Designing of Piped Water Supply Scheme with Functional Household Tap Connection

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Abstract

The most basic necessity of human life is water and we know one can't survive without water but the main question arises how we can get a clean drinking water directly to our homes. Still in India there's a big population who don't have access to clean drinking water, so our government initiated many projects under which we can get clean drinking water through functional household water tap connections. So, my project is totally depending on the designing of water supply pipelines and providing functional household tap connections. The water sector is the next big infrastructure revolution in India, so we are working with the aim of providing clean drinking water through household tap connection.

In this study I have given a detailed discussion on designing of pipelines and tap connections through which water can be accessible to each and every household 24x7. It includes selection of source (River, Borewell etc.), Estimation of Population from 2011 census, Survey of Village includes type of road, type of soil, road elevations, no. of handpumps, area for the construction of overhead tanks, operation and maintenance strategy and economic feasibility and then finally software based hydraulic design of pipelines for the project. Water found one of the important physical environments of human and has a direct behaviour on the health and hygiene of mankind. There is no denying the fact that the contamination of water leads to numerous health hazards. The facility of safe and adequate drinking water to the growing urban population continues to be one of the major challenging tasks for any state. The present water supply practice is non-confirming to designed hydraulic parameters, and also the system is severely affected insufficient hydraulics, leading to many of the current critical issues which keep the local authorities in an evitable brutal circle. Using data from the local government body, the papers present the condition of intermittent water supply network and compare it with continuous water supply system.

There are two types of schemes i.e., Multi Village water supply scheme and single village water supply scheme. In Multi village water supply scheme, a group of villages involved in a single scheme for which the selected source is river and then intake well, water treatment plant, high capacity overhead tanks is proposed to fulfil the requirement of water because of its high population whereas single village water supply scheme includes only one village and the selected source is borewell because it can fulfil the requirement of water as it has lesser population as compare to multi village water supply scheme. In this study I will give detail discussion on how to design single village water supply scheme through all the reliable date and proper result and conclusion.

Introduction

The proposed scheme is located at Ghutheli village, 35 KM from district headquarters Mungeli. Scheme lies between N=21˚55'28.76", E=82˚52'10.75" & approachable in all weather. This scheme of the Mungeli district having a population of 1551 as per census 2011. Scheme is having 1 village. Ghutheli village, of Mungeli district having a population of 1754 (as per JJM data) in the year 2021. The design population of the proposed scheme at ultimate stage year 2052 i.e., after 30 years from 2022 is 2355 (32% increase per year) and 521 households (as per JJM data and guidelines). The proposed scheme is based on Ground source. The per capita clear water demand of the proposed scheme is @65.19

LPCD i.e., 16% over 55 LPCD (including domestic, UFW, commercial and firefighting demand). So, if the water drawn from source (borewell) for 16 hours average pumping it will become sufficient to fulfil the ultimate demand. The scheme has provision for survey and investigation for preparation of Detailed Project Report (DPR), includes conducting of yield report, proposing tube well, provision for Pump Set, Switch Room, Chlorinator Room with system, Pumping Main, RCC Over Head Tank, Distribution System, FHTC to all balance house hold, boundary wall, trial run and permanent electric connection. The operation and maintenance charges of completed piped water supply scheme shall be borne by the concerning gram panchayat. The generated revenue collection is on higher side of annual operation and maintenance charges. Therefore, the scheme is self-sustainable hence there will be no problem to Gram panchayat to run the scheme systematically.

The district experiences sub-tropical climate and is characterized by extreme summer and winter seasons. The summer months are beginnings from March and to mid-June and the months May-June are the hottest months. The mean daily maximum temperature in summer season goes up to 43°C - 45°C. The rainy season extends from the month of mid-June to end of September with well distributed rainfall through southwest monsoon. December to January is the coldest month with mean daily maximum temperature at 30°C and the minimum is around 5°C.

In the village stromatolites lime stone group of Mungeli of Chhattisgarh supper group is occurred. The age being Proterozoic on the basis of ground water fluctuation in shallow and deep aquifers, it has been observed that the ground water fluctuation for pre monsoon season is about 13.32 to 2.0 MBGL and 0.91 to 7.10 MBGL during post monsoon respectively.

1.1 Objectives:

- The main objective of this study is to review the usage of piped water supply to the households.
- The main purpose is to provide water to each and every household through function household tap connection.

