

Water System Simulation Report – 640-gal Pressure Tank Model

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1) System Description & Parameters

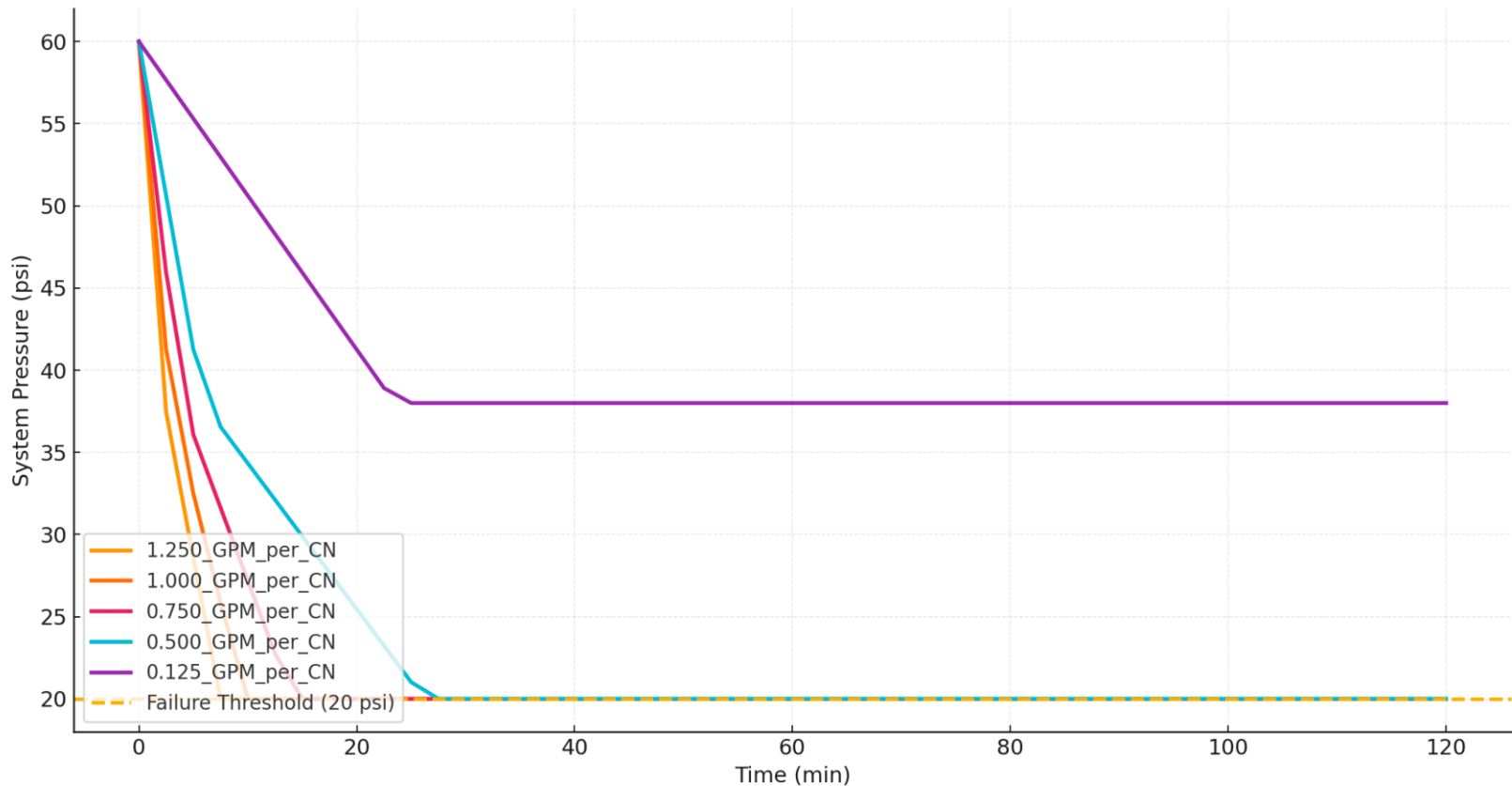
- Pressure tank effective volume (model): 640 gal
- Booster pump(s): one @ 20 GPM (cut-in = 38 psi; cut-out/initial = 60 psi)
- Well (supply): 20 GPM (steady)
- Failure threshold: 20 psi
- Connection nodes: 80
- Flow scenarios per CN: 1.250, 1.000, 0.750, 0.500, 0.125 GPM
- Time step: 2.5 min; Simulation duration: 120.0 min

