CE 3372 Water Systems Design
Exam 1
Spring 2014

1. What is a water use system?

2. What is a water control system?

3. Which kind of system is depicted in Figure **??**? Explain your reasoning.

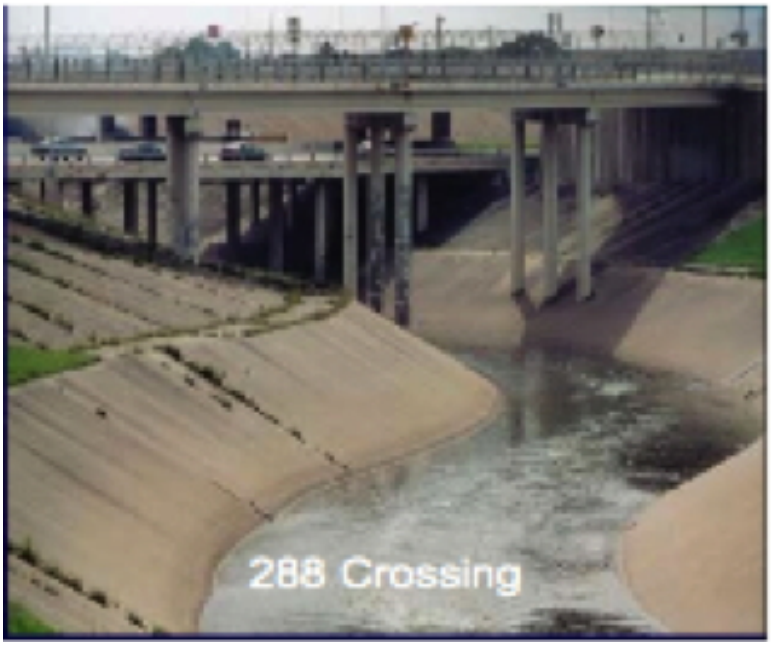

Figure 1: Braes Bayou at SH288

4. Use Title 30, Part 1, Chapter 290, Subchapter D, Rule 290.44 of the Texas Administrative Code to answer the following questions:

   a) What is the minimum pressure requirement for a public water system during normal (non-fire suppression) operation for parts of the system that deliver 1.5 gallons per minute or more?

   b) What is the minimum pressure requirement for a public water system during emergency (fire suppression) operation for parts of the system that deliver 1.5 gallons per minute or more?

   c) What is the minimum distance for new potable water distribution lines in feet to wastewater collection facilities?

   d) What is the minimum free chlorine residual in mg/L required in Texas water distribution systems (if using free chlorine)?

5. List four sources of design guidelines for water systems design in Texas.

   a)

   b)

   c)

   d)

6. An EPA-NET simulation produced the "full report" listed below.

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Link - Node Table:

Link ID	Start Node	End Node	Length ft	Diameter in
1	2	3	1000	12
2	3	4	1000	12
3	2	5	1000	12
4	3	6	1000	12
5	5	6	1000	12
6	6	4	1000	12
7	1	2	1000	12

Node Results:

Node ID	Demand CFS	Head ft	Pressure psi	Quality	
2	0.00	76.94	33.34	0.00	
3	0.00	75.55	32.74	0.00	
4	3.00	74.51	32.28	0.00	
5	0.00	76.23	33.03	0.00	
6	0.00	75.51	32.72	0.00	
1	-3.00	100.00	0.00	0.00	Reservoir

Link Results:

Link ID	Flow CFS	Velocity fps	Unit Headloss ft/Kft	Status
1	1.76	2.25	1.39	Open
2	1.51	1.93	1.04	Open
3	1.24	1.57	0.71	Open
4	0.25	0.32	0.04	Open
5	1.24	1.57	0.71	Open
6	1.49	1.89	1.01	Open
7	3.00	3.82	23.06	Open

Using the information contained in the EPA-NET report on the previous page:

a) How many pipes are in the network?

b) How many junctions (nodes) are in the network?

c) How many reservoirs/tanks are in the network?

d) Sketch the network, label the pipes, junctions, and reservoirs. Indicate any demands at nodes. Indicate the flow rates and flow directions on your sketch.

7. Figure **??** is a collection of annotated images of the Edmonston Pumping Plant and pipeline/tunnel system at the southern end of the California Aqueduct. The 10+ mile system lifts water from the Edmonston forebay at elevation 1239 feet to the Tehachapi afterbay at elevation 3131 feet for subsequent distribution to various parts of southern California.

   Figure **??** is a pump performance curve for one of the 14 pumps arranged in two 7-pump bays, each supplying one of the parallel 16-foot diameter steel pressure pipes.

