**പതിനാലാം കേരള നിയമസഭ**
**പതിനഞ്ചാം സമ്മേളനം**

**നക്ഷത്രചിഹ്നമിടാത്ത ചോദ്യം നമ്പർ.1886** **13.06.2019-ൽ മറുപടിയ്ക്ക്**

## വാട്ടർ ടെയിൻ പദ്ധതി

| ചോദ്യം | | മറുപടി | |
|---|---|---|---|
| ശ്രീ. പി.ടി. തോമസ്: | | പിണറായി വിജയൻ (മുഖ്യമന്ത്രി) | |
| (എ) | കേരളത്തിന്റെ പരിസ്ഥിതിക്ക് ഏറ്റവും അനുയോജ്യമായ പദ്ധതി എന്ന നിലയിൽ വാട്ടർ ടെയിൻ പദ്ധതി നടപ്പാക്കുന്നത് സംബന്ധിച്ച് ഏതെങ്കിലും പ്രൊപ്പോസൽ പരിഗണനയിലുണ്ടോ; വിശദാംശം ലഭ്യമാക്കുമോ; | (എ) യും (ബി യും) | ഉണ്ട്. വിശദമായ പ്രോജക്ട് തയ്യാറാക്കുവാൻ നടപടി സ്വീകരിച്ചുവരുന്നു. ഇതുമായി ബന്ധപ്പെട്ട് രണ്ട് യോഗങ്ങൾ കൂടിയിട്ടുണ്ട്. യോഗ മിനിറ്റ്സിന്റെ പകർപ്പ് അനുബന്ധം I ആയി ചേർത്തിട്ടുണ്ട്. |
| (ബി) | ഇതുമായി ബന്ധപ്പെട്ട് കേരള ഡെവലപ്പ്മെന്റ് ആന്റ് ഇന്നൊവേഷൻ സ്ട്രാറ്റജിക് കൗൺസിലിൽ (K-Disc) ഏതെങ്കിലും യോഗം കൂടിയിട്ടുണ്ടോ; എങ്കിൽ അതിന്റെ വിശദാംശവും മിനിറ്റ്സും ലഭ്യമാക്കുമോ; | | |
| (സി) | ഈ മീറ്റിംഗുകളിലെ മിനിറ്റ്സിൽ പറഞ്ഞിരിക്കുന്ന കാര്യങ്ങൾ നടപ്പിലാക്കിയിട്ടുണ്ടോ; ഇല്ലെങ്കിൽ കാരണം വിശദമാക്കുമോ; ഇത് അടിയന്തരമായി നടപ്പിലാക്കാൻ നടപടി സ്വീകരിക്കുമോ ; | (സി) | ഒന്നാമത്തെ യോഗത്തിലെ തീരുമാനങ്ങൾ നടപ്പിലാക്കിയിട്ടുണ്ട്. രണ്ടാമത്തെ യോഗ തീരുമാനങ്ങൾ അനുസരിച്ചുള്ള നടപടികൾ സ്വീകരിച്ചുവരുന്നു. |
| (ഡി) | കൊച്ചിയിൽ ഇടപ്പള്ളി കനാലിൽ ലുലുമാൾ മുതൽ ചെമ്പുമുക്കുവരെ 2.6 കി.മീ ദൈർഘ്യത്തിൽ വാട്ടർ ടെയിൻ പദ്ധതി നടപ്പിലാക്കുന്നതിന് ഏതെങ്കിലും പഠനങ്ങൾ നടത്തിയിട്ടുണ്ടോ; എങ്കിൽ വിശദാംശം നല്കുമോ; | (ഡി) | ഉണ്ട്. ഇതു സംബന്ധിച്ച് നാറ്റ്പാക്കും, കൊച്ചി സർവ്വകലാശാലയും സംയോജിതമായി പഠനം നടത്തി റിപ്പോർട്ട് സമർപ്പിച്ചിട്ടുണ്ട്. റിപ്പോർട്ടിന്റെ പകർപ്പ് അനുബന്ധം II ആയി ചേർത്തിട്ടുണ്ട്. |

