Extract of TAC Proceedings dated 7.11.2020

Filling of 30 Tanks in Hosakote Taluk in Bangalore rural district from K.R. Puram STP. Estimated Cost Rs.100.00 Crores

- The above estimate is cleared for Rs.100.00 Crores in the sixth TAC meeting held on 8.1.2019 with certain observations. The estimate is sanctioned for Rs.100 Crores vide CER No.978 dated 8.3.2019.
- As per the approved estimate to fill up 30 tanks of Hosakote taluk from K.R.Puram.
- Entrusted to Sri Srinivasa Constructions (I) Private Limited on tender basis for Rs.125.00 Crores. The work is yet to be commenced. It is reported that for the present, only 20MLD STP at KR puram is in operation and another 20MLD STP is under construction which may take another 2 to 3 years for completion. Hence for the present only 20MLD available quantity can be used for filling of 30 tanks in Hoskote taluk, The balance 20MLD of STP water from KR puram STP which is under construction may take some tore time thus unnecessary delay in implementation of the Hosakote project.
- Further as per the meeting held on 19.12.2019 under the Chairmanship of Hon'ble Chief Minister, in this meeting the Committee has advised to prepare the project to fill tanks in Bengaluru East Taluk from 15 MLD Medahalli STP. Accordingly the estimate amount to Rs.80.00 Lakhs was prepared and placed in the Technical Appraisal Committee Meeting dated 4.5.2020 is reported to be submitted to Government for approval.
- The committee expressed that instead of filling water to tanks of Bengaluru East Taluk from Medahalli STP it is advisable to propose 15 MLD of water from K.R.Puram STP which is under construction to fill the tanks of Bengaluru East Taluk which avoids rising main to cross NH twice.
- In the meeting it is observed that Rising main of the above cited two projects runs parallel to each other and in opposite direction crossing NH4 at Medahalli underpass which is not advisable. In order to avoid crossing NH4, it is felt correct that Remaining 25 MLD of secondary treated water at KR puram STP and short fall of 15MLD secondary treated water can be drawn from Medahalli STP. Further, as the proposed raising main is passing near kadugodi STP. It is advisable to propose separate Jack well and pump house near this STP and use this additionally available secondary treated water to fill tanks of Hoskote taluk through the same raising main. As of now, only 3MLD of Secondary treated water is available at kadugodi STP, it is not feasible to propose a separate project for utilizing this water . Hence total 25 (KR Puram STP)+15 (Medahalli STP)+3(Kadugodi STP)= 43 MLD of secondary treated water is proposed to fill the tanks in Hoskote taluk.

- Five tanks of Bengaluru East Taluk which were earlier proposed is now dropped from this project. In turn it is proposed to include additional 8 tanks of Hosakote Taluk viz., Koralur Tank, Appajipura Tank, Jinnagara Tank, Devashettyhalli tank, Tarbahanahalli Tank, Gangaluru Tank, kattigenahalli Tank-2 Byalhalli Tank-2.
- The capacity of 30 tanks in Hosakote Taluk is 258.09 Mcft including 8 ZP additional tanks of capacity 29.362 Mcft in Hosakote Taluk. Koralur Tank, Appajipura Tank, Jinnagara Tank, Devashettyhalli tank, Tarbahanahalli Tank, Gangaluru Tank, kattigenahalli Tank-2 Byalhalli Tank-2. The above tanks are falling in the alignment of proposed rising main of Hosakote project. Thereby, ensuring immediate implementation of the Hoskote project along with filling water to 8 additional tanks of Hoskote taluk, which are available en route the proposed raising main of the Hoskote project. The total capacity of 38 tanks is 287.452 Mcft.
- The addition of 8 tanks are proposed to be covered as follows:- Jinnagara, Devashettyhalli tank are proposed to be filled extending raising main through bleeder from main raising main. Similarly Tarabanahalli tank is also filled by extension of raising main through a bleeder. Appajipura, Koralur tank, Byalahalli Tank-2, Kattigenahalli Tank-2, Gangaluru Tank are proposed to be filled through bleeders.

