WATER SUPPLY DISTRIBUTION SYSTEM BY USING WATERGEMS SOFTWARE AT SAIGAON VILLAGE

Mr. Prashant Machhindra Darunte [1], Prof. Shankar C. Wadne [2], Dr. P.A. Hangargekar [3]

[1]PG Student ME (Water Resource Engineering),
[2] Assistant Professor,
[3] Associate Professor and Head.
[1,2,3](Department of Civil Engineering, Shree Tuljabhavani college of engineering Tuljapur Dist Osmanabad, Maharashtra, India.)

---***---

Abstract – *Now a day water distribution supply pipe network very essential in population growing city also large villages because need of water distribution system provide good quality of water that can be minimize health problem of peoples. Then We Choose rural area in Nashik District that is Growing In population In that Village is Very Important To design Water distribution network of Saigaon Village situated in Yeola Taluka Place is designed which is located at district of Nashik, State Maharashtra, India. For the design of water distribution network For Saigaon Village, Water distribution network for the villages is analyzed and designed with help of Bentleys WATERGEMS software.*

We will use a scaled background drawing to assist in drawing the pipe network, As We draw a schematic of a pipe network, you will enter pipe lengths, while the software

Automatically assigns labels to each pipe and node. If building a scaled model of a pipe network, as you draw elements, the software will automatically manage pipe lengths based on position of pipes bends, start nodes, and stop nodes, and allow customized labeling formats.

After design the water Distribution Network We also Getting idea What Cost Should required for water distribution network so it also tentative cost also calculated.

Key Words: *WATERGEMS software1, Water distribution network2*, **Google map3, counter map4, Data collection5, Data analysis6, Adopted Methodology7.**

1. INTRODUCTION

shutterstock.com · 2185524879

Image No.01

Above Image Also showing Typical water distribution Network of water supply distribution system.

Firstly We Have to do Preliminary Survey of Village. That mean of collecting information of village that we help us for design of water distribution supply system after we taking preliminary survey also we get match government scheme that is jal jeevan mission that scheme to provide pure water to city also population growing cities and villages but previous that we collaecting information the village also main source from Palkhed dam situated in Niphad taluka in Nashik district also previous scheme that means 38 Village water supply network. That is main source of water proving to Saigaon Village that is very important to conspiring factor also w e collect information of 38 village water supply network the 38-village regional water supply scheme currently draws water from Palkhed Dam, but the new scheme is expected to draw water from Nandumadhmeshwar Dam. Pre-feasibility report for the project was presented by the Maharashtra Jeevan Pradhikaran in the month of September 2017. The above information we get basic idea of Village and also getting Idea of previous water supply network drawback that can be remove for future improvement & each houses get pure water. Also we getting Idea below map shows the location of Maharashtra state Nashik district and particular taluka region where situated study Village.
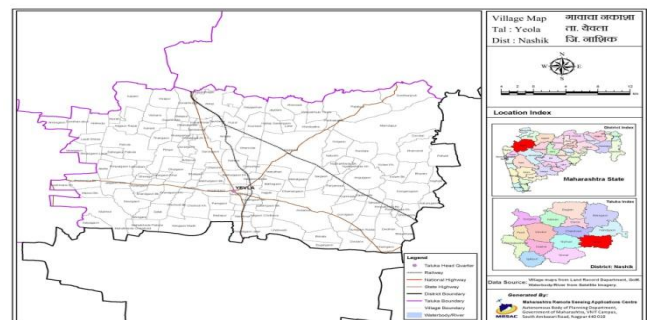

Image No.2 Key map Of Yeola Region (Source Gov. website)

Below show that census population of village for getting accurate result.

Saigaon Local Language is Marathi. Saigaon Village Total population is 3117 and number of houses are 721. Female Population is 49.85%. Village literacy rate is 72.18% and the Female Literacy rate is 32.72%. as per 2011 census data getting from government record.

