED WASTEWATER FOR IRRIGATION IN CHICKBALLAPURA DISTRICT***

We are pleased to inform that your student project proposal referred above, has been approved by the Council under "Student Project Programme - 44th Series" with a budgetary break-up as detailed below:

Student / s	Ms. Priyanka S B	**Budget**	
	Mr. Shaik Noor Mohammed	**Particulars**	**Amount (Rs.)**
	Ms. Pravalika A	Materials/Consumables	4,000.00
	Mr. K Devarajgowd	Labour	500.00
Guide/s	Prof. Ravindra M V	Travel	500.00
		Miscellaneous	500.00
Department	Civil Engineering	Report	500.00
		Total	**6,000.00**
	SIX THOUSAND RUPEES ONLY		

The following are the guidelines to carryout the project work :

a) The project should be performed based on the objectives of the proposal sent by you.

b) The project should be completed in all respects and softcopy of the full report in a CD (single file .pdf format only) should be submitted to KSCST.

c) Any change in the project title and objectives, etc., or students is liable to rejection of the project and the amount sanctioned needs to be returned to KSCST.

d) Please quote your **project reference number printed above** in all your future correspondences.

e) **Important:** After completing the project, 2 to 3 page write-up (synopsis) needs to be sent by e-mail [spp@kscst.iisc.ernet.in] and should include following :

1) Title of the project
2) Name of the College & Department
3) Name of the students & Guide(s)
4) Keywords

ACKNOWLEDGEMENT

The satisfaction that accompanies the successful completion of any task would be but incomplete without the mention of the people who made it possible, whose constant guidance and encouragement crowned my efforts with success. I wish to express my sincere gratitude and respect to all those who guided me in completion of this technical project work.

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I also express my deep sense of sincere gratitude and humble pranamas to **Parama Poojya Jagadguru Sri Sri Sri Dr. NIRMALANANDANATHA MAHASWAMIJI,** President, Adichunchanagiri Mahasamsthana Math and **Poojya Sri Sri MANGALANATHA SWAMIJI,** Adichunchanagiri shakha Math, Chickballapur**.**

I am grateful to **Dr. G T RAJU, Principal of SJCIT, CHICKABALLAPUR** for having encouraged me in our academic endeavors.

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I would like to express my sincere thanks to my project guide **Mr. RAVINDRA M V, Associate Professor in Department of CIVIL Engineering** for his valuable guidance, and constant support.

I would like to express my gratitude to my project coordinator Mr. **MANJUNATH K A, Assistant Professor in Department of CIVIL Engineering** for constant motivation, support and guidance.

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ABSTRACT

Chickballapur district consists of many artificial lakes which was constructed for agricultural, domestic water supply and also for recreational purpose. Due to drought, less rainfall the lakes are drying day by day.

Due to increasingly stringent regulations on the discharge of wastewaters as well as the decreasing availability of freshwater resources, there is a need to consider the expanded use & reuse of marginal quality water for irrigation & other purposes.

The longer-term efficiency of irrigation with marginal quality waters is dependent on several factors, such as unique limiting water quality characteristics and site-specific crop, soil & climatic conditions. Opportunities exist to use marginal quality water beneficially. However, their use requires more intensive management and monitoring than use of higher quality waters. The present study deals with studying and analyzing of the physicochemical and biological parameters of H-N valley water at its different sampling points. The following parameters were analyzed in laboratory using different analytical method i,e P^H, Electrical conductivity, Total Dissolved Solids (TDS), Hardness, Calcium, Magnesium, Chloride, Biological oxygen demand (BOD) & Nitrates. The BOD exceeded the maximum limit as per the standards 6mg/lit prescribed by BIS. It was concluded the H-N valley water is used for irrigation and groundwater recharge. This paper presents the qualitative assessment of H-N valley water and its remedial measure for water crisis in Chickballapur district.

Keywords— Chickballapur district, H-N valley water, Physico-Chemical Parameters, Water Quality Assessment.

CONTENTS

CHAPTER 1:

INTRODUCTION

GENERAL

Sewage is a type of waste water that is produced by community of people, characterized by volume or rate of flow, physical condition, chemical and toxic constituents. The use of sewage water for irrigation is a positive way to dispose of sewage water for irrigation is a positive way to dispose of sewage. Such large volumes of water in a country with persistent droughts and can be of great agronomic and economic importance. It has been estimated that typical wastewater from domestic sources could supply all the nutrients that are normally required for agricultural crop production (FAO, 1992). In hyper-arid Fezzan region of Libya (UNESCO, 1997) in the central Sahara Desert where groundwater is the only natural water resource available, increasing water demand has necessitated reusing treated municipal waste water for irrigation of sandy soils.

The sewage water contains permissible amounts of Total Nitrogen (N), Total Phosphorus (P) and Potassium (K) which are considered essential nutrients for soil fertility. In soil concentration the irrigation with sewage water (SW) induces significant decrease of soil p^H. Electrical conductivity (EC) is greater with SW. For major elements contents and fertilizer as observed in the irrigation with SW led to a significant increase of N, P, K, Ca, Mg and S contents.

In rural and urban areas of most emergent countries, the application of sewerage and wastewater for irrigation is a regular practice. In these areas, polluted water is often the only supply of water for irrigation. Yet small farmers often prefer wastewater where other water sources are also available because wastewater has high nutrient content which may reduce or even eliminate the need for other costly chemical fertilizers. The use of wastewater for crop growth is a centuries old practice in many arid and semi-arid regions of the Globe.

Farmers often have no alternative, so they depend on unprocessed wastewater as there is no wastewater collection and treatment and freshwater is either out of stock

or too expensive. The uses of wastewater in agriculture create key risks to the health of the community due to chemical and microbial contaminants. Wastewater use can also produce ecological risks in terms of soil and groundwater contamination. Irrigation with wastewater can have a number of benefits and environmental applications if appropriately planned, implemented, and managed.