<u>In view of the above changes, certain additional works are required which are as follows</u>:

1. One additional Jack well and Pump house with IR at Medahalli STP and one more Jack well and Pump house at Kadugodi is added in this project. Additional Head works at Yellemallappashetty tank (IR)and Kadugodi STP are included in the project.
2. Addition of Extra Pump house at Medahalli STP and Pump house at Kadugodi STP, it is proposed to add additional pumping machinery at the above two locations.
3. Extra Jack well and Pump house at Medahalli STP and at Kadugodi STP. Additional provision for express feeder channel (UG cable) is made in the modified proposal.
4. Addition of Extra Jack well and Pump house at Medahalli STP and at Kadugodi STP, additional provision for operation and maintenance has been made in the modified proposal.
5. The provision for increase in raising main in modified proposal due to addition of 8 tanks of Hosakote Taluk.

Due to above additional modified proposal cost modified proposal works out to Rs.149.85 Crores.

Sanctioned estimate Cost	Rs.100.00 Crores
Tender premium & GST	Rs.124.50 Crores
Cost of additional works	Rs.25.35 Crores
Total	Rs. 149.85 Crores

<u>The subject is cleared subject to the following observations and notings</u>:-

- ❖ The conditions stipulated in the earlier proceedings dated 08.01.2019 would remain same and to be followed.
- ❖ The designs and drawings are to be got up after detailed surveys.
- ❖ The estimate for the changed additional works is to be got up based on the SR of M.I.& GWD Circle, Bengaluru and WRD and PWD SR for 2018-19
- ❖ The data rates are to be got approved by the S.E.
- ❖ The Rising Main allied works designs are to be got up as follows:-
- ❖ The DPR is to be got up after detailed surveys, drawings and designs and placed before the TAC for deliberations and clearance.
- ❖ While designing the several components viz., intake arrangements, jackwell cum pump house, Rising main and gravity main. The following are to be kept in mind:

The following components are required and the same are to be designed for completion of the project.

(a) Design of Pumping Machinery & Pump House
(b) Design of Electrical Substation & Transmission Line
(c) Design of Rising Main
(d) Design of Break Pressure Tank
(e) Design of Gravity Main
(f) Design of Thrust Blocks
(g) Design of Valves & Valve Chambers
(h) Design of Crossings
(i) Design of Outlet Chambers

(a) <u>Design of Pumping Machinery & Pump House:</u>

Vertical Turbine Pumps for lifting are to be considered with 2 or 3 working plus one standby depending upon the discharge requirements.

To arrive at total head, static head is to be calculated as the difference between the delivery level at break pressure tank and LWL in the sump + pump losses.

Pump House Losses:

Head losses occur at the entrance to the strainer/bell mouth in the pump house. There will also be losses at entrance and exit from the manifold. There are formulae to calculate these losses, but they are valid only when there is sufficient straight length of pipe upstream and downstream of the components. In a pump house, there is no such sufficient straight length, different components occur a short distance apart and losses will always be higher than those given by the formulae. A good practice is to take the pump house losses equal to 6V2/2g, where V is the velocity in the discharge pipe. Exit loss is also included in the above formulae.

Friction Losses in the Rising Main:

Hazen-William's formula is extensively used to calculate friction loss in Water Supply and Irrigation Pipelines:

hf = (10.65/(D4.87)) x (Q/C)1.852 x L

Where hf is head losses due to friction in m, L is length of the pipe line in m, Q is discharge in cum/sec, C is Hazen Willam's coefficient and D is pipe diameter in m. The value of C depends on the pipe material. Field measurements indicate that C for cross country pipelines in India

Other Losses in the Rising Main:

In addition to friction losses, minor losses occur in the rising main due to joints, bends and other fittings, air pockets etc. As per general one bend accounts for loss of 0.5V2/2g and losses due to air pockets cannot be quantified. So minor losses are taken as 3V2/2g, where V is velocity of rising main in m/sec.

The total pump head is calculated as follows.

1. Static Head = Delivery Level at BPT – Low Water Level in the Sump

2. Pump House Losses = 6V2/2g
   Where V = Velocity in Delivery Pipe in m/sec
   g = Acceleration due to Gravity in sqm/sec
3. Friction Losses in Rising Main (hf) = (10.65/(D4.87)) x (Q/C)1.852 x L

   Where hf = Friction Losses in m
   L = Length of Rising Main in m
   Q = Discharge in Rising Main in
   cum/sec C = Hazen Willam's

Constant

D = Inner Diameter of Rising Main in m

4. Other Losses in Rising Main = 3V2/2g or 10% of hf, whichever is higher

Where V = Velocity in Rising Main in m/sec

g = Acceleration due to Gravity in sqm/sec

If other losses are less than 10% of the losses due to friction then higher of these two will be taken.