Village Location:

Taluka Name:	Yeola
District	Nashik
State	Maharashtra
Region	Northern Maharashtra
Language	Marathi
Time zone	IST (UTC+5:30)
Elevation/Altitude	577.6 meters. Above msl
Telephone Code	02559
Pin Code	423402
Post Office Name	Andarsul

Image no.03 Google Earth Image Of Saigaon Village

1.1 Need of Water supply distribution System In Rural Areas.

Image N0.4 Source Of Water Supply

Image N0.5 Source Of Water Supply

Image N0.6 Source Of Water Supply

Human life, as with all animal and plant life on the planet, is dependent upon water. Not only do we need water to grow our food, generate our power and run our industries, but we need it as a basic part of our daily lives - our bodies need to ingest water every day to continue functioning. "Basic needs of about 70litres per person per day". It includes the need for water to maintain a basic standard of personal and domestic hygiene sufficient to maintain health. The effects of inadequate water supply causes disease, time and energy expended in daily collection, high unit costs, etc. provision of basic daily water needs is yet to be regarded by many countries as a human right.

1.2 Scope of the Work: 1) Preparation of water pipe network in Bentley Water GEMS from GIS files. 2) Preparation of hydraulic model and extended period simulation of the same. 3) Load elevations to the hydraulic model from the 3D contour data

1.3 Aims and Objectives Of Project

- To find out water demand calculation of Saigaon village in Yeola city.
- Analysis and Design of Water Distribution Network for Steady State condition.
- To find out Optimum Diameter for the Water Distribution Network.

2 Methods and Material

2.1 For design a water distribution network of Saigaon village.

Following data Required

1. Collection of the population From 1991 to 2011 of Saigaon village.

2. Collection of the existing work data of head work, ESR and raw water pipeline.

3. Road map of Saigaon villages.

4. Data of existing water pipeline.

5. location of Existing Village .

2.2 Software used:

1) Watergems

2) AutoCAD 2014

3) GPS visulizer

4) GOOGLE Earth pro

2.3 Population Forecasting

2.3.1 Arithmetical Increase Method: Rate of change of population with time is assumed to be constant. Applicable to old and large cities with no industrial growth and reached a saturation or maximum development. This method yields lower result for rapidly growing cities.

$Pn = (P_\circ + n.x)$ Where

$p_\circ$ = Latest known population;

Pn = prospective population after „n „decades.

X = Average increases in population per decade.

Year	Population
1991	560 person
2001	1500 person
2011	3117 person (census data from gov website)
2021	6951
2031	13341
2041	22926

Table shows population using arithmetic increase methods

2.4 Adopted Methodology

- Data Collection

- Data analysis

- Modeling Using Software

- Comparison

- Final Results

2.4.1 Data Collection:

Collection of data like select area, population, water demand, source of water, etc. and calculate the reduce level of this area by Google earth.

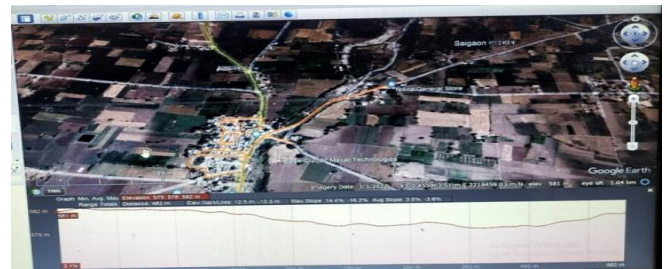Image no.7　Selected area For Project work

Image no. 8 Profile Of Elevation Through Google Earth Pro

2.3.1.1 Longitude, Latitude and altitude Data Prepared For Watergems Software Input.
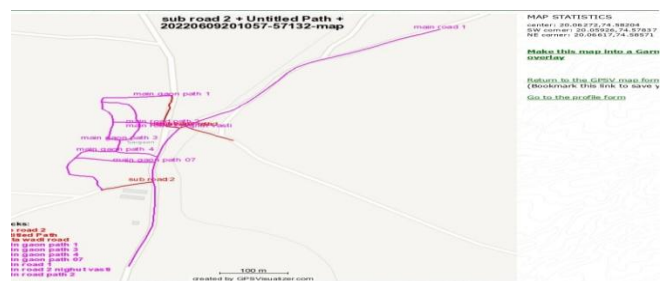

