PRESSURE MANAGEMENT

ST. JOHN'S

DEPARTMENT OF PUBLIC WORKS
WATER & WASTEWATER DIVISION

Overview

- Basics of Pressure Management
- Advanced Pressure Management
- City of St. John's Examples

Pressure Management

Basics

Pressure Management applies to all water distribution systems regardless of their size. The DOEC Guidelines for the Design, Construction and Operation of Water and Sewerage Systems states the following required water pressures:

- High Elevation in Distribution System – minimum 40 psi
- Low Elevation in Distribution System – maximum 95 psi
- Fire Flow Event – minimum 20 psi in Distribution System
- Sensitive Customer – varies by demand

Pressure Management

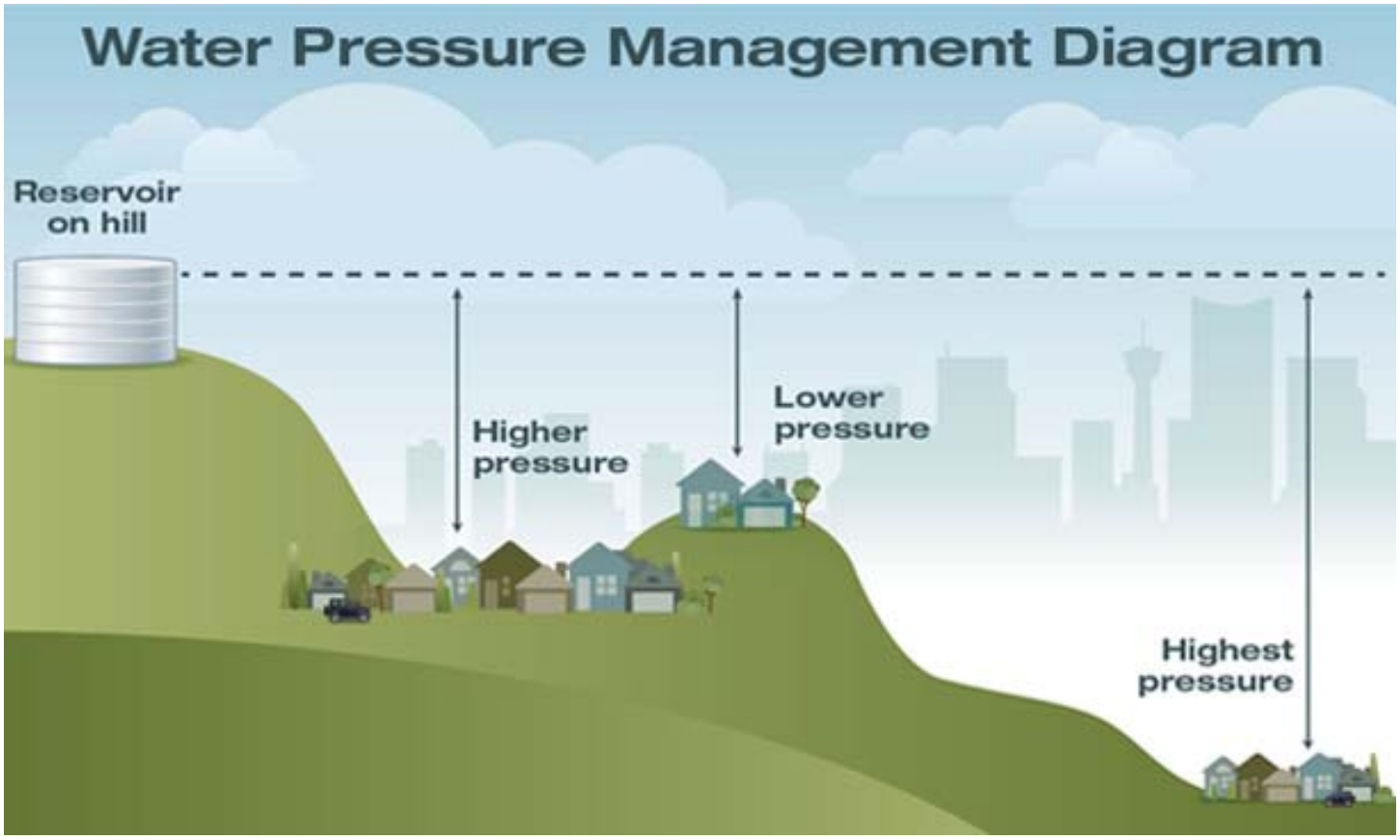
Basics

Water pressure is typically maintained within the water distribution system using pressure control infrastructure, such as:

- Water Pumping Station
- Water Storage Reservoir
- Pressure Reducing Station

Pressure Basics

Maintain Pressure at Critical Locations



Pressure Basics

Determining Pressure

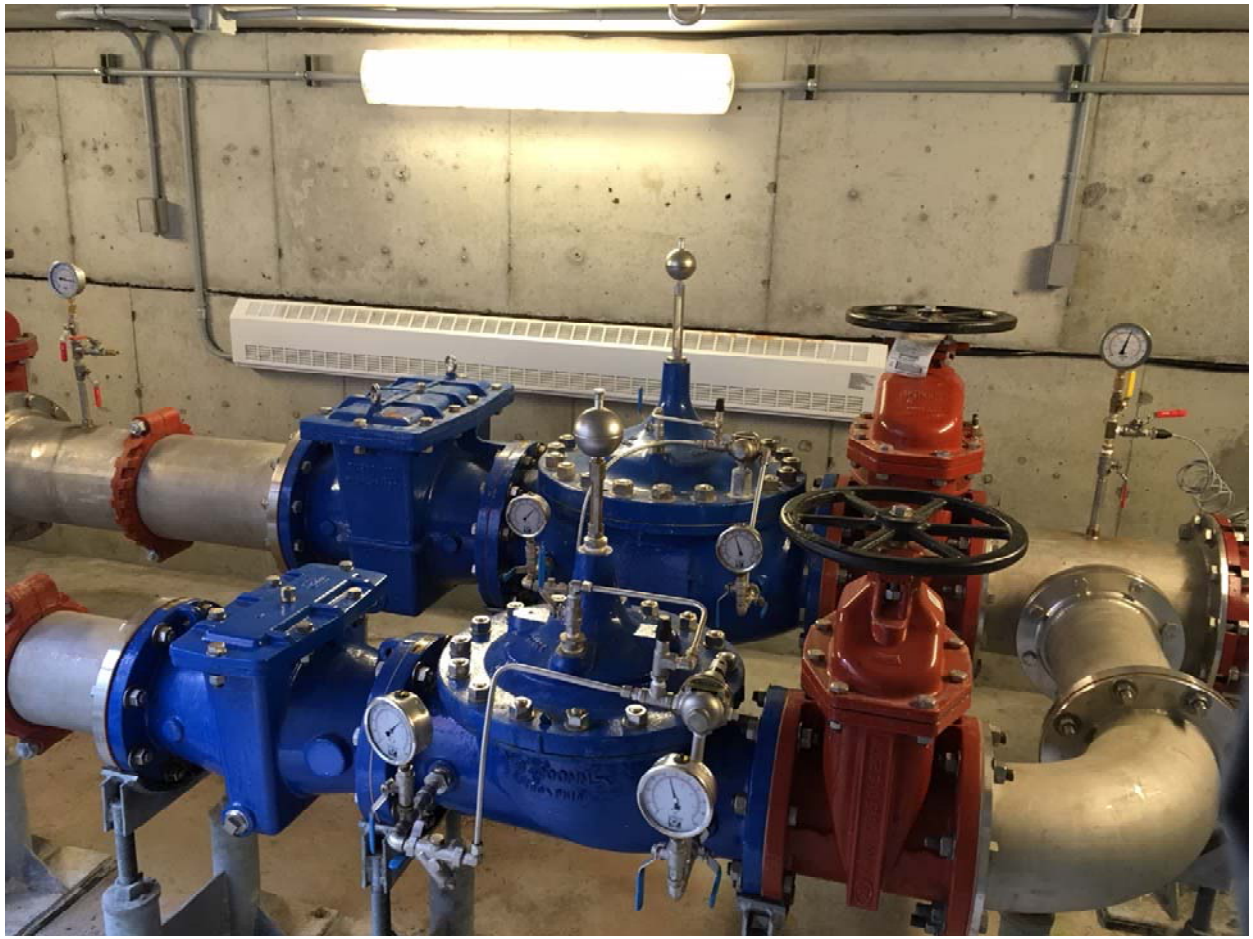
How do you determine or calculate the available water pressure within the water distribution system?

