

## **HRWPA Water Distribution Class**

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### **Objective:**

The primary objective of this class is to provide students with an understanding of the engineering aspects of a water distribution system so they can make an informed decision on career paths within a water utility.

**Part 1:** Provide a general overview of a water utility and the disciplines involved in supporting this operation.

**Part 2:** Provide more detailed understanding of the water distribution component of a water utility. This will include,

- A discussion on energy, flow, pressure, and force with demonstrations to explore these concepts.
- A display of pipe materials and parts used in construction.
- A discussion on water quality and the impact pipe materials have on water quality. Concepts demonstrated by measuring chlorine decay in various pipe samples.

### **Outline**

- 1) Part 1
  - a) Water Utility Overview
    - i) Watershed
    - ii) Source Water: surface water, ground water, brackish ground water
    - iii) Source Water Pumping
    - iv) Treatment
    - v) Distribution
    - vi) Business
  - b) Disciplines Required
    - i) Professional
      - (1) Engineering
      - (2) IT
      - (3) Business
    - ii) Operators

- iii) Laboratory
- iv) Security
- v) Trades
  - (1) Plumbing
  - (2) Electrical
  - (3) Mechanical
  - (4) Instrumentation
  - (5) Drafting
  - (6) Forestry
  - (7) Automotive

2) Part 2

- a) Pipe Materials
  - i) New Pipes
  - ii) Old Pipes
  - iii) Lining
  - iv) Coating
- b) Hydraulics
  - i) Energy, Pressure, Flow, Force
  - ii) Flow through Pipes and the Hydraulic Grade Line (demonstration)
  - iii) Pumps
  - iv) Surge (demonstration)
  - v) Forces Generated (demonstration)
  - vi) Math Involved
- c) Tanks – Why We Have Them
  - i) Elevated Tanks
  - ii) Ground Tanks
  - iii) Hydropneumatic Tanks
- d) Designing a System
  - i) Domestic Flow
  - ii) Fire flow
  - iii) Chlorine Decay
  - iv) Computer Applications

3) General Discussion and Answer Questions

## Notes on Conducting Class

<u>Elapsed</u>	<u>Duration</u>	<u>Action</u>
0:00:00	0:05:00	Begin with Part 1, presenting slides and diagrams to assist in understanding. Expect to keep this very brief, about 10 min.
0:05:00	0:10:00	Fill sample pipes with water, measure total chlorine, start a spreadsheet to
0:15:00	0:10:00	Discuss the physics of fluid flow. Use combination of slides and chalkboard.
0:25:00	0:15:00	Operate the hydraulic system to demonstrate grade line. Calculate grade line
0:40:00	0:10:00	Operate the hydraulic system to illustrate pump operation. Review concepts
0:50:00	0:05:00	Measure chlorine residual in sample pipes. Plot points.
0:55:00	0:15:00	Operate the hydraulic system to demonstrate what causes surge pressures. Show slides on impacts from surge – pressure vs time charts as well as busted pipes.
1:10:00	0:10:00	Scheduled break
1:20:00	0:20:00	Operate the hydraulic system to demonstrate forces created by static pressure on bends. Show on chalkboard how forces are calculated. Look at ductile iron fittings to see how they hold the force.
1:40:00	0:05:00	Brief discussion of math used.
1:45:00	0:15:00	Discuss diurnal curves and why we need tanks. Use slides to illustrate calculation of required volume. Demonstrate tank operation with hydraulic
2:00:00	0:15:00	Discuss how we design a water system. Use slides to show concepts. Show hydraulic model operation. Bring sample drawings – typical drawing prepared at the utility and drawing of the sample hydraulic system. Discuss importance of records.
2:15:00	0:15:00	Measure chlorine residual in sample pipes. Plot points. Discuss results.
2:30:00	0:15:00	Discuss typical day in my job. Answer any questions.

## Materials

1. Hydraulic pipe system. Pump, plastic tubing, valves, etc.
2. Pipe samples for chlorine testing. galvanized iron, copper, pvc
3. Pipe samples. Ductile iron, bell joint, restrained joint
4. Sample drawings. One from Waterworks, one of sample hydraulic system
5. Samples of my work, reports, etc.
6. Laptop computer
7. Projector
8. Chlorine test kit