Business Case for Water Loss Control
Minimizing Water Losses with Acoustic Monitoring

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### New Jersey American Water

**Population Served**: 2.5 million

**Counties Served**: 18

**Municipalities Served**: 192

**Total Employees**: 820

**Water Systems**: 33

**WW & Sewer Collection Systems**: 21

**Average System Delivery**: 330 MGD

**Average Non Revenue Water**: 15%

**Annual Electric Energy**: 196 million kWh

**Annual Greenhouse Gas Emissions**: 129,000 metric tons CO2e
## NJAW Infrastructure

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<table>
<thead>
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<tbody>
<tr>
<td><strong>Surface Water Treatment Plants</strong></td>
<td><strong>7</strong> (combined capacity of 350 MGD)</td>
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<tr>
<td><strong>Reservoirs</strong></td>
<td><strong>5</strong> (combined capacity of 6 billion gallons)</td>
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<tr>
<td><strong>Wells</strong></td>
<td><strong>170</strong> (combined capacity of 110 MGD)</td>
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<tr>
<td><strong>Tanks</strong></td>
<td><strong>241</strong></td>
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<tr>
<td><strong>Operating Centers</strong></td>
<td><strong>11</strong></td>
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<tr>
<td><strong>Water &amp; Sewer Mains</strong></td>
<td><strong>8,600 miles</strong> (2” to 72” diameter)</td>
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<tr>
<td><strong>Aging Pipes</strong></td>
<td><strong>15% of pipes over 100 years by 2020</strong></td>
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<tr>
<td><strong>Valves</strong></td>
<td><strong>170,000</strong></td>
</tr>
<tr>
<td><strong>Hydrants</strong></td>
<td><strong>45,000</strong></td>
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Controlling Real Losses

- **Unavoidable Annual Real Losses**: (This reference value varies with pressure)
- **Economically Recoverable Annual Real Losses**
  - Real Losses in this range are not technically recoverable
  - Real Losses in this range are not economic to recover
- **Current Annual Real Losses**
- **Pressure Management**: Losses flex with pressure
- **Speed and Quality of repairs**
- **Active Leakage Control**
- **Pipeline and Asset Management Selection, Installation, Maintenance, Renewal, Replacement**

Source: AWWA M36 Manual (4th Ed.)
The NJAW water loss strategy follows the latest AWWA standards while also maximizing customer satisfaction, return on investment, and operational efficiency at an acceptable level of risk.

The key elements are:

- Providing accurate, regular metering of production flows and customer consumption volumes;
- Maintaining a system of real time hydraulic data collection and monitoring via a Supervisory Control and Data Acquisition (SCADA) System, Advanced Metering Infrastructure (AMI), or similar system of instruments and data collection technology;
- Compiling an annual water audit as a standard business practice for all systems; and
- Employing sufficient loss control methods to contain water and revenue losses at economic levels and to minimize system upsets.
High-quality headphones

Extension rod for probe

Base unit – filters and displays noise

Contact probe

Overnight correlators

Leak noise correlator

Shielded ground microphone used on hard, even ground surfaces

NJAW Traditional Toolbox

NEW JERSEY AMERICAN WATER
The Need for Permanent Leak Monitoring

**Innovation Overview**

Early detection of leaks is vital for water distribution systems, with the ability to identify system failure points:

- mitigate impact customer levels of service
- minimize water loss
- extend asset life
- schedule and prioritize repairs on an informed, proactive basis
- minimize the risks of catastrophic failures
The Need for Permanent Leak Monitoring

In 2007, New Jersey American Water deployed its first automated leak reporting system in Irvington, Maplewood and West Orange. Approximately 3500 sensors have been placed on service pipelines with some connected to AMI. All return acoustic information to the vendor’s cloud and the data is available to our staff.
The Need for Permanent Leak Monitoring

