CE 365 Project

Fall 2023

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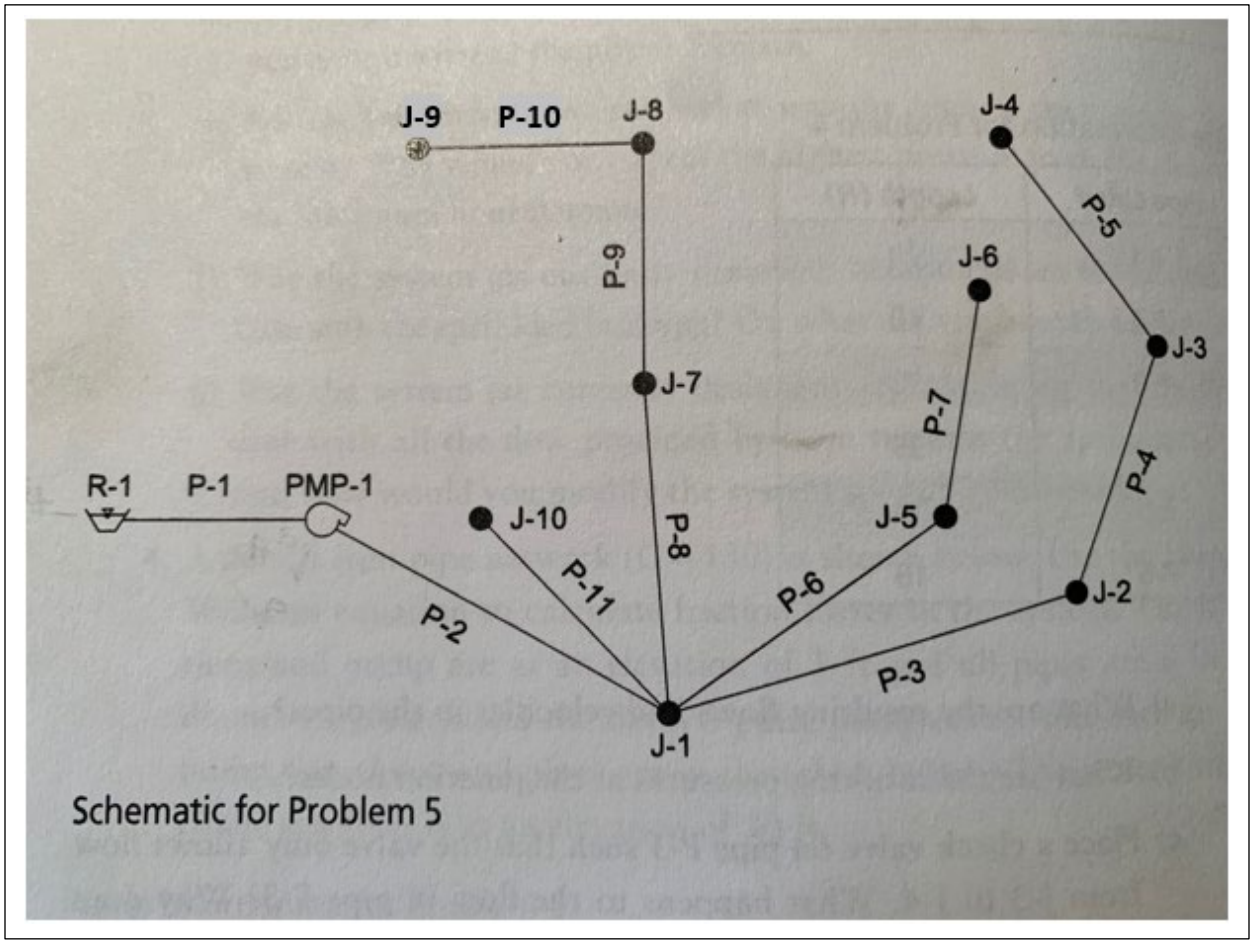
Specific Project Problems

Problem 5

A local country club has hired you to design a sprinkler system that will water the greens of their nine-hole golf course. The system must be able to water all nine holes at once. The water supply has a water surface elevation of 10ft. All pipes are PVC (C_hw = 150, use the Hazen-Williams equation to determine friction losses). Use a standard, three-point curve for the pump, which is at an elevation of 5ft. The flow at the sprinkler is modeled using an emitter coefficient. The data for the junctions, pipes, and pump curve are given in the tables that follow. The initial network layout is shown below.



