

# Innovative Mapping Solution Revolutionizes Water System Operations

June 19<sup>th</sup>, 2007

Author: Steve Schebler, P.E.

Coauthors: Allison Gruber, Chris Havstad,  
Larry Ayers



**City of Phoenix**

BROWN AND  
CALDWELL

# Innovative Web-Based Mapping Solution Revolutionizes Water System Operations

Brown and Caldwell needed to perform over 700 water and wastewater system shutdowns within urban Phoenix as part of the construction process for the City's \$1.5 billion Light Rail project. To meet this need, an innovative web-based solution was devised incorporating mapping and consumer information to produce shutdown plans within minutes instead of weeks. The tool combines the capabilities of cartography, geometric networks and GPS data with the Internet. It utilizes existing water and wastewater GIS data, determines critical customers along pipeline routes, and incorporates real time, as-built progress information. Demonstrations for public officials, contractors, and engineers continually receive praise for the speed, innovation, accuracy, and contribution to public health and safety the tool has provided. It is successfully being used for utility system shutdowns for over 100,000 customers while saving millions of dollars in planning costs and allowing construction schedules to proceed without delay.

# Project Background

- City of Phoenix to install 15 miles of Light Rail Line as part of a \$1.5 billion dollar project
- Light Rail to travel through downtown corridor, industrial and residential districts
- Impact of 5-year construction on residents and businesses should be kept to a minimum



# The Challenge

- Over 700 water and wastewater shutdowns planned for utilities running under the Light Rail route
- \$50 million water and wastewater piping need to be relocated
- Over 100,000 customers need to have seamless service

# Water & Wastewater Shutdowns

- Planning water or wastewater shutdowns traditionally can take weeks or months
  - QS maps and shop drawings used to determine the valves to be closed
  - Billing information assessed to determine customers affected
  - Hard copy of planned shutdown needed to be transmitted to crews performing shutdown

# The Approach

- Utilize GIS data and Utility Networks to create a computerized shutdown planning tool
- Develop a tool that produces shutdown plans in minutes instead of weeks
- Generate hard copy for documentation and for use by construction crews and public relations
- Make the tool easy to access and easy to use by all project team members

# The Solution: Water and Sanitary Sewer Shutdown Planning Tool

- Utilizes City of Phoenix existing GIS Data
- Geo-processing functionality via ArcGIS Server
- Access to system via World Wide Web

PHOENIX  
DATA



+

ARCGIS SERVER &  
GEO-PROCESSING



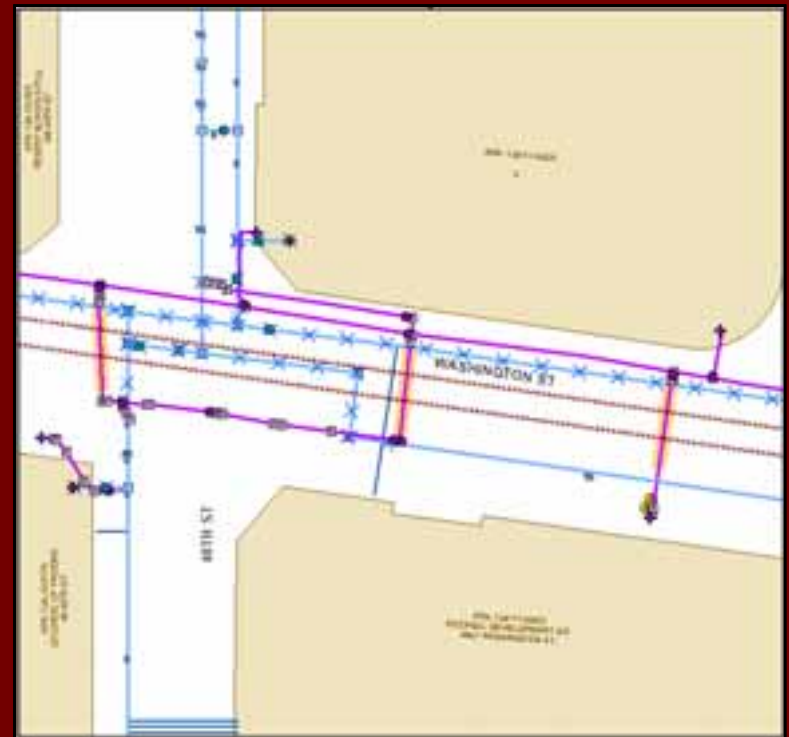
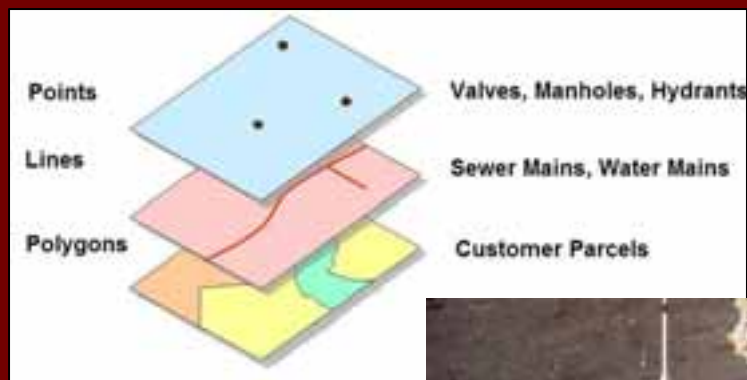
+

