This presentation premiered at WaterSmart Innovations

watersmartinnovations.com
A Non-Revenue Water Tale of Five Cities

Will Jernigan
Cavanaugh & Associates, P.A.

will.jernigan@cavanaugh.com
AWWA adopts international standard, abandons Unaccounted For Water


AWWA Audit Software v1  AWWA Audit Software v4 (2,000 downloads)  AWWA Audit Software v5

AWWA Compiler developed for large audit sets

~8,000 downloads to date of AWWA Audit Software v5

Performance Indicator Task Force WRF 4695-Effective WLC Planning

Validity method developed

Ongoing Research & Development:

WRF study shows audit validity is a widespread challenge
<table>
<thead>
<tr>
<th>IWA/AWWA Standard Water Balance</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Own Sources</strong></td>
</tr>
<tr>
<td>Total System Input</td>
</tr>
<tr>
<td>(allow for known errors)</td>
</tr>
<tr>
<td>Water Imported</td>
</tr>
<tr>
<td>Water Supplied</td>
</tr>
<tr>
<td>Total System Input</td>
</tr>
<tr>
<td>Water Supplied</td>
</tr>
<tr>
<td><strong>Water Exported</strong></td>
</tr>
<tr>
<td><strong>Authorized Consumption</strong></td>
</tr>
<tr>
<td>Billed Authorized Consumption</td>
</tr>
<tr>
<td>Unbilled Authorized Consumption</td>
</tr>
<tr>
<td><strong>Water Losses</strong></td>
</tr>
<tr>
<td>Apparent Losses</td>
</tr>
<tr>
<td>Real Losses</td>
</tr>
<tr>
<td><strong>Non-Revenue Water</strong></td>
</tr>
<tr>
<td>Billed Water Exported</td>
</tr>
<tr>
<td>Billed Metered Consumption</td>
</tr>
<tr>
<td>Billed Unmetered Consumption</td>
</tr>
<tr>
<td>Unbilled Metered Consumption</td>
</tr>
<tr>
<td>Unbilled Unmetered Consumption</td>
</tr>
<tr>
<td>Unauthorized Consumption</td>
</tr>
<tr>
<td>Customer Metering Inaccuracies</td>
</tr>
<tr>
<td>Systematic Data Handling Errors</td>
</tr>
<tr>
<td>Leakage on Mains</td>
</tr>
<tr>
<td>Leakage on Service Lines</td>
</tr>
<tr>
<td>Leakage &amp; Overflows at Storage</td>
</tr>
</tbody>
</table>
- 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

Management of NRW
Water Efficiency Management

1. Determine Loss Volumes
   - AWWA water audit
   - Apparent & Real Loss volumes

2. Distinguish Types of Leakage/Losses
   - breakdown of types of leakage (Component Analysis Model)
   - sources of Apparent Loss

3. Evaluate Economics
   - costs of losses
   - costs of intervention strategies

4. Implement Interventions
   - leak detection
   - repair time improvement
   - pressure management
   - cost effective!
Data Validity Score

- Kansas
- Alabama
- Kentucky
- Indiana
- N Carolina
System #1 - Kansas

- **Existing Programs:**
  - Leak Detection
  - Customer Meter Testing

- **Initial Assessment:**
  - Unrealistically low ILI – (0.2)

- **Validation Efforts:**
  - Finished Water Meter Testing
  - Billing Data

- **Current Program Focus:**
  - Calendar Year 2016 Audit – ILI solved?
    - Unmetered Interconnection?
  - Large Meter Testing Optimization
  - Small Meter Testing/Optimum Replacement
  - Leak Detection Optimization
System #2 - Alabama

- **Existing Programs:**
  - Leak Detection based on High Volumes of perceived leakage
  - % Based Performance Indicator
    - Large Industry left → % ↑ → “Water Loss Problem”

- **Initial Assessment:**
  - High Pressure = High UARL = ILI of 2.1

- **Validation Efforts:**
  - Level 1 Water Audit

- **Current Program Focus:**
  - M36 Methodology based tracking & metrics
  -Finished Water Meter Testing
  - Large Meter Testing Program
  - Leak Detection Optimization
System #3 - Kentucky

**Existing Programs:**
- Leak Detection based on High Volumes of perceived leakage
- % Based Performance Indicator
- Finished Water Meter Testing
- Master Meter Testing

**Initial Assessment:**
- Very high ILI of 13
  - Preliminary Bottom-up Analysis

**Validation Efforts:**
- Level 1 Water Audit

**Current Program Focus:**
- M36 Methodology based tracking & metrics
- Billed Metered Level 2 Validation
- Large Meter Testing Program
- Leak Detection Optimization
System #4 - Indiana

• Existing Programs:
  o Leak Detection
  o Customer Meter Testing
  o Rolling 12 month auditing

• Initial Assessment:
  o % Metric used as Indicator

• Validation Efforts:
  o Level 1 Water Audit
  o Customer Meter Inaccuracy Analysis
  o Billing Data Analysis

• Current Program Focus:
  o Large Meter Testing Optimization
  o Redistricting/Pressure Reduction
  o Leak Detection Optimization
  o Unmetered Fire Line Analysis
  o Small Meter Testing Analysis
System #5 – North Carolina

• **Existing Programs:**
  - Capital based line replacement
• **Initial Assessment:**
  - High Pressure = High UARL
• **Validation Efforts:**
  - Level 1 Water Audits
  - Billing Data Analysis
  - Real Loss Component Analysis
  - Lag-time adjustment (bi-monthly billing)

• **Current Program Focus:**
  - Large Meter Testing Optimization
  - Pressure Optimization
  - District Metered Areas
  - Leak Detection Optimization
  - FWM Testing
Non Revenue Water

- Kansas
- Alabama
- Kentucky
- Indiana
- N Carolina
Infrastructure Leakage Index (ILI)

- Kansas
- Alabama
- Kentucky
- Indiana
- N Carolina

Bar chart showing theInfrastructure Leakage Index (ILI) for different systems across different states. The chart indicates that Kentucky has the highest ILI, followed by Indiana and Alabama, with Kansas and N Carolina having significantly lower values.
Water Audit Data Validity Score

- Alabama
- Kentucky
- Kansas
- North Carolina
- Indiana
Real Loss: Gallons per Connection per Day

Years of Proactive Water Loss Control Program

Real Loss per Connection-Day

Kentucky
Alabama
N Carolina
Indiana
Program Maturity = Higher Validity, Lower Loss

- Data Validity
- Real Loss

Years of Proactive Water Loss Control Program

Alabama
Kentucky
Indiana
North Carolina
Kansas
What do Water Loss %s Tell Us?

hint: nothing

Infrastructure Leakage Index (ILI)
Non-Revenue Water as % by Volume of Water Supplied
SAVE THE DATE
December 3 - 5, 2017
Paradise Point Resort · San Diego, CA

Presented by: American Water Works Association
California-Nevada Section

In cooperation with the American Water Works Association, the Alliance for Water Efficiency and the NAWL 2017 Conference Planning Committee.

Partnering Organizations:
Alliance for Water Efficiency
American Water Works Association
EPA WaterSense

www.northamericanwaterloss.org
A Non-Revenue Water Tale of Five Cities

Will Jernigan
Cavanaugh & Associates, P.A.

will.jernigan@cavanaughsolutions.com