Restoration of TS Canal: A Case Study

K. Vidhya[1], R. Dhilipkumar [2], C. Ashokraj [3], Karthika Ravindran [4]
[1,2,3]*Assistant professor, Department of Civil Engineering, The kavery Engineering College*
[4]*PG scholar, Department of Civil Engineering The kavery Engineering College*
Mecheri, Salem.

***Abstract*— The present study addresses the need of resurrecting navigation through one of the oldest and historically significant inland waterways of our nation, the TS canal. Even though restoration projects were being proposed by various government agencies in the past, significant milestones remain to be encountered in this field.The study is aimed at the engineering aspects of restoration of the Kollam-Eravipuram stretch of the TS canal along with a generalised public opinion about the same. It is also intended to deal with the harmful social and being posed by the poor quality of water in nearby aquifers as a result of groundwater intrusion through the canal water body.The study is designed to pin point the major factors that have led to the pathetic condition of the canal as seen today. On the basis of this, a set of recommendations and proposals are enlisted for ensuring restoration of inland navigation in a safe and eco-friendly manner through the same. A suitable waste water treatment plant is also being suggested with its design criteria.**

***Index Terms*— Restoration, Environmental Effects, Groundwater, Navigation.**

I. INTRODUCTION

Kerala, with numerous backwaters, is one of the states in India, where waterways are successfully used for commercial inland water transport. The inland canals play an important role in the economy of the state as they interconnect rivers on the banks of which are situated places of commercial and industrial importance.

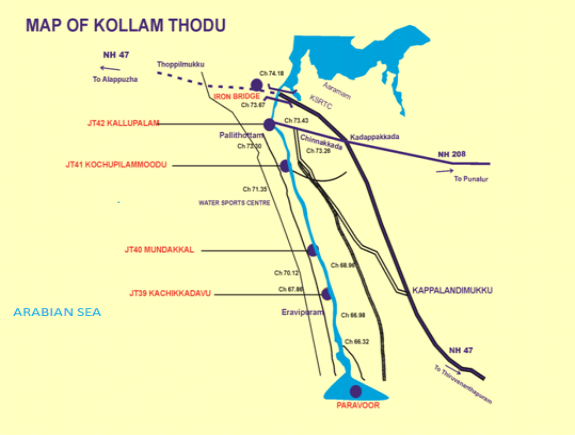

Fig.1.1. A map of Kollam canal

A canal known as the 'West Coast Canal' (WCC) serves as the main arterial waterway of the region. This canal connects Neeleswaram in the north and Kovalam in the south expanding to a stretch of about 590 km. The portion of this canal from Thiruvananthapuram to Ponnani and then along Bharathapuzha River up To Shoranur is known as the 'Thiruvananthapuram-Shoranur Canal' (TS Canal). The portion of TS canal that passes through the city of Kollam connecting the lakes at Eravipuram and Ashtamudi and spanning a length of about 7860 m is called 'Kollam Canal'. Till the time of independence, the Kollam canal served as the main channel of transport between Kottapuram and Trivandrum. During these periods, no residences could be observed along the banks of the canal. Moreover the canal water was being utilized as a fishing source for the traditional inland fishing community.

Fig.1.2. A view of Kollam canal in the 19th century

II. NEED FOR THE STUDY

The canal is highly contaminated with solid waste and liquid waste; hence the need for managing, treating and disposing the sewage and solid waste is inevitable for the entire locality.After independence, with the continuous development of other modes of transport, the canal traffic ceased. This resulted in subsequent negligence and consequently the pathetic condition of the canal as seen today.

The name 'Parvathy Puthanar' was considered synonymous with crystal clear water, as was the case with the canal during the reign of the king of Travancore. Fast forward to the present day world and the name would contradict itself. For a present day man, Its ecosystem has degraded into a weed house and provided habitats for rats, vibio-cholerae, E-coli and thy mates. The quality of water has deteriorated to such an extent that the canal has begun to threaten the groundwater along with the lakes at Akkulam and Veli.

So, there seems a need for safe water for domestic as well as drinking purposes for the people depending on this canal.and also for the safer and healthier living standards of local dwellers the pathetic condition of the canal water should be improved by minimising the waste loads to it and make it suitable for their needs.The survey area comprised of the TS canal stretch between Kollam and Eravipuram, including Vadakkumbhagam, Pallithottam, and Mundakkal.

