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'ESURVEY HYDRAULICS' A TOOL FOR DESIGN OF WATER SUPPLY DISTRIBUTION NETWORK

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Abstract – *The ESurveying Softtech Bangalore have recently launched a software for design of water supply distribution network. The software is user friendly and the design outputs are comparable with watergems.*

Key Words: Water Supply Distribution network, Shape files,Thiessan polygon, ESurvey Hydraulics, autocad

1. INTRODUCTION

Water is one of the most basic amenities required for every living being. Apart from using the water for domestic needs, water resources have been the most widely exploited natural system since man occupied this earth. The other beneficial uses of water includes, for industries, generation of electric power, transportation, recreation and many other uses. Not only the use of water is increasing rapidly with the growth in population, but also there is an acute shortage of both surface and underground water due to many manmade activities. Thus, man himself is the root cause of many problems and the proper management of water usage, which assumes a great importance in this modern world.

The water distribution network plays important role in supplying the water to the consumers. The water distribution network can be designed using softwares like loop, watergems,epanet etc. Out of these the Watergems from Bentley is used widely.

Recently Esurveying softtech Bangalore have launched software for water distribution network, viz Esurvey hydraulics.

1.1 KEY FEATURES OF ESURVEY HYDRAULICS

Water Hydraulics is based on the EPA Net Engine.

The design output can be imported from EPANET and vice versa.

Innovative methods to give the inputs for Junctions, Links have been adopted, which includes attaching design and input parameters in bulk, which saves considerable time, while avoiding inputs as given on individual basis to Junctions and links.

Extended Time simulation tools are provided for better analysis of the flow and head during various periods.

All the curves and Patterns are packed in a single window to avoid accessing them from multiple locations. These include pump curves, Head Loss curves etc. and demand Pattern, Head Pattern etc. in Pump and Pattern sections respectively.

- Auto-update Ground surface elevations at the Node from TIN
- Demand loading is simplified to support calculations with population, peak factors, demand etc. and the same is integrated to hydraulics module.
- Editing of the data is eased with the provision of bulk editing tool.
- Overshoot and undershoot issues are eliminated with the validation tool.
- No limitation on the number of nodes or pipes in a project
- Diameter Optimizer is a unique and special tool provided to achieve the practical solution for the network to achieve telescopic approach. It also considers unit head loss along with velocity and pressure.

- Compatibility features to seamlessly integrate with other hydraulic modelling tools like Water gems, EPA Net etc.
- Generates comprehensive reports to Analyze and to finalize the optimal hydraulic model.
- Provision to specify Zone is an additional feature which can be used as District metered areas.
- Hydraulic entities like Pump, Valve can be used in modelling with proper settings

2. CONCEPT OF USING ESURVEY HYDRAULICS

There are many features common between ESurvey water hydraulics and watergems such that they become comparable. Also, water gems have more features which are sparingly used.

The author has studied comparative analysis between Watergems and ESurvey Hydraulics.

A typical DMA is considered for comparative analysis. The DMA consists of three wards and the population details are shown in Annexure 1.

1. **Population density of the DMA.**

The population, population density is shown in Annexure 1.

ANNEXURE 1.

POPULATION DETAILS

WARD NO	POPULATION	AREA_ SQKM	PD
1	4000	0.443	9029
2	4500	0.21	21429
3	1500	0.134	11194

The pattern loading is shown in Annexure 2.

ANNEXURE 2.

PATTERN LOADING

Time	Multiplier	Time	Multiplier	Time	Multiplier
1	0.2	9	2.5	17	0.5
2	0.2	10	2.2	18	1
3	0.2	11	0.8	19	2
4	0.2	12	0.7	20	3
5	0.8	13	0.5	21	0.2
6	2.5	14	0.5	22	0.2
7	2.5	15	0.2	23	0.2
8	2.5	16	0.2	24	0.2

Thus the typical network is designed using both the watergems and water hydraulics for comparative study. The results are the same as seen from the output/drawings/thiessan polygon generated. The design output is the same as the sample output shown in Table 1.

