Hydraulic Modeling

The Why, The How To and The What For

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AMERICAN STRUCTUREPOINT INC.

Overview

- Uses
- Modeling Software
- Creating a Hydraulic Model
- Capital Improvement Planning
- Summary

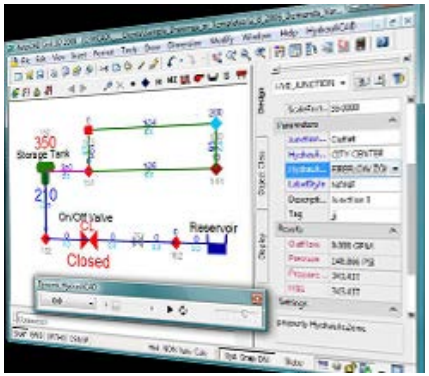
Hydraulic Models

- Provide understanding of distribution system
  - Flow patterns
  - Pressure variations
- Simulate impacts of new customers
- Identify O&M needs and future improvements
- Assist with developing flushing programs

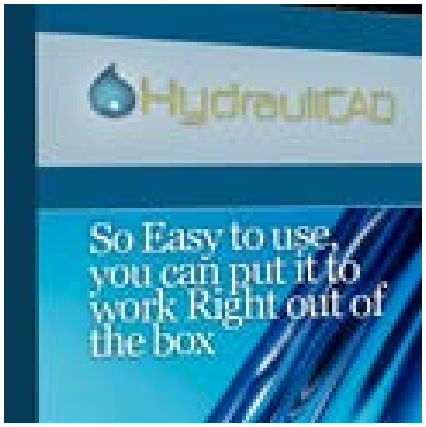
Benefits of Hydraulic Modeling

- Helps in capital improvement planning and budgeting
- Improves distribution system operation and water age
- Identifies “low-hanging fruit” improvements
- Dynamic tool – useful now and in future
- Serves asset inventory and management baseline

Modeling Software



- EPANET – 2008 free download
- WaterGEMS/WaterCAD
- H2ONET
- KYPIPE PIPE2012
  - Steam, SWMM, Gas, Surge, and GoFlow-Sprinklers
- HydrauliCAD
  - No Annual Fees



Creating Hydraulic Model

Creating a model is a collaborative effort between modeler and Utility.