III. OBJECTIVES OF THIS CASE STUDY

•Socio-economic survey in the area: To analyze the impact of socio-economic and sanitary conditions on the quality of water utilized by the local dwellers for drinking and domestic purposes.

•Water quality analysis: To determine and analyze the quality of water in that particular extent.

•Treatment processes: The object of waste water treatment is to produce a disposable effluent without causing harm or trouble to the communities and prevent pollution.

•Treatment plant: Design a Sewage treatment plant to improve the quality of Waste water disposal to the canal.

IV. METHODOLOGY

A. Survey Area

The survey area comprised of the TS canal stretch between Kollam and Eravipuram, including Vadakkumbhagam, Pallithottam, and Mundakkal. A total of 35 dwellings located along the banks of the structure were surveyed. This was so because I believe that the harmful effects of the poor quality of water in the canal would predominate along the banks. The numbers of study stations were restricted to 35 because of time limitations.

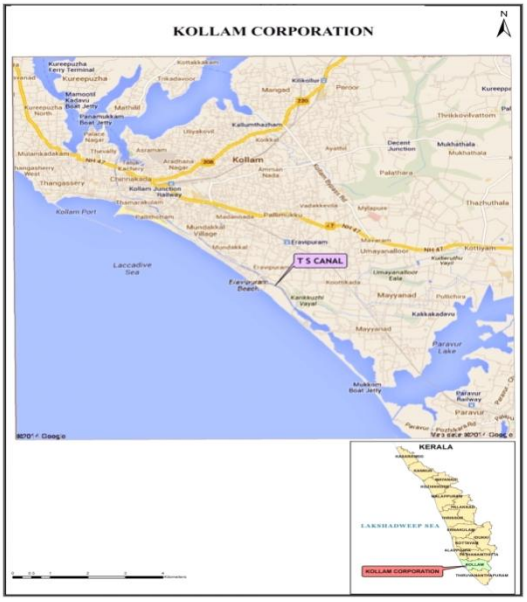

Fig.4.1.The selected survey area

B. Steps

The socio-economic survey phase of our work was conducted within the span of a month. The survey

was done by me with the help of my brother and sister. A well planned household survey questionnaire was prepared while the aims and objectives behind them were in clear focus. The questionnaire comprised of a wide variety of topics covering the highly significant aspects of my project work. I started each session with a preliminary round by producing a set of basic questions aimed at the families of the concerned. After the completion of this round, I began exploring the areas of our interest by producing a secondary set of questions that focused upon the following elements:

•Economic background

•Duration for which the residences were being utilized

•Sources of water being utilized for drinking and domestic purposes

•Waste disposal techniques being practiced by the households

•Harmful consequences posed by the poor canal water quality

•Opinion on canal resurrection and

•Effectiveness of the efforts of government authorities

V. RESULTS OBTAINED

A. Economic Background

The parent interviewees and their family members were classified into three classes namely low, middle, and high on the basis of a set of questions that were designed to focus on certain specific attributes including occupation, educational status of their wards and automobile ownership. We were able to enumerate the analyzed results through a pie chart as shown below.

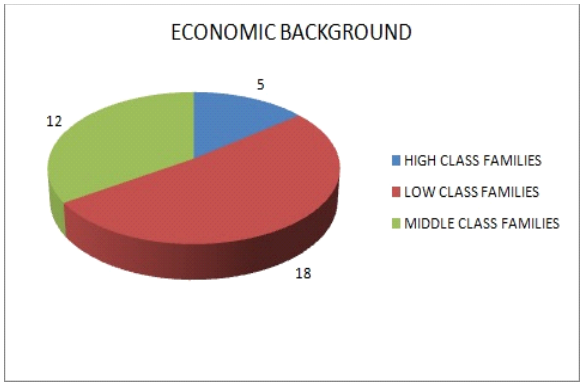

Fig.5.1. Economic Background

B. Dwelling Duration:

Majority of the inhabitants have been dwelling along the canal stretch for more than 50 years. With subsequent passage of time, the intensity of settlement along the banks ceased from 29% between 25 and 50 years to a mere 17% in the last 10 years

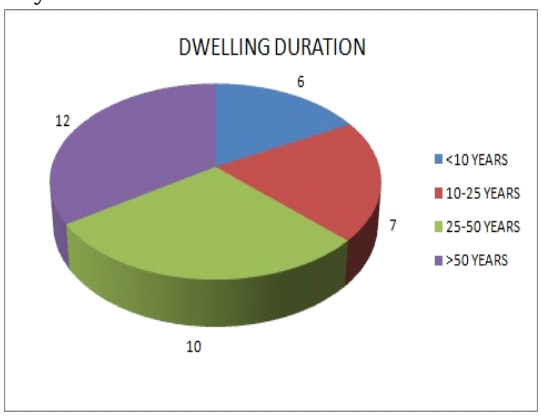

Fig.5.2. Dwelling Duration

C. Drinking Water Source

Majority of the households depended on drinking water from municipal water supplies. Only 40% of households depended on drinking water from open wells, whereas a mere 6% utilised water from tube wells for the same.

