

## Design of Distribution Network for Water Supply Scheme at Pindkepar Village by Branch Software

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### Abstract

In the present study Pindkepar village's Water Distribution Network (WDN) is designed which is located at district Gondia, State Maharashtra, India. For the design of Pindkepar village water distribution network, study of present population, population forecast for the three decades, daily water demand, flow characteristics and also survey of the village is done. with the help of digital global positioning system. From the survey, a road map is created and also contours, lengths, & elevations are determined. The flow is calculated with the help of elevation, length & other data. The node no. and pipe no. are done on the road map of Pindkepar village. Water Distribution Network for the villages is analyzed & designed with the help of branch software.

**Keywords:** Branch, water distribution network, flow, daily demand, population forecast etc.

### I. INTRODUCTION

**1.1 Water Distribution Network:** Water distribution network consists of a system of pipes or links through which the water flows, connected together at nodes which may be at different elevation. 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.

**1.2 Branch Software:** In Branch software, Branch is used to design pressurized, branched (tree-type, non-looped) water distribution networks by choosing from among a set of candidate diameters for each pipeline so that the total cost of the network is minimized subject to meeting certain design constraints. The network is characterized by links connected by nodes, which are points of flow input, outflow or pipe junctions. Version 3.0 of the software can handle up to 125 pipes. BRANCH formulates the linear programming model for the least cost design, solves the model and outputs the design as well as corresponding hydraulic information. Data required include description of network elements such as pipe lengths, friction coefficients, nodal demands and ground elevations, data describing the geometry of the network, the candidate diameters and their unit costs, and system constraints (minimum pressures, minimum and maximum gradients). Outputs include optimal lengths and diameters of pipes in each link, total network costs and hydraulic information.

### II. GENERAL WORK INFORMATION ABOUT PINDKEPAR VILLAGE

**2.1 Pindkepar Village:** Village Pindkepar is situated in Gondia Taluka of Gondia District. Maharashtra. It is

situated on Mumbai Howrah Broad gauge Railway Line. The population as per 2001 census of village is 4280 Souls.

**2.2 Existing Water Supply Arrangement & Necessity of the project:** A water supply scheme designed for population of 2500 souls for design year 2031 is there in the village. There is one supply well of 5 m dia and 10m deep with a switch room of 3m x 3m x 3m size 6HP Submersible pump sets having 13500 LPH discharge and 59m head is installed on the supply well. A PVC 110mm 6kg/sqcm rising main of length 5450m is laid from supply well to existing ESR of capacity 80000 liters and a distribution system of PVC 110mm to 75mm dia length 1385m is laid in the village. This water supply scheme is catering the need of only one third of total village population which is not at all sufficient. Secondly the yield of existing supply well is not sufficient especially in summer season. As the development is very fast and hence a new water supply scheme is urgently needed.

**2.3 Proposed Water Supply Scheme:** Water in Supply well at left bank of Pangoli river is proposed to be pumped by means of 10.0 HP (duplicate set) submersible pump having discharging capacity of 21950 LPH against 63m head, through 150mm to 100mm dia DI K - 9 pipeline 9000m in length to 100000 liters capacity RCC ESR St. Ht. 12.0 m The water will be supplied from ESR through network of distribution system & stand posts. Diameter, class, & length of pipes for distribution are found to be 140mm PVC 4 Kg 834 M, 110mm PVC 4 Kg 1390 M, 90mm PVC 4 Kg 630 M, and 75mm PVC 4 Kg 5581 M respectively.

**2.3.1 Source of scheme:** Supply well is proposed on left bank of Pangoli River

**2.3.2 Head Works - R.C.C. Supply well with Pump house:** It is proposed to 5.0 m dia 15.0 m deep RCC supply well with an overhead Pump house of size 3.00 x 3.00 x 3.00 m The G.L for supply well is 98.085 m.

**2.3.3 Pumping Machinery for lifting water:** A duplicate set of 10 HP Submersible pumps are proposed having discharge capacity of 21950 Lph against 63.0 m head with 100% standby. Hours of pumping are 16 Hrs in ultimate stage.

**2.3.4 Pure Water Rising Main:** A pure water rising main of 150 to 100 mm D.I K-9 pipe of 9000m length is proposed to be laid laid to carry the discharge of 0.351 MLD.

