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Planning Of Water Distribution Network, Using GIS Techniques

Prajapati Mansi[1], B.M.Marvadi[2], Ajay Patel[3], Indra Prakash[3]

[1]PG Student, M.E. (Civil) Infrastructure Engineering, L.D.R.P. Institute of Technology & Research, Gandhinagar,
[2] Faculty , Department of Civil Engineering, L.D.R.P. Institute of Technology & Research, Gandhinagar,
[3]Bhaskaracharya Institute for Space Applications and Geo-informatics (BISAG) Department of Science & Technology, Government of Gujarat, Gandhinagar 382 007

Abstract—This is study of Baspa Village, Sami Taluka, Patan District Gujarat. This study explains the paucity of water supply system in baspa village and planning of sufficient water supply and distribution network using GIS technique. For this field survey has been carried out to assess the exact site conditions. An increasing demand of water due to population growth and agriculture use necessitate proper distribution network system. Application of GIS in this project will help to planning a sufficient water distribution network. The study has been carried out by developing various thematic maps and integrating various field and administrative information in GIS environment. Planning and designing in respective sectors like water distribution network, Road network, and information of land use has been carried out by using Arc GIS Software.

Keywords-component: Infrastructure, Water distribution network, Arc GIS.

I. INTRODUCTION

A large amount of money is invested around the world to provide piped water supply facilities. Even then, an enormous population of the world is suffering by inadequate water supply system. Approximately 80% to 85% of the cost of a total water supply system is contributed toward water transmission and the water distribution network. Study shows the paucity of the water supply system in Baspa village, existing source of water in the village is a bore well which is not able to distribute sufficient amount of water to every houses in the village. This study include the determination of daily water demand and population forecasting within design period of water supply system and planning of piped water network system connecting each house in the village.

II. GENERAL INFORMATION ABOUT BASPA VILLAGE

A. Baspa village

Baspa is a village in Sami Taluka in Patan District of Gujarat state, India. It is located 55km towards west from district headquarters Patan. 11km from Sami, 131km from state capital Gandhinagar. Total area of study area contain Baspa village, which is the prime study area having area of 2776 hac.Village located at dessert area. Therefore village weather is almost hot.

B. Demographic Details

Table 1. Demographic Deatils

Year	Population	Male	Female	No.ofHousehold
1981	2349	1199	1157	431
2001	2916	1510	1406	566
2011	3069	1590	1479	926

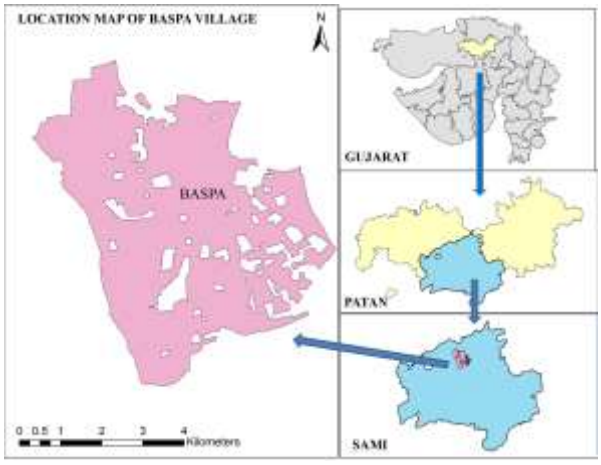


Figure1. Key Map of Baspa village

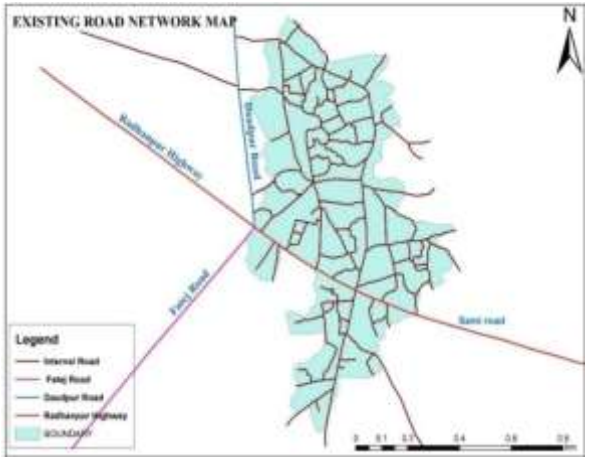


Figure2. Road connectivity of Baspa village

C. *Existing Water Supply*

For planning a new water supply scheme, the existing water supply system must be known. So, that duplication of work will be eliminated and we can know the existing condition.
Existing condition shows that Baspa village gets water from bore well for domestic as well as agriculture purpose.Which is not able to distribute sufficient amount of water to every houses in the village.