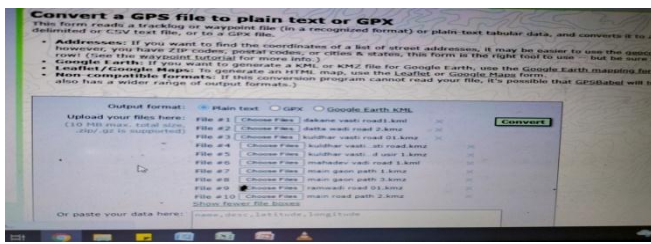Image no. 9 Google Earth Pro Water Distribution Network

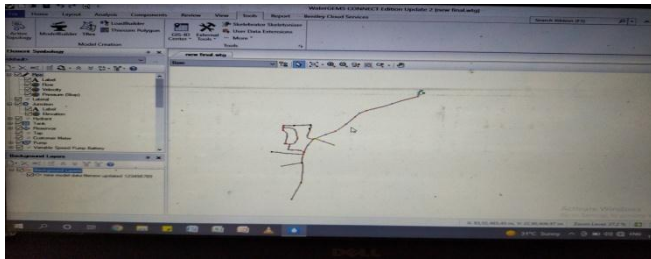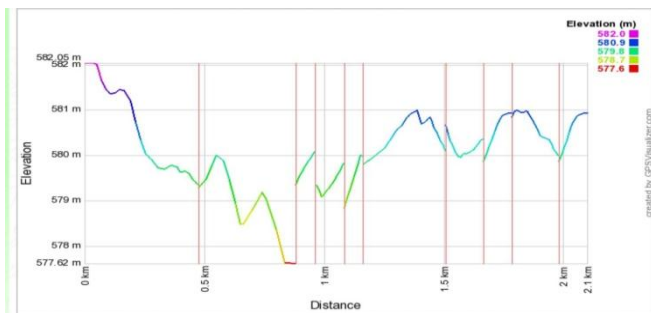Image no. 10 converting GPS file to plain text file

Image no. 11 modeling In watergems software Water Distribution Network
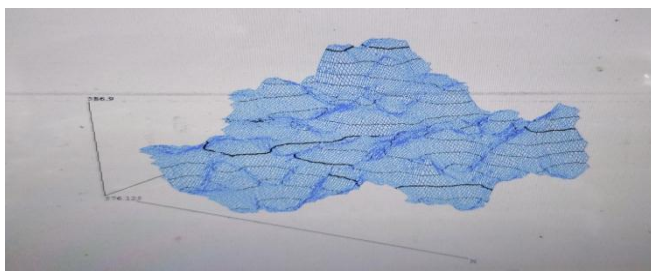

Graph No 1. Showing Distance Vs Elevation

Image No. 12- 3D Counter Map Of Saigaon Village
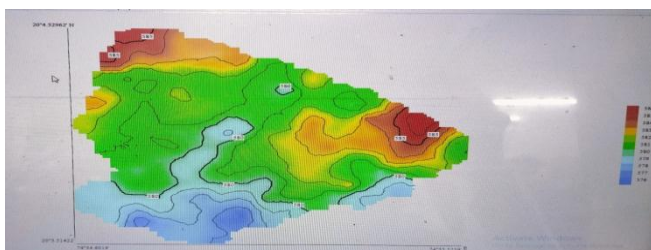
Image No.13-2D Counter Map Of Saigaon Village

2.3.1.2 Input Data Required For Watergems Software:

Below table getting from Google earth map kml file converted GPS File through GPS Visulizer Website then we get below table use in Watergems Software.

Sub road 2			
Sr.No.	Latitude	Longitude	Altitude
1	20.0618	74.5806	578.8
2	20.0618	74.5806	579.0
3	20.0617	74.5806	579.2
4	20.0617	74.5800	579.5
5	20.0616	74.5800	579.9
6	20.0616	74.5799	580.0
7	20.0616	74.5799	580.0