2) Methodology & Equations (script-conformant)

- Phase-split of pressure tank drawdown using proportion of pressure drop:
$$V_{\text{phase1}} = V_{\text{TANK}} \times (P_{\text{OUT}} - P_{\text{IN}}) / P_{\text{OUT}}$$
$$V_{\text{phase2}} = V_{\text{TANK}} - V_{\text{phase1}}$$
- Phase 1 ($P_{\text{OUT}} \rightarrow P_{\text{IN}}$):
$$t1 = V_{\text{phase1}} / Q_{\text{total}}; P(t) = P_{\text{OUT}} - ((P_{\text{OUT}} - P_{\text{IN}})/t1) \cdot t$$
- Phase 2 ($\leq P_{\text{IN}}$): booster provides 20 GPM; deficit $dQ = Q_{\text{total}} - 20$
If $dQ > 0$: $t2 = V_{\text{phase2}} / dQ$; $P(t) = P_{\text{IN}} - ((P_{\text{IN}} - P_{\text{FAIL}})/t2) \cdot (t - t1)$ up to P_{FAIL}
If $dQ \leq 0$: P holds at P_{IN} (no further tank drawdown)

Note: The steady well is not throttled in these constant-demand stress tests; tank drawdown is the dominant buffer to maintain pressure between 60→38→20 psi.

Combined Pressure Decay - 640-gal Pressure Tanks
(1 booster @20 GPM, well 20 GPM, dt=2.5 min)



Time (min)	System Pressure (psi)	Total Demand (GPM)	Booster Flow (GPM)	Net Deficit (GPM)	Pressure Tank Volume Remaining (gallons)
0.0	60.0	100.0	0.0	100.0	640.0
2.5	37.46	100.0	20.0	80.0	393.07
5.0	28.57	100.0	20.0	80.0	193.07
7.5	20.0	100.0	20.0	80.0	0.0
10.0	20.0	100.0	20.0	80.0	0.0
12.5	20.0	100.0	20.0	80.0	0.0
15.0	20.0	100.0	20.0	80.0	0.0
17.5	20.0	100.0	20.0	80.0	0.0
20.0	20.0	100.0	20.0	80.0	0.0
22.5	20.0	100.0	20.0	80.0	0.0
25.0	20.0	100.0	20.0	80.0	0.0
27.5	20.0	100.0	20.0	80.0	0.0
30.0	20.0	100.0	20.0	80.0	0.0
32.5	20.0	100.0	20.0	80.0	0.0
35.0	20.0	100.0	20.0	80.0	0.0
37.5	20.0	100.0	20.0	80.0	0.0
40.0	20.0	100.0	20.0	80.0	0.0
42.5	20.0	100.0	20.0	80.0	0.0
45.0	20.0	100.0	20.0	80.0	0.0
47.5	20.0	100.0	20.0	80.0	0.0
50.0	20.0	100.0	20.0	80.0	0.0
52.5	20.0	100.0	20.0	80.0	0.0
55.0	20.0	100.0	20.0	80.0	0.0
57.5	20.0	100.0	20.0	80.0	0.0
60.0	20.0	100.0	20.0	80.0	0.0
62.5	20.0	100.0	20.0	80.0	0.0
65.0	20.0	100.0	20.0	80.0	0.0
67.5	20.0	100.0	20.0	80.0	0.0
70.0	20.0	100.0	20.0	80.0	0.0
72.5	20.0	100.0	20.0	80.0	0.0
75.0	20.0	100.0	20.0	80.0	0.0
77.5	20.0	100.0	20.0	80.0	0.0
80.0	20.0	100.0	20.0	80.0	0.0
82.5	20.0	100.0	20.0	80.0	0.0
85.0	20.0	100.0	20.0	80.0	0.0
87.5	20.0	100.0	20.0	80.0	0.0
90.0	20.0	100.0	20.0	80.0	0.0
92.5	20.0	100.0	20.0	80.0	0.0
95.0	20.0	100.0	20.0	80.0	0.0
97.5	20.0	100.0	20.0	80.0	0.0
100.0	20.0	100.0	20.0	80.0	0.0
102.5	20.0	100.0	20.0	80.0	0.0
105.0	20.0	100.0	20.0	80.0	0.0
107.5	20.0	100.0	20.0	80.0	0.0
110.0	20.0	100.0	20.0	80.0	0.0
112.5	20.0	100.0	20.0	80.0	0.0
115.0	20.0	100.0	20.0	80.0	0.0
117.5	20.0	100.0	20.0	80.0	0.0
120.0	20.0	100.0	20.0	80.0	0.0