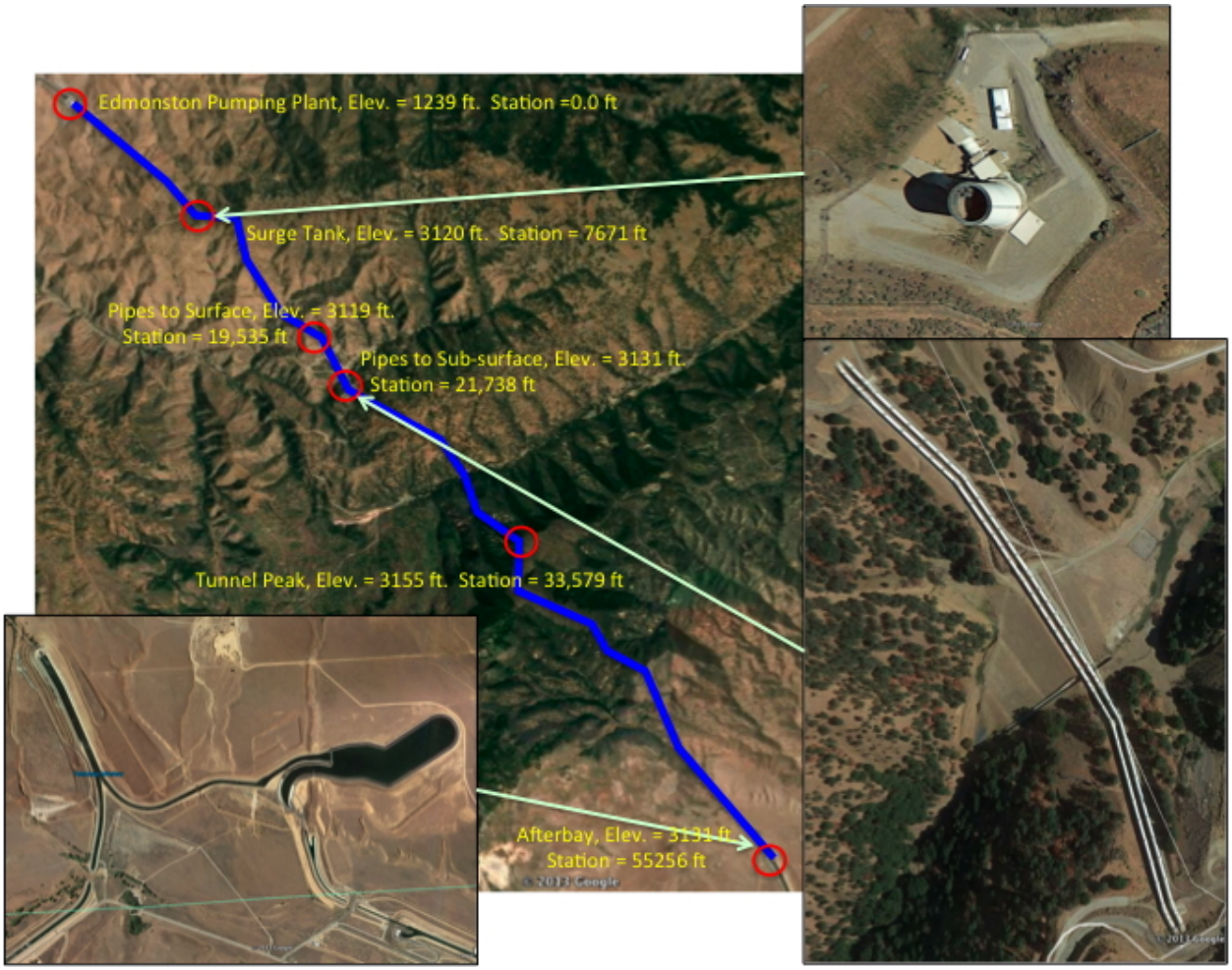

Figure 2: Aerial images of Tehachapi Mountains, California; showing the lift system for the California Aqueduct.