Many wastewater irrigators are generally landless people who are not land-owning farmers; they lease small plots to grow income-generating crops like vegetables that flourish when watered with nutrient-rich sewage. Across Africa, Asia, and Latin America, the micro-economies of sewage water support a large number of low-income individuals. Stoppage or overregulation of these practices could take away the only income source of numerous landless people. However, in these countries, the sewage water is not processed before use for irrigation. Wastewater treatment is generally carried out in developed countries, where major investment on wastewater treatment has been made over the past 40-50 years in order to achieve high treatment levels. Most sewage water is treated in North America, usually up to secondary and, in numerous cases, up to tertiary levels.

The sewage flows to a downstream location that is hazardous due to which the population inside the streams and water sources are at risk. Such risks can be decreased or proscribed by wastewater treatment in a wastewater treatment plant
consisting of physical, chemical and biological processes.

1.1 ADVANTAGES

- Improvement of the economic efficiency of investment in the wastewater disposal and irrigation.
- Conversion of fresh water sources.
- Recharge of aquifers through infiltration water natural treatment.
- Use of the nutrients of the waste water e.g., nitrogen and phosphate reduction of the use of the synthetic fertilizer improvement of soil properties soil fertility higher.

1.2 DISADVANTAGES

- Wastewater is normally produced continuously throughout the year, whereas wastewater irrigation is mostly limited to the growing season.
- Some substances that can be present in wastewater in such concentrations that they are toxic for plants or lead to environmental damage.

SCOPE OF THE STUDY

The supervision of water resources has turned into a challenge in developing nations where the infrastructural evaluation as kept pace with population improvement & urbanization. With the concern of water shortage, the waste water reuse is an appropriate tool in guiding the available water resources & also it is being adopted globally & considered as a substitute water asset in a modifying agriculture environment.

Secondary treatment of domestic sewage from Bangalore city to the adjoining parched district of Chickaballapur through Hebbal & Nagawara valley project.

OBJECTIVES:

- To collect the water samples at different points from Kandavara lake, Mustoor lake & Gopalkrishna lake.
- To evaluate physico-chemical water quality parameters of the Kandavara lake, Mustoor lake and Gopalkrishna lake.
- To plot the physico-chemical water quality parameters of the Kandavara lake, Mustoor lake and Gopalkrishna lake.
- To compare the obtained results with water quality index (WQI).

NECESSITY OF STUDY:

- Wastewater has a naturally high nutrient content which reduces or even eliminates the need for expensive chemical fertilizers. This helps to support people in poorer communities by reducing agricultural running costs.

- Using wastewater to irrigate crops and farmland is a sustainable practice that helps to reduce water wastage and conserve water supply.

- Wastewater irrigation allows farmers to produce higher quality crops and pastures as water stress can dramatically impact on the quality of farm produce.

- Wastewater allows farmers to grow more pastures and crops by providing access to water. Particularly at times when it would otherwise be hard to achieve good plant growth. Having access to water throughout the year also lengthens the growing season. In addition, irrigation allows farmers to grow crops in areas that would otherwise be considered too dry. It provides ‘insurance’ against seasonal variability and drought.

CHAPTER 2:

LITERATURE REVIEW

2.1 Poojashri R Naik, Sankalpasri S S, Bhavya B S and Reshma T V "Water Quality Assessment of Hebbal lake in Bangalore city", International journal of innovative technology and exploring engineering (IJITEE).

Bangalore city consists of many artificial lakes which was constructed for domestic water supply, industrial, agricultural and also for recreational purposes. Due to huge population growth, pollution and urbanization the lakes of Bangalore are depleting day by day. Hebbal lake is one among the oldest lake in Bangalore, with its source being rainwater. Hence there is a need to study, restore and protect this lake. The present study deals with studying and analyzing the physico-chemical parameters of Hebbal Lake at its different sampling points. The following parameters were analyzed in laboratory using different analytical methods i.e., Temperature, Dissolved oxygen, Biochemical oxygen demand (BOD), Chemical oxygen demand (COD), Electrical conductivity, Total hardness, Total dissolved solids (TDS), and chloride. All other parameters were well within the permissible limits. The BOD exceeded the maximum limit as per the standards 6mg/lit prescribed by BIS. Water quality index was plotted to know its water quality fluctuations at different sampling points. The obtained results revealed the importance of lake restoration and management of the hebbal lake. It was concluded that the lake water could be used for domestic purpose, irrigation, and also for drinking purpose with proper filtration. This paper presents the qualitative assessment of hebbal lake and its remedial measures for water crisis in Bangalore city.

2.2 C V Varun, Sampath Kumar. V, Pallavi. M "Studies of Water Quality Assessment of Hebbal Lake", IJESC.

A lake which is filled with water, localized in basin that is surrounded by land, apart from any river or other outlet that serves to supply or drains the lake. Historically lakes in Bangalore region were managed by public works department, but the Hebbal lake was managed by Karnataka state forest department. The management was transferred

in 2002 to lake development authority, A nonprofit society started with the aim of managing lakes in the Bangalore region. An attempt has been made to understand the water quality assessment of Hebbal lake.

2.3 K. K. Tanji, "Irrigation with Marginal Quality Waters: Issues", Journal of irrigation and drainage engineering.

Due to increasingly stringent regulations on the discharge of wastewaters as well as the decreasing availability of freshwater resources, there is a need to consider the expanded use and reuse of marginal quality waters for irrigation and other purposes. This paper addresses broad issues related to the potential reuse of (1) Treated municipal wastewaters; (2) food processing wastewaters; (3) confined animal lagoon waters; and (4) saline waters, including irrigation drainage waters, on croplands and pastures, landscapes, and agroforestry systems. The long-term efficacy of irrigation with marginal quality waters is dependent on several factors, such as unique limiting water quality characteristics and site-specific crop, soil and climatic conditions. Opportunities exist to use marginal quality waters beneficially. However, their use requires more intensive management and monitoring than use of higher quality waters. Site-specific management options are used to partially overcome many of the potentially adverse impacts, but some impacts are unavoidable. In many instances, the upper bounds of wastewater usage are not fully known and potential long-term cumulative impacts on the environment require further research.