- Field Investigation and Testing – record pressures during different flow events
  - Continuously
  - Low flow, typically at night
  - Peak flow, typically during warmest day combined with largest consumers
  - Fire Flow, can be simulated with fire flow testing
- Hydraulic Grade Line
- Computer Modelling – using specialized hydraulic software

Pressure Basics

Field Monitoring

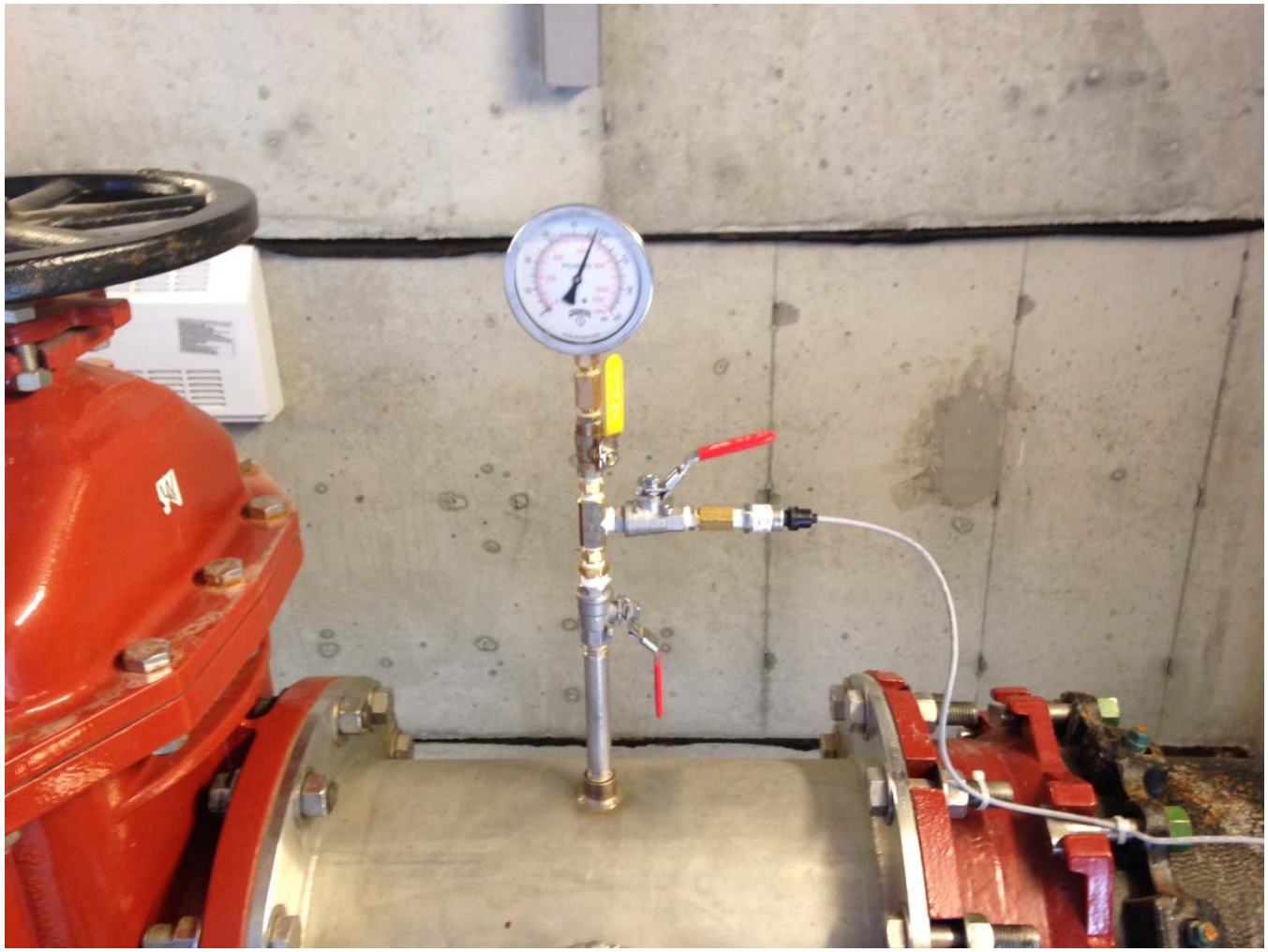
Pressure Basics



Monitoring

- Example - PRV Chamber
- Pressure Gauges
- Sensor & Transmitter

Pressure Basics



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Pressure Basics

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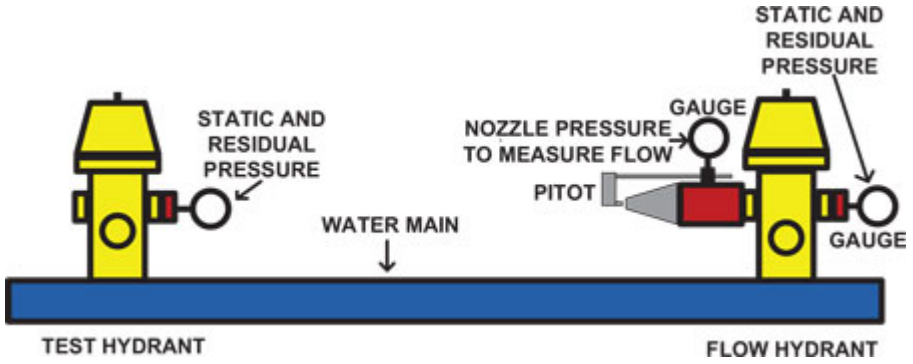
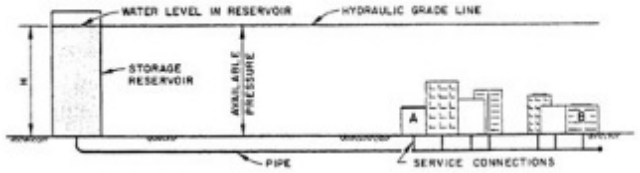
Pressure Basics