Table -1: Latitude, Longitude, Elevation

Sr.No.	Latitude	Longitude(M)	Altitude
1	20.0632	74.5810	579.3
2	20.0632	74.5810	579.3
3	20.0632	74.5809	579.2
4	20.0632	74.5808	579.1
5	20.0633	74.5807	579.1
6	20.0633	74.5807	579.1
7	20.0634	74.5807	579.2
8	20.0634	74.5808	579.3
9	20.0636	74.5808	579.4
10	20.0637	74.5808	579.5
11	20.0638	74.5808	579.6
12	20.0639	74.5808	579.7
13	20.0640	74.5808	579.8
14	20.0640	74.5808	579.8

Table -2: Latitude, Longitude, Elevation

Main Gaon Path			
Sr.No.	Latitude	Longitude(M)	Altitude
1	20.06405	74.58089	579.8
2	20.06406	74.5809	579.8
3	20.06403	74.58051	580
4	20.064	74.58019	580.1

5	20.06401	74.58005	580.2
6	20.06401	74.57993	580.2
7	20.06394	74.57991	580.3
8	20.06381	74.57992	580.4
9	20.06372	74.57992	580.5
10	20.06362	74.58002	580.6
11	20.06354	74.58006	580.7
12	20.06341	74.58007	580.8
13	20.06331	74.58007	580.8
14	20.06318	74.58004	580.9
15	20.0631	74.58003	580.9
16	20.06303	74.58002	581
17	20.06297	74.57999	581
18	20.06295	74.57999	581
19	20.06293	74.58006	580.9
20	20.06292	74.58017	580.7
21	20.06284	74.58016	580.7
22	20.06276	74.58014	580.8
23	20.06267	74.58013	580.8
24	20.06261	74.58011	580.8
25	20.06259	74.58017	580.8
26	20.06258	74.58028	580.6
27	20.06257	74.58039	580.5
28	20.06257	74.5805	580.4
29	20.06255	74.58056	580.3
30	20.06251	74.58063	580.2
31	20.06248	74.58068	580.1
32	20.06247	74.58069	580.1

Table -3: Latitude, Longitude, Elevation

datta wadi road			
Sr.No.	Latitude	Longitude	Altitude (M)
1	20.0632	74.581	579.4
2	20.0631	74.5811	579.5
3	20.0631	74.5813	579.7
4	20.063	74.5814	579.8
5	20.063	74.5815	579.9
6	20.0629	74.5816	580

7	20.0628	74.5817	580.1

Table -4: Latitude, Longitude, Elevation

Main Gaon Path 3			
Sr.N.	Latitude	Longitude	Altitude (M)
1	20.06292	74.58017	580.7
2	20.06293	74.58029	580.5
3	20.06299	74.58034	580.3
4	20.06308	74.58037	580.2
5	20.06316	74.58041	580.1
6	20.06323	74.58043	580
7	20.06329	74.58044	580
8	20.06336	74.58043	580
9	20.06342	74.58041	580
10	20.06348	74.58039	580
11	20.06355	74.58039	580
12	20.06367	74.58037	580.1
13	20.06377	74.58033	580.1
14	20.06383	74.58029	580.1
15	20.06385	74.58021	580.2
16	20.06387	74.58013	580.2
17	20.06388	74.58001	580.3
18	20.06391	74.57991	580.4

Table -5: Latitude, Longitude, Elevation

Main Gaon Path 4			
Sr. No.	Latitude	Longitude	Altitude
1	20.06261	74.58011	580.8
2	20.06261	74.58002	581
3	20.06261	74.57992	581
4	20.06262	74.57982	581
5	20.06263	74.57972	580.9
6	20.0626	74.57963	580.9
7	20.06255	74.57959	581
8	20.06247	74.57955	581
9	20.06241	74.57951	580.9
10	20.06236	74.57948	580.8
11	20.06229	74.57945	580.7
12	20.0622	74.57943	580.6

13	20.0621	74.57945	580.5
14	20.06203	74.57946	580.4
15	20.06201	74.5795	580.4
16	20.06198	74.57962	580.4
17	20.06197	74.57974	580.4
18	20.06195	74.5798	580.3
19	20.06187	74.57985	580.2
20	20.06178	74.57985	580.1
21	20.06174	74.57986	580.1
22	20.06166	74.57991	580
23	20.06162	74.57991	580