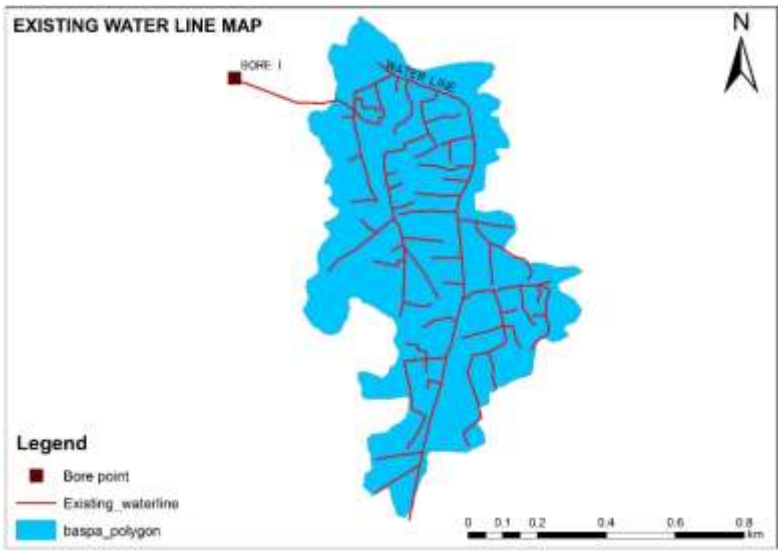


Figure3.Existing water supply Map

III. GIS ANALYSIS OF BASPA VILLAGE

A. *Liss-IV Image of Baspa Village*

The satellite data of study area collected from IRS-P6 (with sensors LISS-IV) for the 3-D visualization.

Figure 4.Liss IV Image

B. *Slope Map*

Slope map has been prepared from DEM and analysis has been done to find out various categories of slope and their percentage.

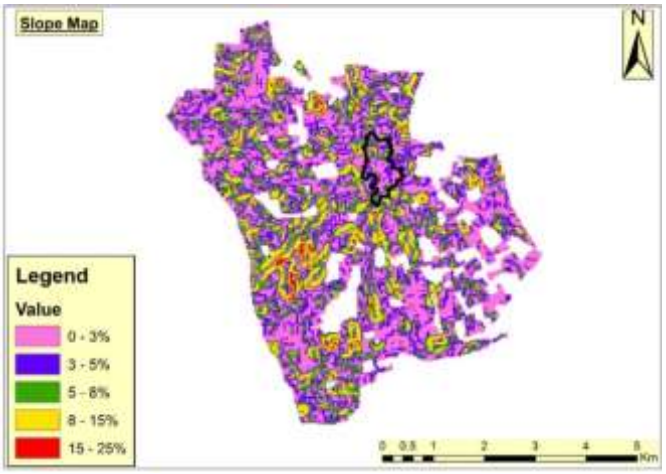


Figure 5. Slope Map

C. Topographical Map

3D Surface relief map showing conoturs (m) and slope direction shown in below map. Below map clearly show the slope of area and flow direction.