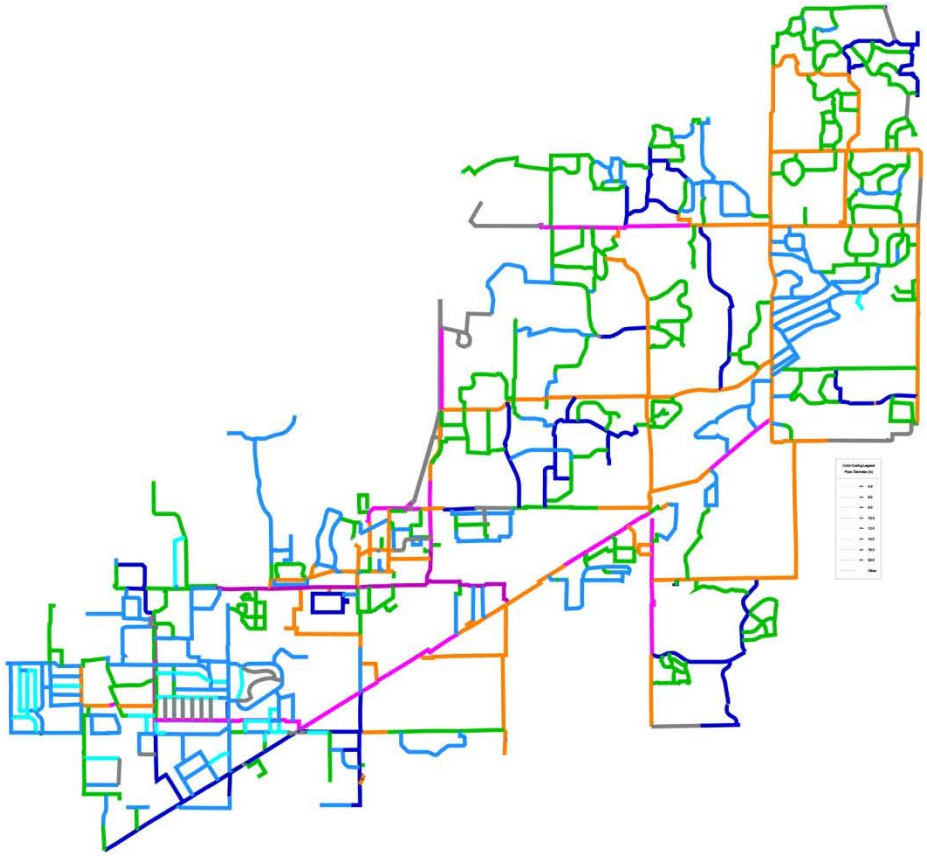
Creating and Running Hydraulic Model

- Data Requirements
- Calibration
- Run Scenarios
- Results

Data Requirements

- Physical System Information
  - Tank dimensions
  - Main sizes
  - Connectivity, mapping
  - Closed valves?
  - Pump curves
  - Control valve locations

Model Display



Data Requirements

- Water demands
  - Average and peak total usage
  - Meter data
  - Residential, commercial, industrial, wholesale
- Diurnal demand pattern
  - Sewer flow monitors

