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Supply of Potable Water in Kuttanad and Regulation of Water Salinity

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ABSTRACT

The Thanneermukkam bund has various problems, including water pollution and the spread of submerged aquatic plants like sea weeds, which were erected to ease the salty concerns faced by Kuttanad's farmers. Thanneermukkam Bund's principal objective is to lessen the salinity level of Vembanad Lake during the summer season, which is the period of the check (TMB). The problem can be fixed easily if the following guidelines are followed. A controller transports Muvattupuzha River water to the Kuttanad area where it is diluted and maintained at 2ppt salinity; in times of severe shortage, water is collected in the pazhnilam and sent to Lake Girding through a pump. Kuttanad's colourful operating techniques and controller design are also thrown about as a way to execute the concept. A plan to use Kuttanad's volume and saltiness of the natural water system is under consideration.Kuttanad, salinity, and add-ons are some of the terms in this section.

INTRODUCTION

Kuttanad, Kerala's rice bowl, is located in the district. For the most part, farming is done at or below sea level in this area. The Vembanad Lake in Kerala is fed by four main rivers, the Meenachil, the Manimala, the Pampa, and Achenkoil. From -0.6 metres above sea level to -2.2 metres below sea level, it has a wide variety of altitudes. Between May and November, the region has a rainy season and a dry season, respectively. During the summer, the most prevalent issue for tourists to the area is a shortage of clean drinking water. Drinkable water is transported from the highlands to Kuttanad year-round via rivers and the seashore thanks to the monsoon rains. However, owing to the low sea level in the region, the salt content of the water in Kuttanad during the summer months makes it unsuitable. In 1968, the Indian government proposed the Thanneermukkam Salt Barrier project, which would see a barrier erected across the lake at Thanneermukkam to prevent saltwater from returning to Kuttanad. the length of summer, enabling farmers to grow one extra year-round cycle. Salt from the Thanneermukkam Water quality deterioration and the growth of aquatic vegetation were unintended consequences of Kuttanad's water barrier, which was intended to keep saltwater away. On rare occasions, the salinity of the water does not rise over the 2ppt limit for paddy i.e. (elements according to thousand).

There is an increase in pollution from agricultural waste and pesticide and fertiliser residues pouring into the lake owing to the barrier being closed during the dry season because of the enormous water withdrawals for agriculture and home usage. Since Kuttanad's rivers flow into a dry environment, their closure resulted in a considerable decline in water levels.

Literature Review

One of the three options offered by the Netherlands to improve Kuttanad's water balance in summer was to redirect the outflow of the Muvattupuzha River from the Idukki project, which now flows into the ocean, to a different river. After the Muvattupuzha split at Kuttanad's northern border, it recommended building two go regulators, one on each branch. The water might be directed to the Thanneermukkam barrior through existing waterways in Vaikom and along the eastern edge of the Cochin lagoon. It was also claimed that low drift augmentation measures were more cost-effective and easier to undertake than protection activities.

Methodology

Small hydrologic system modifications are shown to be effective in Kuttanad during the TMB shutdown period, according to the study.

Vembanad Lake and Muvattupuzha River are separated by the Thanneermukkam Salt-water Barrier in Kerala (TMB). An average of 1700mm3/year is discharged into this river from the tailrace of the Idukki hydroelectric dam. Idukki Hydroelectric Mission has a larger summer tailrace discharge since it is a peaking plant. From December to May, the 1700mm3 total tailrace discharge may be released. The closing water is released into the lake below the TMB after the MVIP, HNL, GCDA, and KWA

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conditions are satisfied. Modest modifications allow some of this freshwater to be moved upstream from the TMB.

Ithupuzha and Murinjapuzha are two streams that the Muvattupuzha River divides into before it reaches Vembanad Lake (Fig. 1). Five tributaries, Vadayar, Puthen, Chirakkuzhi, and Pennar, all flow into the TMB upstream from Ithupuzha. There are both long-term and short-term regulators in Vembanad Lake, which is downstream of TMB. The Ithupuzha River glides closer to the Lake, and the water level varies as the Lake's tidal variations are to blame. This causes the Vadayar thodu to flow to the south at high tide and to the north at low tide, which may be viewed. It's possible to redirect around 15 m3/sec (on average) of water upstream of the TMB for 12 hours per day using an automated valve over Vadayar thodu, which operates according to the level of the canal and the direction of flow.

Approximately 55000ha (or two-thirds) are utilised for punja agriculture (December to March), resulting in an annual fallow area of roughly 16300 ha (55000-38700ha) without paddy rotation. This 16300 acre region may be utilised to store fresh water, which can then be released into the lake through pumping in order to balance for agricultural evapotranspiration and lake evaporation.

