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Design of Water Supply Scheme: A Case Study of Nangargaon Village

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Abstract: ***Design of water supply scheme in around Rural Areas. During classify toward fulfil the water command of the constantly rising population, it is necessary toward supply the plenty with consistent capacity of water through the designed system of pipe. intended for this use the particulars provide via the IPH (Irrigation and Public Health Department) department, the common features of the region similar to in order on the chief water basis, population of the region, insist of water, requirement of the pumps, distribution network and water tanks are essential for efficient design of water distribution system. Water distribution system deals with the supplying of potable water for a village which can be useful for both drinking and wholesome purpose.***

The main stages of distribution system are collection works, transmission works, purification works and distribution works. It includes estimation of future population (population forecasting) by using various methods, layout of pipes and design of valves and joints, finding out the head losses etc.

Keywords: Water supply scheme, Water distribution system, supplying potable water ,QGIS, Watershed management

I. INTRODUCTION

The total volume of water on Earth is estimated at 1.386 billion km³ (333 million cubic miles), with 97.5% being salt water and 2.5% being fresh water. Of the fresh water, only 0.3% is in liquid form on the surface. Providing safe drinking water for the entire population in the country has become a challenging task of the Governments and all Sector Institutions. In order to fulfil the water demand of the continuously growing population we need to provide the sufficient and uniform quantity of water through the designed network of pipes is known as water supply.

In most rural communities in India, the prevailing water supply conditions are very different from urban installations. Usually, the number of people to be served by such a water supply scheme is small and the low population density makes piped distribution of the water costly. On the other hand, rural population often is very poor and, particularly in subsistence farming communities' little money can be raised.

Thus, in providing water supply systems to rural communities, factors such as organization, administration, community involvement and finance are properly blended in order to achieve an economical water supply system.

The general features of the area like information about the main water source, population of the area, demand of water, requirement of the pumps, distribution network and water tanks are essential for efficient design of water distribution system. Existing source of water is limited hence in an order to provide deficient quantity of water by borewell recharging and ground water recharging for spring. Also roof top rain water harvesting potential is estimated. It can be used in case of scarcity.

In the selected Village, there is scarcity of water to overcome this problem we are going to design water supply scheme as well as suggesting measures for recharging of borewell and spring in this area.

II. OBJECTIVES

A. To supply safe and wholesome water to consumers.
B. To study existing water supply arrangement.
C. To estimate the quantity of water required for the users in Selected Village.
D. To estimate the quantity of water available in the selected source.
E. To propose the location of storage tank of required capacity to meet the gap between required water & available water.

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III. METHODOLOGY



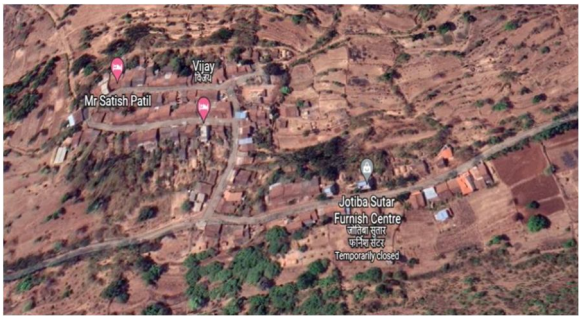


FIG 1. Geographical Map of Nangargaon village, Tal. Bhudargad, Dist. Kolhapur

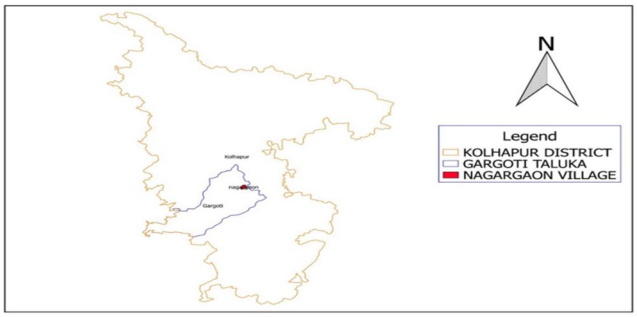


FIG 2. Location Map

The village Nangargaon is selected for Design of water supply scheme. Area of Nangargaon village situated at a distance of about 10 km from the Gargoti, Taluka Bhudargad and District Kolhapur. At present the main water resource of the study area is Well and Borewell. The village of Nangargaon is divided into various zones for proper distribution of water. The economical water distribution system is designed in present study for village.