Total Head = Static Head + Pump House Losses + Friction Losses in Rising Main + Other Losses in Rising Main

H = 1 + 2 + 3 + 4

Design of Motor Rating:

The motor rating is calculated as follows.

Power Input to Pump = Motor Output

= (Q x H) / (367.2 x nP)

Where Q = Discharge per Pump in cum/hr H = Total Pump Head in m

np= Efficiency of Pump at Duty Point in %

Considering 15% cushion in the motoroutput, hence the recommended motor rating will be arrived.

Design of Delivery Pipes:

The number of delivery pipes depends on the number of pumps and the discharge in each delivery pipe should be discharge per pump. As per CPHEEO Manual 11.3.2 (b), the delivery pipe should be of such size that the velocity shall be about 2.50 m/sec.

The diameter of delivery pipe is to be calculated as follows.

Discharge in Each Delivery Pipe (Q) = A x V Where

Area of the Delivery Pipe in sqm

V = Velocity in Delivery Pipe in m

On each delivery pipe one number of Butterfly Valve, Dual Plate Check Valve/ Non Return Valve and Kinetic Air Valve should be provided. The size of the valve should match the size of the delivery pipe.

Design of Manifold:

The number of the manifolds depends on the number of rising mains and number of pumps. A good practice is to take the velocity in the manifold is less than are equal to 1.00 m/sec. Based on the recommended velocity calculate the diameter of manifold. The length of the manifold depends on the spacing of pumps and bell mouth diameter.

Design of Pump House Sizing Calculations:

The main objective of pump house design is as follows.

- To prevent vortex formation.
- To obtain uniform distribution of the inflow to all the operating pumps and to prevent starvation of any pump.
- To maintain sufficient depth of water to avoid air entry during draw down.

The main criteria for arriving the pump house size is based on the "Bell Mouth Diameter". As per IS 15310: 2003 clause 4.2.1.3, velocity at entry of bell mouth shall not exceed 1.30 m/sec. As per CPHEEO MANUAL clause 11.3.1 (c), velocity at the bell mouth shall be about 1.50 m/sec. As per HIS Manual clause 9.8.6 (a) for flows less than 315 l/s, the inlet bell velocity shall be 0.60 to 2.70 m/sec. Considering the above three criteria's, the velocity in bell mouth is designed less than 1.30 m/sec.

The bottom clearance between bell mouth and sump floor, minimum submergence, sump bottom level, pump floor level, pump bay width, back wall clearance from center line of bell mouth, side wall clearance, velocity in the sump, position of trash rack dimension and travelling screen are calculated based on the arrived bell mouth diameter. All the above components are calculated with reference to the IS 15310: 2003 clause 4.1 & 4.2, CPHEEO Manual clause 11.2 and HIS Manual
clause 9.8.1 & 9.8.2.

Rectangular RCC framed structure is to be proposed for accommodating vertical turbine pumps. The pump house is also to accommodate the LT board panels, starters, EOT crane etc. Trash Racks and Stop Log Gates are provided for each compartment of the pump house. Behind the trash racks, grooves for inserting stop log gates with embedded parts are provided. Grade of concrete for all the structural components shall be M-25.

(b) Design of Electrical Substation & Transmission Line:

The selection of transformer based on largest motor starting and voltage regulation during starting and running condition. The primary and secondary voltages are 11 kV and 0.433 kV respectively. The impendence of the transformer is considered as per IS 1180: 2014. The transformer rating is calculated 80% of the maximum demand load.

LT power cables shall be of 1100 V grade, aluminium/copper conductor, extruded XLPE insulated. Control cables shall be of 1100 V grade, copper conductor, extruded PVC insulated. Derating factor for single core & multi core cables is to be laid in Duct. The de-ration effect due to temperature correction and grouping has been considered on the full load current by the factors imposed by these conditions. These increased current values are compared with the rated current carrying capacity of the cable. Hence rated current carrying capacity of the cable shall be greater than the load current after taking into account.

$$\text{Required Cable Current Rating} = \frac{\text{Full Load Current}}{\text{Ambient Deration x Grouping Deration}}$$

All Circuit Breakers will be MCCB up to & 1000 Amps and ACB's above 1000 Amps. AC (SQIM) motors of ratings up to 200 kW shall be connected to 415 V system protection selections as per type 2 coordination. The load factor for continuous drives shall be considered as 0.90 and the demand factor shall be considered as one.