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|---|---|---|---|
| (ഇ) | ഇടപ്പള്ളി കനാലിൽ ലുലുമാൾ മുതൽ ചെമ്പുമുക്കുവരെ വാട്ടർ ടെയിൻ പദ്ധതി നടപ്പിലാക്കുന്നതിന് അടിയന്തര നടപടി സ്വീകരിക്കുമോ എന്ന് വിശദമാക്കുമോ; | (ഇ) | ഈ പദ്ധതി നടപ്പിലാക്കുന്നത് സംബന്ധിച്ചുള്ള ടെക്നിക്കൽ ഫീസിബിലിറ്റി പരിശോധിച്ച ശേഷം ഉചിതമായ തീരുമാനം കൈക്കൊള്ളുന്നതാണ്. |
| (എഫ്) | 1985 ൽ കേരളത്തിൽ നിന്നുതന്നെയുള്ള എൻജിനീയർ ആവിഷ്കരിച്ച വാട്ടർ ടെയിൻ പദ്ധതിയുടെ ഊർജ്ജക്ഷമത കൊച്ചിൻ യൂണിവേഴ്സിറ്റി ഓഫ് സയൻസ് ആന്റ് ടെക്നോളജി വിലയിരുത്തിയിരുന്നോ; എങ്കിൽ വിശദാംശം നൽകുമോ? | (എ) | കൊച്ചിൻ യൂണിവേഴ്സിറ്റി ഈ പദ്ധതി സംബന്ധിച്ച് വിലയിരുത്തിയതായി ശ്രദ്ധയിൽപ്പെട്ടിട്ടില്ല. |

സെക്ഷൻ ഓഫീസർ

Annexure-I (അനുബന്ധം-I)

Minutes of the meeting held on 24/09/2018 with regard to the feasibility of the Water Train as an innovation for Water Transport.

List of Participants

1.Dr.K.M.Abraham,Chairman K-DISC

2.Dr.Suresh Das, Ex-Officio Principal Secretary ,Science and Technology Dept

3.Sri.P.Bala Kiran, Director,Tourism

4.Smt. Malathy S, Addl Secretary Transport Dept

5.Sri.N.R.Joy, Chief (Industries), State Planning Board

6.Sri.Biju Bhaskar,Joint Secretary Industries Dept

7.Sri.Arun MV, Mechanical Engineer,State Water Transport Dept, Alapuzha

8.Dr.P.V.Unnikrishnan,Strategic Advisor,K-DISC

9.Sri.Kurian George,Executive Engineer (Rtd) KSEB

10. Sri.Anil Kumar V, Secretary K-DISC.

1. An initial presentation meeting was held on 24/09/2018 at 10.30 am in the Conference Hall of the KIIFB with regard to the feasibility concept of Water Train put in by Sri.Kurian George ,Executive Engineer (Rtd),KSEB.Dr.K.M.Abraham,Chairman K-DISC chaired the meeting.

2. Sri.Kurian George made a presentationon the concept of Water Train,a new technical concept in which vessels move one behind the another like a locomotive in a rail track . These vessels float in water one behind the other.The front vessel has a hydrodynamic shape in its front and also the last vessel has such a shape in the rear end.These vessels are connected with a monorail track which is about 2.5m above water level and is supported on concrete pillars fixed in the bed of the water ways at a regular interval of about 5m.The pillars have cross arms at the top to carry the monorail of slender cross sections.

3. It was explained that three projects have been tried out on the concept-:

1. a mini working model having eight bogies was developed for the Kerala State Science and Technology Museum, Tvpm for establishing the viability of the new idea.
2. One tractor tailer system developed at the Cochin University of Science and Technology .
3. A Water Train running on waves was developed and tested at the Indian Institute of Technology,Kharagpur.

4. He suggested that as a pilot project the 5km stretch from Akkulam Vallakadavu route or from Kochi Fort to Ambalamughal could be selected.He had also produced Certificates of recognition from the Kerala State Science and Technology Museum and from the Indian Institute of Technology,Kharagpur in this regard.