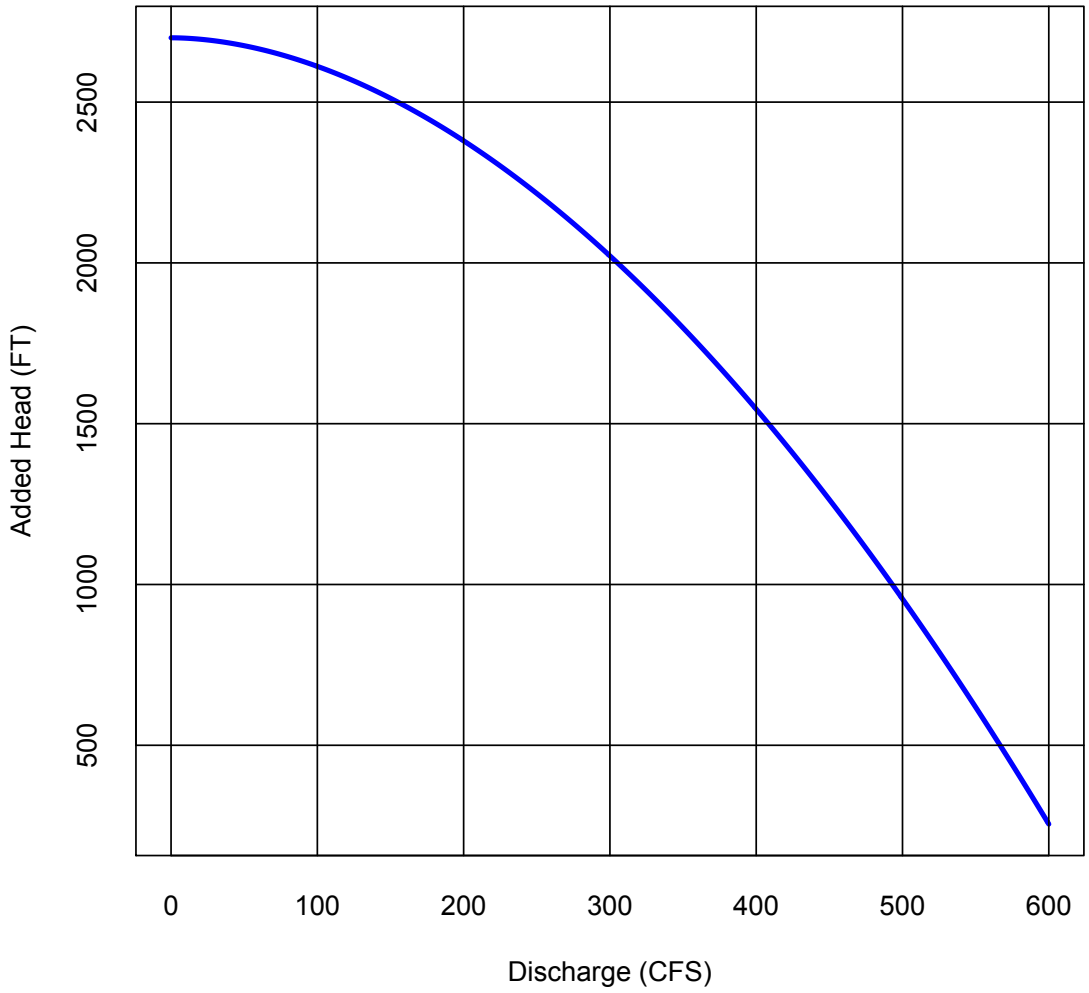

Figure 3: Lift pump performance curve for single pump. System has 14 identical pumps in two parallel galleries; each gallery has 7 pumps operating in parallel.

Use EPANET to simulate the system.

a) Sketch your proposed EPANET layout[1].

[1]Make the sketch first then read the rest of the questions before you actually start the EPANET modeling – it should help you devise an appropriate model. Label the sketch with node elevations, node names, pipe names, and pipe lengths.

b) What are the pipe lengths between the indicated locations in Table **??** (i.e. complete the table)?

Table 1: Selected Pipeline Locations and Pressures

ID	Location	Distance from Pumps (feet)	Connection Sequence	Pipe Barrel Length
1	Edmonston Pump House	0	N/A	0
2	Surge Tank	7,671	1 to 2	
3	Pipes to Surface	19,535	2 to 3	
4	Pipes to Ground	21,738	3 to 4	
5	High Tunnel	33,579	4 to 5	
6	Tehachapi Afterbay	55,256	5 to 6	

c) What is the total length of pipe/tunnel required (in miles)?

d) What is the total head at the Edmonston Pump Forebay (the pumphouse)?

e) What hydraulic element is used to represent the forebay?

f) What is the total head at the Tehachapi Afterbay?

g) What hydraulic element is used to represent the afterbay?

h) What head-loss model is most appropriate for this analysis?

i) What is the total discharge in the system in cubic-feet-per-second when all 14 pumps are running?

j) What is the pressure at the locations in Table **??** (i.e. complete the table)?

Table 2: Selected Pipeline Locations and Pressures

ID	Location	Distance from Pumps (feet)	Elevation (feet)	Pressure (psi)
1	Edmonston Pump House	0	1,239	
2	Surge Tank	7,671	3,121	
3	Pipes to Surface	19,535	3,119	
4	Pipes to Ground	21,738	3,131	
5	High Tunnel	33,579	3,566	
6	Tehachapi Afterbay	55,256	3,131	

k) What is the velocity of water the each of the pipes?

l) What is the mechanical energy required to move the water in kW-h (kilowatt-hours)?