Table -6: Latitude, Longitude, Elevation

Main Gaon Path 7			
Sr.No	Latitude	Longitude	Altitude(M)
1	20.06234	74.58066	579.9
2	20.06234	74.58053	580
3	20.06235	74.58043	580.2
4	20.06234	74.58033	580.3
5	20.06237	74.58021	580.5
6	20.06236	74.5801	580.7
7	20.0624	74.57992	580.9
8	20.06243	74.57977	580.9
9	20.06245	74.57965	580.9
10	20.06245	74.57954	580.9

Table -7: Latitude, Longitude, Elevation

Main road 1			
Sr.N.	Latitude	Longitude	Altitude
1	20.06578	74.58464	582
2	20.06564	74.58434	582
3	20.06556	74.58417	582
4	20.06549	74.58401	581.7
5	20.0654	74.58385	581.5
6	20.06532	74.58371	581.4
7	20.06524	74.58356	581.4
8	20.06517	74.58342	581.4
9	20.06509	74.58323	581.4
10	20.065	74.583	581.2
11	20.06491	74.58281	580.7

12	20.0648	74.58264	580.3
13	20.06465	74.58251	580
14	20.06446	74.58238	579.9
15	20.06426	74.58224	579.7
16	20.06407	74.5821	579.7
17	20.06388	74.58194	579.8
18	20.06369	74.58175	579.7
19	20.06365	74.58167	579.6
20	20.06361	74.5816	579.6
21	20.06355	74.58151	579.6
22	20.06346	74.58135	579.6
23	20.06336	74.58121	579.5
24	20.06326	74.58107	579.3

Table -8: Latitude, Longitude, Elevation

Main road 2 nighut vasti			
Sr.N.	Latitude	Longitude	Altitude
1	20.06323	74.581	579.3
2	20.06295	74.58085	579.5
3	20.06277	74.58077	579.8
4	20.06261	74.58073	580
5	20.06234	74.58066	579.9
6	20.06213	74.58063	579.5
7	20.06188	74.58062	579
8	20.0617	74.58066	578.5
9	20.06161	74.58066	578.5
10	20.06127	74.58066	578.8
11	20.06088	74.58063	579.2
12	20.06071	74.58063	579
13	20.06035	74.58052	578.4
14	20.06005	74.58042	577.6
15	20.05966	74.5803	577.6

Table -9: Latitude, Longitude, Elevation

Main road Path 2			
Sr.N.	Latitude	Longitude	Altitude
1	20.06333	74.58078	579.1
2	20.06333	74.58064	579.5
3	20.06336	74.58049	579.8

4	20.06336	74.58032	580.2
5	20.06337	74.58017	580.6
6	20.06338	74.58007	580.8

Table -10: Latitude, Longitude, Elevation

Total station Survey Sheet: After we get all Ground elevation Of Saigaon Village Then we easily put all the value in Watergems software For getting accurate results. above all ground elevation verified with taking actual total station survey below the final survey sheet.
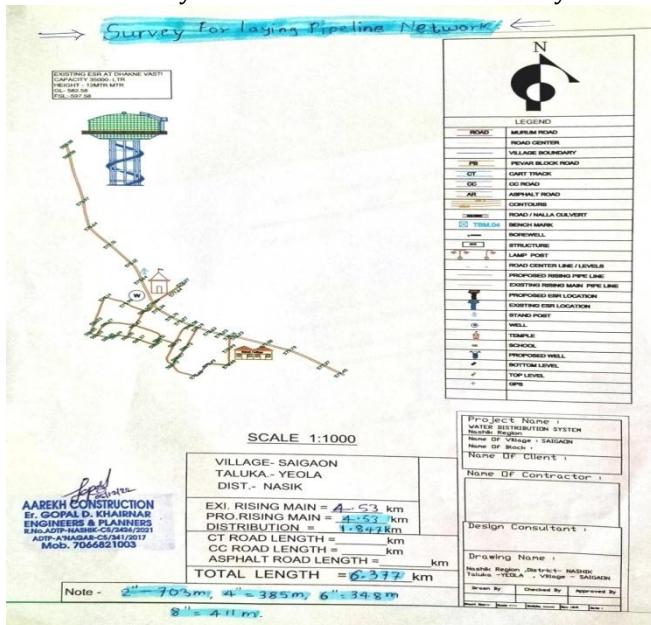
Total station survey work (Visit Date: June 24, 2022)