The Lake's agricultural evapotranspiration losses demand the diversion of water during the barrier's closure from December 15th to March 15th.

Fig.1. Vembanad Lake and associated River system

Data Collection and Field Study

By measuring the river's cross section under the Vadayar New and Vadayar Old bridges, we were able to match the river's water level to a known water tier. AutoCAD 2011 was used to build the pass phase. An simple way to identify watersheds is by looking at the Cad graphic. A variety of well-known water levels were used to calculate float velocity as a function of mean sea level. Figure 4 depicts the (interpolated) relationship between velocity and water level for this purpose. corresponding to distinct water levels.

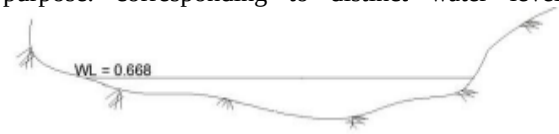

Fig. 2 – Cross section below New Vadayar bridge

Fig.3 – Cross section below Old Vadyar bridge

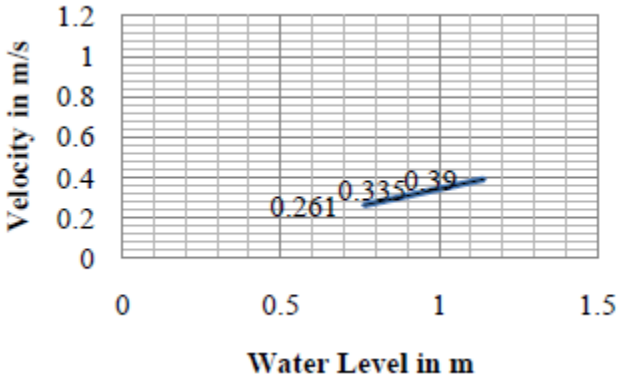

Fig.4 – Velocity v/s Water level Graph

Vadayar Thodu, about 350 metres south of the confluence with the Ithipuzha, was chosen as the site for the Regulator's proposed location, and a gauge was installed there to record the river's daily maximum and minimum water levels during the closure of Thanneermukkam Bund, which lasted from December 15, 2013, to March 15, 2014. Table 1 shows the facts as they are.

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TABLE 1. Water Level Data

Date	Maximum Water Level above MSL (m)	Minimum Water Level above MSL (m)
21-12-2013	0.77	0.28
22-12-2013	0.68	0.23
23-12-2013	0.79	0.31
24-12-2013	0.79	0.34
25-12-2013	0.78	0.29
26-12-2013	0.79	0.25
27-12-2013	0.68	0.31
28-12-2013	0.68	0.21
29-12-2013	0.79	0.36
30-12-2013	0.68	0.38
31-12-2013	0.68	0.25
01-01-2014	0.79	0.34
02-01-2014	0.68	0.4
03-01-2014	0.68	0.38
04-01-2014	0.68	0.32
05-01-2014	0.68	0.36
06-01-2014	0.46	0.22
07-01-2014	0.46	0.22
08-01-2014	0.45	0.23
09-01-2014	0.45	0.31
10-01-2014	0.46	0.28
11-01-2014	0.46	0.3
12-01-2014	0.47	0.23
13-01-2014	0.68	0.37
14-01-2014	0.68	0.39
15-01-2014	0.79	0.41
16-01-2014	*	*
17-01-2014	*	*
18-01-2014	*	*
19-01-2014	*	*
20-01-2014	*	*
21-01-2014	*	*
22-01-2014	*	*
23-01-2014	0.97	0.53
24-01-2014	0.98	0.46
25-01-2014	0.98	0.48
26-01-2014	0.96	0.51
27-01-2014	0.95	0.43
28-01-2014	*	*
29-01-2014	*	*
30-01-2014	*	*
31-01-2014	0.88	0.41
01-02-2014	0.96	0.56
02-02-2014	0.97	0.52
03-02-2014	0.98	0.51
04-02-2014	0.99	0.48
05-02-2014	1	0.49
06-02-2014	0.99	0.51
07-02-2014	1	0.47
08-02-2014	0.99	0.49

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09-02-2014	0.98	0.52
10-02-2014	*	*
11-02-2014	*	*
12-02-2014	*	*
13-02-2014	*	*
14-02-2014	*	*
15-02-2014	*	*
16-02-2014	*	*
17-02-2014	*	*
18-02-2014	0.97	0.47
19-02-2014	0.96	0.5
20-02-2014	0.95	0.49
21-02-2014	0.96	0.51
22-02-2014	0.97	0.49
23-02-2014	0.97	0.54
24-02-2014	0.97	0.52
25-02-2014	0.98	0.52
26-02-2014	*	*
27-02-2014	*	*
28-02-2014	1.05	0.61
01-03-2014	1.05	0.59
02-03-2014	1.05	0.55
03-03-2014	1.03	0.58
04-03-2014	1.08	0.54
05-03-2014	1.05	0.55
06-03-2014	0.95	0.58
07-03-2014	1.04	0.555
08-03-2014	0.89	0.55
09-03-2014	*	*
10-03-2014	*	*
11-03-2014	*	*
12-03-2014	*	*
13-03-2014	*	*
14-03-2014	*	*
15-03-2014	*	*

so as to discover that the proposed channel (Vadayar River) is unfastened from excessive salinity at some point of the summer time, different samples were accumulated and tested and the acquired facts is tabulated in table 2.