Diurnal Curve - Example

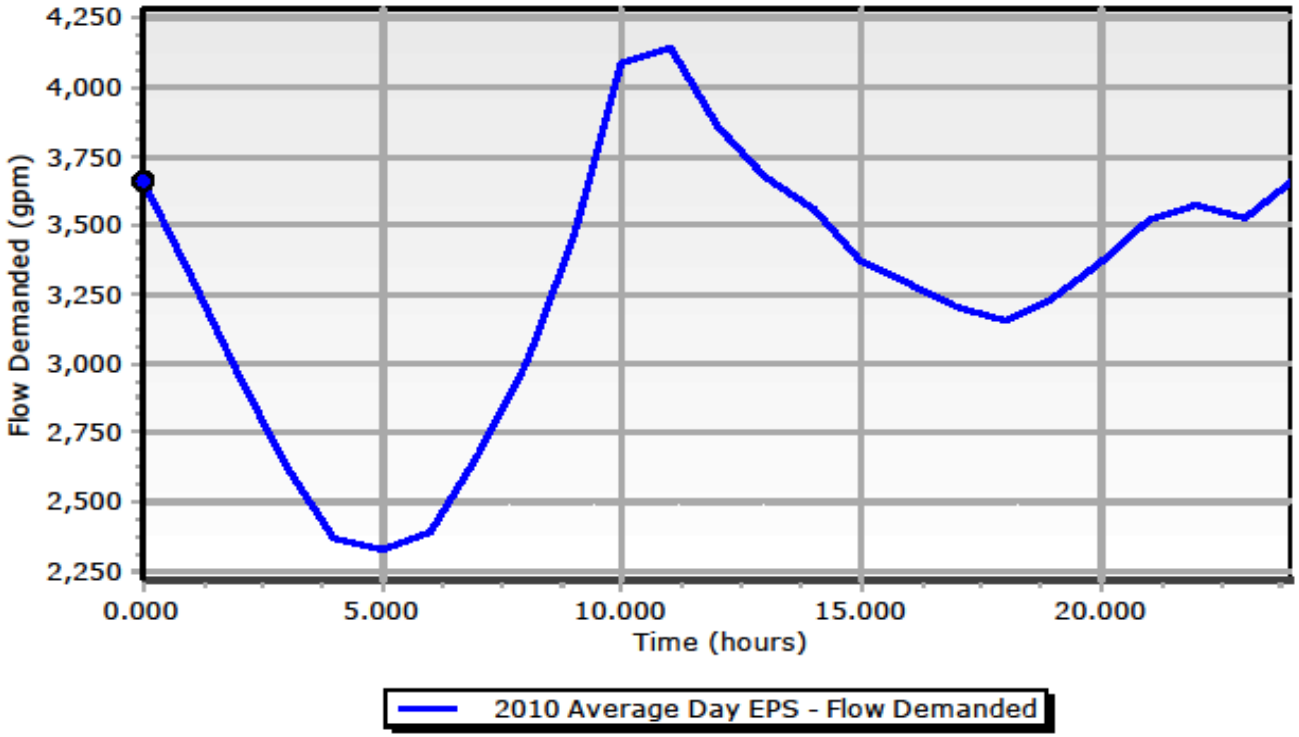
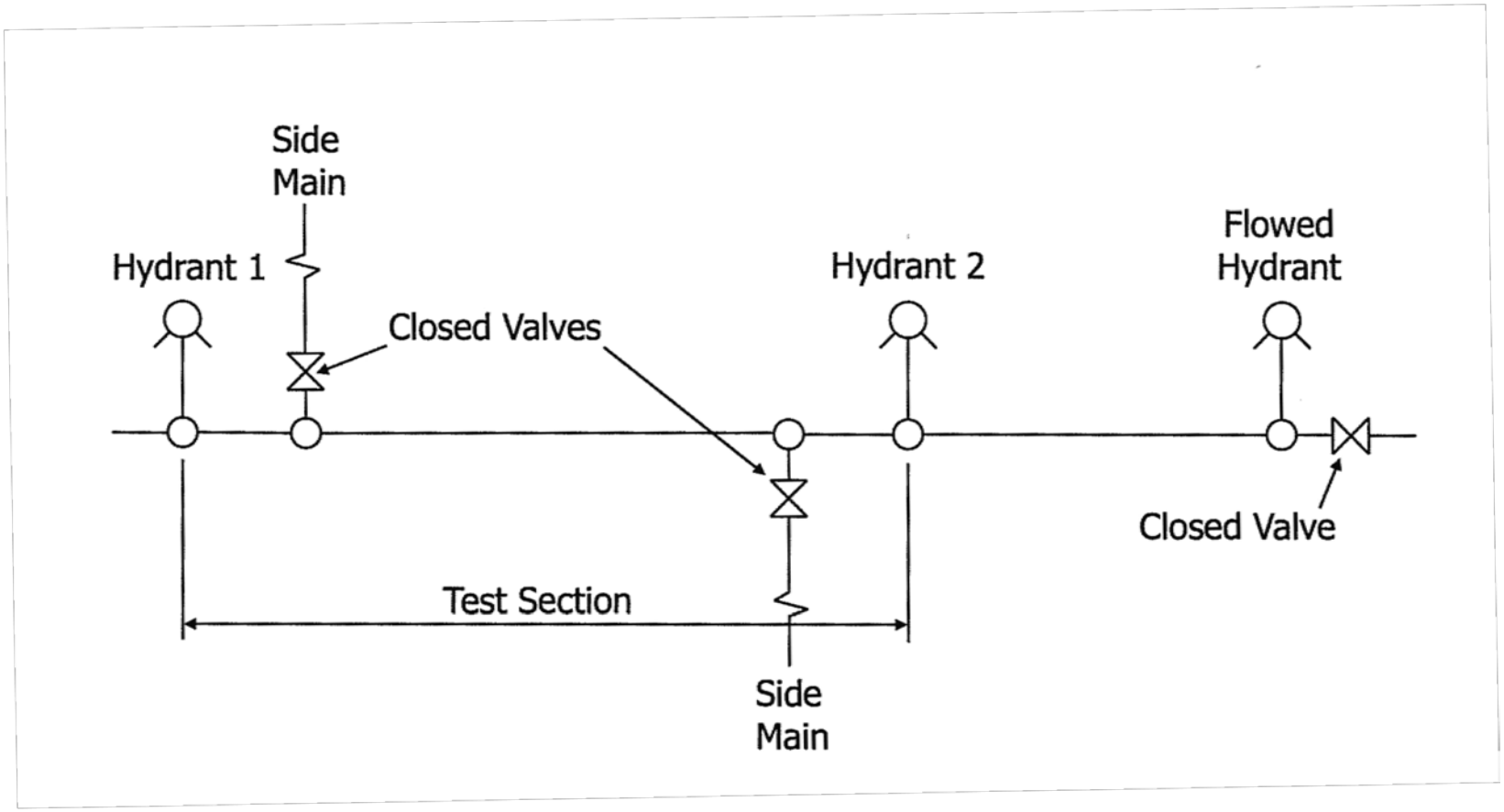


Figure 7-3 Composite Diurnal Curve

Data Requirements

- Hydrant flow test data
  - Locate in strategic points in water system
  - Provides data regarding:
    - Localized static pressures
    - Available flow
    - Headloss

Hydrant Flow Test Setup



What is Calibration?

- Making adjustments to model to match measured data
  - Hydrant flow tests
  - Use any available SCADA data for tank levels, pump status, etc. at time of flow test
- Iterative process

How is Calibration Accomplished?

- 1st: Compare model results to a measured static condition
- 2nd: Compare model results to flow test results

How is Calibration Accomplished?