Field Monitoring

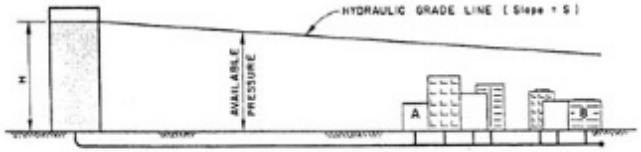


Pressure Basics

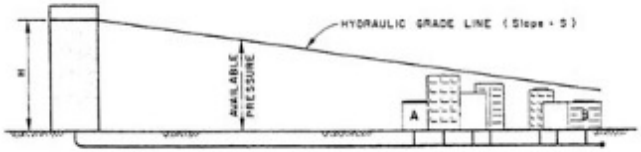
Hydraulic Grade Line



No Flow Condition



Low Flow Condition



High Demand Condition

HYDRAULIC GRADE LINE

Pressure Basics

Hydraulic Grade Line – CSJ Example

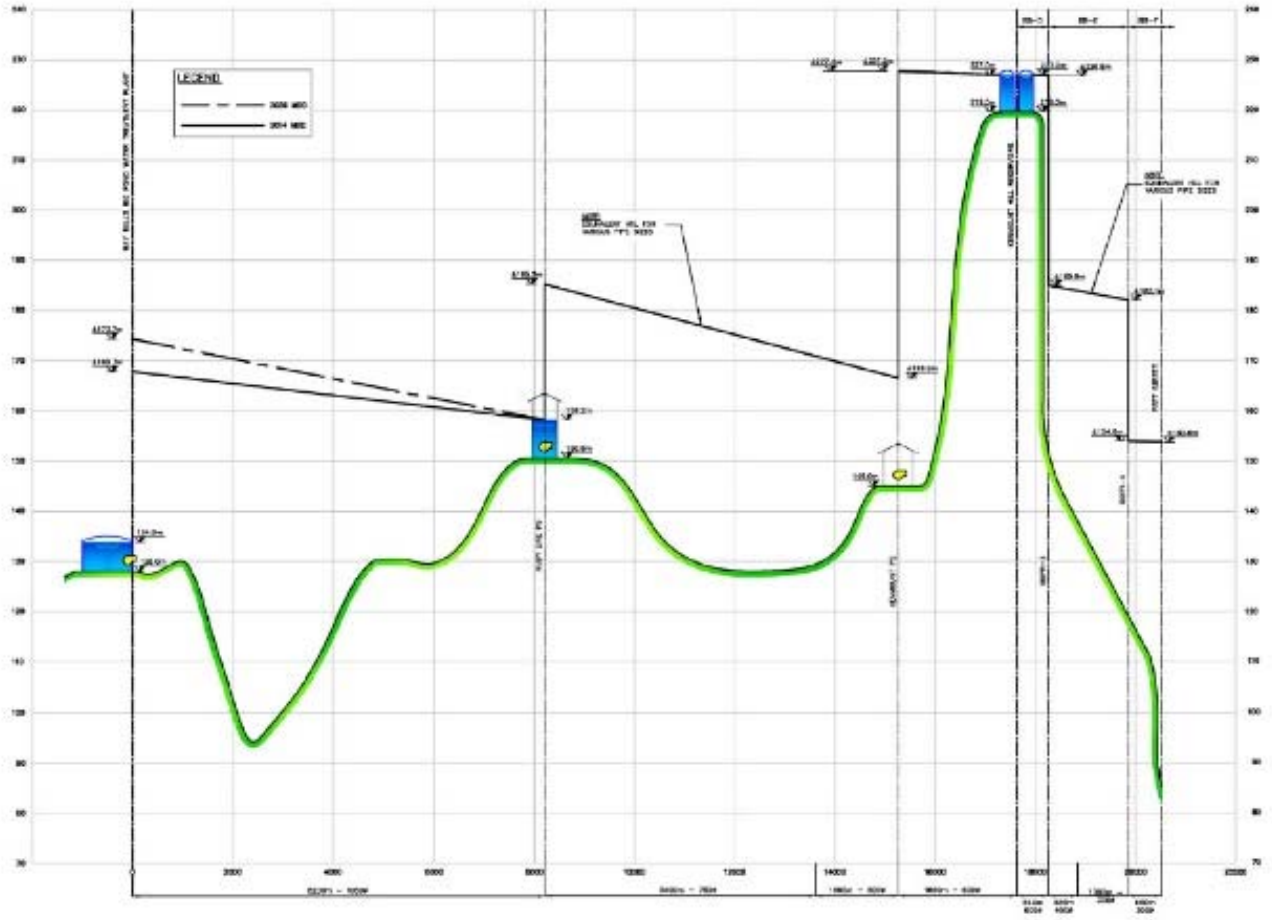


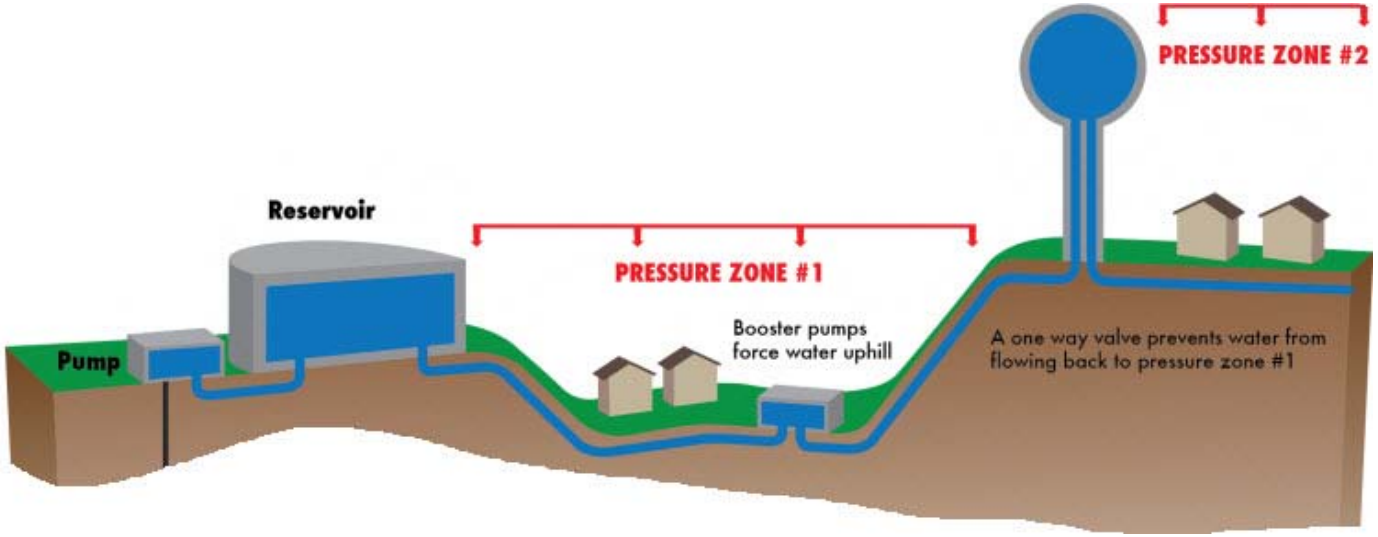
Figure 6.3: HGL Profile: BBBP to Pressure Zone BB-F

Pressure Zones

Every water distribution system regardless of size is comprised of at least one pressure zone.

A pressure zone is a distinct area that is supplied by one or more pressure control device:

- Water Pumping Station, Pressure Reducing Station, Water Storage Reservoir

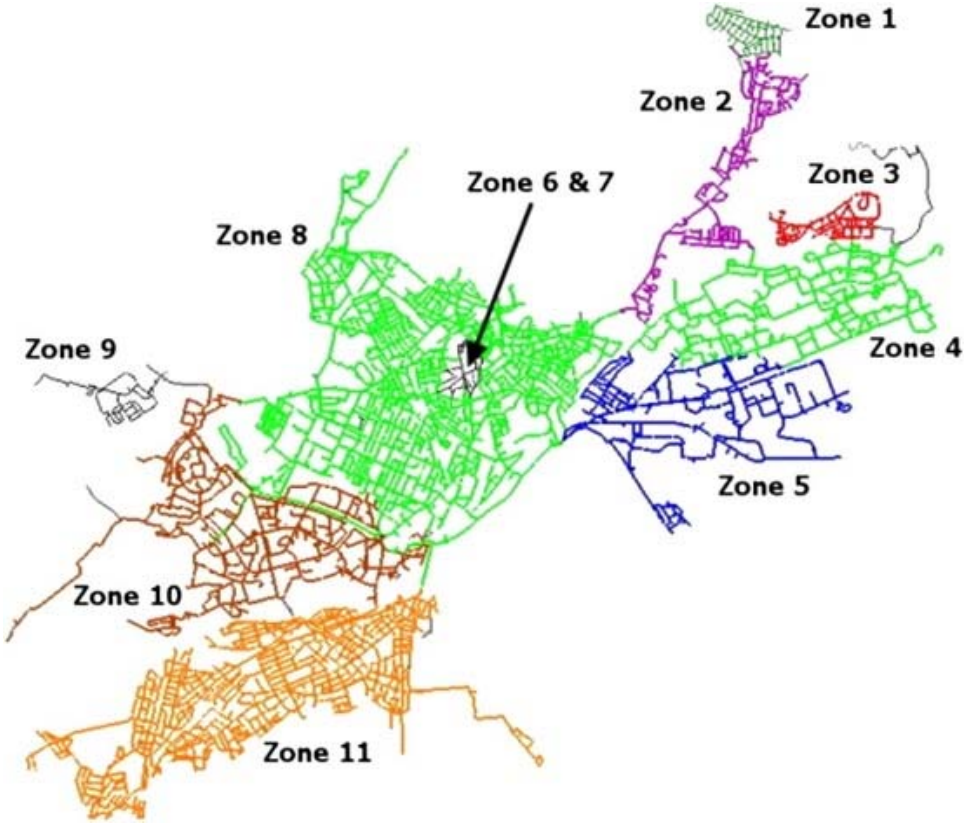


Pressure Zones

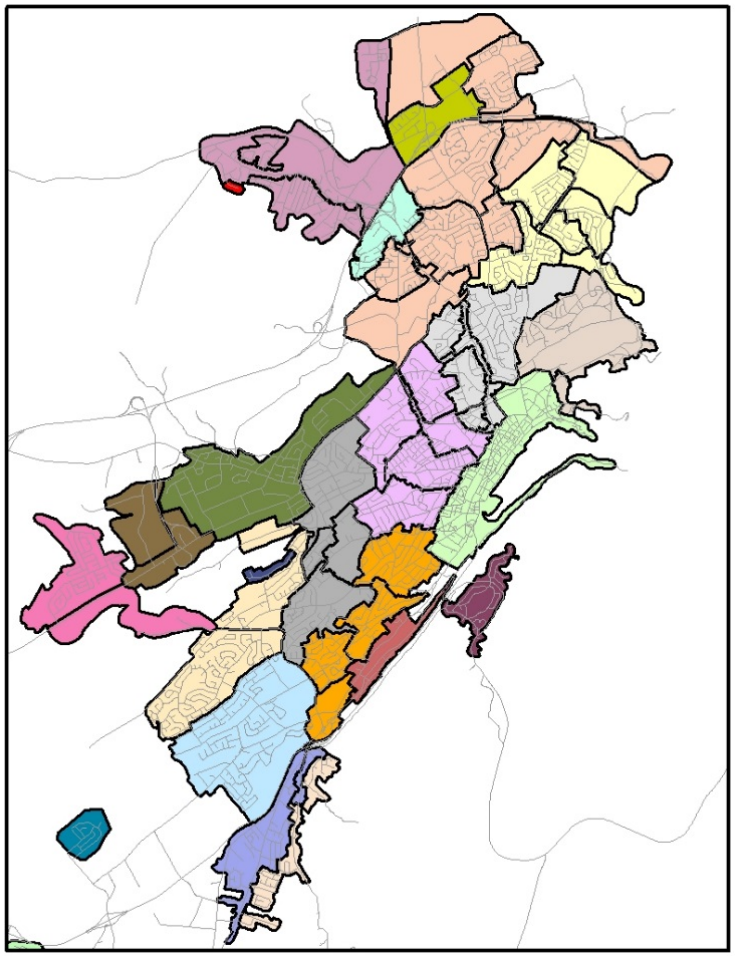
The majority of water distribution systems are comprised of more than one pressure zone.

Pressure zones can have multiple arrangements:

- single inlet & no outlet
- single inlet & outlet
- multiple inlets & no outlet
- multiple inlets & outlets



Pressure Zones

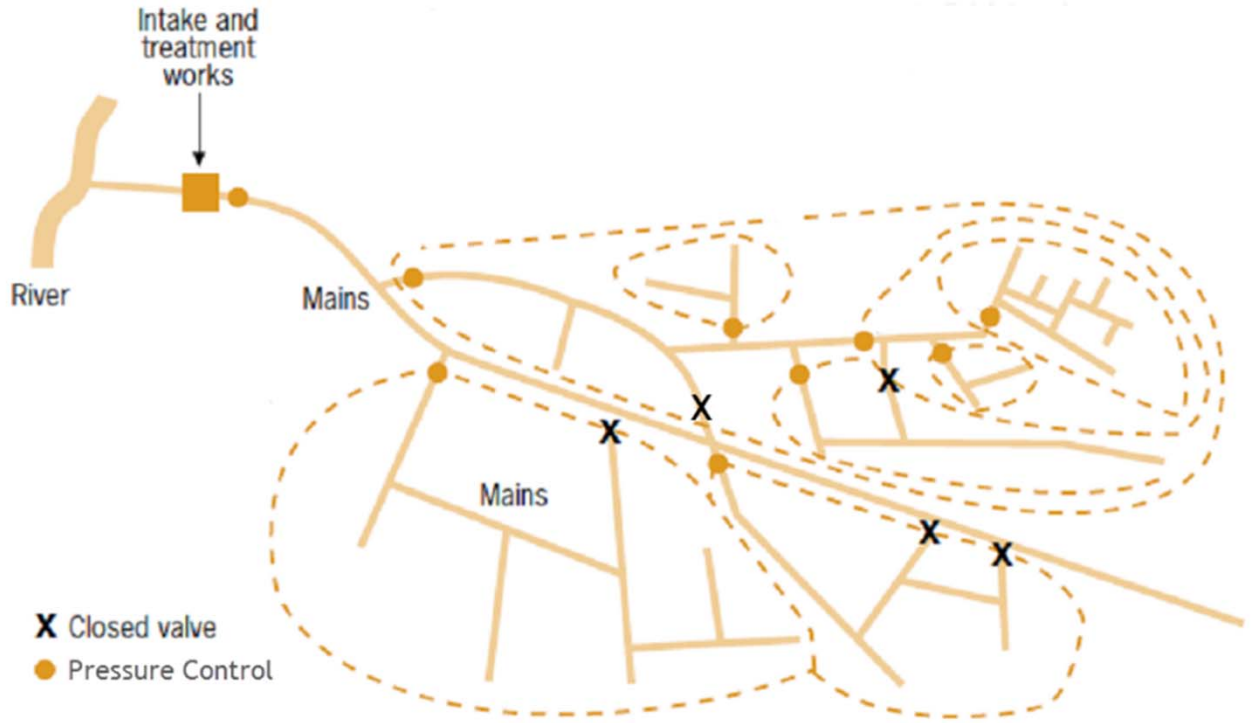


City of St. John's

- 3 Water Treatment Plants
- 24 Pressure Zones
- 14 Pressure Reducing Stations
- 6 Pump Stations
- 6 Storage Reservoirs

Pressure Zones

Each Pressure Zones require distinct boundaries created by natural “gaps” in the distribution system or closed valves.

