Pump Curve design

Water · https://mes100.com/docs/loopwin-pump-curve-design/

In Water Module, there are 2 types of pump can be used;

1. Constant Power
2. Pump Curve

Pump is used to increase/boost the Residual Pressure to reach the minimum required but not exceeding the maximum pressure allowed where as in other word to kept the pressure within range. User may constructively add a pump to their water reticulation network system. However the design of water reticulation network system depends on how user allocates the pump location and how the design will be constructed.

The principle output parameters are flow(LPS) and head(m) gain.

However, this guideline will be focussed on how to use ‘**Pump Curve**’ in water reticulation network system. Image below shows a ‘Pump Curve’ properties:

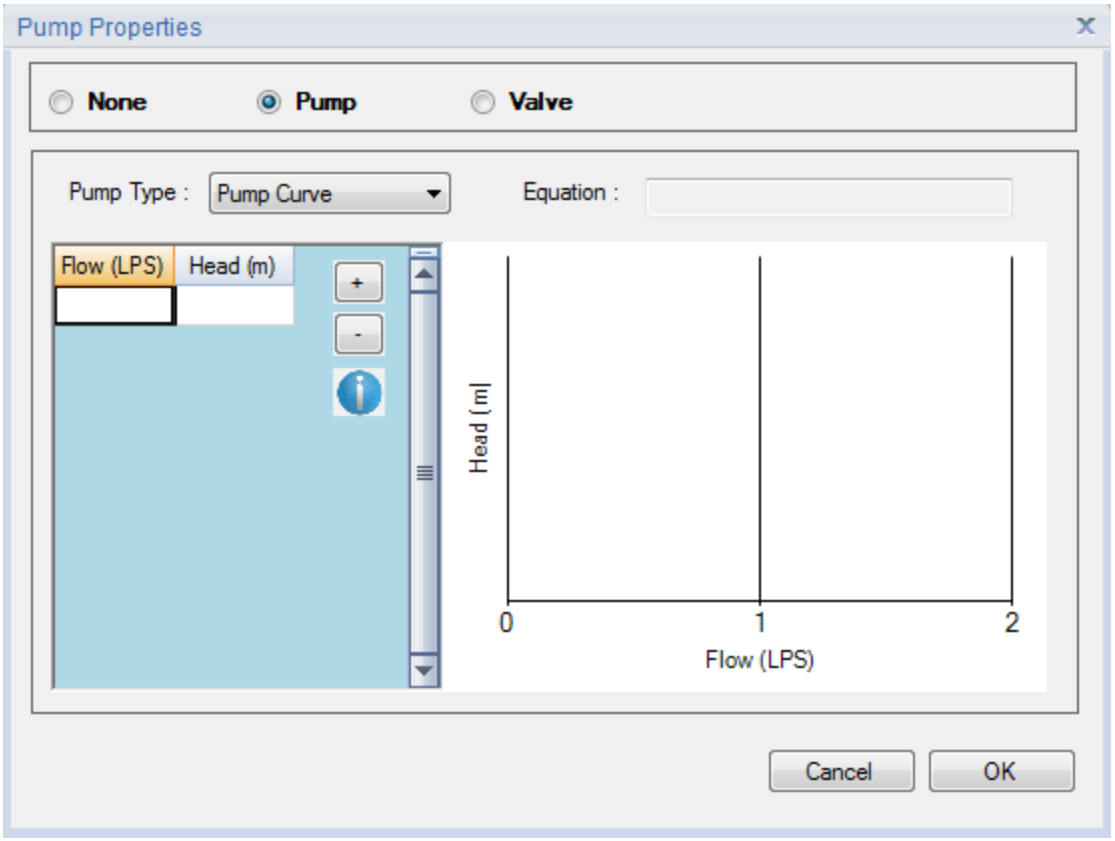
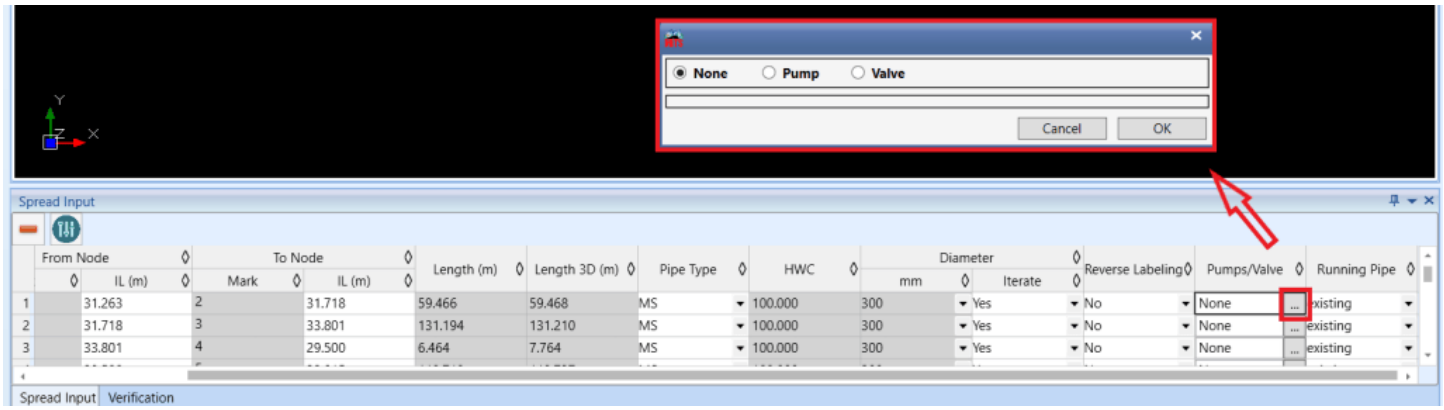


