Research Paper Engineering

Design of Water Distribution Supply Network For Kuchhadi Village

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ABSTRACT

In present study of Kuchhadi village have done and Water Distribution Network (WDN) was designed, which was located at district Porbandar, State Gujarat, India. For the design of Kuchhadi water distribution network study of present population, forecast Population for the three decade, daily water demand, flow and also survey of village Kuchhadi was done with the help of Auto Level. From the Level survey, map was created and also elevation and length of Pipe line required for the village was calculated. The node no. and pipe no. was denoted on map of villages. Water Distribution Network of village was designed with the loop software and compared with manually result. It was found that software result were more accurate, save time and manpower than manual result.

KEYWORDS Loop software, Water Distribution Network, Auto Level.

INTRODUCTION

1.1 History of Water Distribution Network:

The most extensive water distribution systems in ancient times were the roman aqueducts, which conveyed water long distances by mean of gravity through a collection of open and closed conduits. The first aqueduct was built in 312 B.C., and several more were added over the centuries. The Roman also Introduced lead pressure pipe. While complex water distribution systems were not common in the middle ages, systems of channels were constructed to move water from the well source in and out of castles.

1.2 Water Distribution Network:

Water distribution network consist of a planar system of pipe connected together at nodes which may be at different elevation.

In general, the complex will also include pumps, reservoirs and valves. A node usually has one of the two main functions; it either receives a supply for the system or it delivers the demand required by consumers. As a special case, it may satisfy neither of these requirements but merely serve as a junction between two or more pipes. The pressure head at a supply node is established by the presence of a pump or a reservoir. The effect of minor losses may be including as equivalent pipe lengths.

In Loop software, Loop simulates the hydraulic characteristics of a pressurized, looped (close circuit) water distribution network. The network is characterized by pipes and nodes (points of inputs demand or pipe junction). Data required are the description of the elements of the network such as pipe length, diameter, friction coefficient, nodal demand and ground elevation, and data describing the geometry of the network. The program outputs include flows and velocities in the link and pressures at the nodes. It does not accommodate inline booster pumps and pressure reducing valves. Loop 4.0 handles up to 1000 pipes and can simulate up to 10 nodes with known hydraulic grade lines (e.g. Storage reservoirs).

1.3 Necessity of project and condition leading to the planning of the project

This village is 15 km from Porbandar city, Gujarat, India. The village has facilities like primary school, *Anganvari*, Electricity, *Panchayat Office* etc.

Hence Water Supply Scheme for Kuchhadi villages with as source is proposed along with water supply rate of 70 lpcd at consumer end Kuchhadi village.

The main occupation of the people is agriculture which is primarily depends on rain fall which is about 750mm study region. The Village has relatively flat Topography. hence a new water supply scheme is urgently needed.

EXISTING WORK INFORMATION OF KUCHHADI

Village *Kuchhadi* is situated on **N-H8 B** at a distance of about 15 km *Porbandar* taluka head quarter. The nearest railway station is *Porbandar Railway Station*. Population of this village is 4358 souls according to census 2011. The ST bus service is also available throughout the year in the village.

2.1 *Barda* Regional Water Supply Scheme Profile (BRWSS):

Barda RWSS is based on *Sorthi dam* which includes 27 villages of Porbandar taluka. The Dam is located near *Advana* village of *Porbandar taluka*. Water is pumped from *Sorthi dam* and send to filter plant located at main h/w of this scheme. The treated water again pumped from sump to ESR at *Advana* h/w.

Then water is distributed from ESR to sub h/w *Visavada* sump. Further this water is pumped from the sump to distribution service reservoir of village.

The village *Kuchhadi* comes at tail end of Regional Water Sup-

ply Scheme (RWSS) network hence, They did not get sufficient water so a new scheme named Porbandar group Phase-II has been developed for 47 villages of Porbandar taluka.

Under this scheme treated water pumped from sump to ESR at *Advana* h/w and then distributed to the villages of *Majivana, khanbhodar, bagvadar, bharvada, degam, rinavada, kuchhadi.*

During the Summer season if there no sufficient water in *Sorthi Dam* then entire *Barda* RWSS getting water from the *Mahi-Narmada* based water distribution trunk line named *Lakhtar-Dwarika* trunk line(NC-21).

2.2 Data Collection of Kuchhadi Village
Primary data were collected from *Kuchhadi* village such population data, existing infrastructure facilities.

Secondary data were collected from Gujarat Water Supply and Sewerage Board such as *Sorthi Dam* and *Mahi-Narmada based Barda* regional water supply Scheme and Porbandar Group Phase-II map and manual.