2.4 Ramesh N, Krishnaiah S, "Scenario of Water Bodies (lakes) In Urban Areas-A case study on Bellandur lake of Bangalore Metropolitan city". IOSR journal of Mechanical and Civil engineering.

Environment is made up of natural factors like air, water and land. Each and every human activity supports directly/indirectly by natural factors. India is facing a problem of natural resource scarcity, especially of water in view of population growth and economic development. Due to growth of Population, advancement in agriculture, urbanization and industrialization has made surface water pollution a great problem

and decreased the availability of drinking water. Many parts of the world face such a scarcity of water. Lakes are important feature of the Earth's landscape which are not only the source of precious water, but provide valuable habitats to plants and animals, moderate hydrological cycles, influence microclimate, enhance the aesthetic beauty of the landscape and extend many recreational opportunities to humankind .For issues, perspectives on pollution, restoration and management of Bellandur Lake Falls under Bangalore Metropolitan city is very essential to know their status but so far, there was no systematic environmental study carried out. Hence now the following studies are essential namely Characteristics, Status, Effects (on surrounding Groundwater, Soil, Human's health, Vegetables, Animals etc.,), resolving the issues of degradation, preparation of conceptual design for restoration and management.

2.5 Maria Fernanda Jaramillo and Ines Restrepo, "Wastewater Reuse in Agriculture: A Review about its Limitations and Benefits.

In this study it reveals that agricultural reuse significantly affects soil texture properties, while also causing possible alterations of the biomass and microbiota. The use of treated waste water is agriculture benefits human health, the environment and the economy. Thus, the lack of quantitative of evaluation of microbiological risk, referring to the concentration of helminths, is the missing piece that is required for the proper implementation of agricultural reuse. This deficiency has promoted the use of raw sewage water, triggered by the incipient development of norms and standards of some countries that do not conform to global guidelines. In addition, the improvement of the detection technique of helminths should be the next milestone to eliminate subjectivity and to advance the safe reuse of residual water.

2.6 Mohamed Elsayed Gabr, Hoda ussa, Ehab Fattouh, "Groundwater Quality Evaluation for Drinking & Irrigation Uses in Dayrout City Upper Egypt", J Elsevier.

In this study, water quality index (WQI), its correlation with the water quality

parameters, and Gibbs and Piper diagrams were used to analyze groundwater suitability for drinking and irrigation purposes. Groundwater levels fluctuation with physiochemical parameters of thirty boreholes are recorded and analyzed from January to August 2016. The boreholes water levels show seasonal variations of about 2.3 m. (WQI) values showed low groundwater quality for drinking within urban area west of the Ibrahimmia Canal. Whereas in the east of Ibrahimmia Canal has good (WQI) values but needs disinfection, within drinking limits. All the boreholes show good indices for irrigation water quality. Gibbs and Piper diagrams are presented with major samples falling into rock dominance and belonging respectively to hydro-geochemical facies of Mg Ca HCO_3.

2.7 Anupam Khajuria: Application on reuse of wastewater to Enhance Irrigation purposes.

Water resource management has become a challenge in developing countries as the infrastructural development has not kept pace with population growth and urbanization. Even though India is endowed with a network of rivers, the level of water resource availability is still insufficient to meet national demand. With the issues of water scarcity, the wastewater reuse is one of the important methods to save water resource. In the present work, we have discussed the critical issues and opportunities of reusing the wastewater, which helps to overcome the demand of water supply. We have also suggested the recommendations and policy implementations for safe consumption of wastewater reuse in irrigation and various purposes. This article shows the importance of wastewater utilization, and the new and innovative technology and policies which encourage the use of wastewater as a new or reuse resource. The reusing wastewater address the problem of water scarcity and other environmental problems, which reflect the need of environment assessment and able to achieve sustainable management of wastewater.

2.8 OP Gurjar, Ramawatar Meena, AM Latare, Sumit Rai, Surya Kant, Achin Kumar, Ashvini Kumar and MK Sheshama: Effects of sewage wastewater

irrigation compare to ground water irrigation on soil physiochemical properties.

The domestic waste water with fertilizers has shown the improvement in the physico-chemical properties of the soil. The domestic wastewater irrigation applied for a season had no significant effects apart from, slight changes in salt solubility and alkalinity on soil with sewage wastewater irrigation. The sewage waste water irrigated field soil was analyzed to study the soil physico-chemical properties. Soil samples were collected from four different locations in Bhilwara region and various parameters were analyzed viz., pH, EC, BD, PD, WHC, OC, Nitrogen, Phosphorus, Potassium, Calcium, Magnesium and Sulphur. The samples were found to contain mean of pH 7.49, EC 0.84 dSm-1, OC 0.79 %, N 231.13 kg ha-1, P 15.12 kg ha-1, K 439.18 kg ha-1, S 16.47(Cmol (P +) Kg-1), Mg 9.13 (Cmol (P +) Kg-1) and Ca 2.43 (Cmol (P +) Kg-1) respectively.

CHAPTER 3:

DETAILS OF THE STUDY AREA

GENERAL

A Lake is an open area filled with water, surrounded by land. Lakes lie on the land which is larger & deeper than ponds. The drought-prone Chickaballapur district in Karnataka has suffered water scarcity for years. Kandavara was once the largest lake in the district, but it is not what it used to be 25 years ago when it had water. Spread over 330 acres, the dried-up lake is full of weeds.

To resolve this, the government has decided to rejuvenate the lake using treated sewage water from the hebbal-nagavara sewage treatment plants. This rejuvenate programme is part of the second phase of the Hebbal-Nagavara valley project, in which 44 irrigation tanks will be revived in the Chickaballapur district which involves carrying 210millions liters per day (MLD) of treated sewage water through pipes to fill up the water bodies. The project, which is expected to make available 2.7 tmcft of water, envisages rejuvenating the lakes & improving the groundwater table.