Image 1: Pump Properties

How to Use a Pump Curve in a water reticulation network

1.Please go to Water >> Input >> Pipe >> Spread Input >> Pump & Valve

Click at the three dot button and a pump/valves dialog pop up



2. As you can see image below, Residual Pressure for Node 21 is less than the minimum pressure which is 7.5 m.

Analysis Verification | Design Check | Analysis Output (Excel) | Analysis Output (Word) | Draw-off Table | Water D

Node Count	Node No	Flow (LPS)	Ground Level (m)	HGL (m)	Highest Supply Level(m)	Residual Pressure (m)
1	2	0.00000	33.900	41.74	33.90	7.84
2	3	-0.79000	33.400	41.56	33.40	8.16
3	4	-0.95200	30.300	41.40	30.30	11.10
4	5	-2.17000	29.900	41.30	29.90	11.40
5	6	-0.58000	29.900	41.30	29.90	11.40
6	7	0.00000	29.900	41.30	29.90	11.40
7	8	-0.86700	30.000	41.30	30.00	11.30
8	10	0.00000	27.400	41.30	27.40	13.90
9	11	0.00000	27.600	41.30	27.60	13.70
10	12	0.00000	27.750	41.30	27.75	13.55
11	13	0.00000	27.900	41.30	27.90	13.40
12	14	0.00000	31.000	41.68	31.00	10.68
13	15	-3.61800	31.000	41.59	31.00	10.59
14	16	0.00000	31.000	41.45	31.00	10.45
15	17	-12.62800	31.400	41.44	31.40	10.04
16	18	0.00000	29.900	41.29	29.90	11.39
17	19	-17.36200	30.400	41.29	30.40	10.89
18	20 R	38.96700	25.000	42.00		
19	21	0.00000	34.040	41.49	34.04	7.45

Image 3: Analysis Output (Node 21 Fail)

3. Hence, in order to push the pressure up above the minimum pressure allowed, there will be a pump located at node 3.(this is because previous node is 3, pipe 3 is from node 3 to node 21)

4. Here is the most critical part where the pump curve properties for Flow(LPS) and Head(m) is taken into consideration. To determine the value of the flow and head to be input at the pump properties, you may have to use the flow result generated previously. (*please refer to the flow at >> Result >> Analysis Output >> Pipes for Peak Calculation*)

Input ✕ Key Plan Output ✕ Result ✕ QS ✕ Schematic Plan ✕

Analysis Verification | Design Check | Analysis Output (Excel) | Analysis Output (Word) | Draw-off Table | Water Demand

Pipe Count	Pipe No	From Node	To Node	Pipe Type	Length (m)	Diameter (mm)	HWC	Flow (LPS)	Velocity (MPS)	Head Loss (m/km)	Head Loss (m)
1	2	2	3	DI	151.34	250	100	18.74420	0.38	1.14	0.1730
2	3	3	21	DI	67.08	250	100	17.95420	0.37	1.06	0.0708
3	4	4	5	DI	66.22	250	100	20.97900	0.43	1.41	0.0932
4	5	5	6	DI	64.86	250	100	1.01522	0.02LO	0.01	0.0003
5	6	6	7	DI	44.98	250	100	0.43522	0.01LO	0.00	0.0000
6	7	7	8	DI	47.68	250	100	0.43522	0.01LO	0.00	0.0001
7	9	5	10	DI	115.29	250	100	0.43178	0.01LO	0.00	0.0001
8	10	10	11	DI	65.07	250	100	0.43178	0.01LO	0.00	0.0001
9	11	11	12	DI	48.77	250	100	0.43178	0.01LO	0.00	0.0001
10	12	12	13	DI	53.47	250	100	0.43178	0.01LO	0.00	0.0001
11	13	13	8	DI	127.36	250	100	0.43178	0.01LO	0.00	0.0001
12	14	2	14	DI	41.69	250	100	20.22281	0.41	1.32	0.0548
13	15	14	15	DI	69.06	250	100	20.22281	0.41	1.32	0.0908
14	17	17	4	DI	24.99	250	100	21.93100	0.45	1.53	0.0382
15	18	16	17	DI	14.22	250	100	16.60480	0.34	0.91	0.0130
16	19	5	18	DI	12.26	250	100	17.36200	0.35	0.99	0.0122
17	22	15	16	DI	154.85	250	100	16.60480	0.34	0.91	0.1414
18	23	20	2	DI	59.48	250	100	38.96700	0.79	4.43HI	0.2636
19	24	21	17	DI	53.35	250	100	17.95420	0.37	1.06	0.0563
20	25	18	19	MS	162.66	600	100	17.36200	0.06LO	0.01	0.0023