Topographical map of *Porbandar Taluka* and 3 decades population data of village were collected from *Taluka Panchayat office, Porbandar.*

Hydrological data: Average rainfall of *Porbandar* district is 750mm.

Geological data: The village *Kuchhadi* is situated on sea bank hence, The rock in this area is affected by sea water and format *bhatt* type of rock, The Village has relatively flat Topography. Water quality data: The Available water is of good quality, The source of water is *Sorthi Dam* and *Mahi-Narmada based Barda* regional water supply Scheme(27 villages) and Porbandar Group Phase-II.(27 Old +20 New= 47 villages.)

Data on existing water supply: presently, people of village getting water from 2 wells and 6 hand pumps at various places.

Public survey: Opinion poll regarding need of village people has been carried out.

2.3 Existing water supply facilities are listed below:
Source of RWSS: *Sorthi Dam* + Mahi Narmada trunk line.

Local Sources: Well – 2,

Hand Pump– 6.

RCC U/G Sump: 250000 lit capacity.

RCC ESR: 130000 lit capacity with 12m height.

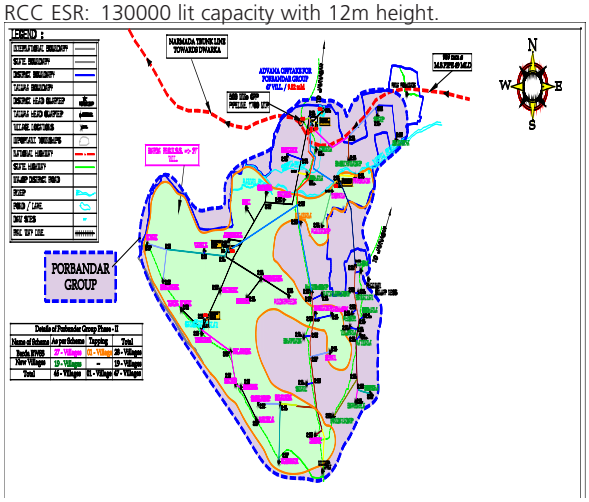

Fig 1 – PORBANDAR DISTRICT MAP

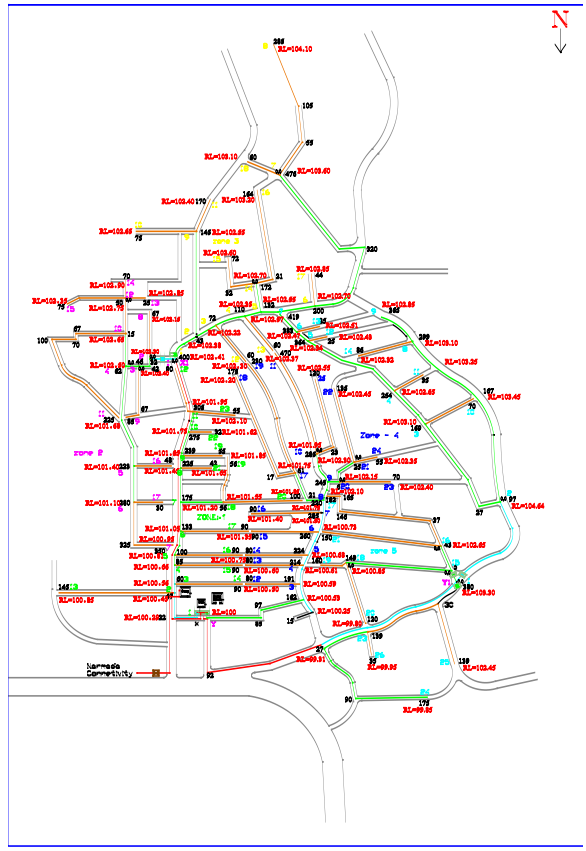

Fig 2 - Kuchhdi Village Map with Node No., Pipe No., Length and Elevation

3.0 POPULATION OF VILLAGES
On the basis of population of last 3 decades (1991,2001,2011) the calculated forecast population of 2013, 2028 and 2043 of KUCHHDI village was 4708, 6221, and 8171.

4.0 DESIGN COMPARISON
The proposed was of PVC pipe Design the distribution network in Loop software and also a manually and For manual calculation Hazen William's formula was used:

$$\text{HEAD LOSS } h = \frac{(10.68 \times L \times Q1.852)}{(C1.852 \times D4.87)}$$

Where,

h = Head loss in m

L = Length of Pipe in m

Q = Flow in m3/s

C = Friction Coefficient (Taken C=140)

D = Diameter of Pipe in m

5.0 RESULT AND DISCUSSION
A node number and pipe number marking of Kuchhadi village is represented in Fig 2.The presented results are based on the Loop software and manually. It is also based on forecast population of 2001, 2011 & 2014. The comparison of result of Loop and manually is same.