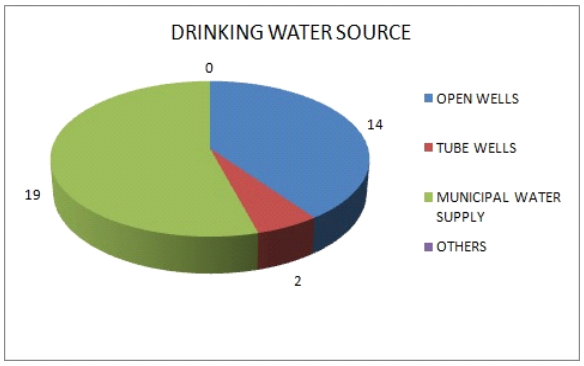

Fig.5.3. Drinking Water Source

D. Domestic Water Source:

Majority of the households depended on water from open wells for domestic purposes. About 37% of households depended on water from municipal water supply for domestic usage whereas none of the dwellings used tube wells for the same.

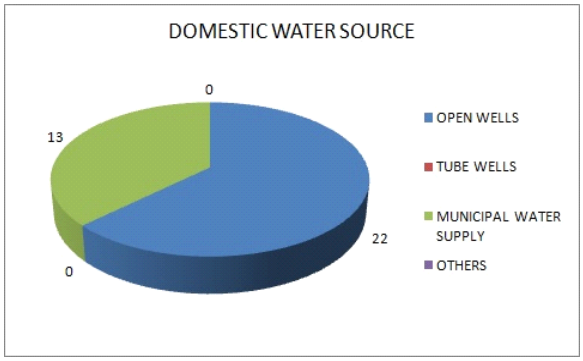

Fig.5.4. Domestic Water Source

E. Sewage Disposal

Majority of the households depended on septic tanks as a mean of disposing off of sewage wastes. Approximately 11% of the dwellings reported that they dispose off their sewage in the waters of TS canal.

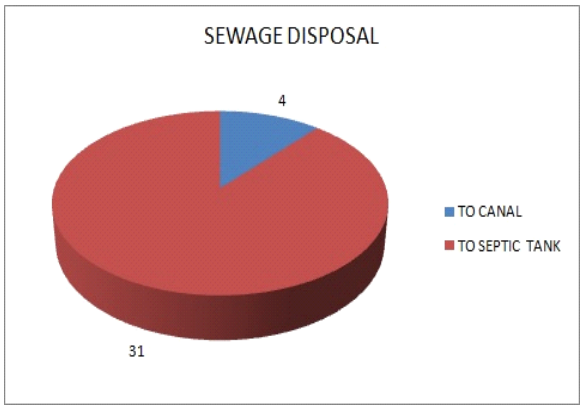

Fig.5.5 . Sewage Disposal

F. Consequences of Poor Water Quality

Approximately 66% of households reported high concentration of mosquitoes along with foul odours emanating from canal water as two of the major problems faced by them.6% of households revealed health concerns whereas over 14% of dwellings reported no threat being imposed on them by the poor quality of canal water.

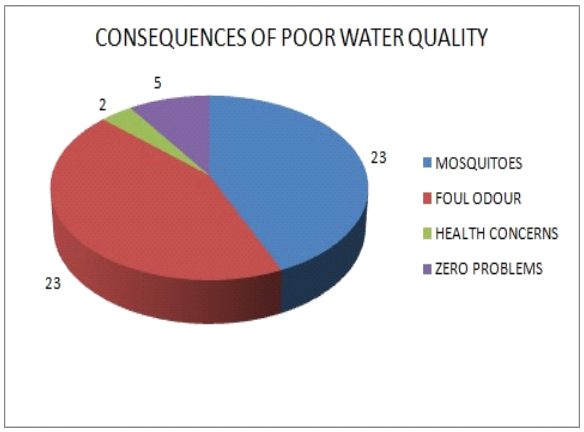

Fig.5.6. Consequences of Poor Water Quality

G. Consequences of Poor Water Quality

All households were found to be highly optimistic and enthusiastic on the prospect of restoration of TS canal at the earliest. None of the households were of the opinion that the canal should not be restored.