TABLE 2 Salinity Level in Vadayar Thodu

Date	Salinity (ppt)
10-01-2014	0.08
15-02-2014	0.17
08-03-2014	0.203

Calculations

5.1 Estimation of Water Required

Thanneermukkam bund's five-year water level data (from gauges installed on the north and south sides; in Cochin and Kuwait) is used to determine how much water needs to be added (table three). During the closure period, the area south of the TMB barrier where the Vembanad Lake is located is enlarged as the lake's water level drops to its lowest possible level. Kuttanad's Cad design from NATPAC was

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used to identify the area.

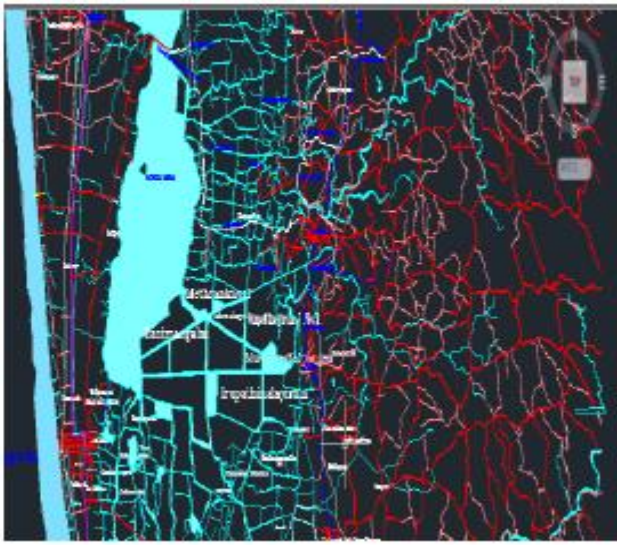

Fig.5 Kuttanad Region

maximum discount in water degree is found to be 38cm. the total area of Vembanad Lake south of TMB become obtained as 103.51x106m2. as a result a total volume of 39.33 x106m3 (103.51x106m2 x .38m) water desires to be augmented.

Table 3. Thanneermukkam Bund and Water level

Date	Maximum Water level in cm	Water Level when bund is closed	Bund Closed Date	Bund Opened date	Minimum water level in corresponding year (cm)	Differen in wate level
19-12-07	64	34	15-12-07	07-04-08	17	17
21-12-08	64	44	23-12-08	31-03-09	12	32
26-12-09	71	48	21-12-09	26-03-10	10	38
30-12-10	68	39	03-01-11	24-04-11	11	28
19-12-11	58	39	21-12-11	26-04-12	15	19
24-12-12	61	41	24-12-12	01-04-13	12	20
07-12-13	61	40	03-01-14			

5.2 Estimation of water regulated

The quantity of water that may be diverted to Kuttanad at some stage in the closure period of Thanneermukkam bund is calculated from the located maximum and minimum water stage and velocity measured. The water that may be augmented throughout each fortnight is calculated one after the other with the aid of taking the average of the water levels. The area similar to the common water stage is taken from the cad drawing and the common of the move section below the new bridge and antique bridge is taken because the common go sectional vicinity of the river. the velocity is likewise The rate vs. water temperature graph was used to determine this. An element of 0.64 was added to account for the velocity variations caused by the horizontal and vertical effects. Because the minimal velocity is zero, the minimum discharge is regarded as 0 for calculating the common discharge. hence, the half-way point of the highest discharge was used to compute the average speed.

Each fortnight, the amount of water moving south is computed using the assumption that at some point during an excessive tidal length, there is a 6-hour flow toward the south, which is seen twice a day. Table 4 shows the final results.

Design of Regulator

Vadayar thodu, approximately 350 metres south of the Ithipuzha River's confluence, is intended to have a regulator installed. To allow for drift to the south at high tide and block flow to the north during low tide, it is recommended that the regulator shutter be operated in this way..