**2.3.5 Elevated Service Reservoirs:** An RCC. ESR of Capacity 100000 Liters having F.S.L. of 121.89 m, L.S.L of 117.19 m and Average G.L. of 105.19 m with safe bearing capacity of 10 Ton/sqm of 12 m staging height is proposed to be used.

**2.3.6 Distribution Network:** The network of distribution system is proposed for Pindkepar village from E.S.Rs to all the tail ends to facilitate proper water supply till ultimate stage by considering 3 volume flows. Diameter, class, & length of all the newly proposed lines for distribution are found to be 140mm PVC 4 Kg 834 M, 110mm PVC 4 Kg 1390 M, 90mm PVC 4 Kg 630 M, and 75mm PVC 4 Kg 5581 M respectively.

- 1] Collection of the population of last 6 decades of Pindkepar village.
- 2] Collection of the existing work data of head work, ESR and raw water pipeline.
- 3] Road map of Pindkepar villages.
- 4] Data of previous existing water pipeline.
- 5] Existing location of ESR.
- 6] Capacity of existing ESR.

**3.2 Population forecast:** On the basis of population of last 6 decades the calculated forecast population of 2012, 2020, and 2028 of Pindkepar village is found to be 5542, 6737 and 8196 souls respectively.

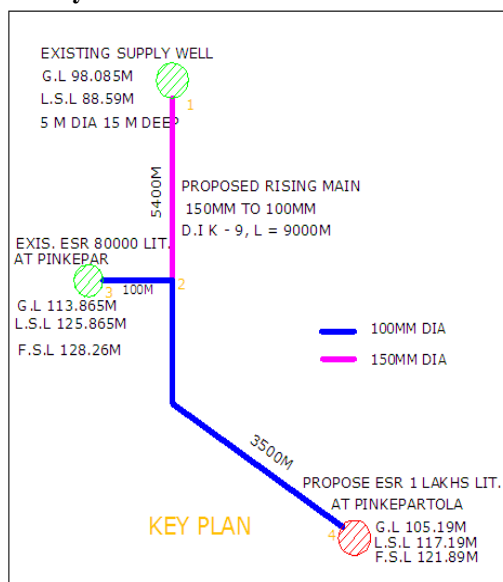
**3.3 Daily Water Demand:** The rate of water supply of 40 lpcd is taken. The daily & gross requirement of water in MLD for period of 2012, 2020 & 2028 is found to be 0.222, 0.269, 0.328 and 0.261, 0.316, 0.386 MLD respectively.

**3.4 Distribution System:** The network of distribution system is proposed for Pindkepar village from E.S.Rs to all the tail ends to facilitate proper water supply till ultimate stage by considering 3 volume flows. For designing the distribution network the entire village is divided into two zones viz Zone I & Zone II considering the location & position of existing and proposed ESRs. Diameter, class, & length of all the newly proposed lines for distribution by using BRANCH software are found to be 140mm PVC 4 Kg 834 M, 110mm PVC 4 Kg 1390 M, 90mm PVC 4 Kg 630 M, and 75mm PVC 4 Kg 5581 M respectively. The software had made use of Hazen William's formula for the calculation purposes.

### III. MATERIALS AND METHODS

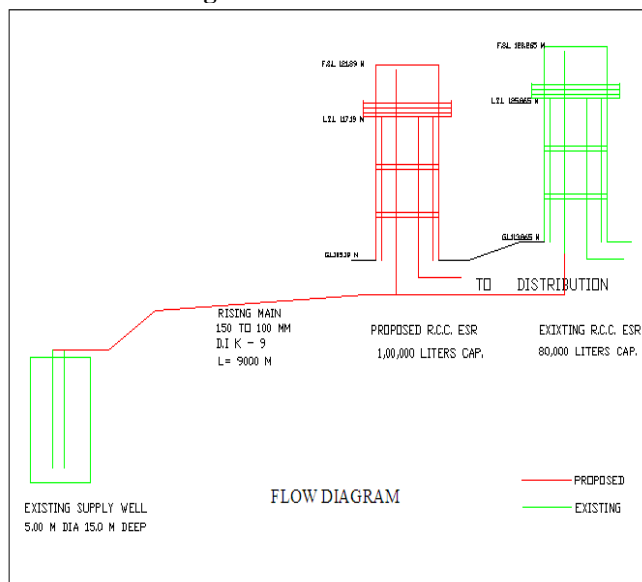
**3.1 Data collection:** For design a water distribution network of Pindkepar village, the following data were obtained from MJP (Maharashtra Jeevan Pradhikaran).