Waste water is any water that has been contaminated by human use. Waste water is used water from any combination of domestic, industrial, commercial, agricultural activities, surface runoff or storm water and any sewer inflow.

Due to increasingly stringent regulations on the discharge of wastewaters as well as the decreasing availability of freshwater resources, there is a need to consider the expanded use and reuse of marginal quality waters for irrigation and other purposes.

The long-term efficiency of irrigation with marginal quality waters is dependent on several factors, such as unique limiting water quality characteristics and site-specific crop, soil & climatic conditions. Opportunities exist to use marginal quality water beneficially. However, their use requires more intensive management & monitoring than use of higher quality waters.

Fig:1. Kandavara lake before filling with H-N valley water

Fig:2. Kandavara lake after filling with H-N valley water

CHAPTER 4:

METHODOLOGY

4.1 SELECTION OF THE STUDY AREA

Kandavara kere, Gopal Krishna kere, Mustoor kere was selected as a study area to analyze and assess its water quality, which is nearly 150 acres in area. These lakes receive water from rainfall covering catchment area localities like Nandi valley region, Sankadagiri mountain region, rural area of Chickaballapur, town area of Chickaballapur & Hebbal- Nagavara valley treated waste water filled.

Fig:3.
Kandavara lake

Fig:4.
Mustoor lake

Fig:5.
Gopalkrishna lake

4.2COLLECTION OF SAMPLES

Initially, cleaned sample bottles are taken to the sampling site along with the record sheets to make a note of sample name, date of sample collection and accurate GIS position of the sampling site and other general observations are observed.

Samples are collected and the sample no's and dates are mentioned on the sample bottles and then they are transferred to the laboratory.



Fig:6. Collection of samples

4.3 ANALYSIS OF SAMPLE

After transferring sample bottles to the laboratory, analysis of samples is carried out. The following parameters are analyzed in the lab:

- pH
- Turbidity

- Temperature
- Conductivity
- Alkalinity
- Chlorides
- Hardness
    - Total hardness
    - Calcium hardness
    - Magnesium hardness
- Nitrates
- DO
- BOD
- COD
- Solids (TDS)

METHODS FOLLOWED TO ANALYZING THE SAMPES

SL.NO	EXPERIMENT	METHOD FOLLOWED
01	p^H	Direct reading p^H meter
02	Turbidity	Direct reading Nephlon Turbidity meter
03	Electrical conductivity	Direct reading conductivity meter
04	Alkalinity	Titrimetric method
05	Chlorides	Titrimetric method
06	Total hardness	Titrimetric method
07	Calcium hardness	Titrimetric method
08	Magnesium hardness	Titrimetric method
09	Nitrates	U-V spectrophotometer
10	DO	Titrimetric method
11	BOD	Titrimetric method
12	COD	
13	Total Dissolved solids (TDS)	Direct reading conductivity meter

Analysis is done as per the standard procedure given in standard method.

The data connected to the quantity of wastewater was personally analyzed the samples collected from various sampling stations in Environmental Engineering laboratory, Civil Engineering Department, SJCIT, Chickaballapur. The analytical report of HN valley water samples in lakes which were collected are tabulated in table.

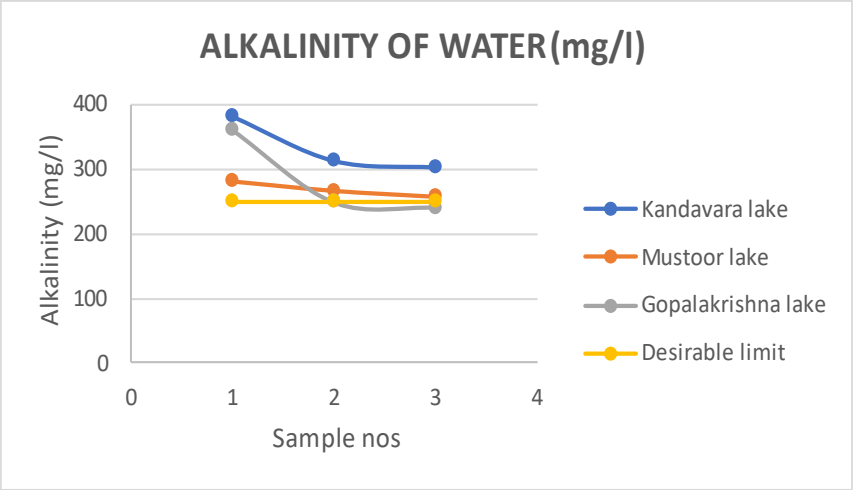
TABLE -Analysis for parameters of sample collected during month of April

PARAMETERS / SAMPLES	KANDAVARA LAKE			MUSTOOR LAKE			GOPALAKRISHNA LAKE		
	INLET	MIDDLE	OUTLET	INLET	MIDDLE	OUTLET	INLET	MIDDLE	OUTLET
p^H	7.534	9.072	8.762	7.099	7.214	7.290	7.423	7.38	8.175
conductivity	850	750	740	590	600	530	980	810	1000
Turbidity	20.1	36	60.2	16.3	37.3	42.9	70.2	72.5	52.9
Alkalinity	380	312	302	282	266	256	360	248	240
Chlorides	180.99	193.99	197.99	139.99	138.99	122.99	175.99	290.99	295.99
Total hardness	236	172	142	130	112	94	174	144	138
Ca hardness	180	100	94	88	82	70	156	112	68
Mg hardness	56	72	48	42	30	24	18	32	70
Nitrites	35	20	43	32.6	35.8	31.4	36	33.5	40.2
DO	6.8	6.8	6.8	6.9	6.8	6.9	6.9	6.9	6.9
BOD	280	200	180	120	80	100	180	200	180
COD	350	250	225	150	100	125	225	250	225
TDS	552.2	487.5	481	383.5	390	344.5	637	526.5	650

CHAPTER 5:

RESULTS AND DISCUSSIONS

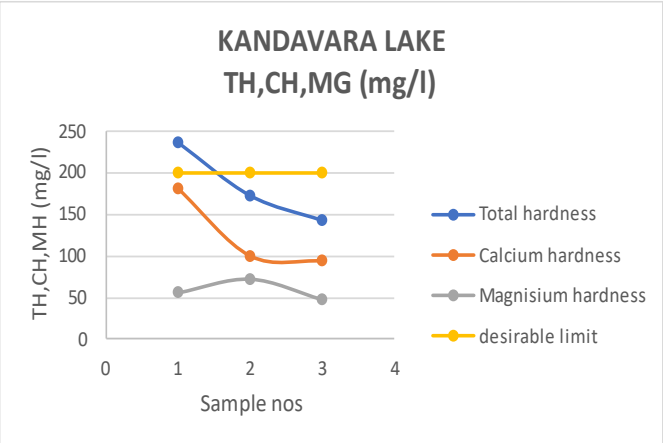
1. ALKALINITY

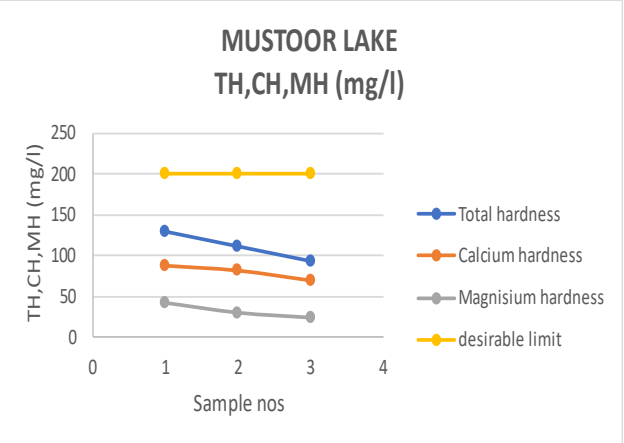


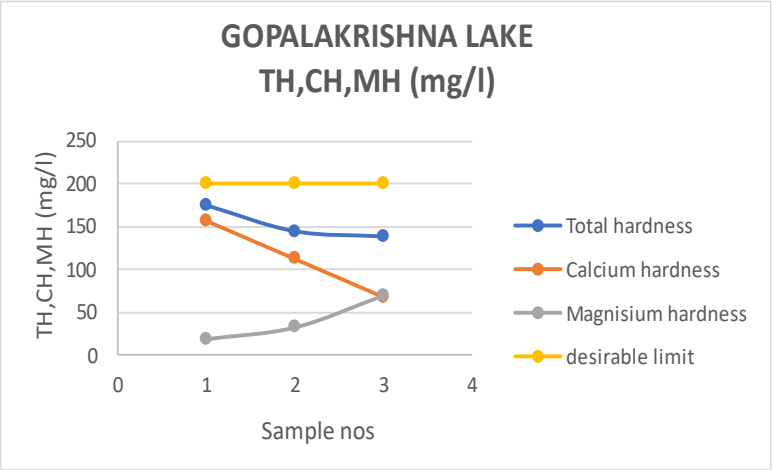
It was found that the alkalinity of Gopalkrishna lake, Kandavara lake, Mustoor lake water samples are varied as shown the figure.

It was found that the samples had more alkalinity due to the presence of more minerals.

2. HARDNESS



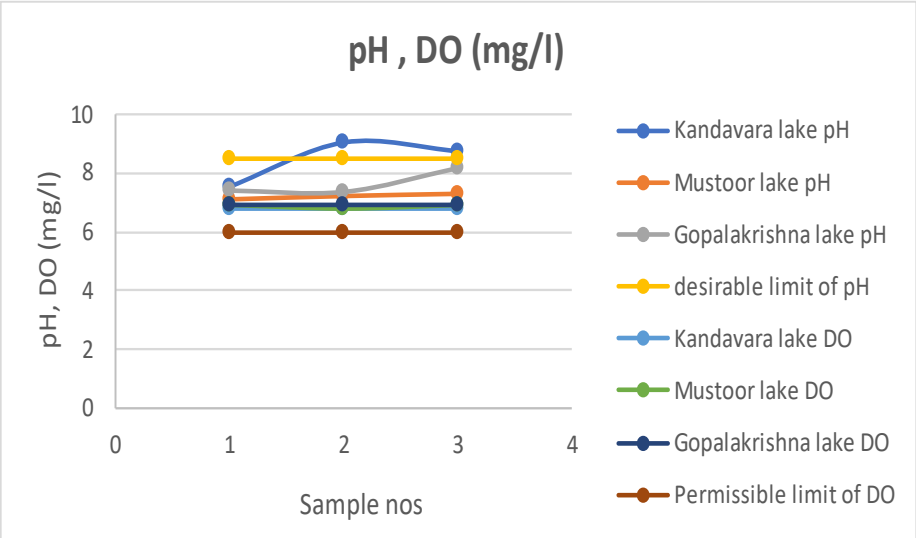




The above figure shows the experimental study which was conducted on TH, CH, MH with a graphical representation.

The desirable limit of total hardness should be within 200mg/l, whereas, calcium hardness should be 75 mg/l and magnesium hardness should be 30 mg/l respectively. All samples were below the limit which were collected in the month of June. In the lake ecosystem, calcium precipitates add up to water by various sources like plant precipitation, bone deposition underneath, shell construction etc., concentration of magnesium is generally lower than calcium and is usually associated with calcium.