General | Pipes for Peak Calculation | Nodes for Peak Calculation | Pipes for Fire Calculation | Nodes for Fire Calculation

Image 4: Result (reference Flow (LPS)

5. Referring to the image attached above, the pipe no 24, Node 21 to node 17, the flow is 17.954 LPS. Hence, at the pump properties, the LPS should be input to make the flow at Pipe no 24 is within range.

6. Therefore, the input data is as follows;

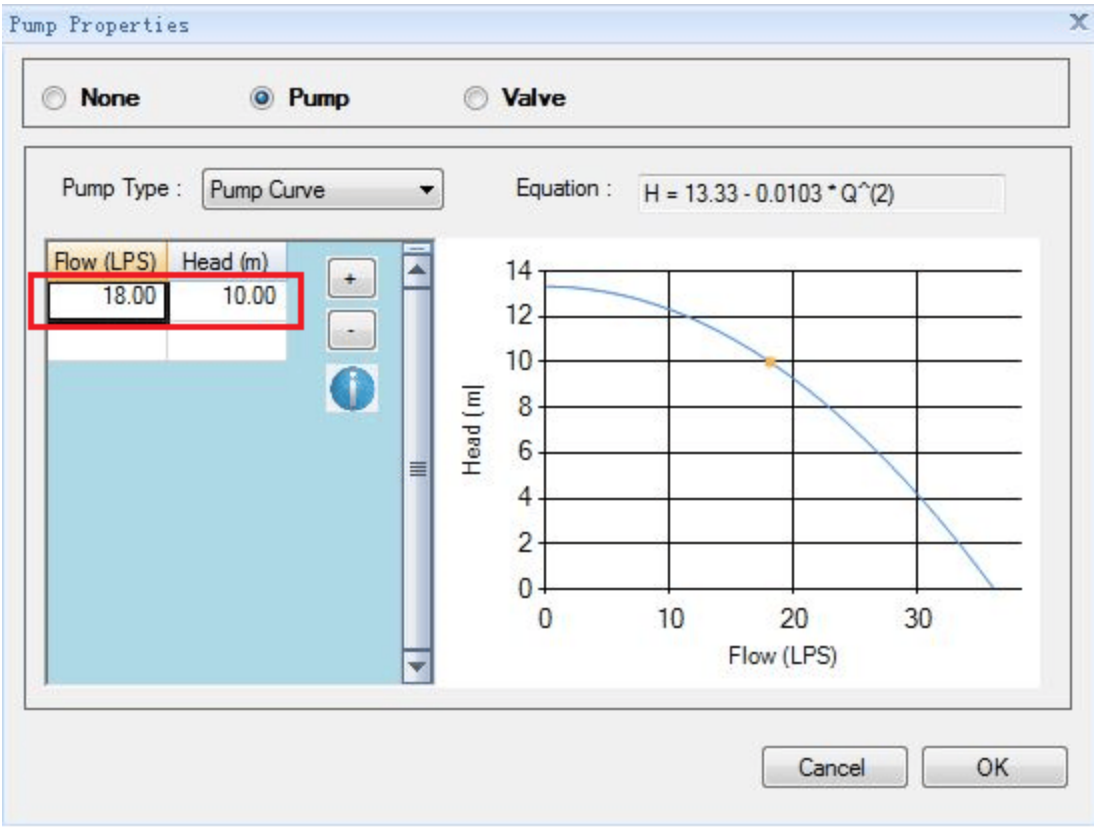


Image 5: Pump input value

7. Then , you may proceed to analyse. Now you can check that the Residual Pressure at node 21 is pump up and it is now more than 7.5m. (please refer image attached below)

Analysis Verification | Design Check | Analysis Output (Excel) | Analysis Output (Word) | Draw-off Table | Water