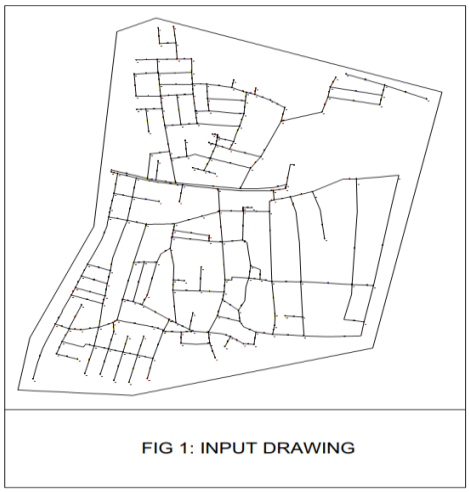


FIG 1: INPUT DRAWING

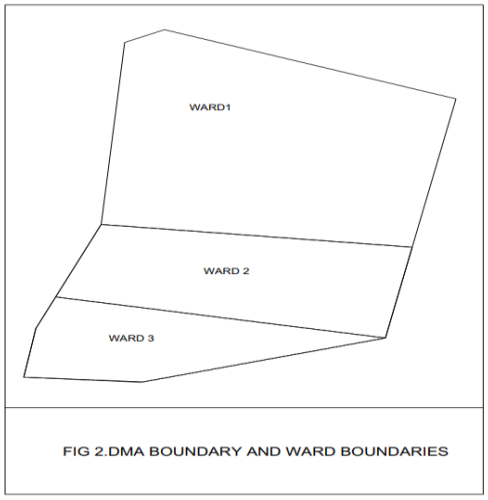
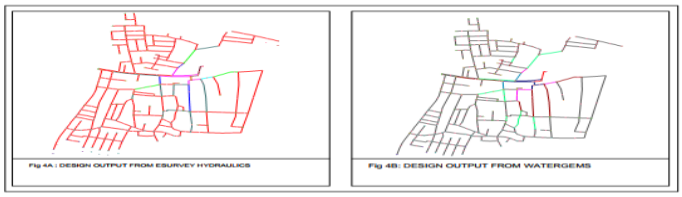


FIG 2.DMA BOUNDARY AND WARD BOUNDARIES



3. CONCLUSION:

- Ease of use and simple learning curve with a user-friendly interface
- Bulk data inputs, instead of handling each object individually to assign the properties
- Automatic tools to eliminate overshoot and undercut errors in the network drawings
- Water quality analysis made Simple
- Supports importing of networks and surfaces from cad packages
- Comprehensive reports, displaying many inputs and derivates
- Import and export from other hydraulic modeling software's viz EPANET

4. SUGGETIONS FOR IMPROVEMENT

- Further addition of modules like design of rising main / gravity main is required.
- The editing of drawing is to be improved in the software as in case of watergems.
- However all these features are made available in cad packages by Esurvey water hydraulics.
- Provision for merging of population data to the thiessan polygon is made in AutoCAD. The same to be included in the software
- Consolidated summary of pipes could be handy and good for ready reference.

TABLE 1. SAMPLE PIPE REPORT FROM ESURVEY HYDRAULICS

ID	Name	Start Node	End Node	Category	Zone	Remark	Material	Dia	Length(2D)	Length(3D)	Length(User)	Roughness	Loss Coeff.	Initial Status	Bulk Coeff.	Wall Coeff.	DMA Boundary	Existing	Isolation Valve
								mm	m	m	m								
1	P-1	J-1	J-2	MAIN	0		HDPE	63	54.557	54.5597408	60.0127	120	0	Open	0	0	None	0	0
2	P-2	J-3	J-4	MAIN	0		HDPE	135	134.91	134.912446	148.399	120	0	Open	0	0	None	0	0
3	P-3	J-5	J-3	MAIN	0		HDPE	135	67.997	68.0078909	74.7967	120	0	Open	0	0	None	0	0
4	P-4	J-6	J-5	MAIN	0		HDPE	118.1	44.42	44.4207241	48.862	120	0	Open	0	0	None	0	0
5	P-5	J-7	J-8	MAIN	0		HDPE	63	156.77	156.768853	172.443	120	0	Open	0	0	None	0	0
6	P-6	J-9	J-8	MAIN	0		HDPE	135	67.134	67.1388899	73.8474	120	0	Open	0	0	None	0	0
7	P-7	J-10	J-11	MAIN	0		HDPE	63	48.061	48.0616784	52.8671	120	0	Open	0	0	None	0	0
8	P-8	J-12	J-10	MAIN	0		HDPE	63	46.198	46.1993817	50.8178	120	0	Open	0	0	None	0	0
9	P-9	J-11	J-13	MAIN	0		HDPE	63	68.403	68.4028751	75.2433	120	0	Open	0	0	None	0	0
10	P-10	J-13	J-6	MAIN	0		HDPE	118.1	70.906	70.906807	77.9966	120	0	Open	0	0	None	0	0