Questions:

a) Determine the discharge at each hole?

b) What is the operating point of the pump?

Junction and Pipe Information:

Junction and Pipe Information for Problem 5

Junction Label	Emitter Coefficient ($gpm/psi^{0.5}$)	Elevation (ft)
J-1	–	10
Hole 1	8	7
Hole 2	10	7
Hole 3	15	40
Hole 4	12	5
Hole 5	8	5
Hole 6	8	15
Hole 7	10	20
Hole 8	15	10
Hole 9	8	12

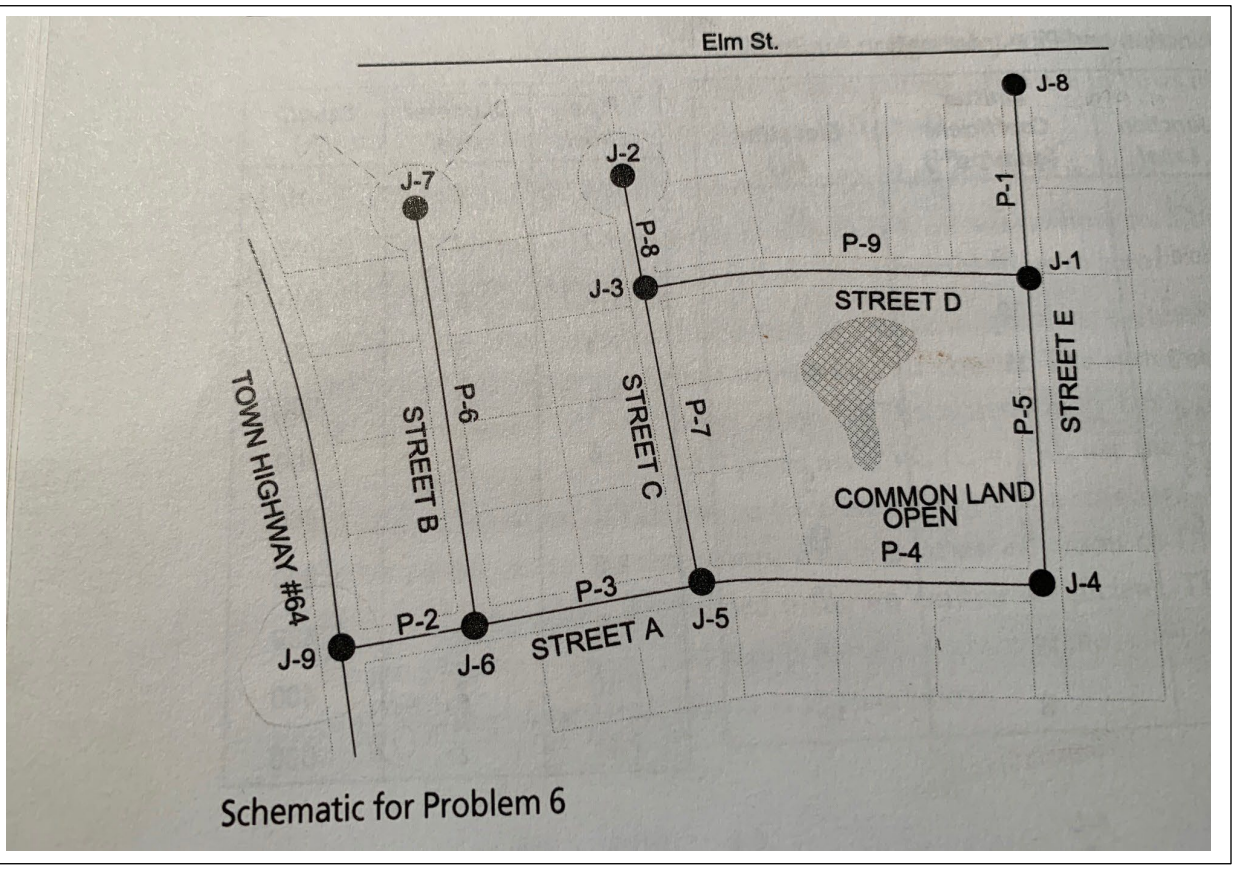
Pipe Label	Diameter (in)	Length (ft)
P-1	4	10
P-2	4	1,000
P-3	4	800
P-4	3	750
P-5	3	500
P-6	3	700
P-7	2	400
P-8	4	800
P-9	3	500
P-10	2	400
P-11	2	500