Node Count	Node No	Flow (LPS)	Ground Level (m)	HGL (m)	Highest Supply Level(m)	Residual Pressure (m)
1	2	0.00000	33.900	41.74	33.90	7.84
2	3	-0.79000	33.400	41.16	33.40	7.76
3	4	-0.95200	30.300	41.69	30.30	11.39
4	5	-2.17000	29.900	41.60	29.90	11.70
5	6	-0.58000	29.900	41.60	29.90	11.70
6	7	0.00000	29.900	41.60	29.90	11.70
7	8	-0.86700	30.000	41.60	30.00	11.60
8	10	0.00000	27.400	41.60	27.40	14.20
9	11	0.00000	27.600	41.60	27.60	14.00
10	12	0.00000	27.750	41.60	27.75	13.85
11	13	0.00000	27.900	41.60	27.90	13.70
12	14	0.00000	31.000	41.73	31.00	10.73
13	15	-3.61800	31.000	41.73	31.00	10.73
14	16	0.00000	31.000	41.73	31.00	10.73
15	17	-12.62800	31.400	41.73	31.40	10.33
16	18	0.00000	29.900	41.59	29.90	11.69
17	19	-17.36200	30.400	39.65	30.40	9.25
18	20 R	38.96700	25.000	42.00		
19	21	0.00000	34.040	41.93	34.04	7.89

Image 6: Analysis Output (Node 21 Design Passed) 1

Input ✕ Key Plan Output ✕ Result ✕ QS ✕ Schematic Plan ✕

Analysis Verification | Design Check | Analysis Output (Excel) | Analysis Output (Word) | Draw-off Table | Water Demand

Pipe Count	Pipe No	From Node	To Node	Pipe Type	Length (m)	Diameter (mm)	HWC	Flow (LPS)	Velocity (MPS)	Head Loss (m/km)	Head Loss (m)	Remark
1	2	2	3	DI	151.34	250	100	35.74822	0.73	3.78HI	0.5718	
2	3 Pump	3	21	DI	-	-	-	34.95822	-	-	-0.7605	Working
3	4	4	5	DI	66.22	250	100	20.97900	0.43	1.41	0.0932	
4	5	5	6	DI	64.86	250	100	1.01522	0.02LO	0.01	0.0003	
5	6	6	7	DI	44.98	250	100	0.43522	0.01LO	0.00	0.0000	
6	7	7	8	DI	47.68	250	100	0.43522	0.01LO	0.00	0.0001	
7	9	5	10	DI	115.29	250	100	0.43178	0.01LO	0.00	0.0001	
8	10	10	11	DI	65.07	250	100	0.43178	0.01LO	0.00	0.0001	
9	11	11	12	DI	48.77	250	100	0.43178	0.01LO	0.00	0.0001	
10	12	12	13	DI	53.47	250	100	0.43178	0.01LO	0.00	0.0001	
11	13	13	8	DI	127.36	250	100	0.43178	0.01LO	0.00	0.0001	
12	14	2	14	DI	41.69	250	100	3.21878	0.07LO	0.04	0.0018	
13	15	14	15	DI	69.06	250	100	3.21878	0.07LO	0.04	0.0030	
14	17	17	4	DI	24.99	250	100	21.93100	0.45	1.53	0.0382	
15	18	17	16	DI	14.22	250	100	0.39922	0.01LO	0.00	0.0000	
16	19	5	18	DI	12.26	250	100	17.36200	0.35	0.99	0.0122	
17	22	16	15	DI	154.85	250	100	0.39922	0.01LO	0.00	0.0001	
18	23	20	2	DI	59.48	250	100	38.96700	0.79	4.43HI	0.2636	
19	24	21	17	DI	53.35	250	100	34.95822	0.71	3.63HI	0.1934	
20	25	18	19	MS	162.66	150	100	17.36200	0.98	11.94HI	1.9423	

Image 7: Analysis Output (Node 21 Design Passed) 2

How to check the residual pressure manually

Example

Pipe no.3 (node 3 to node 21)

Before pump is applied GL : 34.04 m HGL : 41.49 m HSL : 34.04 m RP : 7.45 (< 7.5 m) design fail	After pump applied at Node 3 GL : 34.04 m HGL : 41.93 m HSL : 34.04 m RP : 7.89 (> 7.5 m) design passed Manual Calculation RP = HGL - HSL = 41.93 m - 34.04 m = 7.89 m How to get HGL = 41.93 m? *we have to take note that the HGL at every nodes is related and dependable at the previous node, for node 21, the HGL for node 21 will depends on HGL at node 3 and the head loss at node 3. *therefore, HGL (node 3) = 41.16 m Head Loss (m) = - 0.7605 m Hence, HGL at node 21 = HGL - Head Loss = 41.16 m - (- 0.7605 m) = 41.93 m **Head Loss in negative value means that the pressure is restore instead of losing it.*

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