5. The Director Tourism pointed out that the construction in canals will raise serious problems and the National Water ways cannot be touched .He doubted whether the proposal would adversely affect the natural beauty of the canals.The Chairman K-DISC observed that the objections have to be answeredand reactionsto be found out. The energy savings have to be clearly worked out and established. The design elements have also to be fabricated.

6. After detailed deliberations on the feasibility of the proposal it was decided to conduct one more meeting including the following personnel for detailing next steps to be taken in this regard.

1. Dr.Sreedevi from NATPAC

2.Director Water Transport Dept

3.Dr.Sudheer ,Dept of Ship Technology CUSAT

The meeting came to a close at 12 noon.

Dr.K.M.Abraham

Chairman K-DISC

## Minutes of Meeting held on 30.01.19 with regard to the feasibility of the water train as an innovation for water transport

List of participants

1. Dr. K.M.Abraham, Chairman, K-DISC
2. Dr. Sharmila Mary Joseph, Secretary Industries Department
3. Anil Kumar. V, Secretary, K-DISC
4. Dr. B. G. Sreedevi, Chief Scientist, NATPAC
5. Dr. C.V Sudheer, Associate Professor, Department of Ship Technology, CUSAT
6. Joy N.R Chief (Industries) State Planning Board
7. Kurian George, Former Executive Engineer, KSEB
8. Malathy. S, Additional Secretary, Transport
9. Dr. P. V. Unnikrishnan, Strategic Advisor, K-DISC
10. Pravadha P.R., Section Officer, K-DISC
11. Shri. Shaji V Nair, Director, State Water Transport Department
12. Sabitha N.M, Scientist, NATPAC
13. V.S. Satheesan, Planning officer, Tourism Department
14. Wilson K.C, Scientist, NATPAC

At the outset Chairman, K-DISC informed that an earlier meeting was held on 24.09.2018 on the feasibility concept of water train proposed by Shri. Kurian George, Former Executive Engineer, KSEB.

The Chairman recalled that in the previous meeting the Director Tourism had raised a concern on the aesthetics and ecological implications of the structures.The present meeting is to further explore the feasibility of the project by taking expert opinion from the NATPAC, Water Transport Department and the Department of Ship Technology, CUSAT.

Chairman opined that theoretically the concept proposed is acceptable, but the overall feasibility considering the total infra-structure to be put in place return of investment needs to be examined. Chairman proposed that a detailed feasibility report covering the aspects of technical feasibility and commercial viability shall be prepared. A pilot stretch for implementation has to be also identified. The location should have intersections with mass rapid transport systems to look to feasibility of signaling systems.

Taking part in the discussion, Dr. Sreedevi pointed out that KIIFB funded canals in Cochin can be utilized for pilot study Dr. Unnikrishnan indicated that designing of the water train shall look in aerodynamic aspects of the moving engine for optimization of aspects of air friction, water resistance, etc Shri. Kurian George suggested that Prof Nicholas has agreed to extend technical support, Dr. Abraham may connect with him for his guidance and support.

Dr. C.V. Sudheer responded to the query raised by Dr. K.M. Abraham whether he could prepare Draft Project Report (DPR) with his civil engineering experts Dr. Sreedevi

pointed out that Kochi Metro Rail Limited (KMRL) is in charge of implementation of water metro. It would be appropriate to incorporate KMRL in the study.

After detailed discussion the following decisions were taken:

1. A 3 KM stretch should be identified by NATPAC in consultation with CUSAT for pilot implementation.
2. The technological feasibility regarding the construction of the moving parts shall be undertaken by CUSAT after undertaking necessary modeling and simulation studies. Computational Fluid Dynamics (CFD) study shall be also undertaken by CUSAT.
3. Shri. Kurian George was asked to prepare a write up so that K-DISC could approach Prof. Nicholas for guidance and advice
4. An inter disciplinary team may be constituted within CUSAT including experts in Mechanical Engineering, Electrical Engineering, Civil Engineering or any other specific area found necessary.
5. Expenses if any with regard to the implementation of the pilot study will be met by K-DISC
6. KMRL may be asked to prepare DPR in consultation with CUSAT and NATPAC.
7. NATPAC may involve in overall co-ordination and technical support.

