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Example Procedure for Flushing an Actual 3 Floor Office Building

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I. Background

Sometimes buildings are shutdown or experience long-periods of low occupancy and the water inside the property plumbing stagnates. Water can stagnate inside the building pipes and tanks, but also in the buried water service line that transports drinking water from its source to the building. Stagnation allows for contaminant levels of metals such as lead and copper to increase in the water. Microbes are also likely to grow. Under routine building water use, the amount of contamination in water is not typically a problem, but long stagnation periods can cause water quality to deteriorate to unacceptable levels. To remove this water from the property plumbing, a procedure was developed based on as-built construction drawings and experience inside the building. The procedure below is provided to help demonstrate the steps needed to flush the stagnant water from the plumbing and replace it with fresh water from the water utility main buried out in front of the property.

This guidance was developed using specific assumptions, stated below. ***Factors of safety were not applied.*** Due to non-ideal flows commonly encountered in plumbing, stated flushing times may need to be increased. In a prior study for flushing home interior faucets the factor of safety applied was 10. So, all flushing times may need to be 10% longer. No safety factors were applied.

Building Characteristics

Year Built 2010

Size:

- 3 floors, 20,000 square feet area

Water Use:

- A regulated public water system (PWS) delivers chlorinated drinking water to the property through a buried service line.
- The building only relies on PWS water for drinking, appliances, and hot water
- Rainwater is collected and used for toilet flushing.
- 1 shower exists in the building that includes a showerhead and shower wand.

Plumbing Characteristics:

- The buried water service line (111.25 ft, 30 gallon) consists of 3 different sections: 25 foot galvanized pipe + 72.5 feet copper pipe + 13.75 feet two copper pipe.
- Total volume storage in the service line = 30 gallons.

In-Building Devices:

- Point-of-entry water softener (19.2 gallon).
- Water heaters: No central water heater exists. Instead, on-demand tankless water heaters are utilized. For smaller fixtures (e.g. bathroom sinks) and larger fixtures (e.g. showers and kitchen sinks) the capacity of the water heaters were approximately 0.17 gallon and 0.5 gallon, respectively.
- The following devices exist: Dishwashers [Basement and Floor 1], Refrigerator with water dispenser [Floor 1], ice machine [Floor 1], water bubblers [Floor 2].
- Standalone water cooler in the basement with treatment.
- Point-of-use faucet filtration device was located on Floor 2.

Plumbing Type:

- Soldered copper pipe

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II. To Prepare for Flushing

1. Remove faucet aerators where possible and replace them after flushing is completed. Their removal will allow water flowrate to be faster and limit the amount of sediment to become trapped during flushing.
2. Remove point-of-use filters and replace them after flushing. This will limit the amount of sediment to become trapped during flushing and also a potential source of contamination.
3. Remove shower hoses and replace them after flushing.
4. Consider only opening 1 fixture at a time. The more fixtures you open, the slower the water will flow inside the building because pressure loss through multiple fixtures being open.
5. Consider turning on vent fans where present and opening windows and doors to maximize building ventilation.
6. Turn off the automatic motion fixtures where possible. These are the hands-free faucet functions. This will ensure the fixture continuously flushes and doesn't shutoff every few seconds. By allowing these fixtures to continuously run, this will reduce the amount of labor needed and time required. If this is not possible, someone should be physically present and make certain the actual flushing time exceeds the required amount.

The goal is to replace water in the building starting at the service line and then moving sequentially from the bottom floor to the top floor. A major assumption is that the drinking water delivered to the property through the water utility main is fresh, meets all federal drinking water standards, and contains residual disinfectant.

III. Step-by-Step Procedure (you may need 2 people to do this)

- Fixture water flowrate is assumed 0.5 gallons per minute unless otherwise stated. Fixture flow rates may be faster this depending on the building, which would reduce the necessary fixture flushing time.
- A 0.5 gallon per minute flowrate can be measured by filling a 5 gallon bucket in 2 minutes and 30 seconds. The same flowrate would fill a 1 gallon milk jug in 2 minutes.
- This guidance assumes no fixtures were not clogged.

