Design of Water Distribution System for Thirumitta code Grama Panchayat

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Abstract. The aim of this project is to supply the water to client with acceptable grade and amount. Jal Jeevan Mission (JJM) has been launched that aims at providing practical functional household tap connection (FHTC) to each village unit by 2025 in Republic of India. This project aims on designing a water distribution system for the Thirumittacode gramam panchayath situated in Pattambi Municipality, Palakkad district, Kerala. This project revolves around population prediction of the general practitioner by 2024 and 2054, water demand calculations, planning the water distribution system with associate degree acceptable water resource and value estimation. Use of loop4 software system adds on to the advancement of this project.

Keywords: Water distribution, Distribution system, deliver water, water source estimation, associate degree acceptable, designing water, revolves population, project.

1. Introduction

Water is the foremost necessary needs of life. With a Guaranteed handiness of moveable water is essential for human advancement. With the increasing population and increasing usage of water, there's a rise in carving for water in varied fields such as farming, industry, infrastructure development, agricultural activities etc. The aim of this project is to deliver water to client with acceptable standard, amount and enough force. A distribution system is one during which the water is transported from the centralized treatment plant or well provides to the service association or consumers’ faucets. These systems aim to preserve the standard and amount of water, also as maintain ample pressures within the distribution of water. Basically, these systems accommodate a network of taps, water carrying tanks, and different parts. Water distribution systems square measure aimed toward distributing water from reservoirs or aqueducts to the tip users. Jal Jeevan Mission (JJM) has been launched that aims at providing useful functional household tap connection (FHTC) to each rural family by 2025. The program aims on service Transportation at each family i.e., installation on well-organized basis in sufficient amount and of specified quality. These technology in designing and implementation of installation schemes, development of water sources, treatment and provide of water, authorization of Gram panchayat / area people, concentrate on service supply, partnership deals with different stakeholders, union with different programs, organized
observation of program and to find service supply information mechanically to making certain standard services. this may facilitate in achieving the goal of Jal Jeevan Mission in its true spirit.

2. Water Distribution System
2.1 Methods Of Water Distribution System And Layout Of Distribution Network

There are some methods used for distribution of water that are Gravity system, pumping system, and combined gravity system. The operation of pumping stations where gravity pressure isn't enough, should be ensured. There are four principal ways to style a distribution system.

3. Results and Discussion
3.1 Population Forecasting of Thirumittacode GP

The most important element that calculate the amount of water to be supplied to a region is the population of that region. Population is forecasted based on design period. Various methods can be used for population forecast such as decadal growth rate method, Arithmetical Increase, Geometrical Increase, Incremental Increase etc. Here the method adopted is decadal growth rate method.

Total population = Urban population + Rural population
Decayed growth rate = 10%

Population in 2011: 31998
Population by 2021:
\[ \text{Population by 2021} = 31998 \times 1.1 \]
\[ = 35197.8 \approx 35198 \]
Population by 2024:
\[ \text{Population by 2024} = 35198 + 35198 \times \frac{3}{100} \]
\[ = 36253.94 \approx 36254 \]
Population by 2034:
\[ \text{Population by 2034} = (36254 \times 1.1) 39879.4 \]
\[ \approx 39880 \]
Population by 2044:
\[ \text{Population by 2044} = (36254 \times 1.1 \times 1.1) 43867.34 \]
\[ \approx 43868 \]
Population by 2054:
\[ \text{Population by 2054} = (36254 \times 1.1 \times 1.1 \times 1.1) \]
\[ \approx 48254.074 \approx 48255 \]

3.1.1 Water Demand Calculation for Thirumittacode Grama Panchayath

Water demand is the total amount of water used by people or customers in an area. Hence it is a function of population. The domestic water demand is assumed as 130lpcd.

Estimated population by 2039 = 41693 (15 years from 2024)
Total domestic water demand = 41693*130 = 5420090 L/d = 5.42009 ML/d
Estimated population by 2054 = 48255 (30 years from 2024)
Total domestic water demand = 48255*130 = 6273150L/d = 6.27315 ML/d

3.1.2 Water Resource Selection

BHARATAPUZHA River is selected as the water resource for the water distributing system in Thirumittacode grama panchayath. The supporting reasons for selecting Bharathapuzha River are the river BHARATHAPUZHA is a perennial source of water and also the required head of the river is maintained in the catchment area with the help of regulator cum bridge at
Vellyamkallu, Ottapalam Taluk, Palakkad and it has good water quality parameters.