The power factor compensation equipment has been envisaged at 0.433kV bus for improvement of the overall power factor of the system. The capacitor and control panel conform to the latest applicable standards IS: 13585. The capacitor bank may comprise of suitable number of single phase units in series parallel combination. However, the number of parallel units in each of the series racks shall be such that failure of one unit shall not create an overvoltage on the units in parallel with it, which will result in the failure of the parallel units. The complete capacitor banks with its accessories shall be metal enclosed (in sheet steel cubicle), indoor floor mounting and free standing type. Capacitors shall be of Mixed Dielectric of polypropylene and paper with internal element fuses. The impregnate shall be non PCB (poly chlorinated biphenyl) oil.

(c) <u>Design of Rising Main</u>:

Design of M.S. Rising Main is based on the following considerations.

i) Velocity of flow shall be as far as possible, limited to 1.70 m/sec.
Note: On detailed study of the scheme it is found that major cost involved is pipe line. Small increase in allowable velocity will reduce the cost substantially with marginal increase in pump head. On study of economic analysis it is found that providing 1.70 m/sec velocity as

recommended by MI department (which is generally considered for lift schemes) is suitable for the present scheme. Hence it is proposed to consider velocity of 1.70 m/sec for design of rising main pipe.

ii) The diameter of rising main is designed to carry the required discharge considering the above velocity.

Discharge in Rising Main (Q) = Area (A) x Velocity (V)

Where A = Area of the Rising Main in sqm

V = Velocity of Flow in Rising Main in m

iii) Hazen Willam's formula is used to calculate the friction losses in the rising main as specified in the CPHEEO Manual.

Friction Losses in Rising Main (hf) = (10.65/(D4.87)) x (Q/C)1.852 x L Where hf = Friction Losses in m

L = Length of Rising Main in m

Q = Discharge in Rising Main in cum/sec

C = Hazen Willam's Constant

D = Inner Diameter of Rising Main in m

iv) Wall Thickness is to be calculated based on the following considerations.

- The thickness shall not be less than as specified in IS 1916: 1989.
- D/t ratio not exceeding 150.
- Check for minimum wall thickness as specified in AWWA M-11 Manual 2005.
- Wall thickness shall be without any negative tolerance as specified in IS 3589: 2001.
- To Check for partial vacuum as specified in IS 5822: 1970 and IWWA Manual 2004.
- To Check for hoop stress if working and hydraulic test pressures are used as specified in IS 5822: 1994.
- To Check for water hammer pressure as specified in IS 5822: 1994.
- To Check for deflection as specified in AWWA M-11 Manual 2005.
- To Check for buckling as specified in AWWA M-11 Manual 2005.
- To Check for collapse pressure as specified in AWWA M-11 Manual 2005.

v) Economic analysis of rising main is calculated with different diameter of pipes.

vi) The rising main is laid below the ground level considering 1.20 m overburden depth.

vii) Hydraulic Gradient Line (HGL) is calculated and shown in the drawings.

viii) The internal coating is considered in accordance with clause 12.30 of IS 5822: 1994 and annexure 'B' of IS 3589: 2001.

ix) The external guniting is considered in accordance with IS 3589: 2001

(d) <u>Design of Break Pressure Tank</u>:

Circular RCC Break Pressure Tank is planned at end of the rising main. The break pressure tank is to be designed for retention (detention) period of 90 seconds. From break pressure tank water is planned by gravity to all 24 tanks. The size of the break pressure tank is calculated based on the following formula.

Volume Required (V) = Discharge (Q) x Retention Time (T)

Assume depth of tank based on the total volume required and calculate the size of the tank.

(e) <u>Design of Gravity Main</u>:

Design of Gravity Main is based on the following considerations.

i) The maximum and minimum velocities considered for gravity main design are 1.50 m/sec and 0.30 m/sec respectively.

ii) The diameter of gravity main is designed to carry the required discharge considering the above velocity range.