1. **Begin in the basement**

- a. Connect a hose to the spigot located inside the building at the building entry point and then insert that hose into the janitor sink to drain the flushed water. Turn on the spigot to flush water and have someone monitor the spigot does not leak and janitor sink does not overflow or spill out. **Flush this location for 1 hour.** At the end, shut this off. This spigot is a high flowrate location and is immediately located after water enters the building through the service line.
- b. Contact water softener manufacturer and request a new replacement for the resin. Follow manufacture's guidelines for draining softener bed.
- c. Go to the Basement Kitchen Sink Faucet (Room 006). This is the furthest fixture from the basement entry point within the basement.
 - i. Now flush on the highest COLD WATER flow rate **for at least 8 minutes.**

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- ii. Then flush on the highest HOT WATER flow rate **for at least 1 minute** to flush the onsite water heater (0.5 gallons).
- d. Next, go to the women's restroom. Flush each sink **for at least 30 seconds**. There are 2 sinks in this room.
- e. Next, go to the men's restroom, flush each sink **for at least 30 seconds**. There is 1 sink in this room.
- f. Go to the janitor sink closet in the men's restroom.
 - i. Flush COLD WATER **for at least 1 minute**.
 - ii. Flush HOT WATER **for at least 30 seconds** to flush the water heater.

2. Move to First Floor

- a. Go to the fixture closest to the building entry on the first floor, which is the bathroom shower.
 - i. For the shower, flush the shower head **for at least 3 minutes** on COLD WATER and **for at least 1 minute** on HOT WATER.
 - ii. Next, flush the shower wand **for at least 1 minute** on COLD WATER and **for at least 1 minute** on HOT WATER.
 - iii. Flush the single bathroom sink **for at least 45 seconds**.
- b. Continuing moving away from the basement entry towards the next closest fixture to the first floor kitchen sink. Flush at maximum flowrate **for at least 45 seconds** for COLD WATER and then flush **for at least 45 seconds** for HOT WATER.
- c. Go to the next closest fixtures which are in a first floor co-ed bathroom. There is one sink. Flush the sink **for at least 3 minutes**.
- d. Next, go to the next co-ed bathroom on the first floor that contains one sink. Flush the sink **for at least 3 minutes**.
- e. Finally, go to the furthest fixtures and flush each of the two water fountains **for at least 1.5 minutes**. [Flowrate assumed to be 0.3 gallons per minute.]

3. Move to the Second Floor:

- a. Go to the last location which is the second floor bathroom and flush the bathroom sink for **at least 1 minute**. There is 1 sink in this room.
- b. Go to the bar sink and flush **for at least 1 minute** for COLD and then HOT WATER.
- c. Reinstall any aerators that have been set aside.

Total estimated theoretical and idealistic flushing time

Basement	72	minutes
First Floor	15.75	minutes
Second Floor	3	minutes

90.75 minutes of flushing time for the building

After flushing several additional actions for this building are needed.

4. Final Steps

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- Remove and dispose of all ice in the ice machine. Consider repeating this 2 more times.
- Run and waste several cups of water through the refrigerator water dispenser.
- Run dishwashers through a washing and rinsing cycle.
- Consider replacing and installing new filter cartridges on the water cooler, refrigerator, kitchen sink, and bar sink.

III. Plumbing Diagram

The following rough diagram of plumbing was developed to demonstrate the conceptual plumbing configuration. Figures 1 and 2 are not to scale, but show a general plumbing layout.