Innovation Overview

In 2009, American Water agreed to participate in a consortium focused on the development of fixed leak detection technology for water distribution systems. After a series of successful developmental field trials, the first commercial system, known as EchoShore-DX, was installed in Charleston, West Virginia.
Distribution Main Monitoring

- Integrated processor, radio, and battery
- High Sensitivity Sensor
- Antenna

Optional

EchoShore
Cost Benefit Considerations

3-Year Break Average
Target NRW
Most Recent Year NRW
Rate of Rise
Cost of water
Miles of mains
Annual Production MG/Y
Variable Production Cost Current Year
NRW Cost Current Year
Leakage Current Year
Current Year Recovery Value
Crew Cost Per Year
Crew Repairs Per Day
Current Crew Labor Per Repair
Labor Savings Per Repair
Average Repair Costs Per Break
Material Savings Per Break
Leak Recovery Credit Time - Months
EchoShore-DX Deployment Areas
March, 2016: First Point of Interest (POI) investigations in Washington district

- Results were immediate with 5 non-surfacing leaks being located within the first month

March, 2017:

- 173 POI hits
- 85 leaks repaired, 32 investigations pending
- Estimated 1,600 gpm in leakage eliminated
- Estimated $1.053M savings in Opex
- Actual $1.127M savings in Opex

Acoustic Monitoring Summary
Results and Benefits

• System was proactively surveyed previously by internal and external resources

• 15 leaks repaired

• Estimated flow of all leaks located 410 GPM
  ▪ No leaks were surfacing at the time of location
  ▪ Deferred capex investment value TBD

• Improved regulatory allocation position

• Steady reduction in NRW %
  ▪ 1/31/2016 – 27.7%
  ▪ 1/31/2017 – 23.2%
Major Leaks in First 30 Days

Washington and Belvidere Systems
Results and Benefits

- No leak surveys in Irvington due to safety concerns
- Irvington now monitored 24/7 remotely, reducing risks
  - POI investigations and leak repairs are now scheduled
- April, 2016: First POI investigation
- March, 2017: 67 leaks repaired
  - Estimated flow of all leaks located 880 GPM
  - Over 90% of leaks located were not surfacing at the time location
- **Positive NRW Impact/Reduction: Essex Passaic Area**
  - 1/31/2016 - 27.3%
  - 1/31/2017 - 24.4%
  - 5/31/2017 – 23.3%
- System payback in 9 months
City of Irvington System

Results and Benefits

Time To Payback 0.7 Years
Results and Benefits

- Surveys were conducted during two previous years with no leaks being located.
- MNF analysis indicated loss was about 36 gpm.
- 2 leaks located.
- Significant reduction in NRW %
  - 1/31/2016 – 46.9%
  - 2/28/2017 – 10.2%
- Improved regulatory allocation impact.
- Deferred capital expenditure of $1 million +/- for new well.
Much more than the cost of water

- Water loss nonsurfacing
  - experience suggests 90 day run time underground
  - subject to details of break on case by case basis
- Reduction in restoration materials
  - paving, sidewalk, backfill
- Reduction in repair materials
  - repair parts, pipe
- Reduction in repair labor
  - faster repair, overtime reduction
  - system history suggests repairs average 3 overtime hours
- Reduction in secondary damage
  - to private property, other utilities, impact of outage
• Reduces *Non-Revenue Water* with early detection
  • Average leak goes undetected for up to 9 months
  • Many leaks never surface

• **Monitor leak progression** to determine urgency

• **Minimize risks of catastrophic bursts** by fixing leaks early
  • Liabilities $1M+ considering collateral damages
  • Avoid bad publicity and customer dissatisfaction

• **Saves repair costs**
  • Lessen the extent of pipeline (asset) damage
  • Reduce the number of emergency (overtime) repairs
  • Minimize wasted capital associated with *false positives*

• Improve the **safety of field personnel** by eliminating the need for traffic controls during leak investigations
Detailed questions and inquiries:

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