Presentation Overview

• Brief Summary of the Town of Cary’s **Aquastar** system (AMI system)
  • Infrastructure & Data management

• How the Town has **leveraged the data** from the Aquastar system to drive water use analytics for:
  • Abnormal use detection, Customer communication & outreach
  • Developing insights on system & customer consumption pattern and **trends for water resources planning**

• Summary of **Benefits** of water use analytics for the Town
Aquastar Infrastructure

60,000 Water Meters

14 Regional Collectors

Town Server
Aquastar Infrastructure

• **Fixed** Network Radio Coverage Provides **Hourly** Meter Reading

• Implementation timeline
  • **2011** – Network installation
  • **2012** – Meter installation
  • **2013** – Aquastar system online & start of development of web portal
60,000 water meters

24 hourly meter readings, 365 days per year

525,600,000 data points for 1 year (>20 GB data)
The data management element is complex...

RNI – Raw Meter Data

CIS System - Navilne

SAS – Analytical Tables

MDM – Processed Read Data

Customer Portal
Customer Abnormal Use Detection

- Analytics on:
  - High usage
  - Continuous flow
  - Abnormal usage patterns

- Allowing Customer service to move from **reactive to proactive**
Customer Abnormal Use Detection

- Water Meter & Customer Data
- Combine Data
- Daily Usage Summary
  - Prior Day Usage
    - (compare previous 4 days of usage)
- Hourly Usage Data for Continuous Count
  - (> 20 hours of usage)
Customer Abnormal Use Detection

Prior to contacting, apply customer contact logic based on analytics of customer water usage data
Customer Abnormal Use Detection

Bill Adjustments decreased (in volume & cost) because abnormal water use detected early, adjustments needed were more accurate

Adjustment data through May 2017 (began proactive calls in 2014)
Customer Communication

Customer Web Portal

Aquastar allows you to view up to 13 months of your water consumption data.

Get Started
Hover your mouse over the bars in the graphs to see your consumption in gallons or select one of the bars to get more information about your usage for that period. Need more help? Check out our how to guide for using Aquastar.

Customer Email & Text Alerts

My Tiered Information
Last Read Date: ‘2013-04-17’
Next Read Date: ‘2013-05-17’
Total Usage thus far in Billing Cycle: 275800.00
Average Usage per day in Billing Cycle: 2400.00
Days Remaining in Billing Cycle: 21
Estimated Total Usage this Billing Cycle: 77900.00

Gallon Alert for 72621827 - Water Meter
January 23, 2014 at 3:59 AM

Hello,
You requested the Town notify you when your water usage exceeded 50.0 gallons per day. Yesterday, your actual usage was 109.00 gallons.

Please sign into the Aquastar web portal if you would like to view your usage or to update your alert.
Water Use Analysis Update

Goal: Integrate daily Aquastar data into historical water use analyses ...and leverage data to draw new insights

2017 Analysis objectives:

• Update 2010 water use analysis

• Understand water usage patterns & trends in order to:
  - Define future water demand & wastewater flow forecasts
  - Plan for future water resources management programs
Increased Understanding of Daily Customer Water Usage

- Previously only had WTP production trend...
Increased Understanding of Daily Customer Water Usage

...now can compare daily WTP production with total customer demands...

Finished Water to Cary Service Area

Difference (unmetered ops usage, water loss, bulk sales)

Daily Aquastar Data
Increased Understanding of Daily Customer Water Usage

...and you can disaggregate the daily demand by customer type.
Increased Understanding of Daily Customer Water Usage

We can investigate Maximum Day customer usage.
Increased Understanding of Daily Customer Water Usage

SFR Maximum Day customer usage breakdown
Increased Understanding of Daily Customer Water Usage

SFR Maximum Day customer usage breakdown, 2016
Increased Understanding of Daily Customer Water Usage

SFR Maximum Day Peaking Behaviors

- % of all SFR locations - 31%
- % of Single Meter locations - 30%
- % of Separately Metered locations - 39%

- % of all SFR locations - 48%
- % of Single Meter locations - 45%
- % of Separately Metered locations - 61%

- % of all SFR locations - 5%
- % of Single Meter locations - 6%
- % of Separately Metered locations - 0.3%

- % of all SFR locations - 16%
- % of Single Meter locations - 19%
- % of Separately Metered locations - 1%
Increased Understanding of Daily Customer Water Usage

SFR Daily Weather Correlation - Temperature

Aquastar Daily Meter – SFR Potable Water Demand by Quartile Ranges
Increased Understanding of Daily Customer Water Usage

SFR Daily Weather Correlation - Precipitation

Aquastar Daily Meter – SFR Potable Water Demand by Quartile Ranges

<table>
<thead>
<tr>
<th>Daily Precipitation</th>
<th>Days Since Last Rain (&gt;0.1&quot;)</th>
</tr>
</thead>
<tbody>
<tr>
<td>![Graph 1]</td>
<td>![Graph 2]</td>
</tr>
<tr>
<td>![Graph 3]</td>
<td>![Graph 4]</td>
</tr>
<tr>
<td>![Graph 5]</td>
<td>![Graph 6]</td>
</tr>
</tbody>
</table>

Legend:
- SumOfconsumption 2013-2016_SFR_LQR
- SumOfconsumption 2013-2016_SFR_LQR
- SumOfconsumption 2013-2016_SFR_IQRU
- SumOfconsumption 2013-2016_SFR_UQR
Increased Understanding of Daily Customer Water Usage

Relationship of Water Demand and Wastewater Flows

Sewer Flow Monitoring

Daily Aquastar Data

Daily Rainfall

Flow/Demand (MGD)

Rainfall (inches)
Historical Trends
Water Usage vs. Population Growth

Average Population Growth: 5.0%/yr (2001-2016)
Average ADD Growth: 1.4%/yr (2001-2016)
Average ADD Growth: 0.02%/yr (2007-2016)
Historical Trends
Maximum Day Demand

Peaking Factor

Max Day Demand

Demand (mgd)

Peaking Factor Ratio


Maximum Day Demand (MDD)
MDD Peaking Factor
SFR Annual Average Day - Unit Consumption

Cumulative Distribution Chart


2007: Median Usage ~174 GPD

2016: Median Usage ~132 GPD
SFR Monthly Average Day
GPCD by Residence Age Block

2013-2016 Overall Consumption

National Average GPCD (USGS)

AWWARF REU Study Indoor GCPD

Greatest current indoor efficiency GCPD
How the Town benefits from its commitment to water use analytics

Alignment with value placed on robust & proactive planning:

• Foundational element for forecasting future needs
  – Directly address uncertainty
• Effective water resources management
  – Conservation & reclaimed water programs
• Resiliency planning
  – Long-term (LRWRP) and Short-term (WSRP)
• Water Usage Monitoring
  – Tracking and status or usage trends
• Efficiency
• Customer confidence
• Ready for future innovation
  – LRWRP water resource management options
How the Town benefits from its commitment to water use analytics

Opportunities for the future:

• Predictive Forecasting Simulation
  • Short & mid-range forecasting
  • Operational response planning
  • Neural networks

• Enhancements to Hydraulic Modeling
  • Better data for customer demands
    • Water - diurnals, peak daily demands
    • WW – base flows
  • Real-time modeling with updating of data

• Real time data integration
  • Integration of real time data to make decisions and optimize water quality, level of service and efficiency
  • Smart Water Grid/Network brings it all together