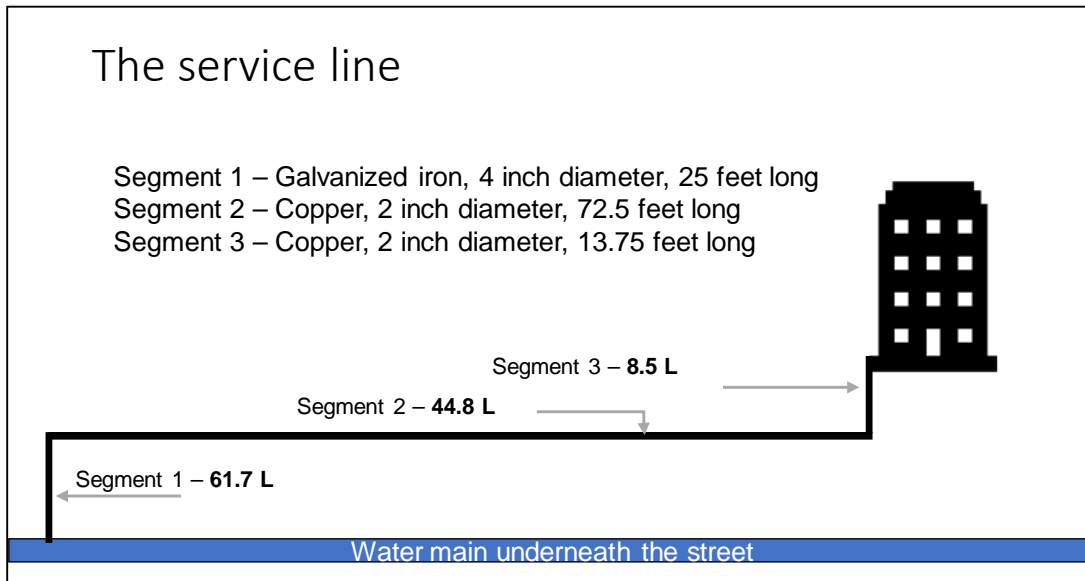


Figure 1. Drinking water travels through a utility water main underneath the street and enters the property service line. This service line links the water main to the building. This example service line has 3 segments.

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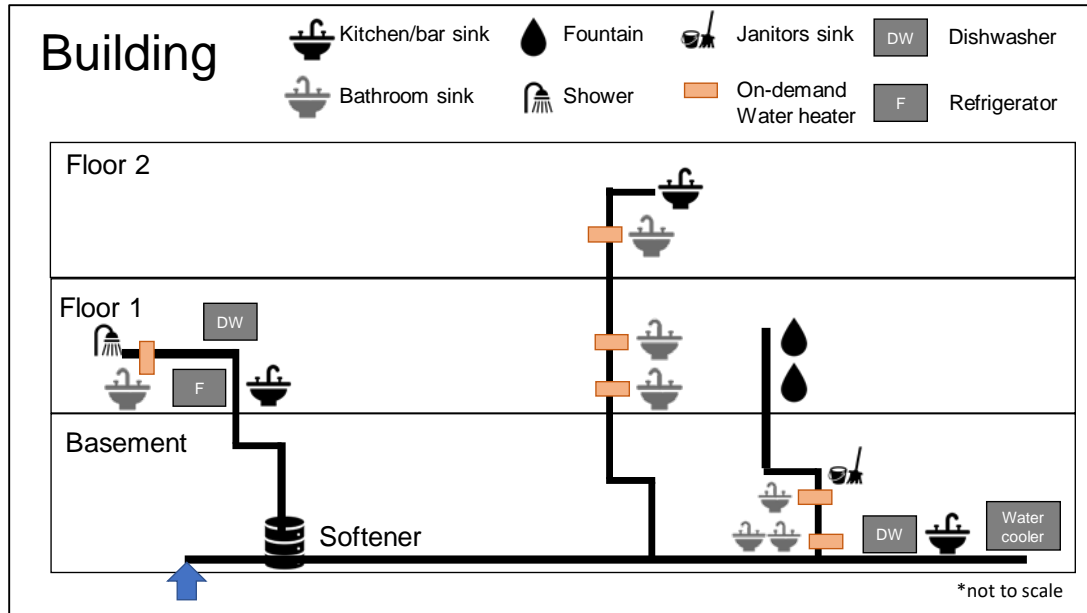


Figure 2. Drinking water enters the building from the service line near the water softener. Next, the drinking water travels through different pipes, valves, and tanks to fixtures throughout the building.

IV. Prepared By

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