The area of the village is about 591 Ha and population of village is 1463 peoples as per 2011 census of India. There are 230 houses in this village and they are divided into four lanes. We had a visit to Nangargaon village and have collected some information regarding this village. Population count in this village is around 1463 people only (census of India 2011). No of houses situated there are around 230 houses 591 hector area of village. Village is located at hilly station. The village have water supply source form well & borewell & spring for the other sources. & borewell & spring for other sources & borewell is for drinking water. Where, borewell & spring is situated at downstream side & village. Water of well & borewell is first collected in the ESR by 10 Hp pump & then distributed to the village by gravity. ESR is from 30 feet high above ground level. The village have dead end pipe connections, almost 108 pipe connections are there among which the pipe from jack well line is of PVC pipe.



FIG 3. Existing Jack well



FIG 4. Existing Spring



FIG 5. Existing Bore well



FIG 6. Existing ESR

A. Population Forecasting For Nangargaon Village

Immediate stage population is considered in 2021 and ultimate stage population is considered in 2061 by considering a design period of 50 yrs.

Table- 1: Population Data

YEARS	POPULATION
1991	492
2001	650
2011	876

Table- 2: Estimation of Population

Sr. No.	Methods	POPULATION				
		2021	2031	2041	2051	2061
1	Arithmetical Method	1068	1200	1452	1644	1836
2	Incremental Increase Method	1168	1559	2050	2446	3704
3	Geometric Increase Method	1137	1331	1526	1722	1919

B. Water Budget Calculation

Demand of Water:

The standard norm for demand are given below:

Types of demand:

Domestic purpose = 55 – 60% of total demand.

Civic or public purpose = 5 - 10%of total demand.

Industrial demand = 10 - 20 % of total demand.

Institutional & commercial demand = 5 - 10 % of total demand.

The demand of water is calculated as per standard norm as 135 litres/capita/day and all other demands like civic, institutional, business of the village are also considered as per standard norms.

C. Requirement of Water Supply for Nangargaon Village

1) Water requirement at immediate stage 2021 will be = 152 m3/day.

2) Water requirement at ultimate stage 2061 will be = 336 m3/day.

3) Therefore, water requirement at ultimate stage in whole year =0.122Mm3

D. To Study of Available Water

1) Available water in summer season (Month May) – 360000 lit.

2) Actual required water in summer season (Month May) - 3547800 lit.

3) Difference in Required water and Actual water - 3187800 lit.

Table- 3: Drinking Water Quality Test of Existing Sources

Sr. No.	Characteristics	Spring	Borewell	Lake	Desirable Limits	Units
1	Turbidity	4.8	3.53	4.1	5	NTU
2	Colour	-	-	-	5	Hazen
3	Odour	Unobjectionab	Unobjectionable	Unobjectionable	Unobjectionab	-
4	Taste	Agree.	-	Agree.	Agreeable	-
5	PH Value	6.53	8.32	7.56	6.5 to 8.5	-
6	Total Hardness	126	156	167	300	Mg/L
7	Chlorides	185	223	196	250	Mg/L
8	Dissolved Solids	250	315	412	500	Mg/L
9	Nitrogen content	33	36	44	45	Mg/L
10	Alkalinity	185	175	181	200	Mg/L
11	Residual Chlorine	0.13	0.35	0.39	0.2	ppm

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E. Selection of Source for Scheme