The meeting concluded at 11.30pm.

K.M. Abraham,
Chairman.

# Implementation of Water Train – Possible Route for Pilot Project

## 1.0 INTRODUCTION

Water Train is a new technical concept in which vessels are moving one behind the other like a locomotive in a rail track. The main advantage of this new concept is its high energy efficiency comparing to all other modes of transportation.

Sri Kurian George, Executive Engineer (Rtd), KSEB, the inventor of the water train had put the concept of water train before the K-DISC and a meeting was held on 24-09-2018 on the question of the feasibility of the project. Further to this a meeting was also conducted on 30-01-2019, in which K-DISC suggested NATPAC to identify a trial stretch of waterway for the implementation of the project in consultation with CUSAT.

The Edappally canal is one of the existing canals in the Kochi included in the proposed development of waterways which was emerged by KSINC and to be implemented by KMRL. Since Edappally canal is located near to major malls in the Kochi and the metro is passing over the canal, the same is selected as a probable location for the implementation of the project.

In order to identify a suitable stretch for the implementation of the project, a combined field visit was conducted by the NATPAC team and CUSAT team along with the inventor Sri Kurian George. Dr.B G Sreedevi, Chief Scientist, SmtSabitha N M, Scientist and Sri Wilson K C, Scientist were the members from NATPAC team and Dr. C B Sudheer, Associate Professor and Dr Manoj T Issac, Assistant professor represented the CUSAT team. The site visit was conducted on 27-3-2019 and a stretch of Edappally canal from Edappally Bridge (Chainage 2.5 km) to Ayyanad Bridge (Chainage 5.1 km) was found to be suitable for the implementation of the project. This section of canal has 2.6 km length and it connects two busy commercial areas in Kochi. The details of the selected stretch is given in the following section.

## 2.0 PRESENT CONDITION OF EDAPPALLY CANAL

Edapally canal starts from Muttar bridge (10° 02' 36.78"N and 76° 18' 12.40"E) and connects with Champakkara Canal (part of NW-3) near Eroor bridge (09° 58' 46.47"N and 76° 19' 56.29"E) as its end point. It passes through Edapally, Vennala, Chakkaraparambu and Chalikkavattom. This canal provides a link between Edappally and the waterway route between Vyttila and Kakkanad (City Water Bus).

Total length of the canal is 11.231 km. Canal width varies from 9m to 100 m and depth ranges between 0.8m to 1.30m. It is perennial water body and presently, there is no visible water flow in most of the portions of the canal. Canal is highly silted and polluted by domestic waste, commercial waste, construction waste, weeds growth and other sources. The canal is divided in to eight stretches according to width, depth, population density and accessibility. The **Figure 2**shows the study area and its divisions.