TABLE 2. SAMPLE PIPE REPORT FROM WATERGEMS

ID	Name	Start Node	End Node	Category	Zone	Remark	Material	Dia	Length(2D)	Length(3D)	Length(User)	Roughness	Loss Coeff.	Initial Status	Bulk Coeff.	Wall Coeff.	DMA Boundary	Existing	Isolation Valve
								mm	m	m	m								
1	118	J-1	J-2	MAIN	0		HDPE	63	0.5974	0.59747552	0.59745	140	0	Open	0	0	None	0	0
2	238	J-3	J-4	MAIN	0		HDPE	63	0.5994	0.59952398	0.5994	140	0	Open	0	0	None	0	0
3	241	J-5	J-6	MAIN	0		HDPE	63	0.8003	0.80036117	0.80033	140	0	Open	0	0	None	0	0
4	240	J-7	J-8	MAIN	0		HDPE	63	0.9961	0.99611295	0.99611	140	0	Open	0	0	None	0	0
5	30	J-9	J-10	MAIN	0		HDPE	63	1.1024	1.10241054	1.10238	140	0	Open	0	0	None	0	0
6	182	J-11	J-12	MAIN	0		HDPE	63	4.008	4.008484	4.008	140	0	Open	0	0	None	0	0
7	181	J-13	J-14	MAIN	0		HDPE	63	8.9561	8.95613293	8.95613	140	0	Open	0	0	None	0	0
8	198	J-15	J-16	MAIN	0		HDPE	63	9.3732	9.37329502	9.37321	140	0	Open	0	0	None	0	0
9	180	J-5	J-17	MAIN	0		HDPE	63	11.318	11.3200133	11.3176	140	0	Open	0	0	None	0	0
10	232	J-18	J-19	MAIN	0		DI	250	11.681	11.6818401	11.6813	130	0	Open	0	0	None	0	0

TABLE 3: SAMPLE JUNCTION REPORT FROM ESURVEY HYDRAULICS

ID	Name	Easting	Northing	Elevation	Zone	Remark	Demand	Demand Pattern	Emitter Coeff.	Initial Quality	Has Source	Source Quality	Source Type	Source Pattern	Initial Age(Hrs)	Initial Trace(Hrs)
		m	m	m			LPS			mg/L	Has Source	mg/L	Source Type	Source Pattern	Hrs	%
1	J-1	6E+05	2E+06	581.92	0		0.1308	pattern	0	0	No	0	Concentration		0	0
2	J-2	6E+05	2E+06	581.43	0		0.0777	pattern	0	0	No	0	Concentration		0	0
3	J-3	6E+05	2E+06	584.36	0		0.0547	pattern	0	0	No	0	Concentration		0	0
4	J-4	6E+05	2E+06	585.47	0		0.0386	pattern	0	0	No	0	Concentration		0	0
5	J-5	6E+05	2E+06	583.14	0		0.0279	pattern	0	0	No	0	Concentration		0	0
6	J-6	6E+05	2E+06	582.86	0		0.0541	pattern	0	0	No	0	Concentration		0	0
7	J-7	6E+05	2E+06	583.84	0		0.0305	pattern	0	0	No	0	Concentration		0	0
8	J-8	6E+05	2E+06	584.86	0		0.0554	pattern	0	0	No	0	Concentration		0	0
9	J-9	6E+05	2E+06	585.71	0		0.0622	pattern	0	0	No	0	Concentration		0	0
10	J-10	6E+05	2E+06	582.83	0		0.0331	pattern	0	0	No	0	Concentration		0	0

TABLE 4: SAMPLE JUNCTION REPORT FROM WATERGEMS

ID	Name	Easting	Northing	Elevation	Zone	Remark	Demand	Demand Pattern	Emitter Coeff.	Initial Quality	Has Source	Source Quality	Source Type	Source Pattern	Initial Age(Hrs)	Initial Trace(Hrs)
		m	m	m						mg/L	Has Source	mg/L	Source Type	Source Pattern	Hrs	%
1	J-1	6E+05	2E+06	582.45	0		0.0122	HydraulicPattern-1	0	0	No	0	Concentration		0	0
2	J-2	6E+05	2E+06	582.46	0		0.0126	HydraulicPattern-1	0	0	No	0	Concentration		0	0
3	J-3	6E+05	2E+06	581.37	0		0.2338	HydraulicPattern-1	0	0	No	0	Concentration		0	0

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