- Make adjustments to physical properties in the model
  - Hazen Williams C Value (pipe roughness)
  - Water demands
  - Open or closed valves
  - Pumps on or off
  - Unknown main sizes

Goals of Calibration

- Depends on use of the model
- For master planning for small/medium systems:
  - Pressure: 2-4 psi at maximum flow
  - Tank level fluctuations: 3-6 feet
  - Treatment plant/well outputs: 10-20 percent
    - Source: Haestad, Walski 2001
- Remember: Iterative process

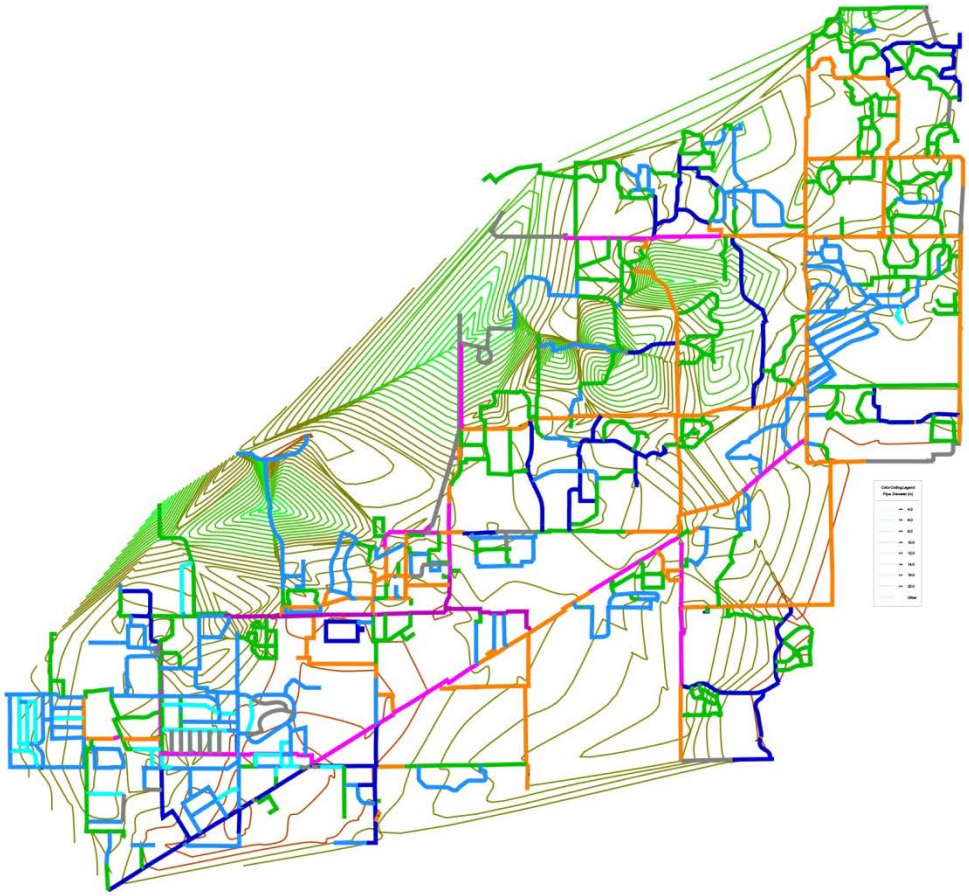
Model is Calibrated...What Next?

- Locate areas with low pressure
- Identify undersized mains
- Find closed valves
- Locate areas with poor turnover
- Evaluate controls
- Is there adequate storage?

