typical water system

Treatment

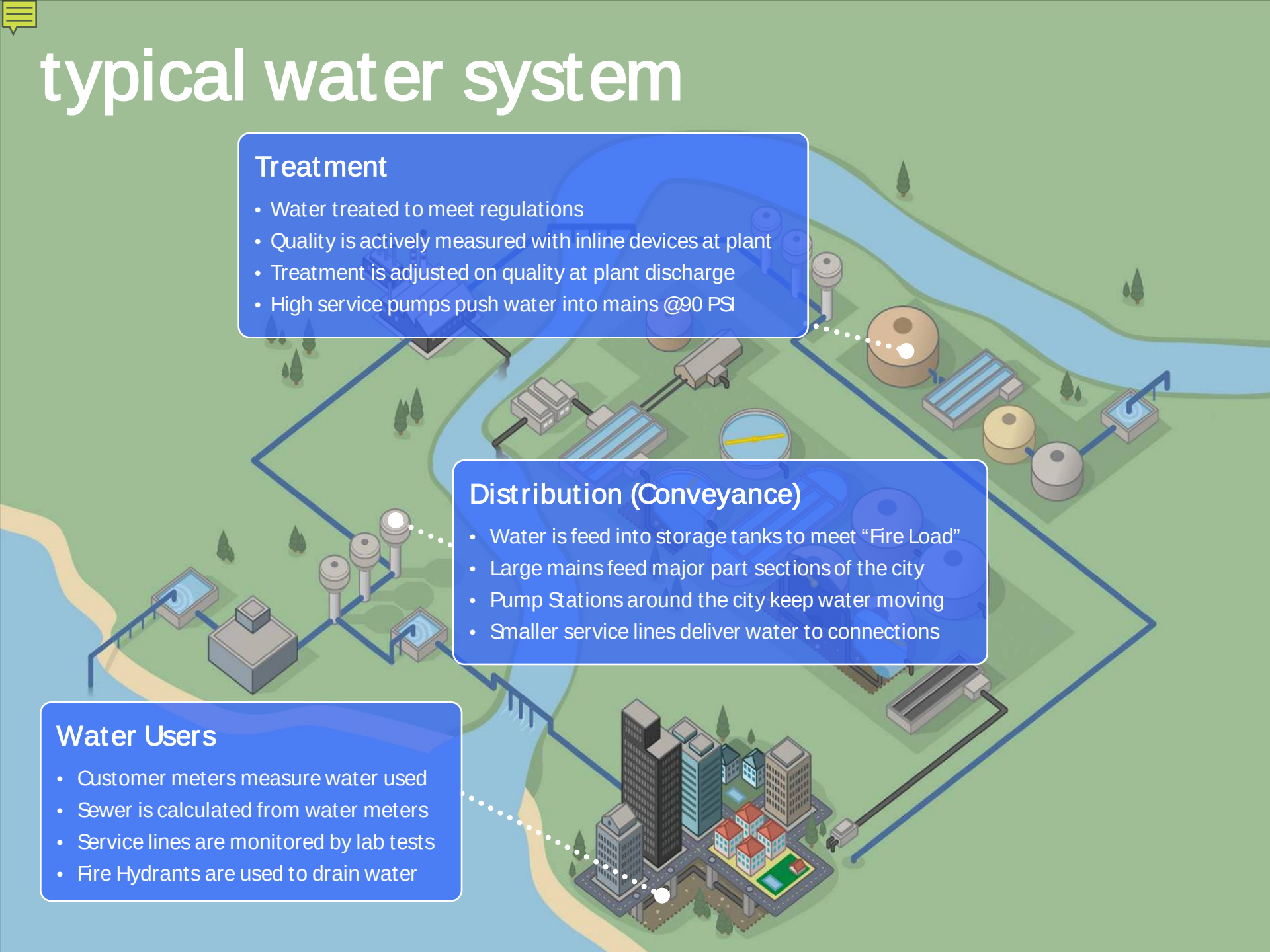
- Water treated to meet regulations
- Quality is actively measured with inline devices at plant
- Treatment is adjusted on quality at plant discharge
- High service pumps push water into mains @90 PSI

Distribution (Conveyance)

- Water is feed into storage tanks to meet “Fire Load”
- Large mains feed major part sections of the city
- Pump Stations around the city keep water moving
- Smaller service lines deliver water to connections

Water Users

- Customer meters measure water used
- Sewer is calculated from water meters
- Service lines are monitored by lab tests
- Fire Hydrants are used to drain water



water system challenges

Treatment

- Quality only measured and adjusted at plant – CL2 addition is on PID control based on residual in water at plant discharge. Water can lose majority of CL2 in first 1000 feet of pipe.