Results:

Above input data getting analysis by the watergems software then we get following results

FlexTable: Pipe Table
Current Time: 0.00 hours

Label	Start Node	Stop Node	Length (Scaled) (m)	Diameter (in)	Flow (L/s)	Velocity (m/s)
P-1	J-1	J-2	224	8.0	5.08	0.16
P-2	J-2	J-3	62	8.0	5.08	0.16
P-3	J-3	J-4	125	8.0	5.08	0.16
P-4	J-5	J-6	89	6.0	1.82	0.10
P-5	J-6	J-7	29	6.0	1.81	0.10
P-6	J-7	J-8	65	6.0	0.97	0.05
P-7	J-8	J-9	42	6.0	0.97	0.05
P-8	J-9	J-10	13	4.0	0.13	0.02
P-9	J-10	J-11	115	4.0	0.11	0.01
P-10	J-11	J-12	56	4.0	0.10	0.01
P-11	J-12	J-13	37	4.0	0.12	0.01
P-12	J-13	J-14	41	4.0	0.12	0.01
P-13	J-14	J-15	27	4.0	0.12	0.01
P-14	J-10	J-16	23	2.0	0.02	0.01
P-15	J-16	J-17	98	2.0	0.02	0.01
P-16	J-17	J-12	21	2.0	0.02	0.01
P-17	J-5	J-15	96	6.0	2.42	0.13
P-18	J-15	J-19	17	6.0	2.53	0.14
P-19	J-19	J-20	60	4.0	1.69	0.21
P-20	J-20	J-21	141	2.0	0.84	0.42
P-21	J-21	J-22	123	2.0	0.84	0.42
P-22	J-23	J-24	86	2.0	0.84	0.42
P-23	J-19	J-25	44	2.0	0.84	0.42
P-24	J-25	J-26	46	2.0	0.84	0.42
P-25	J-26	J-27	37	2.0	0.84	0.42
P-26	J-20	J-28	84	2.0	0.84	0.42
P-29	J-4	J-23	96	4.0	5.08	0.63
P-30	J-23	J-5	10	6.0	4.23	0.23
P-39	R-3	PMP-4	20	8.0	5.93	0.18
P-40	PMP-4	J-1	23	8.0	5.93	0.18

Above Table shows that pipe P-1 To P-40 Also Junction J-1 To J-28, length of pipe, diameter, Flow and Velocity in that particular junction and pipe.
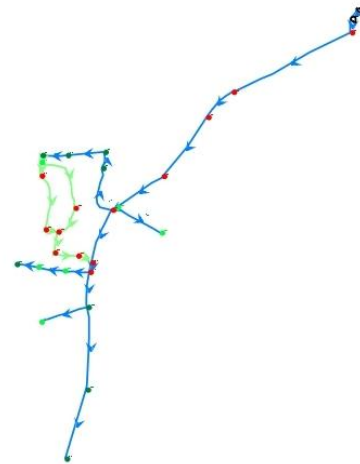
Final We Get Network Diagram Showing Below.

Diagram No.01-Water Distribution In Saigaon Area By Color Coding Diagram In Watergems Software.

Cost estimation of water distribution pipe line:

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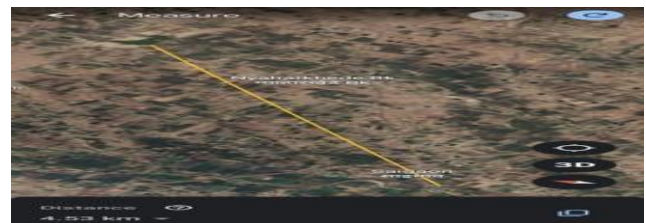

Fig No.14 shows that distance from tank to reservoir

Estimation cost for water distribution pipe:

Sr no.	MainPipe	Length(M)	Rs/M	Cost
1	Reservoir to tank	4530	266	1204980
Total Cost Of Main Pipe in Rs.				1204980/

