Developing Your Meter Testing Program

Will Jernigan, P.E.
Will.Jernigan@cavanaughsolutions.com

IWA/AWWA Standard Water Balance

- Total System Input
- Water Supplied
- Water Exported
- Water Losses
- Apparent Losses
- Real Losses
- Authorized Consumption
- Billed Authorized Consumption
- Unbilled Authorized Consumption

- Revenue Water
- Non-Revenue Water
- Billed Water Exported
- Billed Metered Consumption
- Billed Unmetered Consumption
- Unbilled Metered Consumption
- Unbilled Unmetered Consumption
- Unauthorized Consumption
- Customer Metering Inaccuracies
- Systematic Data Handling Errors
- Leakage on Mains
- Leakage on Service Lines
- Leakage & Overflows at Storage

(allow for known errors)
- Fire Dept Usage
- Operational Flushing
- Tools for control include efficient flushing practices and awareness campaigns

- Non-physical / revenue loss - slow meters, billing issues and theft
- Cost impacts at 'retail' rate
- Tools for control include data management, quality control policies, practices & meter testing & repair

- Physical loss - leakage
- Cost impacts at 'wholesale' rate
- Tools for control include leakage and pressure management

- Water Imported
  - Own Sources
  - Total System Input (allow for physical, non-physical/revenue loss)
  - Water Supplied

- Water Exported
  - Billed Exported
  - Revenue Water

- Total Authorized Consumption
  - Billed Authorized Consumption
  - Non-Revenue Water

- Unbilled Consumption
  - Billed Unmetered Consumption
  - Unbilled Unmetered Consumption
  - Unbilled Metered Consumption
  - Revenue Water

- System Input

- Key Data Input Grades

3-V

- Volume
  - MG per Year
  - Gal/connection/day
  - Leakage Index

- Value
  - $ per Year
  - Economic Loss Index

- Validity
  - Water Audit Data Validity Score
  - 95% Confidence Limits
  - Key Data Input Grades

Validity

- 95% Confidence Limits
- Key Data Input Grades
AUDIT PROGRAM

SUPPLY
CONSUMPTION
METERING
DETECTION
PRESSURE
RENEWAL

Total Non-Revenue Water Volume (MG)
Level 1

- 2,824
- $2,341,420 per year

Data Validity Score: 75 out of 100
Total Volume of NRW = 75 MG/Yr

Total Cost of NRW = $116,513

NRW Components - By Volume (MG)
Level 3

NRW Components - By Value
Level 3

Volume

Value

Show me the VOLUME of Non-Revenue Water
Show me the COST of Non-Revenue Water
Volume Level 3

Value Level 3

Volume Level 4

Value Level 4

Small Meter Inaccuracy

Large Meter Inaccuracy

Meter Mis-Application
Count

- Small Meters: 1000
- Large Meters: 32000

Volume (gal)

- Small Meters: 2,162,060,000
- Large Meters: 958,575,000

AUDIT PROGRAM

- SUPPLY
- CONSUMPTION
- METERING
- DETECTION
- PRESSURE
- RENEWAL
Sample Testing for Small Meter Performance Curve Analysis

**METERING**

Determine sample size
- Statistical significance (confidence, margin of error)
- Consider resources for testing
- Samples at varying amounts of throughput, meter types and make

Testing methods – low, mid & high flow ranges
Described in the AWWA M6 Manual
Sample Testing for Small Meter Performance Curve Analysis

METERING

Sample Testing for Small Meter Performance Curve Analysis

METERING
Economic Optimization for Large Meter Testing Program

**Single Test Cost (est.)**: $300

**Predicted Inaccuracy (avg.)**: 2%

**Single Repair Cost (est.)**: $250

**Test Frequency**
- Semi-annual
- Annual
- Every 2 yrs
- Every 3 yrs

<table>
<thead>
<tr>
<th>Monthly Revenue Threshold</th>
<th>Semi-Annual</th>
<th>Annual</th>
<th>Every 2yrs</th>
<th>Every 3yrs</th>
</tr>
</thead>
<tbody>
<tr>
<td>$4,583</td>
<td>$2,292</td>
<td>$1,146</td>
<td>$764</td>
<td></td>
</tr>
<tr>
<td>$600</td>
<td>$300</td>
<td>$150</td>
<td>$100</td>
<td></td>
</tr>
<tr>
<td>$500</td>
<td>$250</td>
<td>$125</td>
<td>$83</td>
<td></td>
</tr>
<tr>
<td>$1,100</td>
<td>$550</td>
<td>$275</td>
<td>$183</td>
<td></td>
</tr>
<tr>
<td>$55,000</td>
<td>$27,500</td>
<td>$13,750</td>
<td>$9,167</td>
<td></td>
</tr>
</tbody>
</table>

**Annualized Test Cost**: $600

**Annualized Repair Cost**: $500

**Annualized Test+Repair Cost**: $1,100

**Annual Revenue Threshold**
- $55,000
- $27,500
- $13,750
- $9,167

AWWA: test all large meters annually
- this does not consider revenue
- need to evaluate based on benefits v costs

*Example calculation only – very broad strokes - DON’T use these numbers for your system!"
Testing procedures per M6 Manual
- low, mid & high flow ranges
- additional flow ranges for compound meters

Annual consumption revenue = $350,000
Probable benefit = (100% – 96.75%) x $350,000 = $11,375 per year
Cost to remediate = $5,500
single test cost (est.) 300
predicted inaccuracy (avg.) 2%
single repair cost (est.) 250
Test Frequency
semi-annual    annual
Every 2 yrs    Every 3 yrs
monthly revenue threshold $4,583 $2,292 $1,146 $764
annualized test cost $600 $300 $150 $100
annualized repair cost $500 $250 $125 $83
annualized test+repair cost $1,100 $550 $275 $183

annual revenue threshold $55,000 $27,500 $13,750 $9,167

Meter Accuracy

75.00%
80.00%
85.00%
90.00%
95.00%
100.00%
105.00%

I'M HERE TO READ THE METER.