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Drinking Water Supply in Villages by Using Gravity Flow

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Abstract: Over 480 million people in India do not have access to safe drinking water. India has been ranked 133rd among 180 countries for its poor water availability (1880 cubic meters per person) by the United Nations. Lack of access to safe drinking water is a major cause of ill-health and loss of productivity. It is one of the major causes of life-threatening diseases among infants and children. Fetching water from far off places by women and girls is a burden, adding to their already long days of domestic hardship. Provision of piped water to homes and toilets lessens the burden for women and girls who fetch water from distant sources for household consumption. Water is a basic need of life to which every village has an inalienable right. More than 80% of households have no electricity connection and sanitation facilities are found in fewer than 5% of rural homes. Access is a particular constraint, especially in the central, hilly area of the state. In the 21st century, rural communities are far away from getting their most basic needs. We aims to ensure that all homes in rural/tribal areas have access to uninterrupted, protected piped water supply. Rural areas have long been subject to an uneven development process where piped water supply to individual homes has never been seriously considered by the government. In this project we tried to contribute to help those rural people to get potable water economically, by using sustainable gravity flow system. The result shows that alternative we suggest is feasible system over pumping lift system.

Keywords: drinking water, life threatening diseases, no electricity, piped water.

I. INTRODUCTION

Generally the dams are constructed at higher level and the villages are located at lower level. The idea is to use natural gravity flow for drinking water so as to make easy for getting water without lift and hence cut the power bills. It is observed that the Govt. is implementing the water supply scheme to villages which is based on lifting the water by using the pumps and using local resources. To operate the pumps electricity is required. Unavailability of electricity and heavy bills, the water supply scheme is affected many a times in villages. The water is available but because of electricity bills or unavailability, people has to face the problem. When there is drought there is actual shortage of water in villages. This study will solve the problem to some extent.

India is a rapidly developing country and to fuel this growth, the steady water supply is the key mostly rural India is always hit by severe droughts. Due to this drought, growth of this regions is hampered and to avoid that the Government of Maharashtra plan, many water supply scheme to such regions to supply them at least drinking water; Such as in our region Talegaon Dighe and 16 other village water supply scheme is planned and executed by MJP. This scheme was a water lift type of scheme but after it get completed the loop holes are now a days visible. The scheme has suffered many problems recently and water supply stopped. Many times in much needed summer times to resolved this issue, we are bidding our hopes on Gravity flow water supply scheme which is eliminated all the disadvantages of lift water supply scheme.

II. AREA UNDER CONSIDERATION

Talegaon Dighe& other 16 villages are in Sangamner Taluka of Ahmednagar District about 10 to 15 km from Sangamner. Most of these villages are situated along on either side of Sangamner-Kopargaon road within a distance of 20 km from the road. For all these villages, S.T. bus service is available from Sangamner. Most of this village are having school facilities up to the 10^{th} standard. Main occupation of the villagers is Agriculture and main crops are Jawar and Wheat. In addition there are milk societies in each village.

Longitude: In between 74 dig. -12` to 74 dig. – 23`

Latitude: In between 19 dig. -32` to 19 dig. – 47`

Configuration

Considering terrain of all the 15 villages, there is gentle rise from East to West.

Highest Level: 640.00 M
Lowest Level: 549.00 M

Rainfall

Nearest rain gauge station is at Taluka place Sangamner. Maximum, minimum and average rainfall is as given below.

a) Maximum Rainfall : 998.30 mm
b) Minimum Rainfall : 238.70 mm
c) Average Rainfall : 529.60 mm

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III. GRAVITY FLOW WATER SUPPLY

Water is channeled from a perennial spring, (a dug well if necessary), always using only a part of the spring's water flow. A sump is built at the source and water is diverted through pipelines (from as far as 50/60 kilometers) using the principles of gravity flow and siphoning to traverse small hills to reach an overhead water storage tank in the village and from there, to individual homes. With dug wells, the availability of water for the whole year should be ensured.

The villagers take full responsibility for the maintenance of the entire water supply system, including safety of the pipeline. People contribute unskilled labour, stone and sand, while the cost of the pipeline, cement, masons etc. are sourced from outside (wherever possible, the government). Though the initial investment is high (depending on the length of pipeline and size of storage tank), the recurring costs are negligible because gravity flow eliminates the need for a pump and its associated power and maintenance costs.

During construction, care has to be taken that:

1. The pipes are well buried to prevent breakage;
2. The area around the source is kept clean to prevent pollution of the water and Ensure the pipes are not blocked by debris;
3. The tree cover around the source of the spring is maintained for an area of approximately five acres to slow down surface-water run-off;
4. Ground water recharge is encouraged to prevent the spring from drying up.

Methodology:

i. Collection of data of existing scheme
ii. Study of local problem for drinking water
iii. Study of available sources
iv. Taking levels and drawing L section
v. Study of cost benefit ratio & feasibility of the project.
vi. Calculation of breakeven point.