Distribution (Conveyance)

- Elevated tanks can increase water temp to 120 activating biological growth
- Water pressure is controlled based on pressure. This can lead to deadheading of pumps
- No online pipe monitoring system is available today

Water Users

- Lab tech's run samples at customer homes, then drive up to 3 hour before running tests
- Quality tests are not directly connected to operation of water plant
- Water quality varies from home to home

US Utilities on average lose 22% of drinking water in distribution, only a 15% loss is “world class”

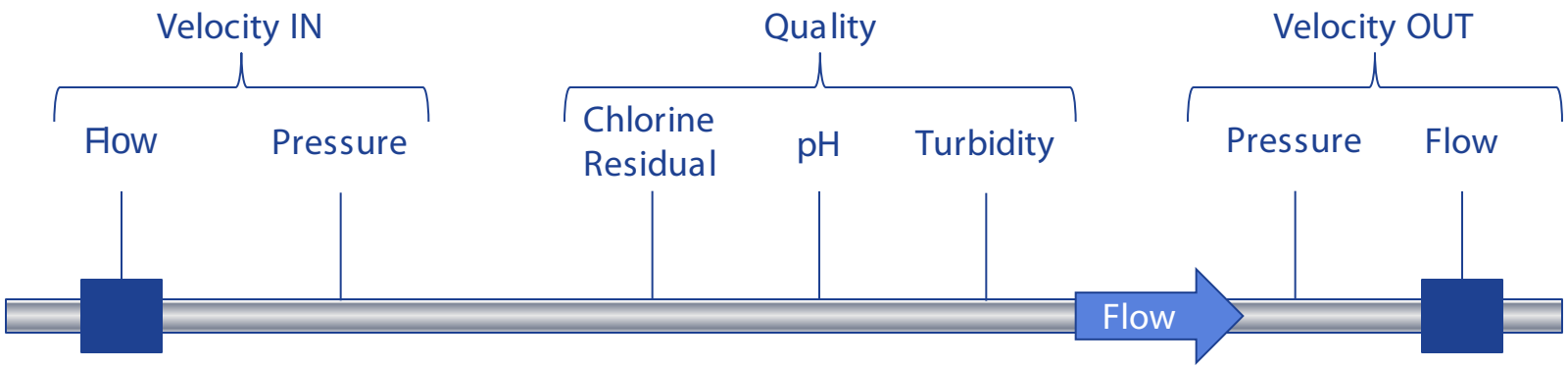
Water quality varies by season, by neighborhood

Energy is up to 1/3 of water utilities budgets

What if...

We could solve the toughest problems?