Scenario Table = 1.250 GPM per CN (Total Demand = 100 GPM)

Time (min)	System Pressure (psi)	Total Demand (GPM)	Booster Flow (GPM)	Net Deficit (GPM)	Pressure Tank Volume Remaining (gallons)
0.0	60.0	80.0	0.0	80.0	640.0
2.5	41.25	80.0	0.0	80.0	440.0
5.0	32.49	80.0	20.0	60.0	281.33
7.5	25.83	80.0	20.0	60.0	131.33
10.0	20.0	80.0	20.0	60.0	0.0
12.5	20.0	80.0	20.0	60.0	0.0
15.0	20.0	80.0	20.0	60.0	0.0
17.5	20.0	80.0	20.0	60.0	0.0
20.0	20.0	80.0	20.0	60.0	0.0
22.5	20.0	80.0	20.0	60.0	0.0
25.0	20.0	80.0	20.0	60.0	0.0
27.5	20.0	80.0	20.0	60.0	0.0
30.0	20.0	80.0	20.0	60.0	0.0
32.5	20.0	80.0	20.0	60.0	0.0
35.0	20.0	80.0	20.0	60.0	0.0
37.5	20.0	80.0	20.0	60.0	0.0
40.0	20.0	80.0	20.0	60.0	0.0
42.5	20.0	80.0	20.0	60.0	0.0
45.0	20.0	80.0	20.0	60.0	0.0
47.5	20.0	80.0	20.0	60.0	0.0
50.0	20.0	80.0	20.0	60.0	0.0
52.5	20.0	80.0	20.0	60.0	0.0
55.0	20.0	80.0	20.0	60.0	0.0
57.5	20.0	80.0	20.0	60.0	0.0
60.0	20.0	80.0	20.0	60.0	0.0
62.5	20.0	80.0	20.0	60.0	0.0
65.0	20.0	80.0	20.0	60.0	0.0
67.5	20.0	80.0	20.0	60.0	0.0
70.0	20.0	80.0	20.0	60.0	0.0
72.5	20.0	80.0	20.0	60.0	0.0
75.0	20.0	80.0	20.0	60.0	0.0
77.5	20.0	80.0	20.0	60.0	0.0
80.0	20.0	80.0	20.0	60.0	0.0
82.5	20.0	80.0	20.0	60.0	0.0
85.0	20.0	80.0	20.0	60.0	0.0
87.5	20.0	80.0	20.0	60.0	0.0
90.0	20.0	80.0	20.0	60.0	0.0
92.5	20.0	80.0	20.0	60.0	0.0
95.0	20.0	80.0	20.0	60.0	0.0
97.5	20.0	80.0	20.0	60.0	0.0
100.0	20.0	80.0	20.0	60.0	0.0
102.5	20.0	80.0	20.0	60.0	0.0
105.0	20.0	80.0	20.0	60.0	0.0
107.5	20.0	80.0	20.0	60.0	0.0
110.0	20.0	80.0	20.0	60.0	0.0
112.5	20.0	80.0	20.0	60.0	0.0
115.0	20.0	80.0	20.0	60.0	0.0
117.5	20.0	80.0	20.0	60.0	0.0
120.0	20.0	80.0	20.0	60.0	0.0

Scenario Table = 1.000 GPM per CN (Total Demand = 80 GPM)