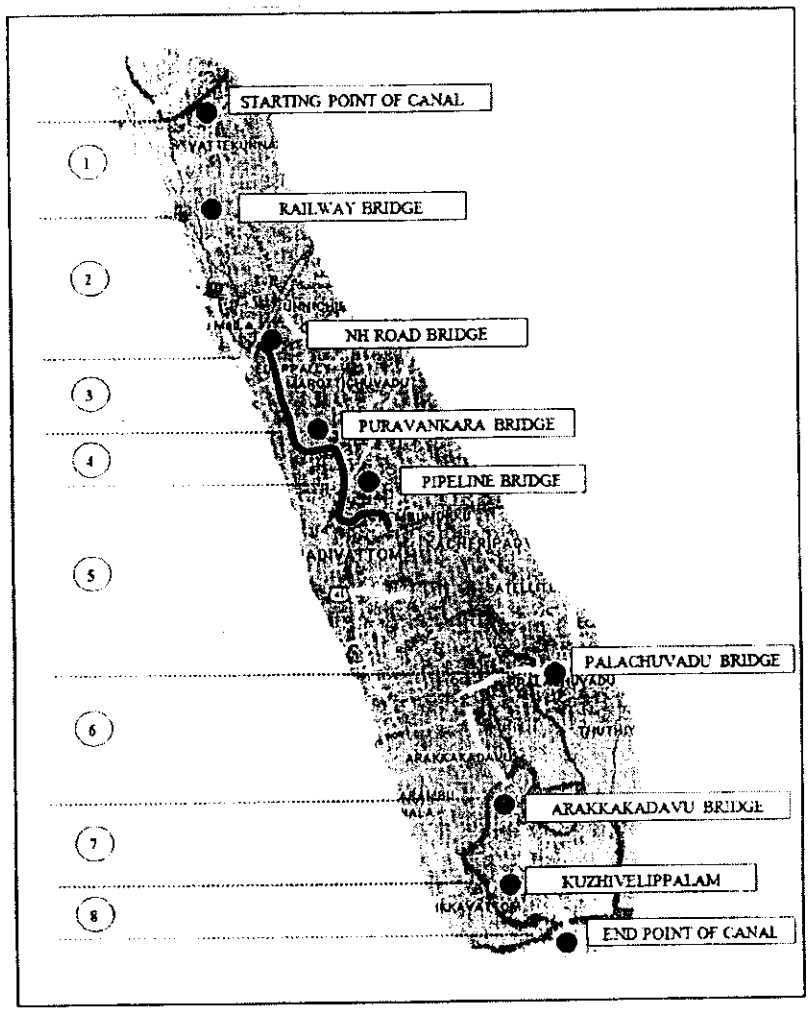



**Figure 2. Study area map of Edappally Canal**

There are 25 cross structures across the canal which includes 16 road bridges, 2 rail bridges and four pipeline bridges, Metro line, a flyover and a skywalk.

**Details of the Proposedstretch**

The Edappallybridge along the NH, near Lulu Mall has less vertical clearance of about 2.7 m only and the water flow is also blocked here. Hence the starting point of the canal for operating the water train is considered after the National highway.The details of cross structures are given in **Table 1.** The section wise details of canal are given below.

**2.1 NH Road Bridge toPuravankara Bridge (Ch 2/5000 – Ch 3/6000)**

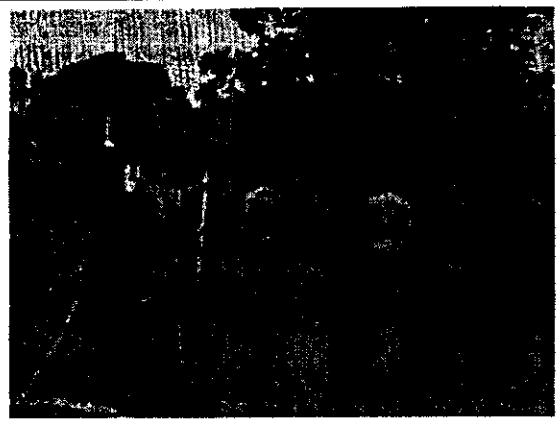
The total length of this canal section is 1.1 km. The width of the canal varies between 8m and 18 m. The depth of the canal varies from 0.2m to 0.4m. Due to the metro construction related activities the canal flow is restricted and this has caused increased siltation of the canal. There arefive cross structures in the stretch which are Marattichodu bridge, pipeline bridge, Oriental timber bridge, Puravankara iron bridge and Puravankara Private bridge.

The commercial activities are predominant at the starting point of the section. UptoMarottichodu bridge the canal is narrow and thereafter the width increases towards the end of the section. The apartments mainly Trinity and Palladium are constructed between ch: 2/600 andch: 2/800. Residential buildings on the left bank are very minimal. Atch: 2/690, a small channel of 9 m width joins to the left bank of the canal. Oriental Timber godownis atch: 3/180, on the left bank of the canal. The land between ch: 2/830andch: 3/050, is predominantly marshy. Two drainage channels having width of 1.5 m joins the canal on left bank atch: 2/550 and ch: 3/510 respectively. Random rubble masonry type bank protection is available between ch: 2/600 ang ch: 3/200 on left bank.On the right bank, the bank protection starts at ch: 2/840 and ends at Oriental timber Bridge (ch: 3/200).