Table 4. Estimated water that can be Regulated

Date	Discharge in Mm^3
15th Dec – 31st Dec 2013	7.342
1st Jan – 15th Jan 2014	6.494
16th Jan – 31st Jan 2014	7.049
1st Feb – 15th Feb 2014	7.197
15th Feb – 28th Feb 2014	3.621
1st Mar - 15th Mar 2014	5.184

The designed regulator had four bays every with a clean way of eight.5m in order that overall clearway become 34m and changed into provided with four piers each of 1.5m width. Cutoff sheet piles of one.5m was provided each on the upstream and the downstream aspect. also an impervious floor of zero.6m thickness and 14m period became provided. The longitudinal cross segment of the designed regulator is proven in Fig. 6

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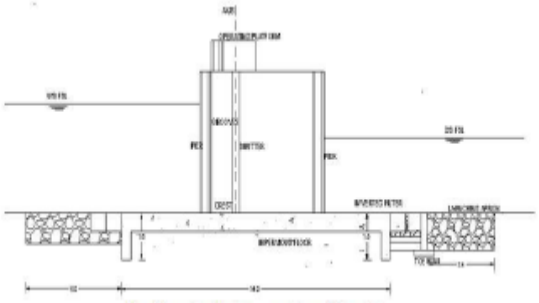

Fig. 6 Longitudinal cross section of Regulator

Result and Discussion

Additional 39.33Mm3 of water will be added to Kuttanad's water supply over the summer. Kuttanad will get 94 percent of its water supply from the proposed Vadayar regulator, and any of the following options may be employed to supplement the remaining 6 percent. In pazhnilam, it's possible to store things. To compensate for any evapotranspiration losses at TMB's southernmost lake, Vembanad Lake, where it is situated, the Thanneermukkam Bund will soon be filled with rainwater. Rani Chitira's subject has not been farmed for many years, and the nearby area is around 5x106 m2. It's possible to offer 10Mm3 of water with 5x106 m2 x 2m water intensity garages in these places. The TMB-closing mechanism now in use might be replaced with an alternate mechanism. (iii) If the salt level in the water exceeds 2ppt, the bund is closed. The Kuttanad Bund may be shut down for the whole month of December to ensure that the greatest amount of water is available to the area's population.. As a consequence, residents on the South Side could rest easy knowing that they had a reliable water supply. So long as the Vadayar River's salt level does not exceed 2ppt, it may be transported from the Thanneermukkam Bund to Kuttanad without risk.

CONCLUSION

Response to the Thanneermukkam Bund's negative impact on Kuttanad is urgent. Over the summer, Kuttanad will get an additional 39.33 million cubic metres of water. The planned Vadayar regulator will provide 94% of Kuttanad's water supply, with the remaining 6% coming from one of the following choices. Things may be stored in pazhnilam. The Thanneermukkam Bund will soon be filled with rainwater to make up for any evapotranspiration losses at TMB's southernmost lake, Vembanad Lake, where it is located. It's been a long time since Rani Chitira's topic has been farmed, and the surrounding region has a total size of 5x106 m2. In these locations, 5x106 m2 x 2 m water intensity garages may provide 10Mm3 water. The current TMB-closing mechanism may be replaced by another one. The bund closes if the water's salinity rises over 2 ppt. Water supplies may be cut off in December to guarantee that as much as possible is supplied to Kuttanad's inhabitants.. Because of this, South Side residents could rest easy knowing that they had a steady supply of water. The Vadayar River was determined to have a salt level below 2ppt during the Thanneermukkam Bund's closure period. safe to convey it to the Kuttanad region by tiny hydrologic machine interventions. Farmers will be able to In order to maintain the salt level in Kuttanad at or below 2ppt, farmers may boost their puncha (summer) crop yields by bringing in more clean water. Even in the summer, lake water may be utilised for domestic purposes owing to a decrease in salt and pollutants due to dilution. Water tourism will be able to return to the area even in the harshest summer conditions, thanks to the additional water. Thanneermukkam Salt water barrier may be kept open year-round to facilitate fish migration and enhance lagoon conditions for fish and other aquatic species.

References

[1]. *"Measures to Mitigate Agraian Distress in Allapuzha and Kuttanad Wet land Ecosystem*", M S Swaminathan Research Foundation, 2002

[2]. Kuttanad Development Project, 1972

[3]. *"Kuttanad Water Balance Study"*, Ministry of Foreign Affairs, Kingdom of Netherlands, 1989

[4]. M.S. Swaminathan Research Foundation Report.

[5]. http://www.kuttanadpackage.in

[6]. *Study for Modernizing the Thanneermukkam bund and thottapally spillway for efficient water management in kuttanad region*; IIT Madras and CWRD Kozhikode.

[7]. IS 6966 Part1:1989 Hydraulic design of barrages and weirs- guidelines.

P-ISSN: 2204-1990; E-ISSN: 1323-6903
DOI: 10.47750/cibg.2020.26.03.009

[8]. IS 11150:1993 Construction of concrete barrages-code of practice.