#### 4.1 Key Plan:

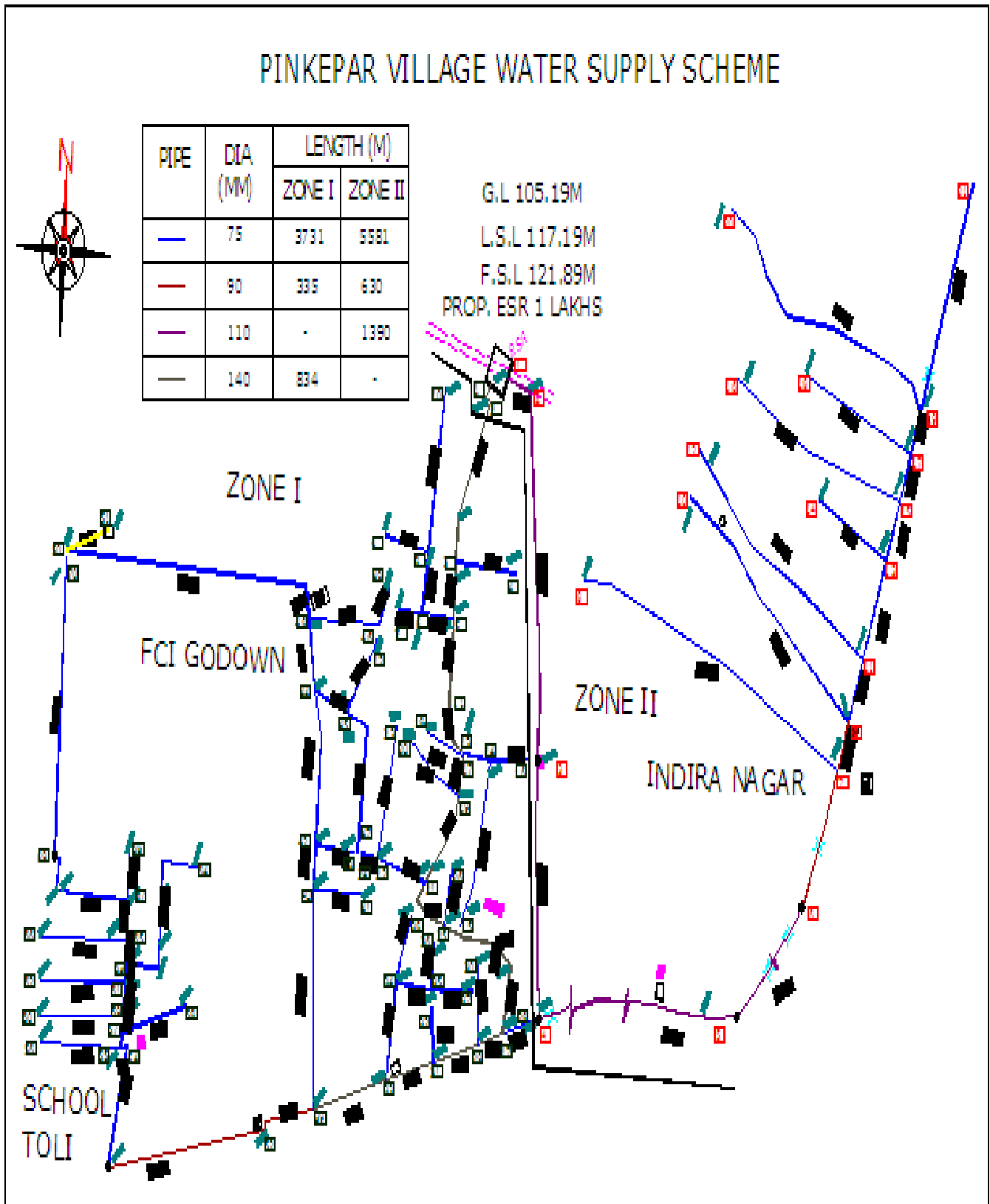


### IV. BRIEF DETAILS OF THE SCHEME THROUGH DRAWINGS

#### 4.2 Flow Diagram:



4.3. Distribution Network Drawing of Zone I & Zone II:



**V. RESULT AND DISCUSSION:**

A node number and pipe number marking of Pindkepar villages is represented in Fig 4.3. The

presented results are based on the Branch software. It is also based on forecast population of 2012, 2020 and 2028. The optimal cost is also given by the software.