**Table 1. Details of Cross Structures – Edappally Canal**

| Sl.No | Chainage (km) | Name of bridge | Type of bridge | Coordinates | | No. of Span | Length (m) | Width (m) | Clearance (m) | | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | LAT | LONG | | | | H | V | |
| 1 | 2/870 | Marattichodu bridge | RCC Road Bridge | 10°1'23.3" | 76°18'37.8" | 3 | 36.3 | 7 | 18.7 | 2 | Edappally to Thrikkakararoad,waterpolluted,growth of vegetation |
| 2 | 2/870 | Pipeline bridge | Pipeline bridge | 10°1'23.3" | 76°18'37.8" | 3 | 36.3 | | 18.7 | 3.5 | (1m dia)pipeline |
| 3 | 3/220 | Oriental timber bridge | RCC Road Bridge | 10°1'12.1" | 76°18'40.5" | 1 | 12.7 | 3.9 | 8.4 | 3.5 | bridge to timber godown, water polluted,growth of vegetation |
| 4 | 3/570 | Puravankara Iron bridge | Steel road bridge | 10°1'1.4" | 76°18'43.7" | 1 | 25.2 | 5.85 | 15 | 2.5 | Puravankara Projects |
| 5 | 3/580 | Puravankarapvt bridge | RCC Road Bridge | 10°1'1.5" | 76°18'44.3" | 1 | 25.2 | 16.85 | 15 | 4.5 | |
| 6 | 4/180 | Pipeline bridge-1 | Pipeline bridge | 10°0'52.9" | 76°18'57.4" | 3 | 27.1 | | 5.5 | 2.2 | (1m dia)pipeline |
| 7 | 4/180 | Pipeline road bridge | RCC Road Bridge | 10°0'52.9" | 76°18'57.4" | 1 | 27.1 | 4.86 | 13.7 | 2 | To Cherumuttapuzhakara,old pipeline crossing,waterweeds.highly polluted water |
| 8 | 4/180 | Pipeline bridge-2 | Pipeline bridge | 10°0'52.9" | 76°18'57.4" | 3 | 27.1 | | 5.5 | 3.2 | (1m dia) pipeline |

Puravankarapvt bridge (ch 3/580)

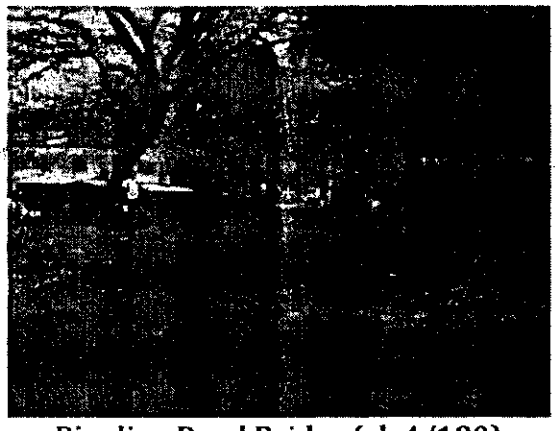


Oriental Timber Bridge (ch 3/220)

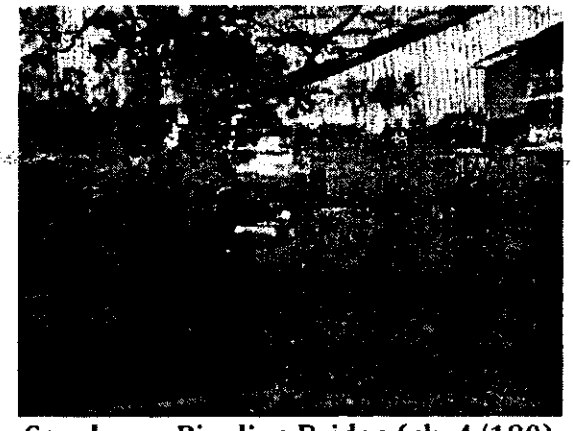
The metro construction activities at the starting point of the canal is spread over 30 sq.m (approx.) in the right bank. The commercial activities are extended uptoch: 3/200 on the right side, up to Puravankara Bridge. An 8 m wide channel is joining on right bank atch: 3/450. The Bank protection of RRM is available from ch :2/840 to at timbergo down bridge (ch: 3/200) on the right bank.