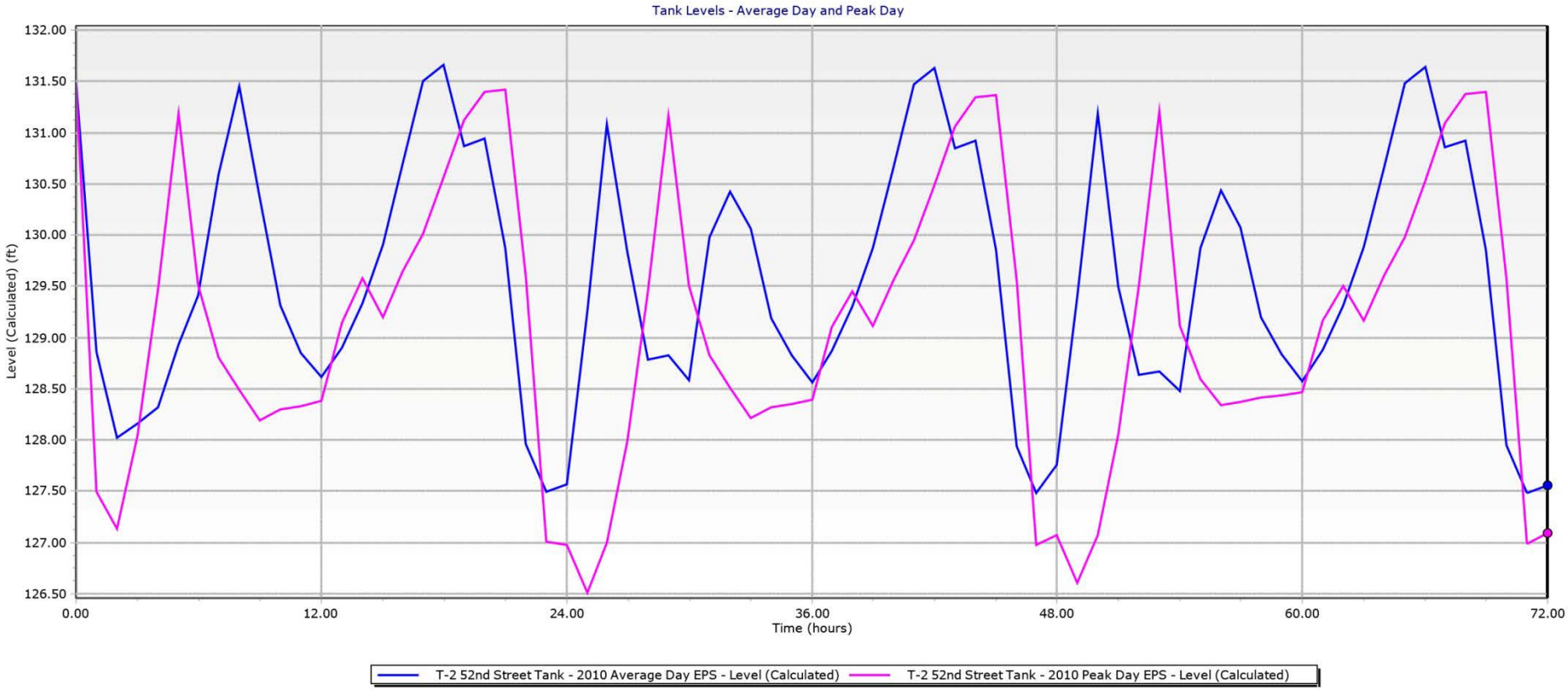
Modeling Scenarios

- Existing conditions and demand
  - Average day demand
  - Peak day demand
  - Static runs
  - Extended period runs – over several days or weeks
    - Do tanks recover?
    - Does water remain stagnant?
  - Fire flow scenarios

Model Results – Pressure Contours



Model Results – Tank Levels



Goals of Existing Condition Scenarios

- Identify high priority problems that need to be addressed immediately or within the next couple years.

Future Condition Scenarios

- Future conditions and demand
  - Predict future demand
    - Is there inevitable population growth, either residential or industrial/commercial?
    - Is there room for expansion?
  - Can the existing infrastructure handle growth?
  - If not, what infrastructure is needed?

Common Problems and Solutions

- Low flow on outskirts of system?
  - Increase water main size
- Low pressure on outskirts of system?
  - Increase water main size, add pressure zones
- Low system-wide pressure?
  - Raise storage height, increase storage volume, increase pump/plant capacity
- High localized pressure
  - Add pressure reducing valve

Modeling with Structurepoint

- Collaborative Process
  - Collecting system information
  - Conducting field work
- Evaluate software
- Options with model
  - Train owner to use
  - Operate and maintain through on-call services
    - Provide analysis and recommendations

Capital Improvement Planning

- Identifies
  - Storage Capacities
  - Water Main Expansions or Extensions
  - Booster Pumping Requirements
  - Fire Protection Needs
    - ISO Requirements vs. AWWA Guidelines
- Sets Priorities
  - Critical System Component
  - Future Concerns
  - Operational Controls

Summary

- Collaborative process
  - Good data in – Good data out.
- Is an inventory of the distribution system
- Supports operational strategies
- Provides understanding to support CIP.
- Useful now and in future
  - Needs to be maintained and updated.

Questions

Thank You

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