Discharge in Gravity Main (Q) = Area (A) x Velocity (V)
Where A = Area of the Gravity Main in sqm
V = Velocity of Flow in Gravity Main in m

iii) Hazen Willam's formula is used to calculate the friction losses in the gravity main as specified in the CPHEEO Manual.

Friction Losses in Gravity Main (hf) = $(10.65/(D^{4.87}))$ x $(Q/C)^{1.852}$ x L Where hf = Friction Losses in m
L = Length of Rising Main in m
Q = Discharge in Rising Main in cum/sec
C = Hazen Willam's Constant
D = Inner Diameter of Rising Main in m

iv) MS/ HDPE pipes are to be used for gravity distribution network taking the topography of the site into account.

v) MS pipes are to be used for the diameter greater than or equal to 350 mm and HDPE pipes are used for the diameter below 350 mm.

vi) Thickness of MS pipes are to be calculated as per IS codes, IWWA and AWWA manuals as explained in design of rising main.

vii) Pressure rating of HDPE pipes are to be calculated as per IS 4984: 1995.

viii) The gravity main is to be laid below the ground level considering 1.20 m overburden depth.

ix) Hydraulic Gradient Line (HGL) is to be calculated based on the drawings.

(f) Design of Thrust Blocks:

Thrust blocks are to be provided in pipeline where it bends more than 15 degree deflection angle in order to resist the tendency of pipe where unbalanced pressure occurs. The unbalanced thrust may be counteracted by longitudinal tension or bearing against the foundation material. The size of the thrust block is calculated using soil mechanics theory. In addition to frictional resistance on the bottom of the thrust block and the circumference of the pipeline, there is a lateral resistance against the outer face of the pipe and block. The maximum resisting pressure a soil mass will offer is termed as passive resistance.

This maximum possible resistance will only be developed if the thrust block is able to move into the soil mass slightly. The corresponding maximum soil pressure is termed as passive pressure. The minimum pressure which may occur on the thrust block is the active pressure, which may develop if the thrust block were free to yield away from the soil mass. The active pressure is considerably less than the passive pressure and will only be developed if the force on which it is acting is free to move away from the soil exerting the pressure.

A thrust block should be designed so that the line of action of the resultant of the resisting forces coincides with the line of thrust of the pipe. This will prevent overturning or unbalanced stresses.

Based on the above theory first calculate the horizontal thrust and then calculate the lateral resistance counteract the horizontal thrust, lateral resistance of soil against the block and lateral resistance of soil when the thrust block is free to yield away from the soil mass i.e., the portion of projected pipes.

Factor of Safety = Lateral Resistance/ Horizontal Thrust

The factor of safety shall be more than 1.50. The minimum surface reinforcement in all thrust blocks shall be 5 Kgs/sqm. The spacing of these bars is not to exceed 500 mm.

(g) Design of Valves & Valve Chambers:

Design of valves and valve chambers are to be done as per norms.

Design of Sluice Valves:

Design of sluice valves are to be done as per norms.

Air Valves:

Air valves at every 500m and exclusively at peaks to be provided.

Scour Valves:

Scour valves are provided at low points above line valves situated in the line on a slope such that each section of the line between valves can be emptied and drained completely.

Design of Crossings:

Crossings to be designed as per norms

Details of Outlet Chambers:

- Circular outlet chambers are planned at end of the branch line. RCC NP-3 class Hume pipes are usedf to design the outlet chambers. The outlet chamber is designed for retention 9detention) period of 90 seconds. From outlet chamber water is conveyed by gravity through natural nala to tanks. The size of the outlet chamber isclaculated based on the following formula.
- Volume Required (V)=Discharge (Q)xRetention Time (T)
- Assume depth of chamber based on the total volume required and calculate the size of the chamber.
- The estimate, designs, drawings are to be scrutinised in the E.I.S.'s office and got approved by the EIC.
- The thickness of M.S.pipe shall be as per IS 3589:2001, IS 5822-1970 and as per manual on design and selection of pipes for water supply as per the practical requirement, the minimum thickness recommended from handling and fabrication consideration by IS 3589-1991. In addition to the above as per the BWSSB circular 1.5 mm is to be added for corrosion. Further as per the guidelines issued by the World Corrosion Organisation NACE International corrosion allowance is to be made for fresh water is 0.8 mm.

  - The financial implication is to be got up and to obtain the approval of the competent authority.
  - After the completion of the work, revised estimate to be got approved from the Government.

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