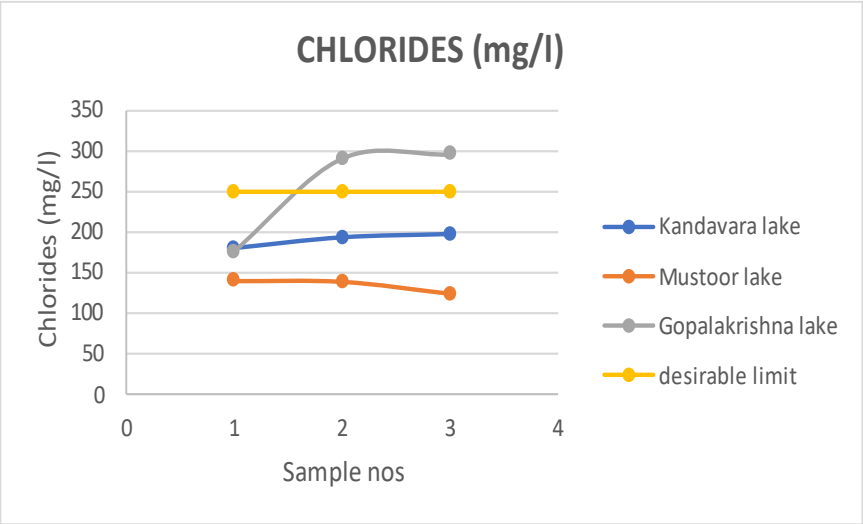
3. p^H and DO



The figure shows variation of p^H, DO in the month June. Generally, as the p^H decreases the concentration of H^+ or the activity increases. Hydrogen ions and oxygen react with water, which results in the decrease of DO.

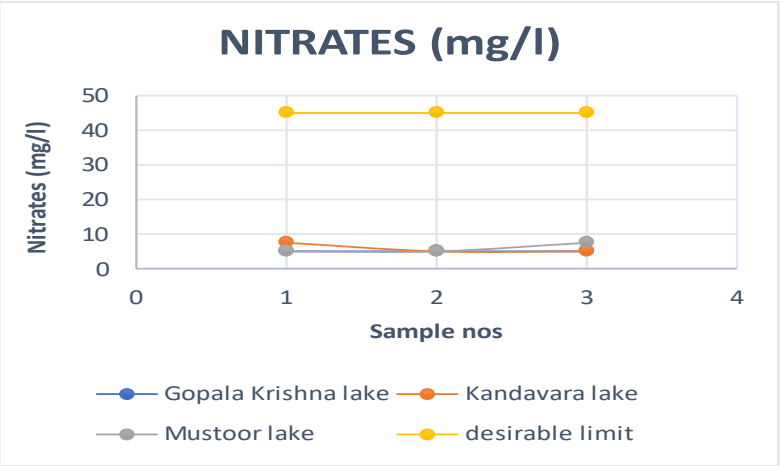
An increase of the p^H value can shift the redox reaction to the left. Almost for all the samples the value of DO was within 6-7 mg/l, which infers healthy environment in the lake ecosystem. Even p^H was within the desirable limits.

4. CHLORIDES



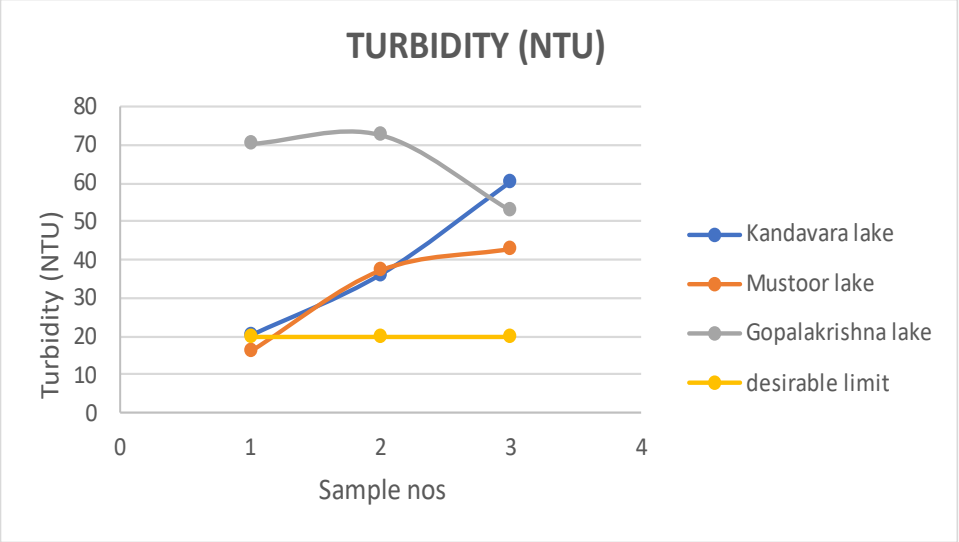
The figure shows graphical representation of chlorides collected in the month of June. The desirable limit of chlorides should be above 250mg/l and less than 600 mg/l. The samples which are collected are within the desirable limit.

5. NITRITES



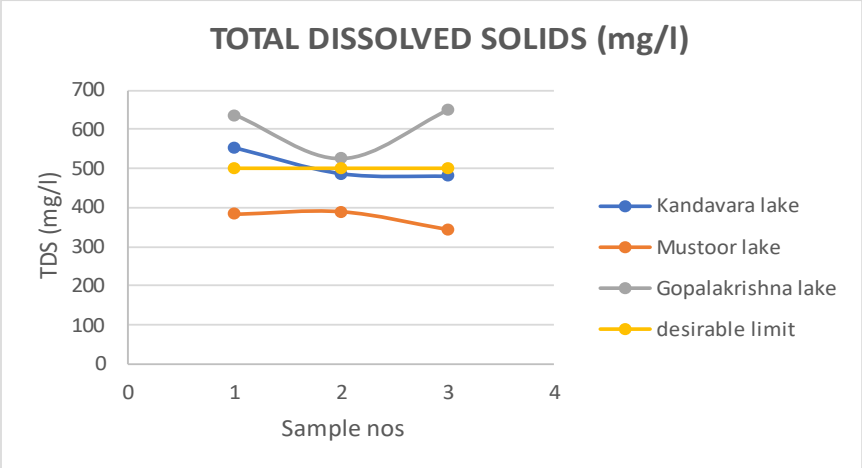
The above figure shows the experimental study which is conducted on nitrates during the month of June. All samples were below the desirable limits which were collected.