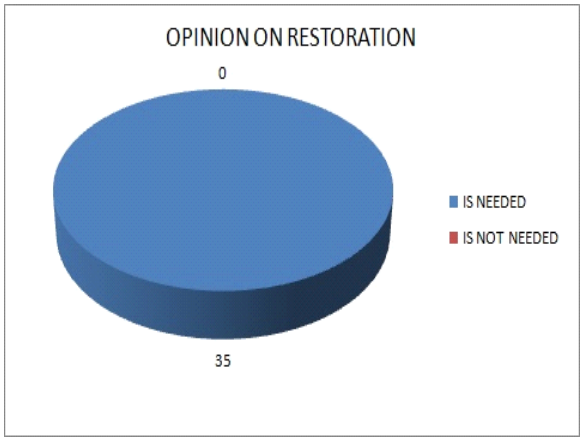

Fig.5.7. Opinion on Restoration

VI. WATER QUALITY ANALYSIS

The number of samples selected for the aforementioned study were limited to 12 because of time and infrastructure limitations. Moreover, I restricted my study area to only 3 locations along the TS canal stretch since my desire is to improve the accuracy of my work by selecting two samples from either banks of the structure. I neglected the analysis of groundwater intrusion since hideous water table studies were required in a short span of time.

F. Sampling Stations

Table No:6.1 Sampling Station Location

Location	Sample Name	Station
1	A	Vilayil Purayidam,
1	B	Nileyil Purayidam,
1	C	Thoppil Puthenveedu,
1	D	Libin Dale, Eravipuram
2	A1	Raja Bhavan. Mundakkal
2	B1	Adil Manzil, Mundakkal
2	C1	Sreelal Bhavan, Mundakkal
2	D1	Malayathil Thekkathil, Mundakkal
3	A2	Sarasamma Nivas, Vadakkumbhagam
3	B2	Shanmuga Bhavan, Vadakkumbhagam
3	C2	Das Bhavan, Kottayckakam
3	D2	Vishakham, Kottayckakam

A. Methods of Analysis

The quality of drinking water was analyzed in terms of pH, hardness, chloride, total dissolved solids (TDS), iron, nitrate, total coli form (TC) and faecal coli form (FC).

Table No:6.2 Location no. 1

Sample	B	A	C	D
Distance(m)	-36	-25	8	23
pH value	6.5	6	7	7.5
Hardness (mg/L)	75	170	135	57
Chloride (mg/L)	41.78	44.98	58.58	77.89
TDS (mg/L	450	460	1070	90
DO (mg/L)	9.0	7.5	1.25	8.2
Turbid-ity (NTU	4	2	3	2
TC (/100mL)	170	90	310	210
FC (/100mL)	90	30	170	110

Table No:6.3 Location no. 2

Sample	B	A	C	D
Distance(m)	13	8	-10	-25
pH value	7.5	7.5	7.5	7
Hardness (mg/L)	282	135	40	74
Chloride (mg/L)	210.94	284.48	7.63	20.55
TDS (mg/L	2570	690	1880	170
DO (mg/L)	7.5	8.0	2.5	8.5
Turbid-ity (NTU	3	1	2	4
TC (/100mL)	50	50	120	600
FC (/100mL)	20	20	20	20

Table No:6.4 Location no. 3

Sample	B	A	C	D
Distance(m)	30	15	-12	-30
pH value	7.5	7.5	7.5	7.5
Hardness (mg/L)	210	186	217	148
Chloride (mg/L)	45.17	68.42	38.33	18.21
TDS (mg/L	340	530	340	2230
DO (mg/L)	8.0	7.5	9.5	3
Turbid-ity (NTU	1	4	2	1
TC (/100mL)	110	70	100	110
FC (/100mL)	50	0	50	40