Literature review:

Swarup Varu, Dr. Dipsha Shah, "Design of 24x7 Water Supply System: A review" [1] It's the critical responsibility of the Local Body to supply 125-150 liters of water per head per day per household 24x7, that too with adequate pressure. However, to cope up with the demographic growth of the urban centers, Local bodies adopted the strategy of limiting the supply period. Now almost all local authorities resort to cut supply to an extent of few hours or even few minutes for their city supplies. Also, Water supply of Ahmedabad (Gujarat) is not as per the required norms. Though there is adequate raw water and treatment plant facility is available, there is lack of effective water supply system result in poor satisfaction level among the users. At present, water supply department supplies the water on basis of time of supply other than demand of users as per standards of CPHEEO manual (Gov. of India). As a result of such practice of shortened water supply from the authorities, people try to preserve as much water that is made available to them during the supply time. This obviously results into excessive inflection of water by every household, with their taps fully open during the supply period. This practice harmfully affects the hydraulics of the pipe network. In fact, people draw water simultaneously, store in their household, and consume for 24 hours the water quantity that has been made available in short supply period. For this, they need to store, and also expend electrical energy for lifting the water to the elevated tanks of every individual household. In short, during the shortened supply period, there is simply transfer of water storage from municipal storage to the individual household.

Gert-Jan Wilbers, Zita Sebesvari and Fabrice G. Renaud, "Water Supplies in Rural Areas of the Mekong Delta, Vietnam" [2] Water utilities pay close attention to the safety and quality of drinking water during distribution, focusing on various aspects and situations, such as pressure transients, cross-connection, deterioration of buried infrastructure, permeation and leaching, nitrification, microbial growth and biofilm, water storage facilities, water age, and pipe repair. Even the accumulation of chemical and biological material in DWDSs have become a widely accepted target of attention. However, the transition effects which can lead to esthetic and health problems have been neglected. The available literature on the characteristics of the material developed and contaminants harbored in DNs and the potential transition effects following the switching of supply-water quality were reviewed for this article, which also incorporates the authors' first-hand knowledge and research.

Gang Liu, Ya Zhang, Willem-Jan Knibbe, Cuijie Feng, Wentso Liu, Gertjan Medema, Walter van der Meer, "Potential impacts of changing supply-water quality on drinking water distribution" [3]

Drinking water treatment makes water potable by removing contaminants present in the source water. Depending on the contaminants present, different technologies and their combinations can be used for drinking water production. In both developing and industrialized countries, a growing number of contaminants are entering water supplies due to human activity: heavy metals, pharmaceuticals, endocrine disruptors, per fluorinated compounds, flame retardants or biocides. Public health and environmental concerns drive efforts to tighten water quality regulations and further treat waters previously considered clean. These efforts have greatly promoted the development of water treatment science and technology and the upgrading of treatment plants over several decades.

Methodology:

Designing of Piped water Supply scheme is designed with the help of number of software's but most popularly and preferably used software is Bentleys Water Gems. So let me give a brief introduction of Water Gems software and how it works so basically we have to import the line diagram of AutoCAD into this software through modular builder, then we can select the type of pipe, initial diameter (which can later be changed according to the elevation) etc. after inserting the RLs of different junctions we can start designing and the it will give the velocity of flow, elevation, pressure and the desired diameter of the pipe which can households access easily.

3.1 Survey Drawing

3.2 Population Forecast

3.3 Calculation of Water Demand

3.4 Calculation of Tube well

3.5 Calculation of Over Head Tank

3.6 Annual Revenue Generation

3.7 Per Capita Cost of Scheme

3.8 Strata Chart of Existing Tube well

3.9 Strata Chart of Proposed Tube well

3.10 Yield Test of Existing Tube well

3.11 Yield Test of Proposed Tube well

3.12 Designing of Pumping Main

3.13 Designing of Pumping Machinery

3.14 Designing of Distribution Network

Discussion and Future Work

- Design of water distribution network, with help of the Water GEMS shows good and clean water through tap connection to each and every household.
- For the 24x7 water supply system, there is need to construct Elevated Service Reservoir
- Using UPVC material pipe for the distribution of water is economically feasible as compare to DI or GI pipes.
- Using PE-AL-PE pipe for the house hold connection is more economically feasible the GI pipes.

Conclusion

- Design of water distribution network, with help of the Water Gems shows good result so for the designing of hydraulic this software is preferable.
- For the 24x7 water supply system, there is need to construct Elevated Service Reservoir
- Using UPVC material pipe for the distribution of water is economically feasible as compare to DI or GI pipes.
- Using PE-AL-PE pipe for the house hold connection is more economically feasible than GI pipes.

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