FIG 7. Geographical Map of Mangnoor Lake



FIG 8. Mangnoor Lake

F. Layout of Whole Structure

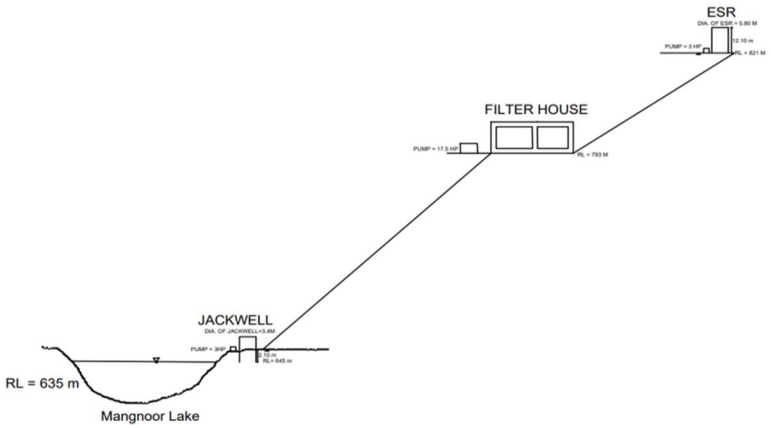


FIG 9. Layout of Whole Structure

G. Head Calculation And Provision Of Pumps

1) Source of water : Existing lake
2) Head of the Jack well from the lake level : 40m
3) 3HP 3 stage pump of model V6. This pump having capacity of 450 LPM
4) Filtered water is transferred to E.S.R.
5) Head from the filter house : 38m (calculated)
6) 3HP – 3 stage pump which have 170LPM of capacity for distribution of water

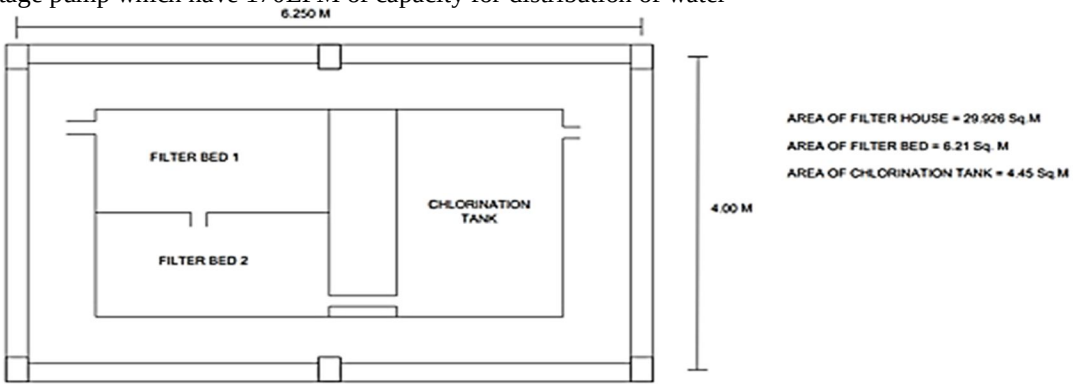


FIG 10. Layout of Filter House

H. Watershed Development Plan in The Catchment Of Source (Spring & Bore Well)

1) Watershed: A watershed 'which is an independent hydrological unit can be defined as the drainage basin or catchment area of a particular stream or river.

2) Watershed management: One of the definitions of watershed management is "the process of creating and implementing plans, programs, and projects to sustain and enhance watershed functions that affect the plant, animal, and human communities within a watershed boundary.

3) Methodology

a) MAPS: a. Digital Elevation Model (Alos Pulsar E-trex(5m)), contour map, satellite image of USGS Landset-2 of Nangargaon village, Kolhapur toposheet from Bhavan.

b) SOFTWARE: a-GIS 2.10, b. Erdas 9.1. c) Global Mapper

c) QGIS Swat Analysis: This was used to obtain all other maps like drainage pattern map, contour map, elevation map & stream line map.