Pump Information for Problem 5

Head (ft)	Flow (gpm)
170	0
135	300
100	450

Problem 6

A subdivision of 36 homes is being constructed in a new area of town. Each home will require 1.7L/s during peak periods. All junction nodes are 192 meter in elevation. All pipes are ductile iron (C_hw = 130, use the Hazen-Williams equation to determine the friction losses in the pipe). The current lot and network layout are shown below.



Currently, a model of the entire water system does not exist. However, hydrant tests were conducted hydrants located on two water mains, one in Town Highway #64 and the other on Elm Street. The following data were obtained:

1) Town Highway #64 Hydrant Test:
   - static pressure: 310.3 kPa
   - Residual Pressure 98.5 kPa at 32 L/s
   - Elevation. of pressure gauge 190 m

2) Elm Street Hydrant Test
   - static pressure 413.7 kPa
   - Residual pressure 319.3 kPa at 40 L/s
   - Elevation of pressure gauge 191.5 m

The subdivision will connect to existing system mains in the streets at nodes J-8 and J-9 (Hint: Model the connection to an existing water main with a reservoir and a pump).

Junction and Pipe Information:

Junction and Pipe Information for Problem 6

Junction Label	Number of Lots Serviced
J-1	5
J-2	4
J-3	4
J-4	5
J-5	6
J-6	6
J-7	6

Pipe Label	Length (m)	Diameter (mm)
P-1	60.0	150
P-2	60.0	150
P-3	110.5	150
P-4	164.0	150
P-5	152.5	150
P-6	204.0	100
P-7	148.0	150
P-8	61.0	100
P-9	194.0	150

Questions:

a) What are the demands at each of the junction nodes? What is the total demand?

b) Does the present water distribution system have enough capacity to supply the new subdivision?

c) Which connection to the existing main is supplying more water to the subdivision? Why?

d) Are the proposed pipe sizes adequate to maintain velocities between 0.15m/s and 2.44m/s, and pressures of at least 140 kPa?

e) Would the subdivision have enough water if only one connection were used? If so, which one?

f) What do you think are some possible pitfalls of modeling two connections to existing mains within the same system, as opposed to modeling back to the water source?

Problem 7

Use the pipe sizes given the table below for the subdivision in **Problem 6**.

Junction and Pipe Information:

Pipe Information for Problem 7

Pipe Label	*Diameter (mm)*
P-1	200
P-2	150
P-3	150
P-4	150
P-5	150
P-6	150
P-7	150
P-8	150
P-9	150

City ordinances require the following:

The pressure at the fire flow discharge and at other points in the distribution system cannot fall below 12.5 kPa during a fire flow of 34 L/s. (Hint: The total flow at the fire flow node does not need to include the baseline demand).

Questions:

a) If a residential fire occurs at J-7, would the current system be able to meet the fire flow requirements set by the city?

b) If not, what can be done to increase the available flow to provide adequate fire flow to that hydrant?

c) If a fire flow is placed at J-4, dos the system meet the requirements with the proposed improvements? Without the proposed improvements?