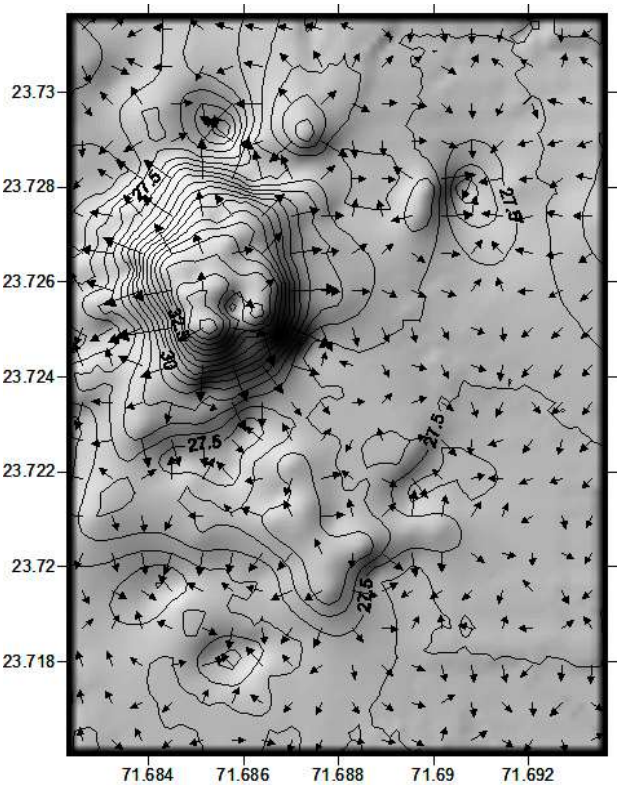
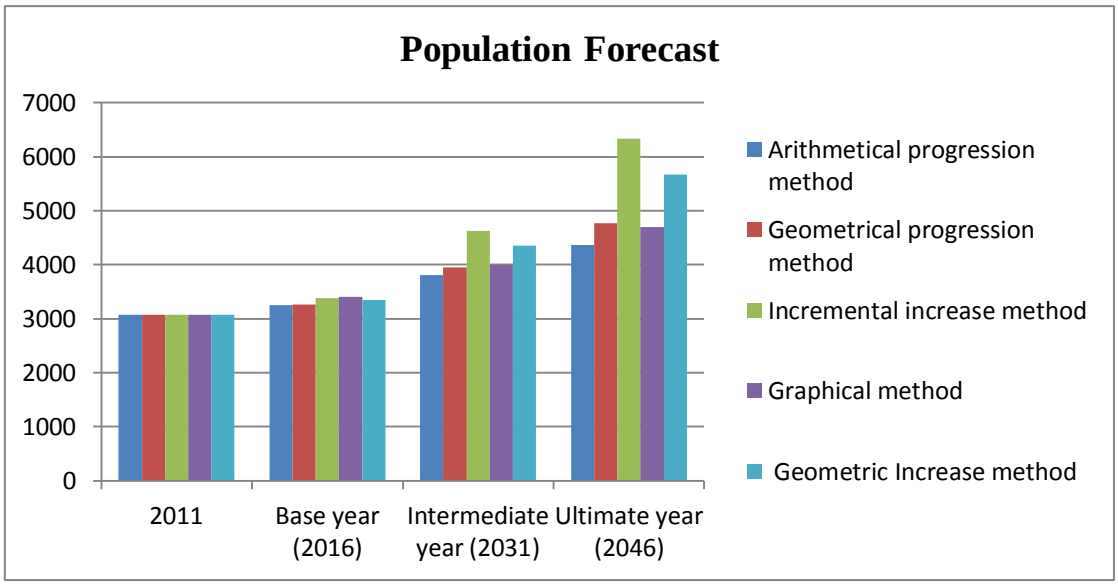