Simple Pipe

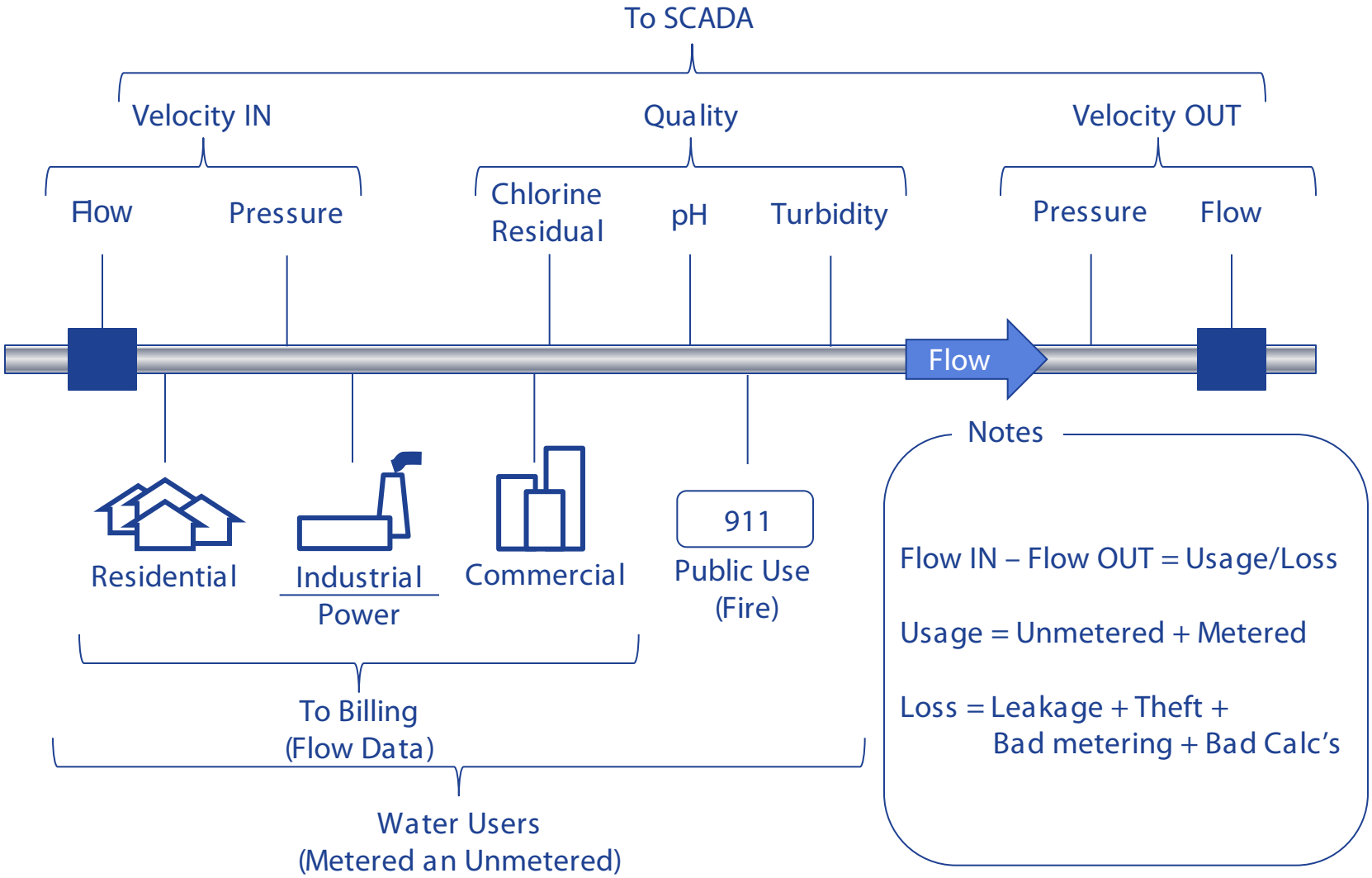


Notes

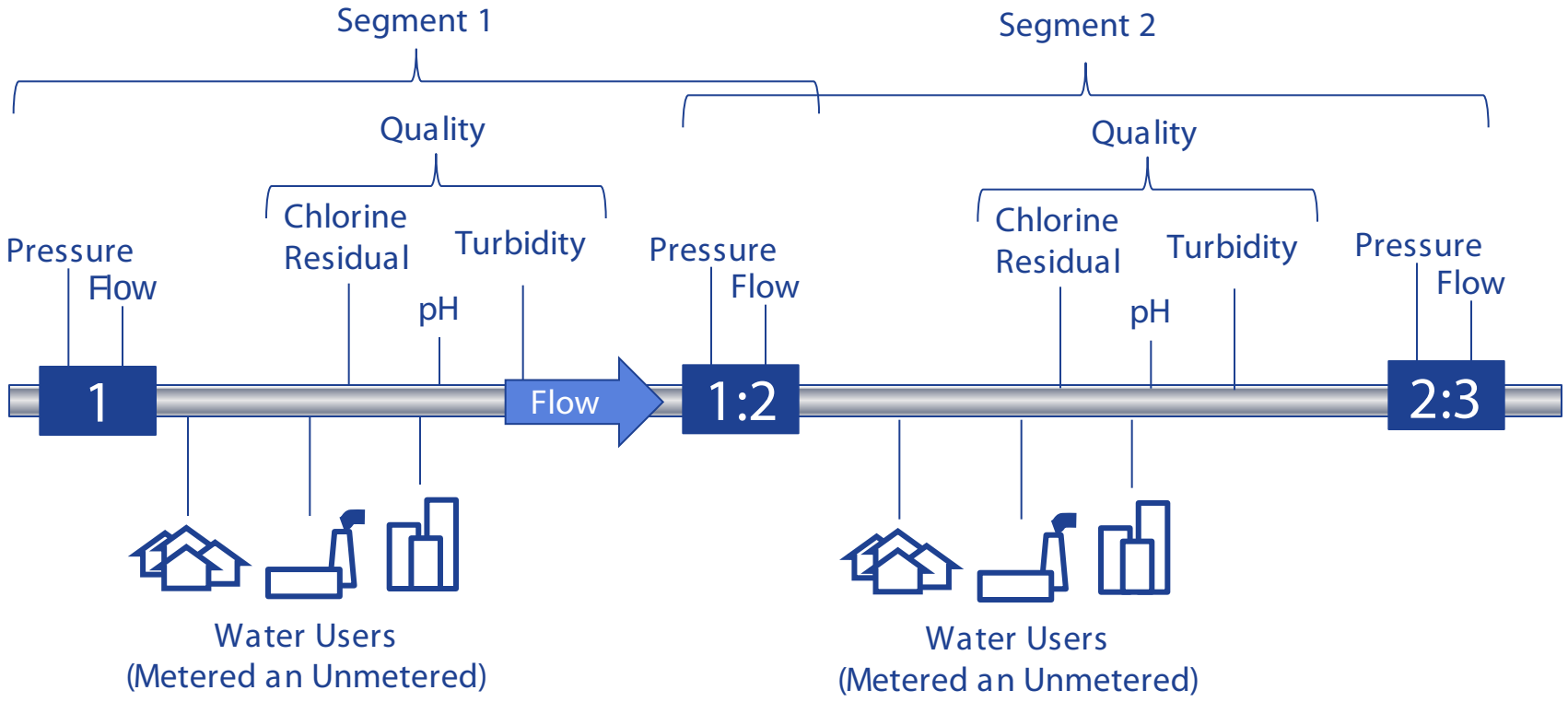
Velocity IN and OUT need to have same sampling rate.

Quality – needs to be at a consistent sample rate timing

Distribution Simplified