Branch software saves the time and manpower. It also calculates the least cost of water distribution network

TABLE 5.1: RESULTS OF WATER DISTRIBUTION NETWORK OF PINDKEPARVILLAGE BY BRANCH SOFTWARE

ZONE I							ZONE II						
Pipe No.	From Node	To Node	L (m)	Dia (mm)	Flow (lps)	HGL (m)	Pipe No.	From Node	To Node	L (m)	Dia (mm)	Flow (lps)	HGL (m)
1	1	2	30	133	.048	117.10	1	1	2	50	104	.069	121.01
2	2	3	114	133	.189	116.10	2	2	3	241	104	.331	120.15
3	3	4	75	71	.123	116.77	3	3	4	169	104	.231	119.62
4	3	5	36	133	.06	116.77	4	4	5	360	104	.495	118.60
5	5	6	37	71	.069	116.67	5	5	6	570	104	.783	117.32
6	6	7	42	71	.066	116.66	6	6	7	295	85	.405	116.18
7	6	8	40	71	.084	116.66	7	7	8	330	71	.453	116.08
8	8	9	50	71	.183	116.66	8	7	9	70	71	.097	115.83
9	8	10	110	71	.093	116.66	9	9	10	240	71	.33	115.79
10	5	11	56	133	.141	116.65	10	9	11	44	71	.06	115.69
11	11	12	86	71	.060	116.54	11	11	12	240	71	.33	115.65
12	11	13	37	133	.090	116.54	12	11	13	72	71	.099	115.54
13	13	14	54	71	.228	116.46	13	13	14	90	71	.124	115.54
14	14	15	138	71	.090	116.45	14	13	15	41	71	.056	115.49
15	14	16	54	71	.012	116.43	15	15	16	210	71	.289	115.46
16	13	17	7	133	.129	116.44	16	15	17	33	71	.045	115.47
17	17	18	77	71	.048	116.44	17	17	18	130	71	.178	115.46
18	17	19	30	133	.117	116.44	18	17	19	30	71	.041	115.46
19	19	20	70	71	.132	116.39	19	19	20	270	71	.371	115.40
20	19	21	80	133	.096	116.39	20	19	21	50	71	.069	115.46
21	21	22	59	71	.147	116.24							
22	22	23	90	71	.039	116.24							
23	22	24	24	71	.063	116.23							
24	21	25	38	133	.075	116.24							
25	25	26	45	71	.291	116.18							
26	25	27	176	133	.072	116.18							
27	27	28	44	71	.048	115.91							
28	27	29	30	133	.084	115.91							
29	29	30	50	71	.090	115.87							
30	29	31	54	133	.078	115.87							
31	31	32	48	71	.096	115.80							
32	31	33	59	133	.111	115.80							
33	33	34	67	71	.069	115.73							
34	33	35	42	71	.078	115.71							
35	34	36	48	71	.153	115.70							
36	35	37	92	71	.099	115.70							
37	34	38	60	71	.144	115.70							
38	33	39	87	133	.237	115.71							
39	39	40	144	71	.099	115.65							
40	40	41	60	71	.045	115.14							
41	40	42	28	71	.084	115.14							
42	42	43	50	71	.168	115.08							
43	44	44	102	71	.168	115.08							
44	45	45	65	71	.078	115.88							
45	45	46	48	71	.141	114.86							
46	44	47	85	71	.078	114.86							
47	48	48	48	71	.183	114.86							
48	48	49	110	71	.433	114.84							
49	50	50	260	71	.084	114.83							
50	39	51	51	71	.114	114.74							
51	52	52	65	85	.444	114.74							

52	53	53	270	85	.153	114.44
53	54	54	93	71	.012	114.66
54	55	55	7	71	.165	114.20
55	55	56	100	71	.160	114.17
56	55	57	11	71	.018	114.17
57	57	58	80	71	.132	114.13
58	57	59	12	71	.021	114.13
59	59	60	100	71	.165	114.10
60	59	61	23	71	.039	114.09
61	61	62	100	71	.165	114.04
62	61	63	9	71	.147	114.04
63	63	64	150	71	.249	114.02
64	63	65	16	71	.027	114.01
65	65	66	100	71	.165	114.01
66	65	67	28	71	.045	114.01
67	67	68	30	71	.048	114.00
68	67	69	115	71	.189	113.92
69	69	70	204	71	.339	113.92

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