Maps Generated using QGIS software

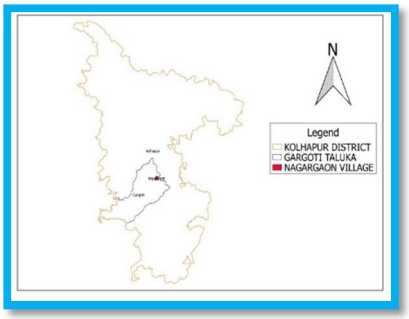


FIG 11. Location map

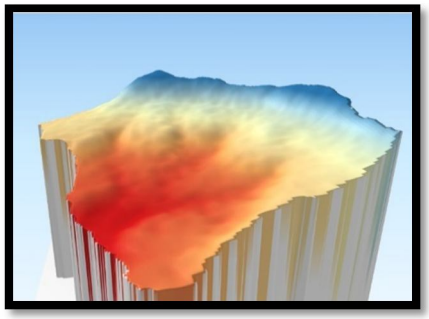


FIG 12. Terrain map

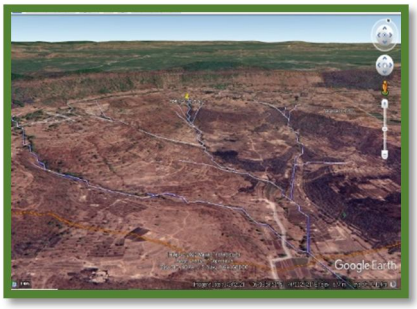


FIG 13. Stream line map

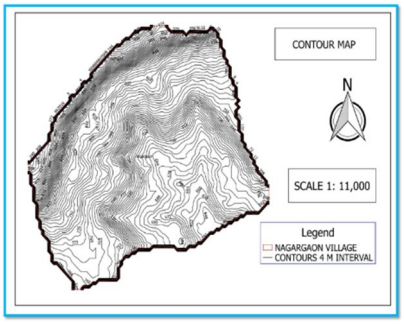


FIG 14. Contour map

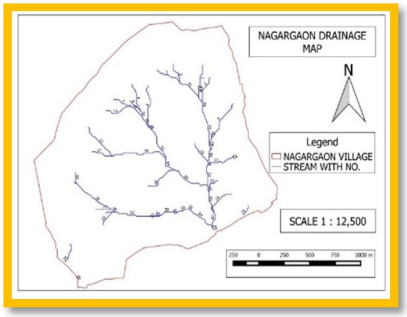


FIG 15. Drainage map

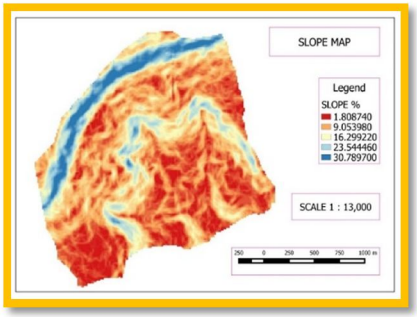


FIG 16. Slope map

IV. RESULTS AND DISCUSSION

Table- 4: Result

Sr. no	Name of Structure	Number of Structure
1	Gabion Structure	13
2	Loose Boulder Structure	26
3	Check Dam	1
4	Farm Pond	1
5	Storage Reservoir	3

V. CONCLUSION

A. The project "Design of water supply scheme for rural area" is related to the subject of water supply and irrigation engineering. The reason of choosing this subject is to fulfil the water supply demand in the selected village. This village is located in Taluka Bhudargad name Nangargaon where this village is facing water supply problems.

B. After visiting and observing this village, we come to know that there is scarcity of water in this village. The area consumed by this village is 591 Ha. and population of village 1463 as per 2011 census of India. There are 230 houses and they are divided into four lanes.

C. After surveying all above the conditions of this village are come to know that the source having by this village should not fulfilled the water demand of the village Nangargoan. Hence, we decided to provide a proper water supply scheme to the village.

D. We had designed now whole scheme of water supply to the village for that we pull up the water from the source of Mangnoor lake to the designed jack well for this we planned to provide a 3 HP of pump. This jack well of water then transferred to the designed filter house for this we have provide 17.5 HP of pump. Then filtered water is to be transferred to the ESR by 3HP of pump.

E. Along with these provisions we have suggested a plan for borewell recharging techniques and ground water recharging techniques for spring by using QGIS software.