WORLD WIDE WEB



# Data

- City of Phoenix GIS Data
- Brown and Caldwell GPS Data
- Updated and synchronized datasets





# Utility Network

- Network Generation
  - Geometric Network created from City's existing GIS database
- Updating Network
  - Existing valves tested and validated
  - New valves (from GPS) incorporated
  - New pipe line segments created
  - Geometric Network updated

# ArcGIS Server

- ArcGIS serves as primary interface between application and geodatabase
- ArcGIS Server's geo-processing engine provides core mapping and spatial analysis
- ArcGIS Server publishes maps to Shutdown Tool application

# The Application

- Shutdown Tool application built on Microsoft's NET 2.0 platform (C#)
- Browser-based application
- Secure, password protected access
- Available anywhere with broadband Internet access

# Appearance

- Map View
- Table of Contents
- Quick Find Guides
- Navigation Tools
- Shutdown Tools

The screenshot displays the 'Water and Sanitary Sewer Shutdown Planning System' interface. The title bar includes the system name and the logo for 'BROWN AND CALDWELL'. The main window is divided into several sections:

- Table of Contents:** A list of system components with checkboxes and expand/collapse icons. The 'Map View' is currently selected. Other items include 'Water System Valve', 'Water System Valve Lab', 'Water System Valve GP', 'Water System Valve GP', 'Water System Valve Rem.', 'Water Hydrant', 'Water Hydrant New', 'Water Hydrant Removed', 'Water Volume Meter GP', 'Water Fitting GPS', 'Abnd Water System Val.', 'Abnd Water System Val.', 'Sewer Manhole', 'Sewer Manhole Label', 'Sewer Manhole GPS', 'Sewer Fitting GPS', 'Light Rail Tracks', and 'Substation Fire Line'.
- Map View:** A map titled 'Water and Sanitary Sewer Utilities' showing a street grid with various utility lines (water and sewer) overlaid. Major roads like I-75 and I-85 are also visible.
- Current System:** A section with radio buttons for 'Water System' and 'Sewer System'. Below are buttons for 'Clear Flags', 'Clear Selection', 'Clear All', and 'Solve'.
- Major Intersection:** A dropdown menu currently showing '19th Ave - Bethany Home Rd'.
- Query Fields:** Two input fields labeled 'Valve Query:' and 'Manhole Query:', each with a 'Find' button.

# Creating a Shutdown Plan

- Locate
- Set flag
- Solve
- Select affected users

The screenshot displays the 'Water and Sanitary Sewer Shutdown Planning System' interface. The main window shows a map of 'Water and Sanitary Sewer Utilities' with a grid of streets including Adams St, 1st St, and Madison St. A green circle highlights a specific valve on the map. The interface includes a 'Table of Contents' on the left with a list of utility types and their status (e.g., 'Water System Valve', 'Sewer Manhole'). At the bottom, there are controls for the 'Current System' (Water System or Sewer System), a 'Major Intersection' field set to '13th Ave - Berry Home Rd', and query fields for 'Valve Query' and 'Manhole Query'. A 'Solve' button is highlighted with a green box at the bottom center.