VII. GRAPHICAL REPRESENTATION

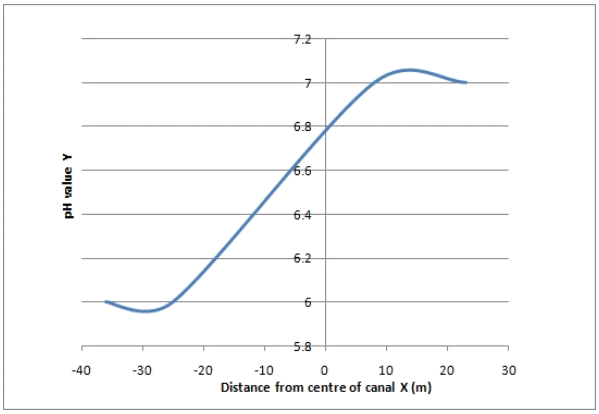

Fig.7.1 .Variation of PH

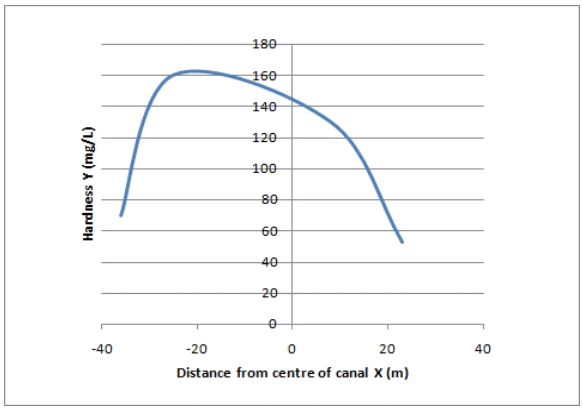

Fig.7.2.Variation of Hardness

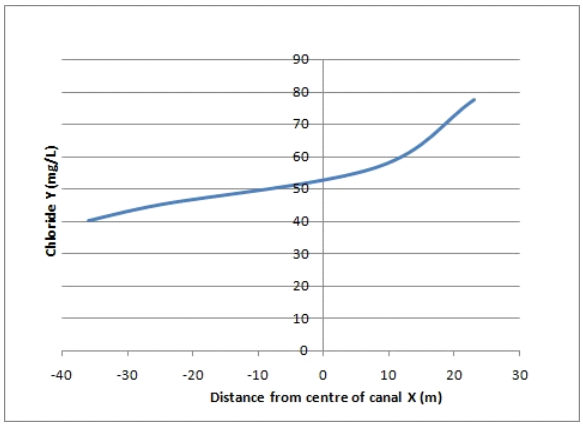

Fig.7.3. Variation of Chloride

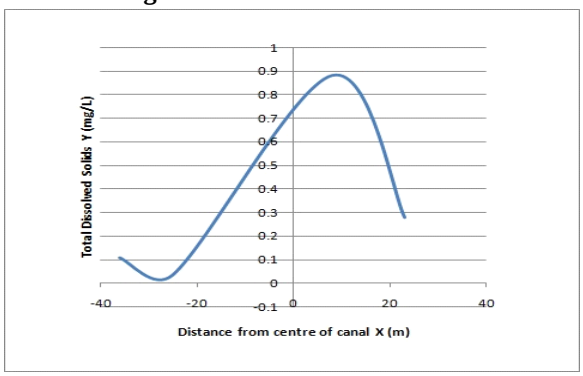

Fig.7.4.Variation of Dissolved Solids

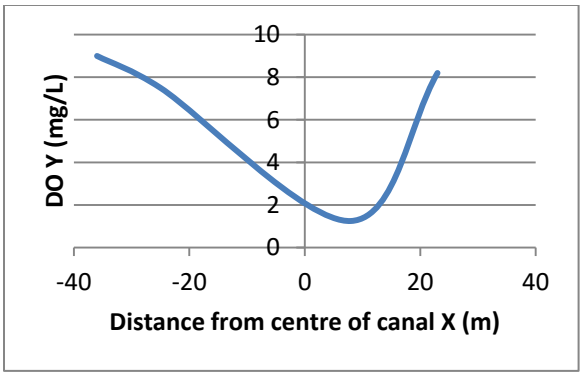

Fig.7.5.Variation of Dissolved oxygen

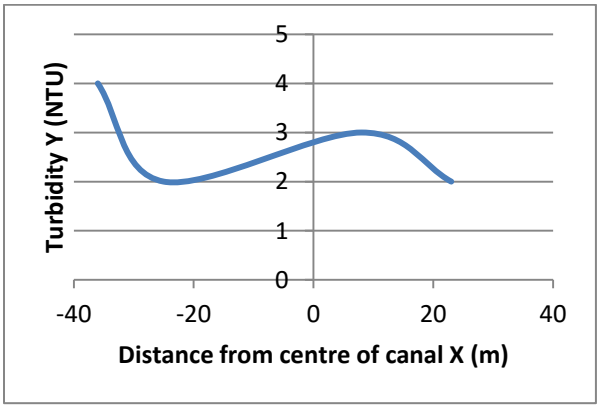

Fig.7.6.Variation of Turbidity

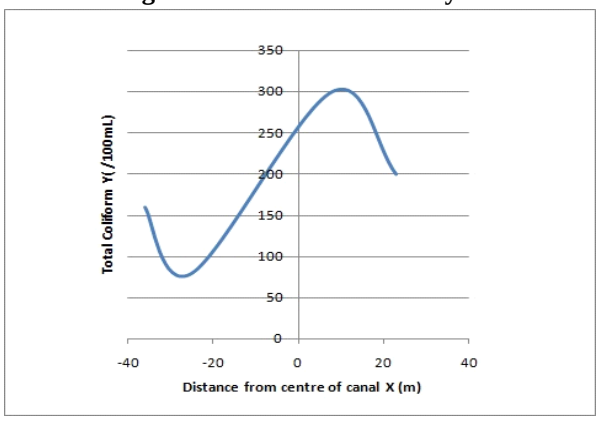

Fig.4.1 : Variation of Total Coliform

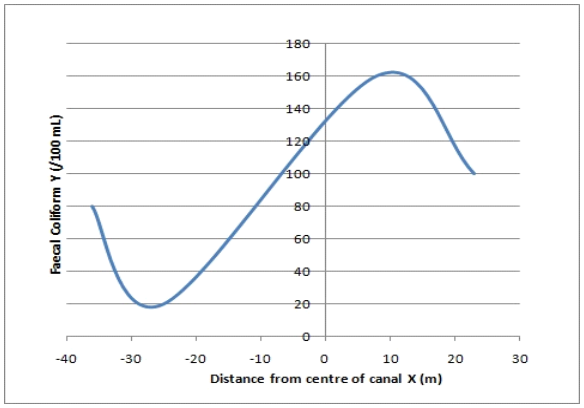

Fig.7.7. Variation of Faecal coliform

VIII. RESULT ANALYSIS

A. Water Quality Analysis

The permissible limit of various parameters in drinking water as per specifications published by the Bureau of Indian Standards (BIS) is as follows

Table No:8.1 BIS specified permissible limits in drinking water

Parameter	Unit	Permissible limit in drinking water
pH	-	6.5 to 8.5
Hardness	mg/L	300 mg/L
Chloride	mg/L	250mg/L
Total Dissolved Solids	mg/L	500 mg/L
Dissolved Oxygen	mg/L	14.6mg/L(0^o C) -7 (35^o C) mg/L
Turbidity	NTU	5 NTU
Total Coliform	/100 mL	Nil
Faecal Coliform	/100 mL	Nil

A. Analysis Of Location 1:

All samples extracted from this location yielded the values of pH, hardness, chloride, and Turbidity within the BIS specified permissible limits. Sample C exceeded the permissible limits specified for total dissolved solids and Dissolved oxygen. All samples exhibited a high concentration of coli form content within them.

B. Analysis Of Location 2:

All samples extracted from this location yielded the values of pH, hardness, and Turbidity within the BIS specified permissible limits. Samples A1, B1, and C1 exhibited high concentration of total dissolved solids. Sample A1 exhibited high chloride content whereas sample C1 exceeded the permissible limits specified for Dissolved oxygen. All samples exhibited a high dosage of coli form content within them.

C. Analysis of Location 3:

All samples extracted from this location yielded the values of pH, hardness, chloride, and Turbidity within the BIS specified permissible limits. Samples B2 and C2 exhibited a high concentration of total dissolved solids. Sample B2 exceeded the permissible limits specified for Dissolved oxygen. All samples exhibited a high concentration of coli form content within them

VII. CONCLUSION

The results of the analysis conducted in this phase have clearly revealed that all of the water samples examined along the Kollam-Eravipuram stretch of the TS canal are highly contaminated and unsafe for drinking as per the specifications laid out by the Bureau of Indian Standards. The fact that all samples are contaminated with high concentrations of coli form bacteria is a clear indication of the intrusion of human excreta into the nearby located groundwater aquifers.

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