**2.2Puravankara Bridge to Pipeline Bridge (Ch 3/6000 – Ch 4/2000)**

The length of this section of canal is 0.60 km. The width of the canal varies between 11m and 24 m. The wider portion of the canal starts from this section. The average depth of the canal varies from 0.4m to 1.5 m.



Pipeline Road Bridge (ch 4/180)



Canal near Pipeline Bridge (ch: 4/180)

The left bank of the canal up to ch: 3/900 is predominantly vacant marshy land. Maruthi Service Centre with 4 buildings is functioning on left bank between ch:4/000 and 4/100. The bank is protected between ch: 3/900 and ch: 4/150 stretch of the canal with random rubble masonry.

After Puravankara bridge there are a cluster of houses uptoch: 3/800 on the right bank. The vacant land starts fromch: 3/900 and extends upto the end of this section. Two pipelines of diameter 1m and 1.5m are passing across the canal near the pipeline bridge.

**2.3 Pipeline Bridge toAyyanad Bridge(Ch 4/2000 – Ch 5/1000)**

The total length of this section of the canal is 0.9 km having an average width of 21 m. The depth of the canal varies from 0.8m to 1.5m. There is potential for navigation without any further land acquisition.Assisi Vidhyaniketan Public School and Snehanilayam Special School are the notable landmarks in this section. At Ayyanad,there are 2 bridges atch: 5/700 which connects to Thrikkakara town.

The canal bank is protected between Pipeline Bridge and Ayyanad bridge by random rubble masonry having slope of 1:1.5. On right side there are four Penta Queen Apartments having G+7 floors are at ch: 4/600 km to 4/720 km which are closer to the bank. Between ch: 4/720 and ch: 4/950 the land use is predominantly residential. Atch: 5/000,Geojit building with G+11 floors is available closer to the bank. Atch: 4/580, a channel having 3.5m width joins the canal. The right bank is well protected from ch: 4/200 to ch: 5/100.

## 3.0 OBSERVATIONS

### i. Water availability

From the site visit and reconnaissance survey conducted by the team and gathering information regarding the high flood level at various points from the public, it is understood that during the recent floods, the water level at the starting point of the study stretch has risen upto the basement floor level of the nearby apartments.But, at Puravankara bridge location only about 2.0 m rise in water level occurred during the floods. Hence the reason for flooding at the starting section is only due to chocking of the canal throughout by solid waste dumping, siltation and weed growth. Hence, if the canal is protected properly the flow can be maintained and availability of water can be ensured.

### ii. Water level variation

Sri. Kurian George has confirmed that 1 m variation in water level will not affect the working of the Water Train and will not cause any operational problem.

### iii. Traffic Potential

The stretch considered provides connectivity to major malls of Kochi and also to the metro station at Edappally. The canal passes through residential areas with many majorhigh-rise buildings and apartments. The road traffic in this section is at present beyond the capacity. Hence there will be assured traffic in the Water Train with the local commuters opting for this mode to cater their needs to travel to the malls and metro station considering its easy accessibility and time savings.

## 4.0 CONCLUSION

The proposed water train is an indigenous technology avoiding borrowed or donated knowhow. It is expected that implementing the Water Trainas a pilot projectin this section would be helpful to decongest the road section between Edappally andChembumukku and also will provide a more convenient accessibility and travel mode to the local residents of the area. Since the proposed route is present in the near vicinity of malls, recreational activities also can be expected.

However, to have effective utilisation of the system, it is necessary to maintain,throughout the entire proposed stretch,adequate water depth of a min of 1.5 m and a vertical clearance of 2.5 m to 3 m from the water level to the crossover bridges. And also, a width of minimum 8 m needs to be maintained.