Time (min)	System Pressure (psi)	Total Demand (GPM)	Booster Flow (GPM)	Net Deficit (GPM)	Pressure Tank Volume Remaining (gallons)
0.0	60.0	60.0	0.0	60.0	640.0
2.5	45.94	60.0	0.0	60.0	490.0
5.0	36.07	60.0	20.0	40.0	361.78
7.5	31.62	60.0	20.0	40.0	261.78
10.0	27.18	60.0	20.0	40.0	161.78
12.5	22.74	60.0	20.0	40.0	61.78
15.0	20.0	60.0	20.0	40.0	0.0
17.5	20.0	60.0	20.0	40.0	0.0
20.0	20.0	60.0	20.0	40.0	0.0
22.5	20.0	60.0	20.0	40.0	0.0
25.0	20.0	60.0	20.0	40.0	0.0
27.5	20.0	60.0	20.0	40.0	0.0
30.0	20.0	60.0	20.0	40.0	0.0
32.5	20.0	60.0	20.0	40.0	0.0
35.0	20.0	60.0	20.0	40.0	0.0
37.5	20.0	60.0	20.0	40.0	0.0
40.0	20.0	60.0	20.0	40.0	0.0
42.5	20.0	60.0	20.0	40.0	0.0
45.0	20.0	60.0	20.0	40.0	0.0
47.5	20.0	60.0	20.0	40.0	0.0
50.0	20.0	60.0	20.0	40.0	0.0
52.5	20.0	60.0	20.0	40.0	0.0
55.0	20.0	60.0	20.0	40.0	0.0
57.5	20.0	60.0	20.0	40.0	0.0
60.0	20.0	60.0	20.0	40.0	0.0
62.5	20.0	60.0	20.0	40.0	0.0
65.0	20.0	60.0	20.0	40.0	0.0
67.5	20.0	60.0	20.0	40.0	0.0
70.0	20.0	60.0	20.0	40.0	0.0
72.5	20.0	60.0	20.0	40.0	0.0
75.0	20.0	60.0	20.0	40.0	0.0
77.5	20.0	60.0	20.0	40.0	0.0
80.0	20.0	60.0	20.0	40.0	0.0
82.5	20.0	60.0	20.0	40.0	0.0
85.0	20.0	60.0	20.0	40.0	0.0
87.5	20.0	60.0	20.0	40.0	0.0
90.0	20.0	60.0	20.0	40.0	0.0
92.5	20.0	60.0	20.0	40.0	0.0
95.0	20.0	60.0	20.0	40.0	0.0
97.5	20.0	60.0	20.0	40.0	0.0
100.0	20.0	60.0	20.0	40.0	0.0
102.5	20.0	60.0	20.0	40.0	0.0
105.0	20.0	60.0	20.0	40.0	0.0
107.5	20.0	60.0	20.0	40.0	0.0
110.0	20.0	60.0	20.0	40.0	0.0
112.5	20.0	60.0	20.0	40.0	0.0
115.0	20.0	60.0	20.0	40.0	0.0
117.5	20.0	60.0	20.0	40.0	0.0
120.0	20.0	60.0	20.0	40.0	0.0

Scenario Table = 0.750 GPM per CN (Total Demand = 60 GPM)

Time (min)	System Pressure (psi)	Total Demand (GPM)	Booster Flow (GPM)	Net Deficit (GPM)	Pressure Tank Volume Remaining (gallons)
0.0	60.0	40.0	0.0	40.0	640.0
2.5	50.62	40.0	0.0	40.0	540.0
5.0	41.25	40.0	0.0	40.0	440.0
7.5	36.55	40.0	20.0	20.0	372.67
10.0	34.33	40.0	20.0	20.0	322.67
12.5	32.11	40.0	20.0	20.0	272.67
15.0	29.89	40.0	20.0	20.0	222.67
17.5	27.67	40.0	20.0	20.0	172.67
20.0	25.45	40.0	20.0	20.0	122.67
22.5	23.23	40.0	20.0	20.0	72.67
25.0	21.01	40.0	20.0	20.0	22.67
27.5	20.0	40.0	20.0	20.0	0.0
30.0	20.0	40.0	20.0	20.0	0.0
32.5	20.0	40.0	20.0	20.0	0.0
35.0	20.0	40.0	20.0	20.0	0.0
37.5	20.0	40.0	20.0	20.0	0.0
40.0	20.0	40.0	20.0	20.0	0.0
42.5	20.0	40.0	20.0	20.0	0.0
45.0	20.0	40.0	20.0	20.0	0.0
47.5	20.0	40.0	20.0	20.0	0.0
50.0	20.0	40.0	20.0	20.0	0.0
52.5	20.0	40.0	20.0	20.0	0.0
55.0	20.0	40.0	20.0	20.0	0.0
57.5	20.0	40.0	20.0	20.0	0.0
60.0	20.0	40.0	20.0	20.0	0.0
62.5	20.0	40.0	20.0	20.0	0.0
65.0	20.0	40.0	20.0	20.0	0.0
67.5	20.0	40.0	20.0	20.0	0.0
70.0	20.0	40.0	20.0	20.0	0.0
72.5	20.0	40.0	20.0	20.0	0.0
75.0	20.0	40.0	20.0	20.0	0.0
77.5	20.0	40.0	20.0	20.0	0.0
80.0	20.0	40.0	20.0	20.0	0.0
82.5	20.0	40.0	20.0	20.0	0.0
85.0	20.0	40.0	20.0	20.0	0.0
87.5	20.0	40.0	20.0	20.0	0.0
90.0	20.0	40.0	20.0	20.0	0.0
92.5	20.0	40.0	20.0	20.0	0.0
95.0	20.0	40.0	20.0	20.0	0.0
97.5	20.0	40.0	20.0	20.0	0.0
100.0	20.0	40.0	20.0	20.0	0.0
102.5	20.0	40.0	20.0	20.0	0.0
105.0	20.0	40.0	20.0	20.0	0.0
107.5	20.0	40.0	20.0	20.0	0.0
110.0	20.0	40.0	20.0	20.0	0.0
112.5	20.0	40.0	20.0	20.0	0.0
115.0	20.0	40.0	20.0	20.0	0.0
117.5	20.0	40.0	20.0	20.0	0.0
120.0	20.0	40.0	20.0	20.0	0.0