Table showing cost of project

Estimation cost for water distribution pipe:

Sr no	Network Name	Length	Rate per meter	Cost(Rs)
1	Sub road 2	80 m		13105
2	Untitled path	121m		19602
3	Main gaon path	347m		52214
4	Datta Wadi Road	464m		75168
5	Main Gaon Path 3	162m	162rs/ meter	26244
6	Main Gaon path 4	198m		32076
7	Main gaon path 7	119m		19278
8	Main road 1	480m		77760
9	Mainroad2nighutvast	412m		66744
10	Main road path 2	76m		12312
	Total cost of Branch pipe			394503/-
	Total cost of Main and Branch pipe			1599483/-

Table showing cost of project

Above Cost are approximately for getting idea the project suitability that help the grampanchayat.

Final Result				
Label	Elevation (M)	Demand (L/s)	Hydraulic Grade M	Pressure (psi)
J-1	582	0.93	1344.45	1082
J-2	581.7	0.02	1344.45	1083
J-3	581.5	0.02	1344.46	1083
J-4	581.2	0.05	1344.46	1083
J-5	581.2	0.02	1344.48	1083
J-6	579.3	0.02	1344.48	1086
J-7	579.1	0.87	1344.49	1086
J-8	579.8	0.02	1344.49	1085
J-9	580.3	0.87	1344.48	1085
J-10	580.5	0.02	1344.48	1084
J-11	580.6	0.02	1344.48	1084
J-12	580.8	0.02	1344.48	1084
J-13	580.9	0.01	1344.48	1084
J-14	581	0.02	1344.47	1084
J-15	581	0.02	1344.47	1084
J-16	580.2	0.02	1344.48	1085
J-17	580.3	0.02	1344.48	1085
J-19	580.4	0.02	1344.47	1085
J-20	580	0.02	1344.47	1085
J-21	579.9	0.02	1344.46	1085
J-22	579.5	0.85	1344.46	1086
J-23	579	0.01	1344.48	1087
J-24	578.5	0.85	1344.48	1087
J-25	578.5	0.01	1344.47	1087
J-26	578.8	0.01	1344.47	1087
J-27	579.2	0.85	1344.47	1086
J-28	579	0.85	1344.46	1087

Table shows Final Result

3. CONCLUSIONS:

We can conclude that water distribution network using watergems software for Saigaon Village, Very first we need elevation of ground that we getting from Google earth pro software after getting elevation and location of village we can find out contour map also latitude, longitude and elevation from KML File from getting Google earth pro software, all this file converter in as drawing in auto cad 2d. We get shape file this file are the main input data for watergems, this software very advance version of Water CAD.

We can conclude that we design pipe 2"-703 meters pipe, 4"-385 meters pipe 6"-348 meters pipe, 8"-411 meters pipe.

The approximate cost of project that is Total cost of Branch pipe -394503/- Rs and Total cost of Main and Branch pipe -1599483/- rupees only.

REFERENCES

[1] Dilip Babubhai Paneria, "Analyzing the existing water distribution system of Surat using Bentlys Watergems", International Journal Of Advance Research in Engineering, Science Management.

[2] Prof. A.G.Chaudhari, "Experimental investigation by WaterGEMS software for redesign of water distribution system of Bhavani Mata ESR", International Journal Of Advance Research in Engineering, Science Management.vol.no.6, issue no.03, march 2017.

[3] Shinde Parmanand Bhaskar, "Feasibility Analysis of Water Distribution System for Yavatmal City using Water Gems Software", International Journal Of

Innovative Research in Science, Engineering and Techomolgy.vol.6,issue7,july 2017.

[4] A.Gheisi, M.forsyth, "Water distribution systems reliability", International Journal Of Technical Research and Application.www.ijtra.com vol3,issue-5(sep-oct 2015), pp. 174-178.

[5] Mandar G. Joshi, Nitin P. Sonaje. "A review of modeling and application of water distribution network softwares".

[6] Sajedkhan S. Pathan, Dr. U.J.Kahalekar, "Optimal design of water distribution network by using WaterGEMS", IJPRET,2015;vol3(8):308-319.