# Generating a Report

- Generate a Report for printing

City of Phoenix Light Rail Shutdown Plan Export

Page 1 of 7

Water Utility Shutdown Report

City of Phoenix Light Rail Shutdown Plan Export

Page 2 of 7

City of Phoenix Light Rail Shutdown Plan Export

Page 3 of 7

City of Phoenix Light Rail Shutdown Plan Export

Page 4 of 7

Water Valves

Valve Identifier	Status Phase II	Status Phase V	Street	Cross Street	Site Direction
1029-203	152094	1390065	711		
1029-202	152380	1899006	53	Central Avenue Washington Street	10 Right
1029-213	152429	71390070	25	1st Street Washington Street	10 Right
1029-252	152076	20991010	45	Central Avenue Adams Street	12 Right
1029-251	152387	4199062	57		
1027-307	152032	44990673	33		
1029-252	152398	4499064	29		

Hydrants

Affected Parcels

APN Number	Customer Name	Address	Street
112-28-111	LUKE E. MOO	28	1ST ST
112-28-152	Phlox Dodge Tower	1	CENTRAL AVE
112-28-074	Vacant	134	WASHINGTON ST
112-28-070	Vacant (formerly Oregon's)	110	WASHINGTON ST
112-28-069	Vacant	9	
112-28-068	Cherry Moon Restaurant	102	WASHINGTON ST
112-28-073	Vacant	1	1ST ST
112-28-072	Vacant	9	
112-28-067	Government	129	WASHINGTON ST
112-27-119	Government	129	WASHINGTON ST
112-27-002	Parking Lot	9	
112-27-004	Parking Lot	21	WASHINGTON ST
112-27-006A	Parking Lot	9	

http://phx.broward.com/Software/Reports.aspx

4/23/2007

4/23/2007

# Critical Services

- Identify critical service customers



City of Phoenix Light Rail Shutdown Plan Report

Page 1 of 7

Affected Critical Services Parcel Info

APN Number	Contact	Company	Address	Phone
112-26-074	Tam Shreve	Sports City Grill	102 E Washington Street	6022291110
112-26-132	Del Arne	Ryan Companies-Phelps Dodge Tower	114 Central Avenue	6023225402
112-26-132	Sarah Rieda	Dock & Detangler	114 Central Avenue	6022609637
112-26-132	Jan Valenzuela	V's Barber Shop	114 Central Avenue	6022512000
112-26-072	Jesse Mendota	Burger King	1 N 1st Street	6022547088
112-26-072	Linda Hollenbeck	Harb's Gyros	1 N 1st Street	6022623636
112-26-072	Lauren Grant	Fast Watch	1 N 1st Street	6023499689
112-27-118	Barbara Speck	Paradise Bakery	3 S 2nd Street	6022600463
112-27-118	Dave Andrea	Lucky Break	3 S 2nd Street	6023079620
112-27-118	Karl Barry	Hard Rock Cafe	3 S 2nd Street	6022617620
112-27-118	Perry Munge	Perry Munge Salon Spa	3 S 2nd Street	6022528880

<http://gis.broward.com/Subarea/Report.aspx>

4/21/2007

# The Benefits

- Saved the City millions of dollars and untold time generating Shutdown Plans
- 60% of shutdowns performed to date with no incidents
- Required water system operations have had no impact on construction schedule
- Tool expandable to entire City water and sewer systems



*Questions?*

# Acknowledgments

- City of Phoenix Water Services Department
- City of Phoenix Water Services Department  
Construction Management Group

# Author Information

- Steve Schebler
- Project Manager
- City of Phoenix Water Services Department  
200 E Washington Street 8<sup>th</sup> Floor  
Phoenix, AZ 85003-1611  
Tel: (602) 262-7531 Fax: (602) 534-4795
- [steve.schebler@phoenix.gov](mailto:steve.schebler@phoenix.gov)