Scenario Table = 0.500 GPM per CN (Total Demand = 40 GPM)

Time (min)	System Pressure (psi)	Total Demand (GPM)	Booster Flow (GPM)	Net Deficit (GPM)	Pressure Tank Volume Remaining (gallons)
0.0	60.0	10.0	0.0	10.0	640.0
2.5	57.66	10.0	0.0	10.0	615.0
5.0	55.31	10.0	0.0	10.0	590.0
7.5	52.97	10.0	0.0	10.0	565.0
10.0	50.62	10.0	0.0	10.0	540.0
12.5	48.28	10.0	0.0	10.0	515.0
15.0	45.94	10.0	0.0	10.0	490.0
17.5	43.59	10.0	0.0	10.0	465.0
20.0	41.25	10.0	0.0	10.0	440.0
22.5	38.91	10.0	0.0	10.0	415.0
25.0	38.0	10.0	20.0	0.0	405.33
27.5	38.0	10.0	20.0	0.0	405.33
30.0	38.0	10.0	20.0	0.0	405.33
32.5	38.0	10.0	20.0	0.0	405.33
35.0	38.0	10.0	20.0	0.0	405.33
37.5	38.0	10.0	20.0	0.0	405.33
40.0	38.0	10.0	20.0	0.0	405.33
42.5	38.0	10.0	20.0	0.0	405.33
45.0	38.0	10.0	20.0	0.0	405.33
47.5	38.0	10.0	20.0	0.0	405.33
50.0	38.0	10.0	20.0	0.0	405.33
52.5	38.0	10.0	20.0	0.0	405.33
55.0	38.0	10.0	20.0	0.0	405.33
57.5	38.0	10.0	20.0	0.0	405.33
60.0	38.0	10.0	20.0	0.0	405.33
62.5	38.0	10.0	20.0	0.0	405.33
65.0	38.0	10.0	20.0	0.0	405.33
67.5	38.0	10.0	20.0	0.0	405.33
70.0	38.0	10.0	20.0	0.0	405.33
72.5	38.0	10.0	20.0	0.0	405.33
75.0	38.0	10.0	20.0	0.0	405.33
77.5	38.0	10.0	20.0	0.0	405.33
80.0	38.0	10.0	20.0	0.0	405.33
82.5	38.0	10.0	20.0	0.0	405.33
85.0	38.0	10.0	20.0	0.0	405.33
87.5	38.0	10.0	20.0	0.0	405.33
90.0	38.0	10.0	20.0	0.0	405.33
92.5	38.0	10.0	20.0	0.0	405.33
95.0	38.0	10.0	20.0	0.0	405.33
97.5	38.0	10.0	20.0	0.0	405.33
100.0	38.0	10.0	20.0	0.0	405.33
102.5	38.0	10.0	20.0	0.0	405.33
105.0	38.0	10.0	20.0	0.0	405.33
107.5	38.0	10.0	20.0	0.0	405.33
110.0	38.0	10.0	20.0	0.0	405.33
112.5	38.0	10.0	20.0	0.0	405.33
115.0	38.0	10.0	20.0	0.0	405.33
117.5	38.0	10.0	20.0	0.0	405.33
120.0	38.0	10.0	20.0	0.0	405.33

Scenario Table = 0.125 GPM per CN (Total Demand = 10 GPM)