Virtual Segments



Notes

Velocity needs direct hydraulic path between IN and OUT (IN-OUT = Usuage/Loss)

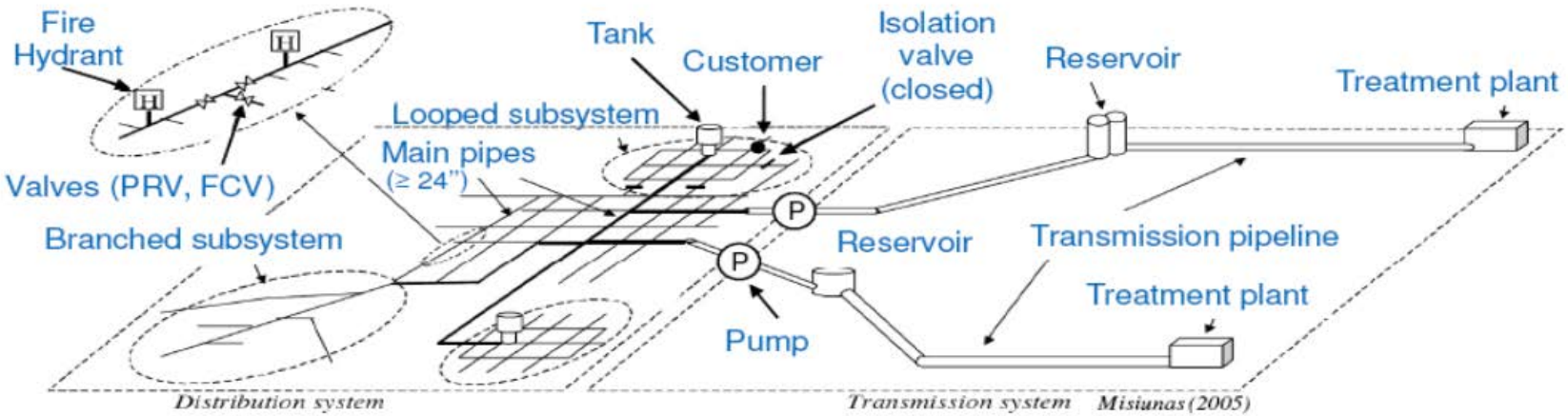
Pressure and Flow do not need to be in same location on relative to IN and OUT