Figure 6.Topographical Map

D. Population Growth and Population Forecast



Graph1. Population Forecast of Baspa village

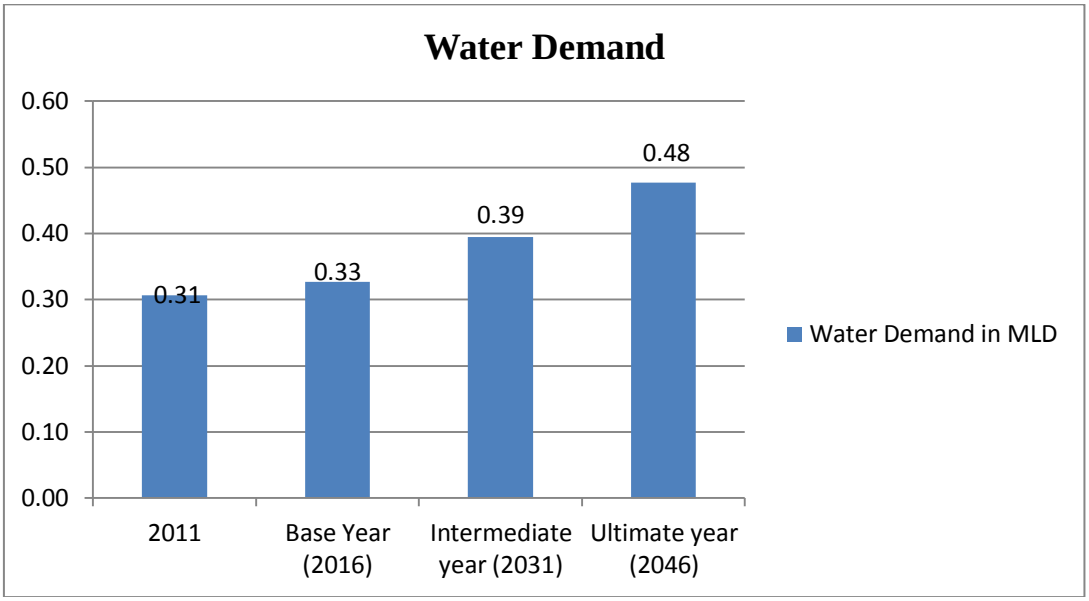
IV. PLANNING OF WATER DISTRIBUTION NETWORK

A. Water Demand

Whole village is divided in to four the wards by considering the area and road network for proper planning of different facilities. For ward vise water demand is shows below.

Table 2. Water Demand

Ward name	Population	Water demand(Per person 100lpcd)
Bharwad vas	1202	120200
Parmar vas	512	51200
Patel vas	855	85500
Thakor vas	700	70000



Graph 2.Water Demand Graph

B. Planning stage

- As per GWSSB Norms daily requirement of people of Baspa village is 100 lpcd but existing water supply system gets fail to fulfil their requirements. For that new planning of water supply system is necessary.
- Suggestion of one Tank, there is already one tank is present in Baspa village which is not in operational condition. Tank A & Tank B of 1 lakh litter capacity would be more better option and also suggest 2 sump well which is required also 1 lakh litter capacity of water.
- From Narmada canal will be connected to the branch pipe line and water will be supply to the ESR and SUMP well.
- Tank A will cover 2 out of 4 wards and Tank B will cover remaining 2 wards.
- As per CPEEHO manual and GWSSB norms, Diameter of pipe from canal to ESR will be of 140mm and ESR to home of villages OR branch pipe lines will be of 110mm.
- There will be ward wise valve and also one emergency valve suggested.
- In case due to some problem Tank A stop working then there will be a provision ina Tank B to supply water in all 4 wards, and if Tank B stop working then Tank A will cover all 4 wards.
- Provision of valve will be there if one want to stop supply to any ward, and it also used for increase the supply ward as well.

C. Alignment of water pipe network

New alignment of water distribution network is prepared with the help of Digital Elevation Model (DEM) map, Contour Map and Slope Map it gives the topographical data of the surface means it provides the information about hilly and flat area along the village which is helpful in alignment of the water distribution pipe lines. Network is prepared with the help of boundary map of village which provides the enclosed area for networking and DEM map gives the elevations of ground. Water distribution network is prepared along with the roads in the village therefore it covers whole village.