6. TURBIDITY



The above figure shows graphical representation of turbidity collected on the month of June. The desirable limit is 6 NTU. The turbidity is more than permissible limit due to presence of colloidal particles in water.

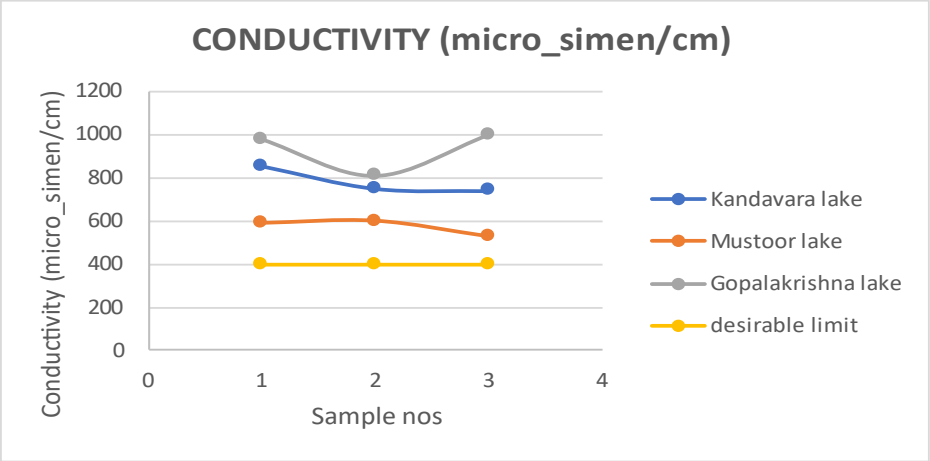
7. TOTAL DISSOLVED SOLIDS



The above figure shows the experimental study which is conducted on TDS with the help of graphical representation. The desirable limits of TDS should be 200-

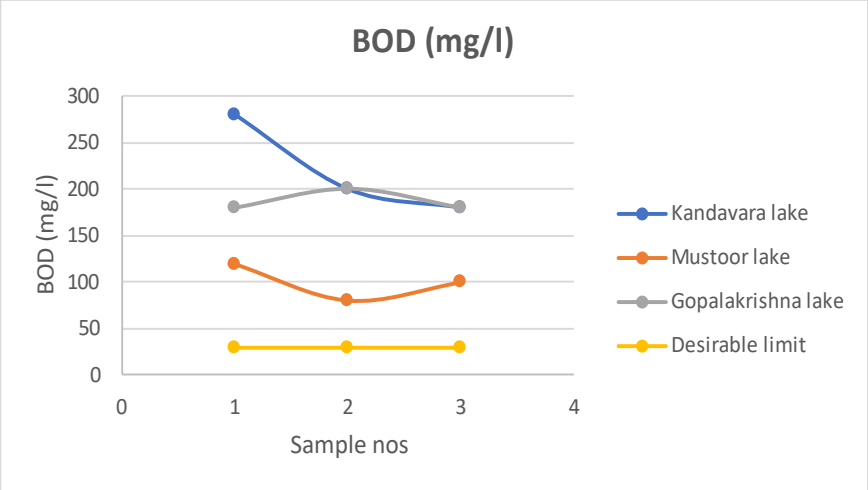
500 mg/l. The samples are within the limit which was collected in the month of June.

8. ELECTRICAL CONDUCTIVITY



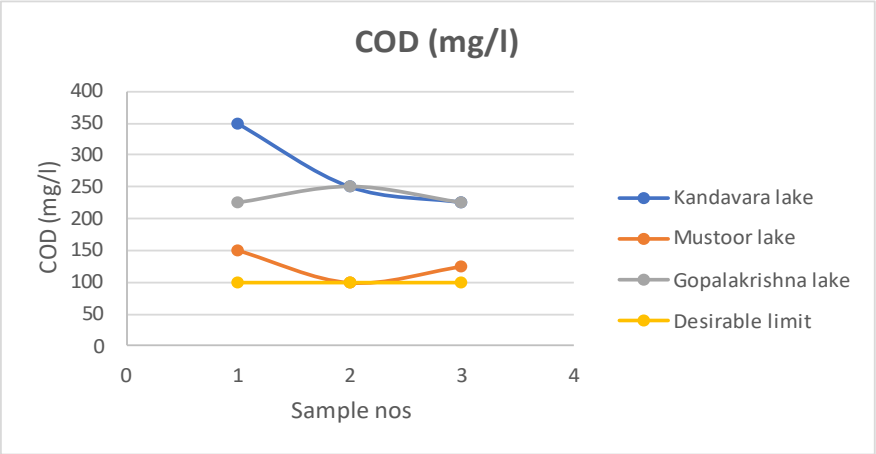
The desirable limit for electrical conductivity is 400 micro_simen/cm. From above graph we observed that electrical conductivity is more than the desirable limit.

9. BOD



From above graph we observed that the BOD levels in all the lakes are more than the desirable limits.

10. COD



From above graph we observed that the COD levels in all the lakes are more than the desirable limit.

Description of Water quality index (WQI) methodology

General

Water quality monitoring data consist of routine measurements of physical, chemical and biological variables that are intended to give insight into the aquatic environment. Once the water quality monitoring data are collected, there is a further need to translate them into a form that is easily understood and effectively interpreted. Water Quality Index (WQI) plays an important role in such translation process.

What is a Water Quality Index?

A water quality is a means to summarize large amounts of water quality data into simple terms (e.g.,) for reporting to management and the public in a consistent manner. Similar to the UV index or an air quality index, it can tell us whether the overall quality of water bodies poses a potential threat to various uses of water, such as habitat for aquatic life, irrigation water for agriculture and livestock, recreation and aesthetics and drinking water supplies.

The WQI serves as a tool to examine trends, to highlight specific water quality conditions, and help governmental organizations to evaluate the effectiveness or regulatory programs. In essence, WQI has following important purpose.

1. **Trend Analysis**

   Index may be applied to water quality data at different points in time to determine the changes in water quality (degradation or improvement), which have occurred over the period.