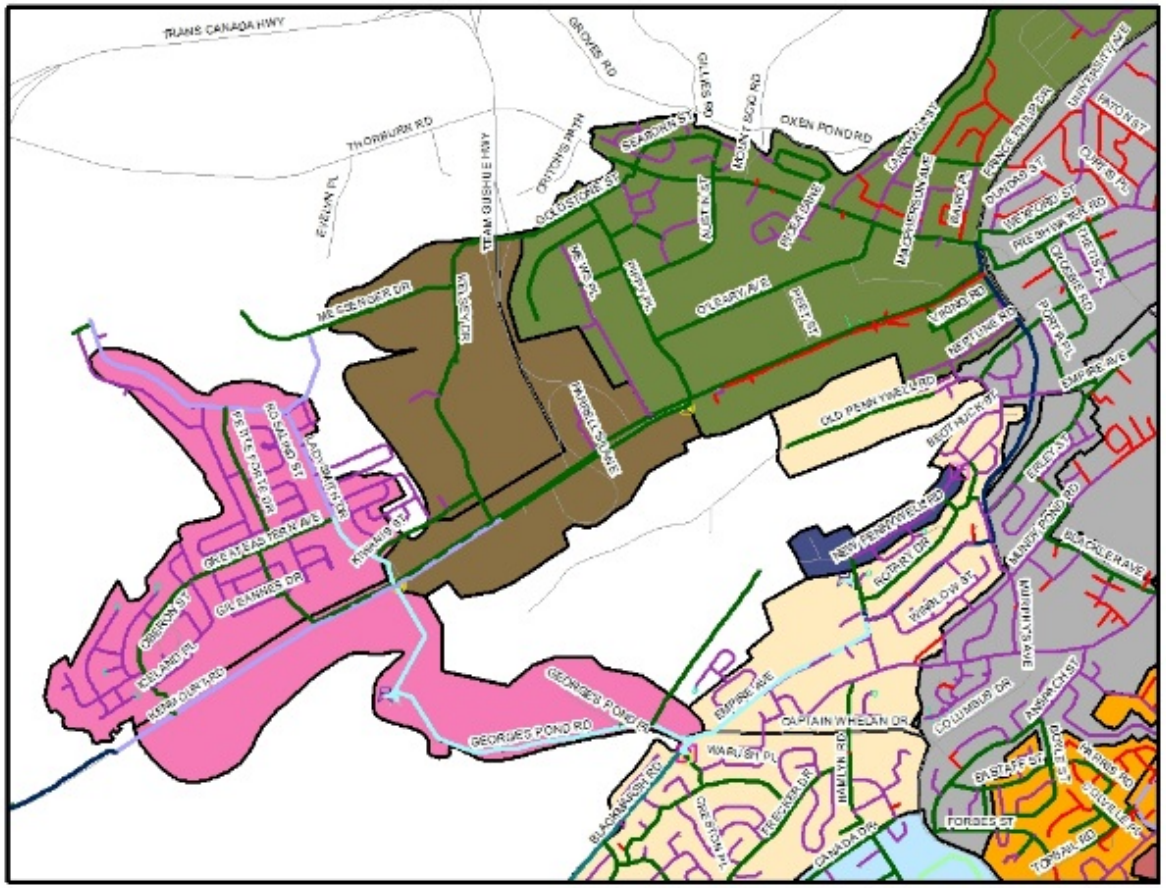


Pressure Zones

CSJ Pressure Zone Example 1

- 1 Inlet
- 0 Outlet
- 1 Pump Station
- 1 Reservoir

Pressure Zones



CSJ Pressure Zone Example 2

- Cascading Style Zone
- 1 Pump Station
- 1 Reservoir
- 3 PRVs
- Inlets & Outlets

Pressure Zones

Management of Pressure Zones

Monitoring of pressure (and flow) should be conducted regularly.

- Visual inspections of facilities and recording of pressure
- Monitoring systems (SCADA)
- Field monitoring
- Customer feedback

Pressure Zones

Management of Pressure Zones

Preventative Maintenance schedules should be developed for equipment – pump stations, pressure reducing stations, valves, etc.

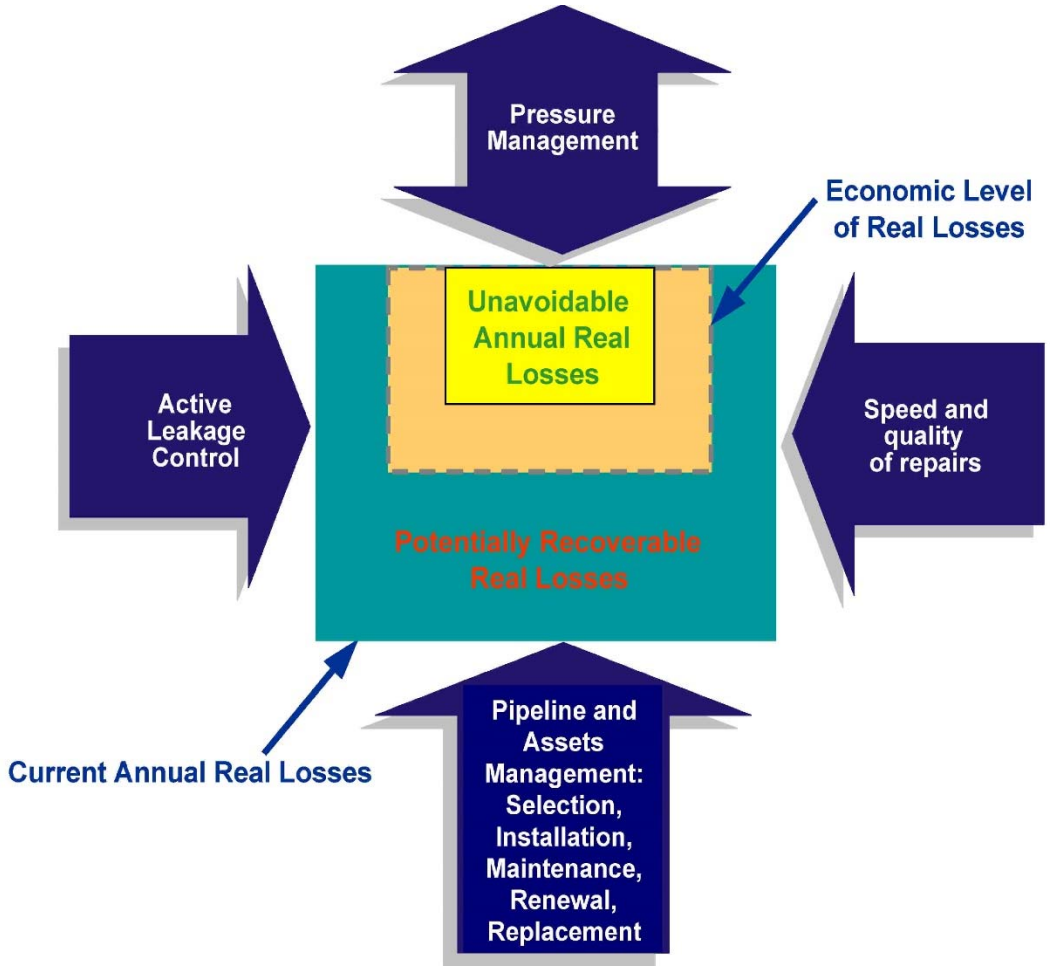
- Equipment should be checked to ensure that it is operating correctly
- Desired output is being maintained:
  - Pressure increase at pump station
  - Pressure reduction at PRV station

Advanced Pressure Management

Why Advanced Management?

- During periods of low demand water pressure is reduced below normal setting.
- Lower water pressure will result in reduced leakage and reduced water main breaks
- Typically pressure management is completed during off-peak hours – night time.