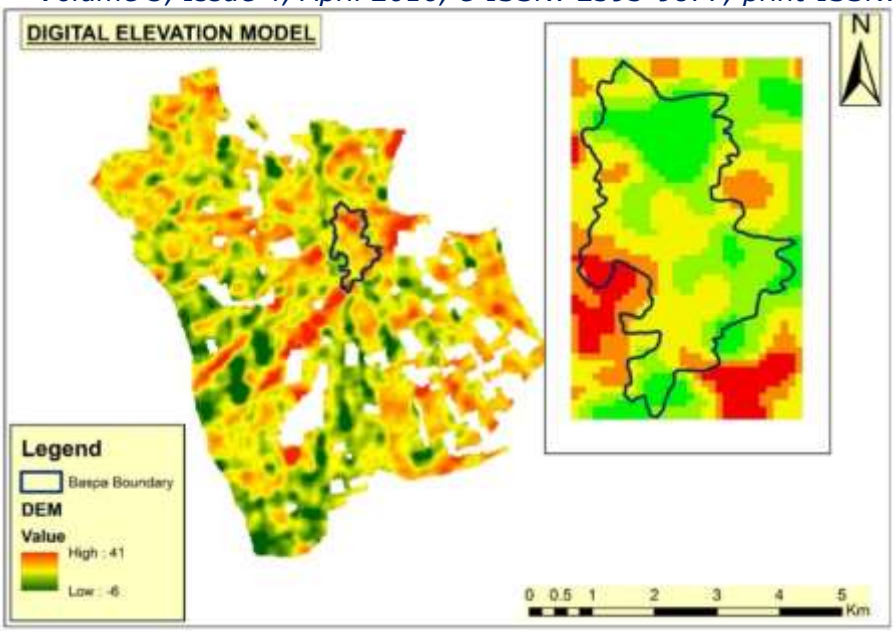


Figure 7.DEM Map

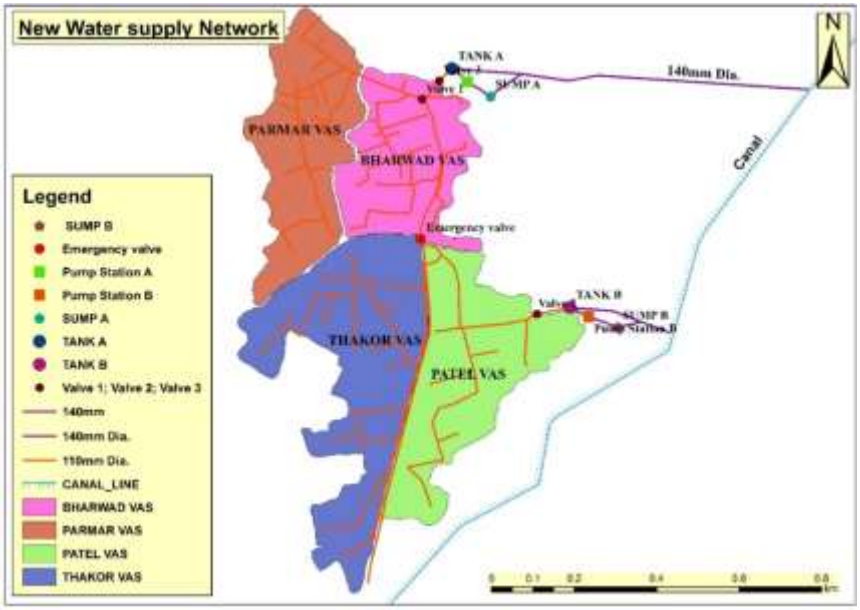


Figure 8. New Water Distribution Network

D. Cost estimation of water distribution pipe line

From the planning of water distribution of Baspa village total length of pipes planned per ward are as below.

Table 3. Estimation cost for water distribution pipe

Sr.NO	Main pipe	Length (m)	Rate per m	cost
1	Canal to tank A	850	266	226100
2	Canal to tank B	236	266	62776
Total cost of main pipe				**288876**

Table 4. Estimation cost for water distribution pipe

Sr.No	Ward Name	Length (m)	Rate per m	Cost (Rs.)
1	Paramar vas	1318	162	214834
2	Bharwad vas	1806	162	294378
3	Thakor vas	2506	162	245478
4	Patel vas	1274	162	207662
Total cost of Branch pipe				**962352**
Total cost of Main and Branch pipe				**1251228**

V. CONCLUSIONS

To improve quality of life and economic well-being of people in rural areas this study has been taken up. Aim of this paper is to assess the inadequacy of the infrastructure facilities in Baspa village and plan better systematic facilities such as suitable Water supply system.The study has been carried out by developing various thematic maps and integrating various field and administrative information in GIS environment. With the help of the GIS studies modification and improvement of the infrastructure facilities like Water supply, Drainage network and sanitation system has been suggested for better management of the area.

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