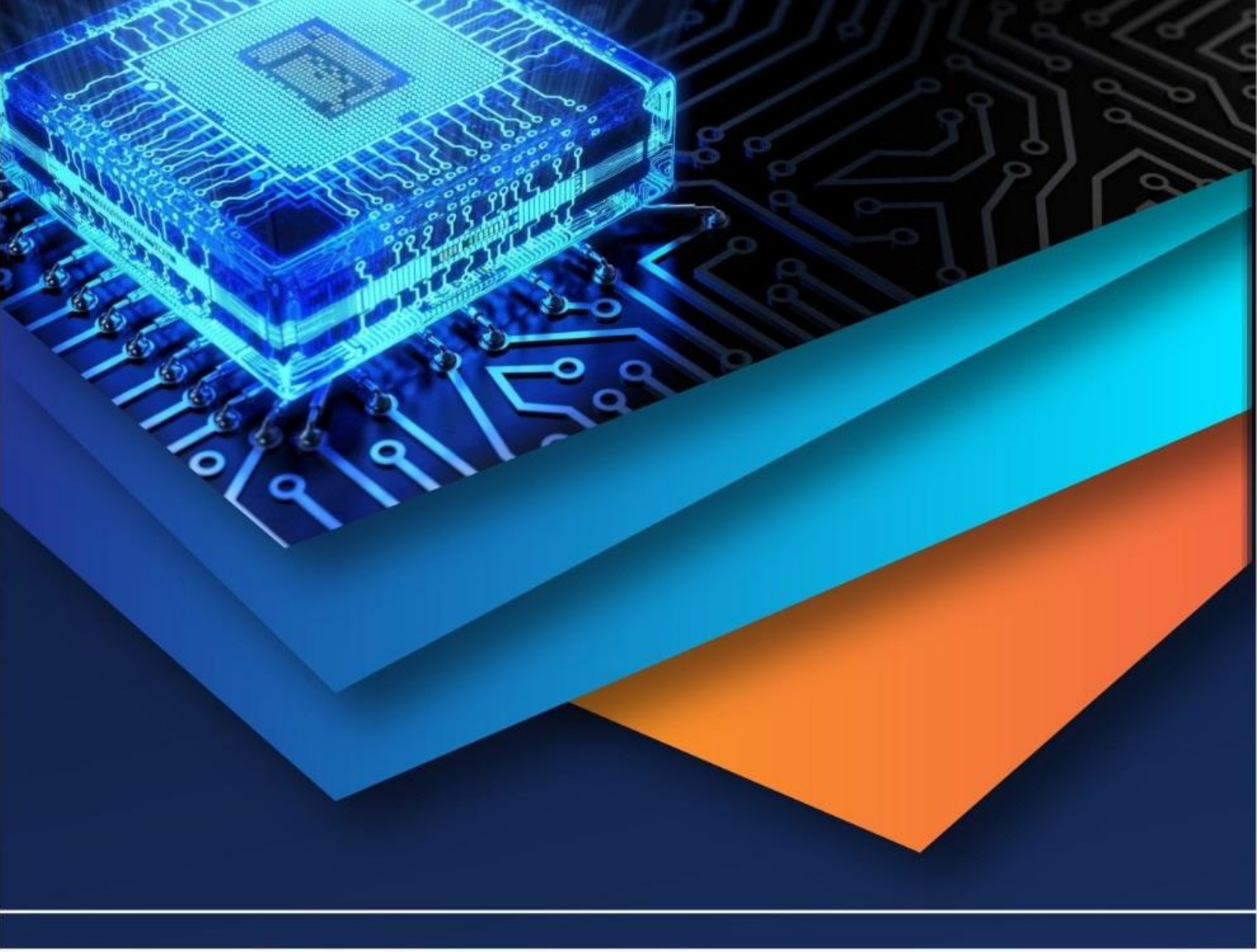
F. The capacity of existing ESR is less Hence new ESR is suggested. 1 lack of capacity structural design of purposed ESR is done.

G. The filtration unit is designed with basis components as rapid sand filter and chlorination units. Also the structural design of filtration units is carried out.

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