Advanced Pressure Management

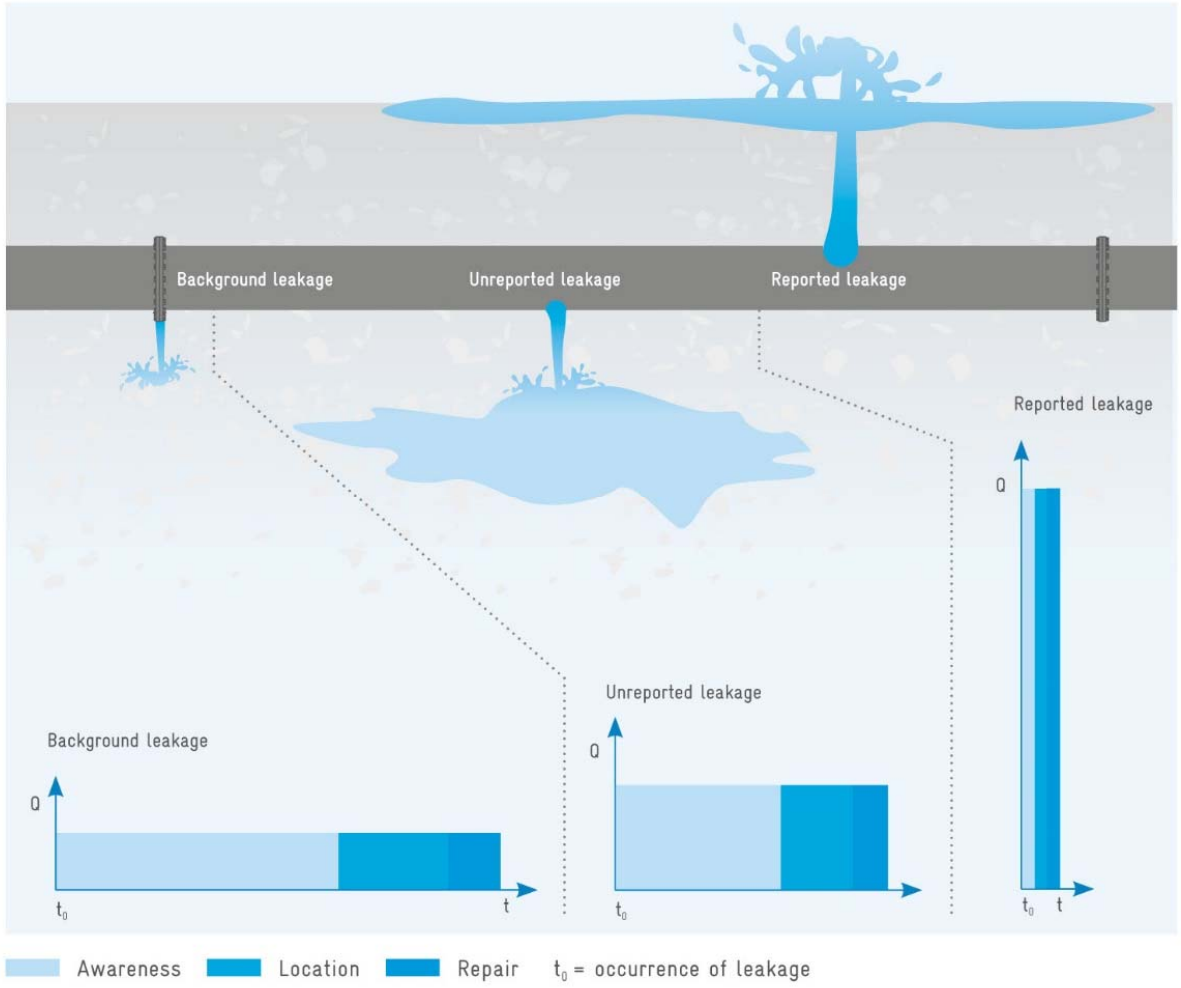


Advanced Pressure Management

All water distribution systems have leakage:

- Watermain breaks or leaks that happen suddenly and are repaired quickly; or
- Watermain breaks or leaks that occur and they do not surface immediately or they are not detected. Typicaly detected and repaired over time; or
- Background leakage – very small leaks that cannot be detected or are not economical to locate and repair.

Advanced Pressure Management



Advanced Pressure Management

Water Loss

Water loss is a dependent upon many factors including the size of the hole and pressure. We cannot control the size of the hole but we can control the pressure.

Example:

1/8” hole @ 80 psi = 5 millon litres per year

1/8” hole @ 60 psi = 4.3 millon litres per year

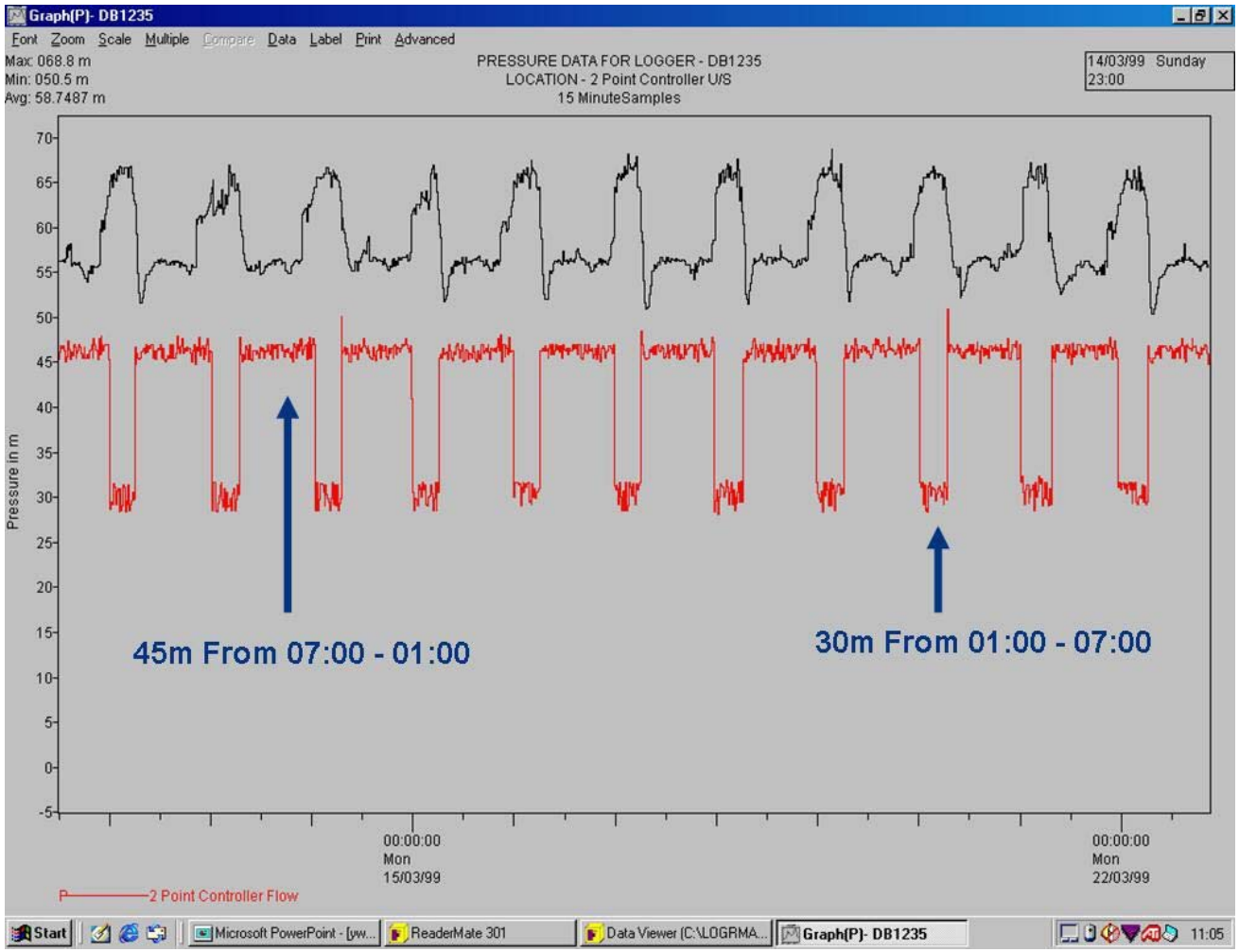
Therefore if we reduce the pressure than we can reduce the volume of water lost to leaks and ultimately reduce the total volume of water supplied to the system.