IV. POPULATION GROWTH

A general rule of thumb for population prediction is 50% growth over 10 years. This is a high-end estimate, but it is always safer to over design then under design. If the over designed system is economically unfeasible, a more accurate assessment of growth can be made but requires more time and a better assessment of the community's future. Population tends to be determined by:

1. Future economic developments in the community
2. The character and location of the community in relation to other population centers
3. The presence or possible introduction of small industries into and around the community (the installation of the water system itself will cause population growth) (helps in create jobs in area)

Table I Population Forecasting For Village Talegaon Dighe

Sr. No.	Year	Incremental Increase Method	Geometric Progression Method	Average Population
1.	2000	7170	7653	7412
2.	2015	10291	12414	11353
3.	2030	14301	20138	17220

V. STUDY OF LOCAL PROBLEM FOR DRINKING WATER AND AVAILABLE SOURCES

For local problems following point are consider
1. Community Water Use
2. Average Daily Water Demand
3. Peak Water Demand
According to local problem we have to decided that sources and distributed according to demand. For above example available sources are
1. Springs
2. river and dam

PIPE LINE ROUTE SURVEY

Surveying is needed for collecting data to help in the design of the transmission main, placement of the water storage tank and, if necessary, placement of the break-pressure boxes. The type of survey needed for planning the pipeline depends on the route topography.

VI. MARKING THE PIPELINE ROUTE

After all of the construction has been finished, permanent markers have to be set along the pipeline to help identify it for future maintenance and repair. A short piece of rebar driven into the ground serves as a good marker. To protect the rebar markers, follow the same methods and using the same materials used to install the valve boxes; set a short piece of GI pipe around the marker and cap it. These markers should be placed at important points in the pipeline, offset exactly 150 meters and marked with an arrow indicating what side the pipeline is on. Sharp changes in direction and pipe size reductions all need markers to identify them. Also place the markers at least every 200 meters along the pipeline in open areas and every 50 meters in jungle or overgrown areas. After all the markers have been placed, a surveyor needs to create a map of where all the markers are located as well as all air release, drain and control valve located. A copy should be kept with the community and with the agency that supervised the construction.

Water treatment systems

Water treatment systems are necessary to render contaminated or unaesthetic water fit for domestic use. The problems with water treatment technology are that they need regular supervision and maintenance. If they fail from lack of care, then the community will probably keep using the water even though it is poor in quality.

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This defeats the purpose of constructing the system to begin with. Therefore, the most important design considerations for water treatment systems in small communities are low cost, minimal use of mechanical equipment, avoiding the use of chemicals when possible, and ease to operation and maintenance. If most of these conditions cannot be met, then choosing another source of water would probably be more feasible, even if it were farther away. There are three general types of water treatment processes. Disinfection treats water contaminated by disease-causing and pathogenic organisms. These organisms are the primary reason proper treatment systems exist to remove them from the water. Clarification treats turbid water removing suspended solids by means of filtering or settling. Conditioning treats water with high concentrations of minerals, salts and/or metals that give water bad taste, poor color or odor. In some cases the metals present are harmful to human health if continuously consumed but mostly this form of treatment is of secondary importance. Conditioning the water can increase the aesthetic value of the water and convince more people to drink it rather than choose a water source that is more aesthetically pleasing but contaminated with undetectable disease causing organism

VII. ESTIMATION AND COMPARISON

Estimation for gravity pipe line will be done as per D S R 2014-15, from available source of water to required storage point.

Total estimation for gravity pipe line is

= Rs **29,39,72,046.10./-**

Total Cost for construction of scheme = Total cost of pipe line construction + Total cost of WTR and distribution system= 293972046.0 + 154385514.0

=**Rs. 44,83, 57,560.0 /-**

Total estimation for pumping or lifting system water scheme (constructed) = **Rs. 38, 28,07,628.0 /-**

The monthly average electricity bill for pumping = **Rs.1,86,712 /-**

Yearly electricity bill = **Rs. 22,40, 554 /-**

Total estimate for pumping or lifting scheme =

Rs. 38,50,48, 182.0/-

Total No. of tab required for area under consideration (data according to GramPanchayat of each village)

= **3985**

Revenue collected for each month = 3985 x 250(per tab charges) = **Rs.9,98,750/-**

Yearly Revenue = 998750 x 12 = **Rs. 1,19,85,000 /-**

Total cost for gravity flow water supply scheme (proposed) =**44, 83, 57,560 /-**

Break –even point :

Total Revenue collected + Total yearly saving in electricity charges

= Rs.**1,42,25,544 /-**

Total initial investment = **44, 83,57,560 /-**

B.E.P. :

448357560 / 14225544 = **31.5 years**

VIII. CONCLUSION

1. Continuous water supply:-

No electricity is required hence supply of water will be continuous. The water will available throughout the year.

2. Drought effect will be minimized:-

As the source of water is a major dam, there will be less effect on supply of drinking water & hence drought effect will be reduced.

3. Beneficial to cattle's:-

As there is continuous supply of water farmers will have water during summer & hence cattle'sfarmers will survive.

4. Less Maintenance:-

As the pumps & pump house are minimized, the maintenance will be less & easy.

5. Water wastage will reduced:-

The water is supplied through closed pipes as per the requirement and by meter system hence the loss of water will reduced.

6. Improved the method of water supply scheme:-

By this research project, it will improve the supply of drinking water to the rural people/population.

7. Need of global era:-

Day by day, there is shortage of water, it is necessary to improve the existing drinking water supply scheme. If not population migrating towards city will not be controlled.

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