WSSC: Changing how utilities interact with distribution systems

Esri UC 2014

Session Title: Using GIS to Manage Your Water Utility

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Agenda

- Presenters
- WSSC Overview
- Project Overview
- Technical Processes
- Accurate GIS Adding Value
- Questions & Answers
Presenters

Ryan McKeon, PMP, GISP, VP Technology & Strategy, Wachs Water Services
Agenda

} Presenters
} WSSC Overview
} Project Overview
} Technical Processes
} Accurate GIS Adding Value
} Questions & Answers
About WSSC

- Established in 1918
- Among the largest water and wastewater utilities in the nation (11,000+ miles of buried pipeline)
- Serving 1.8 million people (460,000 accounts) in Prince George’s and Montgomery counties in Maryland
- FY13 operating and capital budget of $1.4B
WSSC Infrastructure

- Water distribution network consists of over 5,600 miles of pipe
- Three reservoirs/two water treatment plants produce 167 MGD
- 92 pressure zones
- Main size ranging from 2” to 96” in diameter
- System contains mains up to 99 years old
GIS Infrastructure

- Water dataset includes all real-world assets except domestic services and meters
- Data is maintained in 10.2 simple edge geometric network
- Primary drinking water data source was 200 scale drawings
- Primary data publishing tool is browser-based EGIS (ArcGIS Server Application)
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} Project Overview

} Technical Processes

} Accurate GIS Adding Value

} Questions & Answers
Drivers for the Project

- Increase in costs and effort to close valves to manage main breaks, fix leaks and support construction

- Unintentionally closed valves were creating hundreds of dead ends which sparked water quality challenges
Drivers for the Project

- GIS dataset lacked critical data elements and the mapping geometry was derived from 200 scale drawings
Project Objectives

- Perform a physical inventory of the inline valves in the distribution system (recently extended to the transmission system)
- Capture critical data elements for all assets inventoried
- Integrate captured data into existing WSSC business systems (GIS & MMIS)
- Physically cycle assets for preventative maintenance purposes and data documentation purposes
- Return high priority assets to usability by performing light repairs
Asset Inventory Results

- 61,000 small system valves (≤ 12in) inventoried, tested and documented,
- 250 large valves (>12in) inventoried, tested and documented
- Many repairs performed (11,000+) to restore usability
- Sub-foot GPS captured at each asset
Information Usability Improvements

- 6 key attributes for each system valve inventoried
- 350,000+ attributes updated

<table>
<thead>
<tr>
<th>Key Attributes Updated</th>
</tr>
</thead>
<tbody>
<tr>
<td>Current Position</td>
</tr>
<tr>
<td>Operating Nut Depth</td>
</tr>
<tr>
<td>Turns</td>
</tr>
<tr>
<td>Close Direction</td>
</tr>
<tr>
<td>Structure (Valve Box or Vault)</td>
</tr>
<tr>
<td>Valve Type</td>
</tr>
</tbody>
</table>
75,000 field activity records have been integrated with the work management system (MMIS)

1,237 valves that were not documented were “discovered”

~20% of the drinking water dataset has been adjusted to high accuracy GPS (captured at system valves)
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} Questions & Answers
Data Collection & Consolidation

GIS Editing & Spatial Adjustment
Data Collection & Consolidation

Project Tracker
ArcGIS Flex Application

Field Assessments, Repairs, GPS & Data Collection

GPS Post-Processing, Tabular & Spatial Quality Control & Load

Wachs Production SDE GDB, Inspection Records
Assigning Work
Assigning Work
GPS Data Capture

- Equipment: Trimble GeoXH 2008 w/ Zephyr II
- Software: Trimble TerraSync
- Methodology: Post-Processed (PPA workflow)
Quality Control

- Managed with Data Reviewer
- 500+ quality control rules are run daily:
  - Valve turns match size?
  - GPS metadata within thresholds?
  - Null values?
- Each case resolved or flagged as a valid exception
GIS Editing & Spatial Adjustment

- Wachs Production SDE GDB, Inspection Records
- Export One-to-One "Best" GPS, filter invalid GPS data and deliver to Data Editor
- Google™ StreetView
- WSSC's Engineering Records & Information (WERI)
- Spatial Adjustment Process
- Monthly export of secondary asset dataset
- Child Replica of WSSC's production Enterprise GIS
- Weekly Disconnected Two-Way Replication
- Parent replica of WSSC's production enterprise GIS
- Future WSSC internal update
GIS Editing & Spatial Adjustment

- Establish a link table from (X,Y) to (X,Y) on surveyed system valves
- Batch adjust with Spatial Adjustment Rubbersheet tool
- Massage with the Reshape tool (visually referencing drawings)
- More manual massaging is required with sparse control points

Green Lines: Unadjusted Geometry
Red Lines: Adjusted Geometry
GIS Editing & Spatial Adjustment

- 60,555 features adjusted
- 33,319 pipe segment features adjusted (1,220 miles of 5,600)
- 7,277 of 46,196 lateral segment features adjusted
- 13,434 of 61,334 system valve features adjusted
- 6,525 of 45,009 hydrant features adjusted
GIS Editing & Spatial Adjustment

Green Lines: Unadjusted Geometry
Red Lines: Adjusted Geometry

Tee 30'
Valve 30'
Valve 27'
Hydrant 13'
GIS Editing & Spatial Adjustment

Green Lines: Unadjusted Geometry
Red Lines: Adjusted Geometry

Valve 46'
Valve 29'
Valve 39'
GIS Editing & Spatial Adjustment

- Valve 19'
- Valve 32'
- Valve 57'
- Hydrant 16'
- Tee 32'

Green Lines: Unadjusted Geometry
Red Lines: Adjusted Geometry
Quality Control

- Utilize Data Reviewer tool
  - Check for cutbacks (common error when moving many features participating in a geometric network)
  - Check for point features connected to more than 2 pipes (edge count for junctions)
- Water Utility Network tools are used to validate connectivity
Disconnected Two-Way Replication: synchronization takes place on command (on a weekly schedule) when the XML data change messages are imported.
Agenda

- Presenters
- City of Atlanta Overview
- Comprehensive Project Overview
- GIS Implementation Phase
- Accurate GIS Adding Value
- Questions & Answers
Accurate GIS Adding Value

Average system valve search area reduced by 99.8%: $2,300^2 \text{ft} \rightarrow 3^2 \text{ft}$

$\Delta = 27'$
Before

Duration: 7 valves

Footprint: 57 customers
Information Usability Improvements

Duration: 3 valves

Footprint: 57 customers
Information & Asset Usability Improvements

Duration: 2 valves
Footprint: 13 customers
Usable GIS Adding Value
More usable GIS....

- **Much** less dependence on scanned plat cards
- Reduces time to find each asset
- Complete asset registry
- Enhanced content (attributes)
- Reduces risk, improves customer satisfaction, saves money
Questions?

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