Advanced Pressure Management

Two Basic Types of Pressure Management

- Time of Day
  - Pressure Setting Changed for different times of the Day
- Flow Modulation
  - Pressure Varies with Flow
  - Higher Flow = Higher Pressure
  - Lower Flow = Lower Pressure

Advanced Pressure Management



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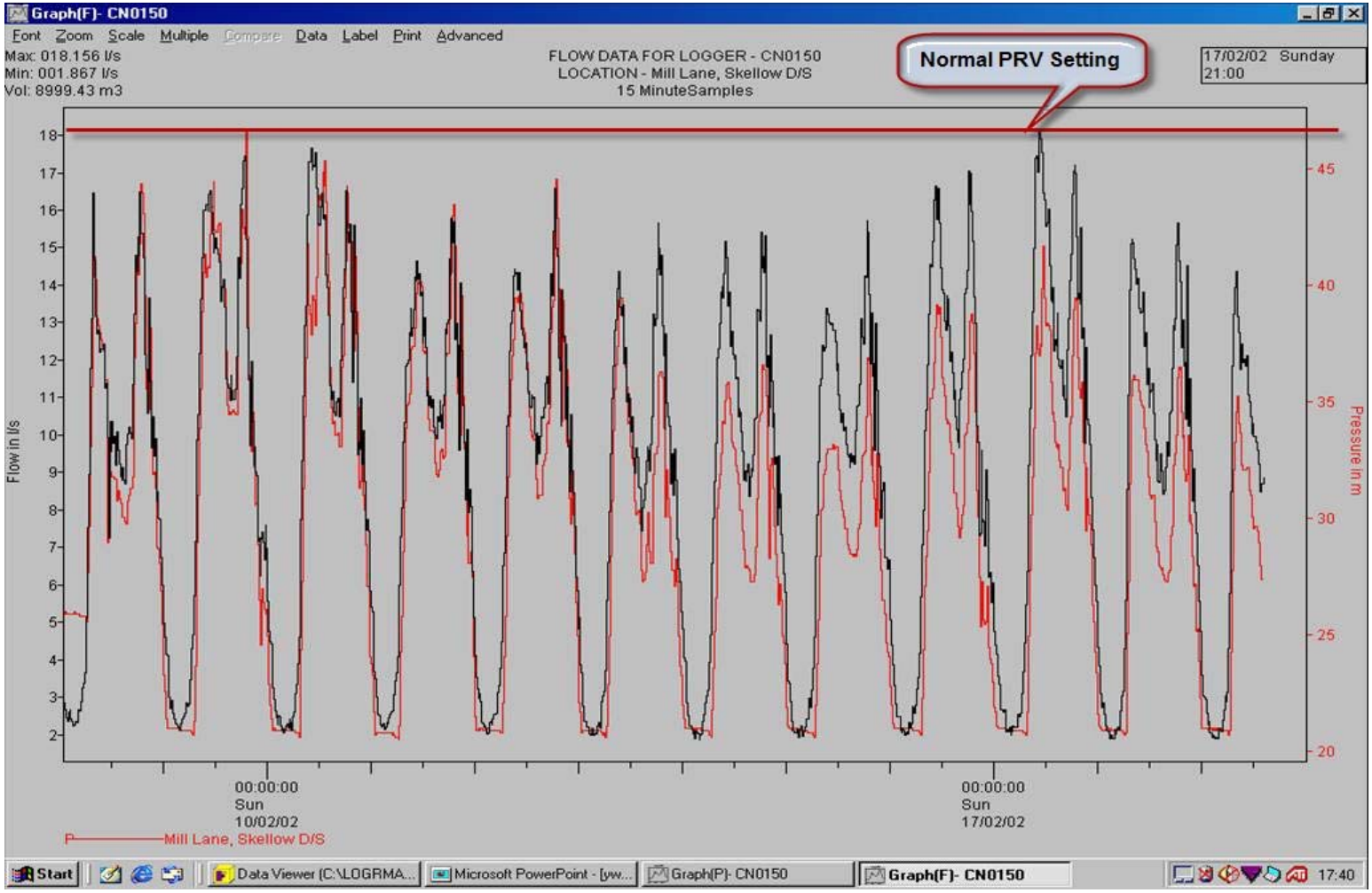
Advanced Pressure Management



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CSJ Example #1

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Summary

- Water main break caused significant damage to newly reconstructed street.
- After water main break occurred – a PRV supplying the area was determined to be malfunctioning.
- What happened first is unknown – the watermain break or the PRV malfunction

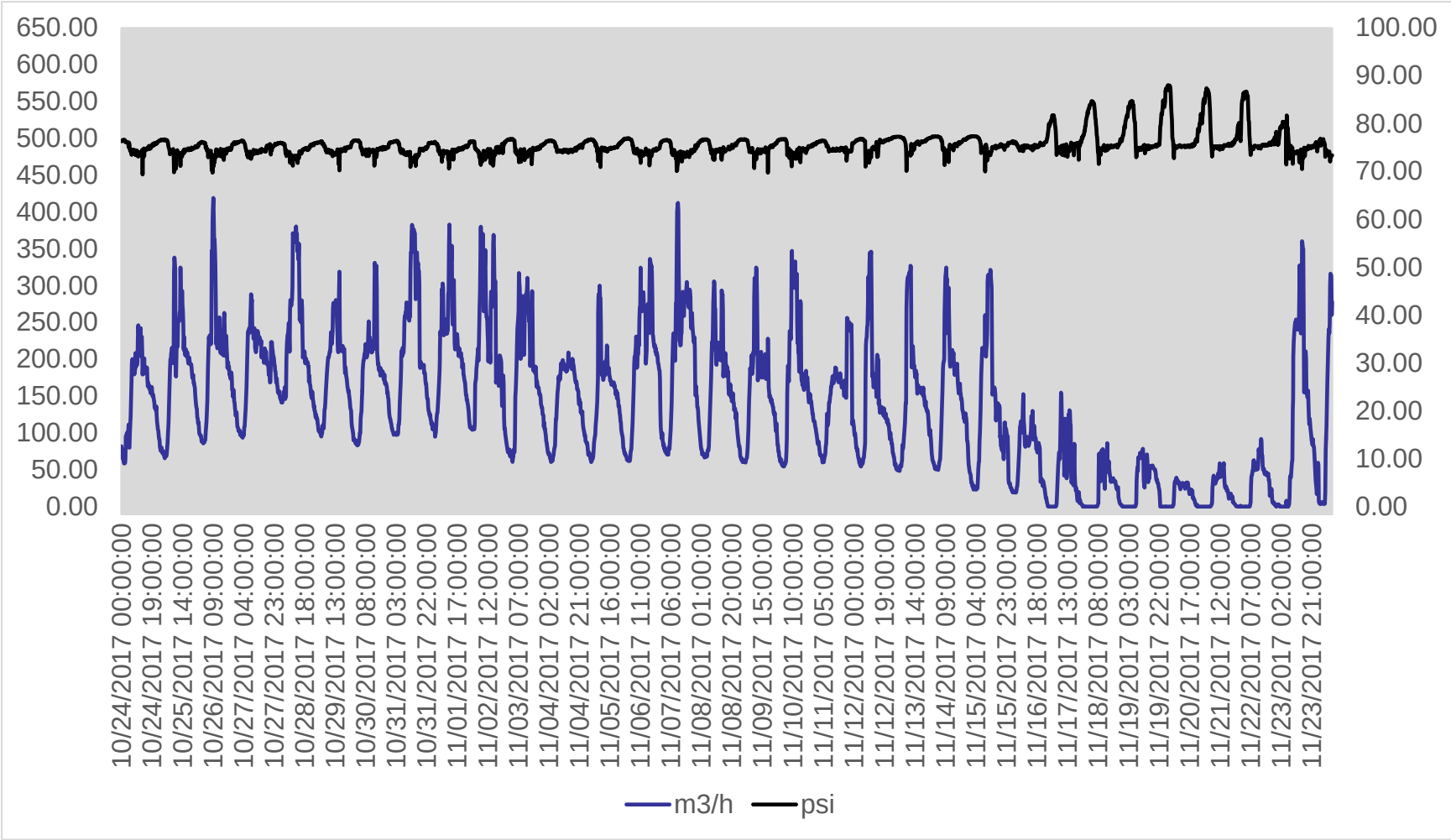
Recommendation

- After major events – pressure control devices should be checked to ensure they are operating correctly.