The result of water distribution network by Loop software and manually is same for ZONE 1 of village is represented in table.

We can calculate & give result of water distribution network by Loop software and manually for all zone of village will be same as we have done for ZONE 1.The Population of ZONE 1 of Village is 1273. The cost of distribution line of Zone – 1 for Kuchhadi village is Rs.1,02,120.00. This cost is given by the software.

Loop software saves the time and power and also more beneficial and calculates the least cost of water distribution network. The Loop software calculation is more accurate than manual calculation.

Pipe No.	NODE		LENGTH	RL		POPULATION	LPCD	LPS
	Node-1	Node-2		Node-1	Node-2			
1	1	2	47	100.00	100.45	0	0	0.000
2	2	3	13	100.45	100.56	20	1400	0.016
3	3	4	25	100.56	100.66	30	2100	0.024
4	4	5	15	100.66	100.81	25	1750	0.020
5	5	6	33	100.81	101.05	35	2450	0.028
6	6	7	42	101.05	101.2	45	3150	0.036
7	7	8	50	101.2	101.45	60	4200	0.049
8	8	9	14	101.45	101.65	20	1400	0.016
9	9	10	36	101.65	101.75	45	3150	0.036
10	10	11	30	101.75	101.95	35	2450	0.028
11	11	12	90	101.95	102.41	90	6300	0.073
12	2	13	145	100.45	100.85	130	9100	0.105
13	3	14	90	100.56	100.50	92	6440	0.075
14	4	15	90	100.66	100.60	92	6440	0.075
15	5	16	90	100.81	100.75	92	6440	0.075
16	6	17	90	101.05	101.35	92	6440	0.075
17	7	18	56	101.2	101.55	60	4200	0.049
18	18	19	56	101.55	101.85	60	4200	0.049
19	9	19	55	101.65	101.85	60	4200	0.049
20	18	20	44	101.55	101.85	50	3500	0.041
21	8	21	42	101.45	101.65	45	3150	0.036
22	10	22	32	101.75	101.62	35	2450	0.028
23	11	23	55	101.95	102.10	60	4200	0.049
			1240			1273		

Table 5.1 Pipe & Node Details for Zone – 1

Result Comparison of Water Distribution of Kuchhadi village by Software and Manual

Table 5.2 Manual result

Pipe	Node		Dia.	HL
No.	From	To	(mm)	(m)
1	1	2	110	0.05
2	2	3	110	0.01
3	3	4	110	0.02
4	4	5	110	0.01
5	5	6	110	0.01
6	6	7	90	0.03
7	7	8	75	0.04
8	8	9	75	0.01
9	9	10	75	0.02
10	10	11	63	0.02
11	11	12	50	0.04
12	2	13	50	0.12
13	3	14	50	0.04
14	4	15	50	0.04
15	5	16	50	0.04
16	6	17	50	0.04
17	7	18	63	0.03
18	18	19	50	0.02
19	18	20	50	0.01
20	8	21	50	0
21	9	19	50	0
22	10	22	50	0
23	11	23	50	0.01

Table 5.3 Software result

Pipe	Node		Flow	Length	Dia.	HL
No.	From	To	(LPS)	(m)	(mm)	(m)
1	1	2	3.094	47	110	0.09
2	2	3	2.730	13	110	0.02
3	3	4	2.433	25	110	0.03
4	4	5	2.149	15	110	0.01
5	5	6	1.840	33	90	0.06
6	6	7	1.507	42	90	0.06
7	7	8	0.948	50	75	0.07
8	8	9	0.790	14	75	0.01
9	9	10	0.535	33	63	0.04
10	10	11	0.365	30	50	0.05
11	11	12	0.219	42	50	0.03
12	2	13	0.316	145	50	0.19
13	3	14	0.224	90	50	0.06
14	4	15	0.224	90	50	0.06
15	5	16	0.224	90	50	0.06
16	6	17	0.224	90	50	0.06
17	7	18	0.413	56	50	0.12
18	18	19	0.146	56	50	0.02
19	18	20	0.146	55	50	0.02
20	8	21	0.122	44	50	0.01
21	9	19	0.146	42	50	0.01
22	10	22	0.085	32	50	0
23	11	23	0.109	55	50	0.02

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