2. **Public information**

   Index may be used to inform the public about environmental conditions.

3. **Ranking and Rationalization of locations**

   Index may be applied to assist in comparing environmental conditions at different locations or geographic areas for ranking and for rationalizations (i.e., eliminations of redundant stations)

4. **Scientific Research**

   Index may be applied as a means of reducing a large quality of data to a form that give insights to the researcher conductivity a study of some water quality processes.

Water quality indices could be broadly classified into two types

i. Objective indices.
ii. Subjective indices.

Objective indices are those, which do not make use of any subjective inference (e.g., based on the expert opinion questionnaires etc.). these are often called as the statistical indices.

Subjective indices on the other hand need two important specifications namely weights (i.e., values according to importance value of the water quality parameters) and rating functions. These specifications are entirely subjective and are drawn out of questionnaire analysis inquiring the opinion of the experts.

CALCULATION OF WATER QUALITY INDEX

In the formulation of a water quality index, the importance of the various water quality parameters depends on the intended use of the water.

The method followed for the weighted arithmetic water quality index as follows

In the first place, the more harmful a given pollutant of water, the smaller in magnitude is its standard for drinking water. So, the unit weight W_i for the i^{th} parameter P_i is assumed to be inversely proportional to its recommended standard S_i (i=1,2…n) and N= no of parameters considered. Thus, we have

$$\mathbf{W_i=k/S_i =1/S_i}$$

Where, the constant of proportionality K has been assumed to be equal to unity for the sake of simplicity.

The quality rating q_i for the i^{th} parameter P_i is given, for all other parameters except p^H, by the relation

$$\mathbf{Q_i=100(V_i/S_i)}$$

Where, V_i is the observed value of the i^{th} parameter and S_i is its recommended standard for drinking water.

For p^H, the quality rating q_{P^H} can be calculated from the relation

$$\mathbf{q_{p^H} =100[(V_{P^H} – 7.0)/1.5]}$$

Where V_{P^H} is the observed value of p^H

Finally, the water quality index (WQI) can be calculated by taking the weighted arithmetic mean of the quality ratings q_i, thus,

$$\mathbf{WQI= [\sum_{i=1} (q_i W_i)/ \sum W_i]}$$

Table: WQI range and water type

WQI VALUE	STATUS
>75	VERY BAD WATER QUALITY
50 to 75	BAD WATER QUALITY
30 to50	MEDIUM WATER QUALITY
10 to 30	GOOD WATER QUALITY
<10	EXCELLENT WATER QUALITY

WATER QUALITY INDEX

SAMPLE NO	LATITUDE	LONGITUDE	JUNE	QUALITY
01	13°24'6.03"	77°42'21.74"	205.1667	Very bad water quality
02	13◦25'33.3"	77°42'33.3"	187.742	Very bad water quality
03	13°25'32.3"	77°43'27.42"	192.703	Very bad water quality
04	13°27'4.16"	77°43'53.18"	135.096	Very bad water quality
05	13°26'4.16"	77°43'37.72"	131.455	Very bad water quality
06	13°27'3.71"	77°43'44.16"	139.792	Very bad water quality
07	13°25'20.7"	77°44'44.68"	193.001	Very bad water quality
08	13°25' 46.3"	77°44'45.98"	202.854	Very bad water quality
09	13°24'50.9"	77°44'35.67"	193.781	Very bad water quality

TYPICAL

KANDAVARA LAKE – INLET POINT

Parameter (Pi)	Standard (Si)	Unit weight (Wi)	Observed value (Vi)	Quality rating (qi)	Subindex (qiwi)
pH	6.5-8.5	0.005	7.534	35.6	0.178
conductivity	400	0.0025	850	212.5	0.531
Turbidity	20	0.05	20.1	100.5	5.025
TDS	500	0.002	552.2	110.44	0.220
Alkalinity	250	0.004	380	152	0.608
Chlorides	250	0.004	180.99	72.396	0.28
DO	6	0.167	6.8	113.33	18.889
BOD	30	0.033	280	933.33	31.111
COD	100	0.01	350	350	3.5
Total Hardness	200	0.005	236	118	0.59
Calcium Hardness	75	0.0133	180	240	3.2
Magnesium Hardness	30	0.033	56	186.667	6.22

Nitrites	45	0.0222	35	77.778	1.728
		0.351			**72.093**

WQI=sum (WiQi)/sum (Wi)

WQI =205.167

- ✓ **q_p^H =100[(V_P^H – 7.0)/1.5]**

  q_p^H =100[(7.534 – 7.0)/1.5] = 35.6

- ✓ **Q_i=100(V_i/S_i)**

  Q_i=100(850/400) =212.5

- ✓ **Qi*w_i =** 212.5*0.0025 = 0.531

- ✓ **WQI=∑WiQi / ∑Wi**

  WQI=72.093/0.351= 205.167

CHAPTER 6:

CONCLUSIONS

- The physico chemical parameters which were analyzed for Kandavara lake, Mustoor lake, Gopalkrishna lake are P^H, Conductivity, Turbidity, Alkalinity, Chlorides, Total hardness, Calcium hardness, Magnesium hardness, Nitrates, DO, BOD, COD, Solids.

- The analyzed values were compared with water quality index, the samples analyzed were not suitable**.**

- After comparing with water quality index, it is concluded that water stored in lakes cannot be used for domestic purpose.

- As there is water crisis in Chickballapur district, lake water can be suggested for the purpose of irrigational and other domestic use after filtration process.

CHAPTER 7:

SCOPE OF FURTURE WORK

1. Similar studies can be taken up for identification of prone area.
2. This helps the farmers to largely depend on groundwater to irrigation.
3. After comparing with water quality index, the water stored in lake cannot be used for domestic purpose, irrigation. If the water is filtered it can be used for various purpose also.
4. Hence by observing and analyzing the physico-chemical parameters, lake water can be used as source of water supply to nearby areas if properly maintained, restored and protected. This is an eye opener for the water crisis problem in Chickballapur city.

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