3.2 Pump Design

This project proposes the design of centrifugal pump with the below computed horse power.

\[
\text{Horsepower or HP} = \frac{\rho \, Q \, g \, H}{\eta}
\]

\( \rho \) = density of fluid = 1000 kg/(m³)
\( Q \) = flow of fluid = 8.62 \times 10^{-3} \, m³/s
\( H \) = 73 m (total head)
\( \eta \) = efficiency of pump = 60% (assumed)
\[
\rho \, Q \, g \, H = 1000 \times 9.81 \times 73 \times 8.62 \times 10^{-3} \, m³/s = 6.17 \, KN \quad \text{Pump Power} = \frac{\text{Water horse power/efficiency of pump water horse power (WHP)}}{\eta} = \frac{6.17 \times 1000}{746} = 8.27 \, hp
\]
*1 hp = 746 watts
Efficiency of pump assumed as 60%
Pump power = 10 hp

3.3 Location Data

![Satellite Map of Thirumittacode](image)

**Figure 1.** Satellite map of Thirumittacode
Table 1. Water quality parameters of a water sample (from a well near Bharathapuzha River)

| Sl.No. | Substance or Characteristics | Unit    | Desirable limits | Permissible limits in the absence of Alternate source | Actual contents |
|--------|------------------------------|---------|------------------|-------------------------------------------------------|-----------------|
|        | Physical and Chemical Analysis |         |                  |                                                       |                 |
| 1      | Turbidity                    | NTU     | 1                | 5                                                      | 0.1             |
| 2      | pH                           |         | 0.5-8.5          | 0.5-8.5                                               | 5.5             |
| 3      | Electrical Conductivity       | mmhos/cm|                  |                                                       | 64              |
| 4      | Acidity                      | mg/l    |                  |                                                       | 50              |
| 5      | Alkalinity (Total)           | mg/l    | 200              | 600                                                   | 18              |
| 6      | Total Dissolved Solids (TDS) | mg/l    | 500              | 2000                                                  | 35              |
| 7      | Total Hardness as (CaCO3)    | mg/l    | 200              | 600                                                   | 0.26            |
| 8      | Ca                           | mg/l    | 75               | 200                                                   | 6.4             |
| 9      | mg                           | mg/l    | 30               | 100                                                   | 0.97            |
| 10     | Cl                            | mg/l    | 250              | 1000                                                  | 14              |
| 11     | Fluoride                     | mg/l    | 1                | 1.5                                                   | NIL             |
| 12     | Fe                            | mg/l    | 0.3              | 1                                                     | 0.1             |
| 13     | Nitrate                      | mg/l    | 45               | 45                                                    | 25              |
| 14     | Sulphate                     | mg/l    | 200              | 400                                                   | 13              |
| 15     | Phosphate                    | mg/l    |                  |                                                       | NIL             |
| 16     | Ammonia                      | mg/l    | 0.5              | 0.5                                                   | NIL             |
|        | Bacteriological Analysis      |         |                  |                                                       |                 |
| 1      | Number of Coliforms in 100ml  |         |                  |                                                       | NIL             |
| 2      | E. coli                      |         |                  |                                                       | NIL             |

Remarks: Low pH
3.5 Designed Intake Well

![Designed Intake Well](image)

**Figure 2.** Designed intakes well in AutoCAD

4. Conclusion

By the end of this project, a water distribution system will be designed for the whole population of Thirumittacode Gram panchayat by 2024 and 30 years thereafter. The designed water distribution system will be including an intake well, storage tank, pumping system, water treatment plant and pipeline network. Then there won’t be water scarcity in the respective Gram panchayat anymore. Ground water table regenerating methods can also add on to this project for more benefits. This project can also help as a reference to other water distribution projects as far as the data collection and designing strategies are concerned. This project can also be considered as a software driven project partially thus can be compared with other normal projects for further add on.

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