Quality need to be measured between IN and OUT inside segment. Distance from in must be known.

IWM-DS basic concept

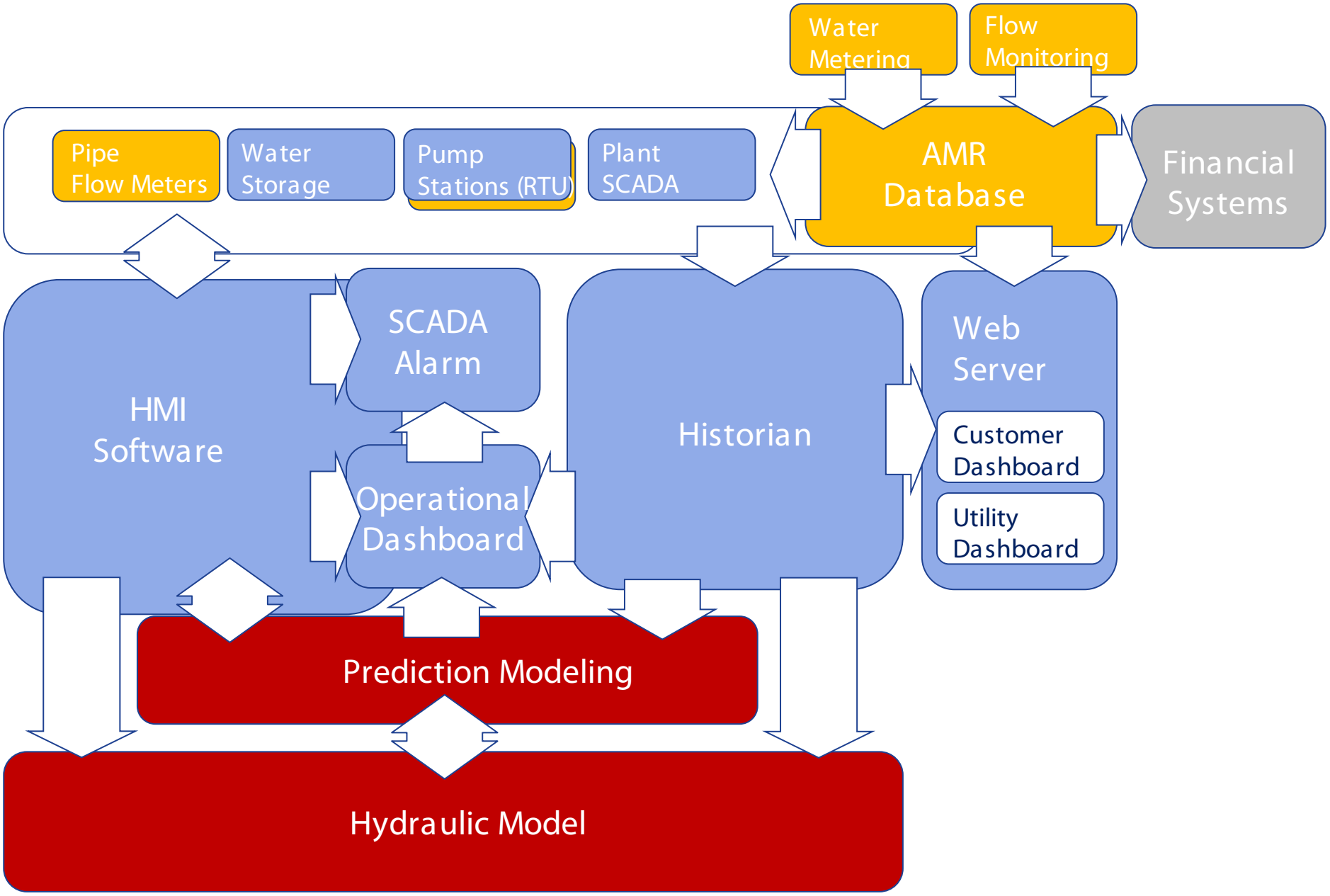
Segmentation

- The water system is broke into virtual segments
- Water quality and velocity are measured
    - CL2 Residual, turbidity, pressure and flow
- These segments are collected back to a central point were trending, historical comparison, and predictive modeling can be conducted.

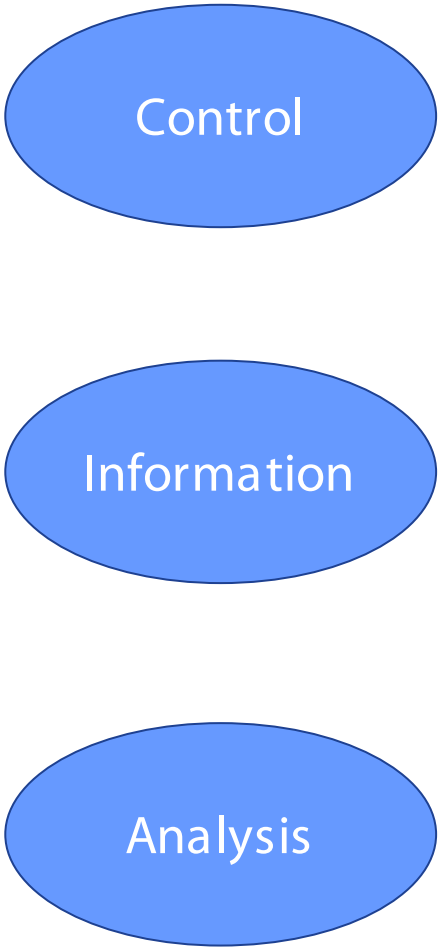


Anomalies

- Purpose of the segments is to provide higher resolution of quality and pump control, but also to detect anomalies such low pressure (pipe break), no flow (damaged pump impellor), etc


Water Metering
Flow Monitoring
Pipe Flow Meters
Water Storage
Pump Stations (RTU)
Plant SCADA
AMR Database
Financial Systems
HMI Software
SCADA Alarm
Historian
Web Server
Customer Dashboard
Utility Dashboard
Operational Dashboard
Prediction Modeling
Hydraulic Model

Layered Concept



Control Types:

1. Monitor Only
2. Information Exchange between Plant(s) and Distribution
3. Passive Control (Trim PID's)
4. Full Distribution control no plant
5. High Service Pumping and chemical addition at Plant and Distribution

Information Management

1. Populate different data sources into single database
2. Build Pipe Segmentation – Connect relationships
3. Build System Items – Pump Stations, Tanks

System Items and Pipe Segments

4. Publish pipe segments to iFIX and Historian
5. Apply "Health Monitoring" – Monitor meters for bad calibration or outage
6. Apply "Anomaly, Rate of Change, and Relationship Alarms"
7. Calculate "Segment Score (Red-Yellow-Green)
8. GIS Style Screen with segment lit by color (Operator)
9. Table Screen with segments listed (Operator)
10. Segment Pop-up with multiple tabs

11. System mass flow module (Start at plant and show usage by segment)
12. System quality model (Snap shot view of water quality readings by time)
13. Energy use model – Compare velocity to pumping data
14. Chemical use model – Compare quality to chemical addition to source

15. Root cause analysis of segment problem
16. Segment Prediction