CSJ Example #2

CSJ Example #2

CSJ Example #2



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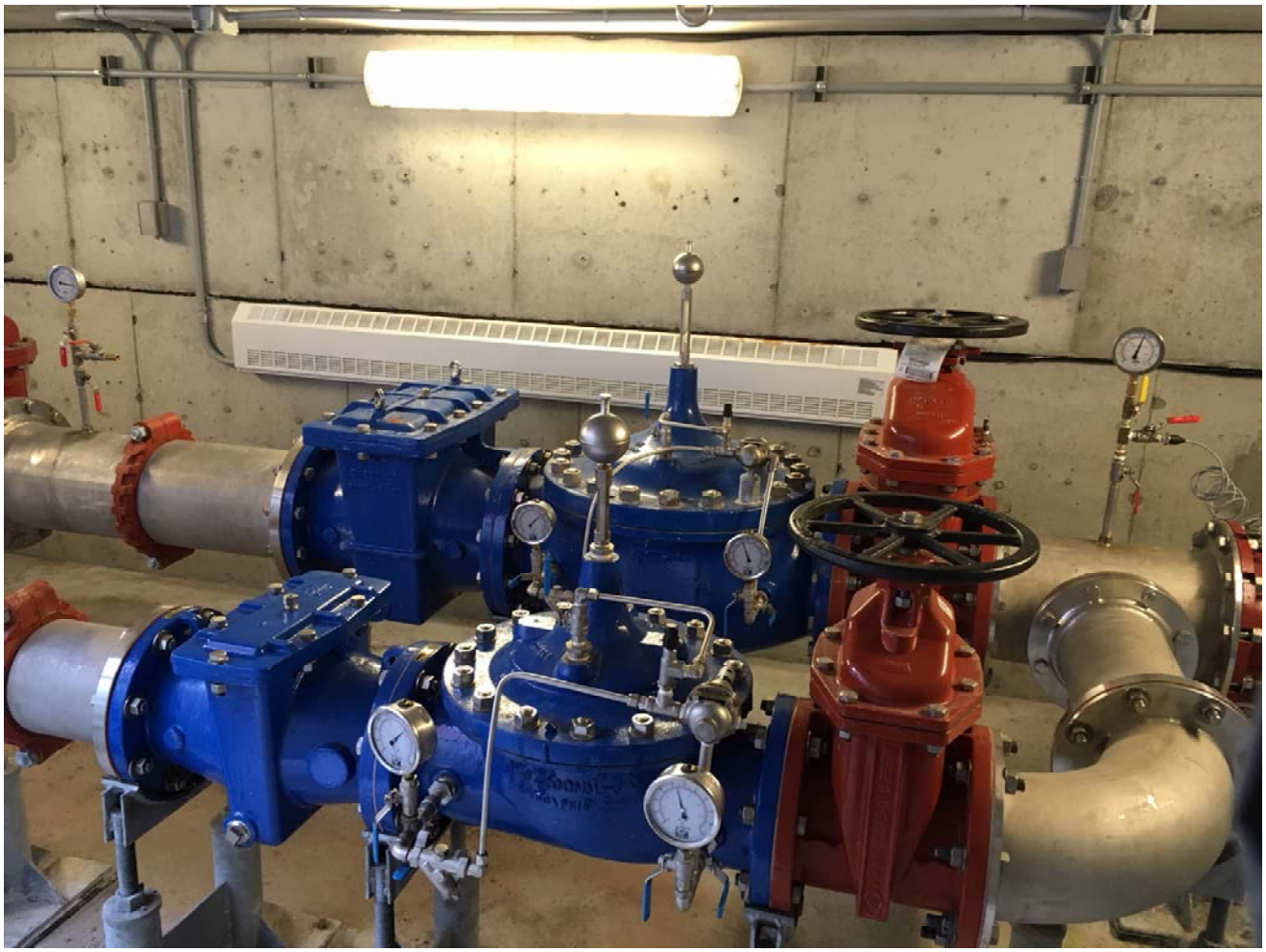
CSJ Example #2



CSJ Example #2

Summary

- Water main break was leaking a significant volume of water – open valve did not impact pressures.
- After water main break was repaired – pressures could not be controlled. Open valve had to located and closed.

Recommendation

- Location of critical valves (ie closed valves) should be known and documented.
- All staff should be aware of these valves and locations

CSJ Example #3

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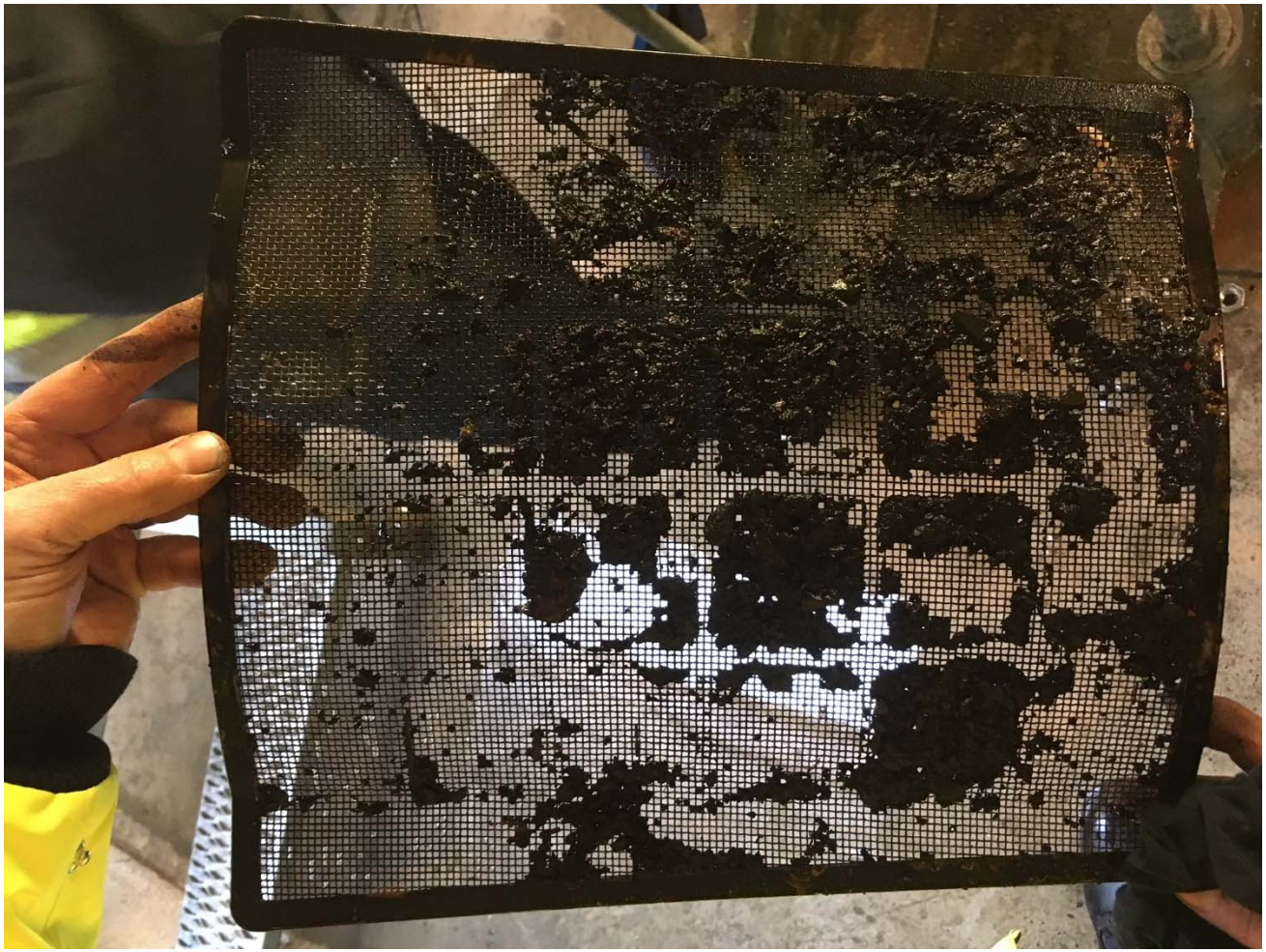
CSJ Example #3

CSJ Example #3



CSJ Example #3

Summary

- Water could not pass through domestic PRV due to restriction in the screens.
- After screens were cleaned, capacity through PRV returned to normal.

Recommendation

- Preventative maintenance and cleaning of the screens to be completed on a regular basis.

Thank You

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