Water Utility Authority

Technical Customer Advisory Committee

AGENDA

Members

Melissa Armijo	Dave Hill
Andrew Bernard	Amy Miller
Janie Chermak	Ege Richardson
Amy Ewing	Scott Verhines
Mike Hightower	

Thursday, September 7, 2017	**4:00 PM**	**ABCGC – 7th Floor Conference Room 7096**

1.	Call to Order	4:00-4:05
2.	Approval of Agenda	4:00-4:05
3.	Approval of June 1, 2017 Action Summary	4:00-4:05
4.	USGS Studies on Gravity and Water Storage Presentation	4:05-5:10
5.	Water System Loss Presentation	5:10-5:55
6.	Public Comment	5:55-6:00
7.	Adjournment	6:00

NOTICE TO PERSONS WITH DISABILITIES: If you have a disability and require special assistance to participate in this meeting, please contact the Water Utility Authority Office, Suite 5012, Albuquerque/Bernalillo County Government Center, phone 289-3100, as soon as possible prior to the meeting date.

Technical Customer Advisory Committee

ACTION SUMMARY

June 1, 2017

Members Present:	Members Excused:
Melissa Armijo	Laura McCarthy
Andrew Bernard	Ege Richardson
Janie Chermak	
Amy Ewing	
Mike Hightower	
Dave Hill	
Scott Verhines	

Water Authority Staff Present:	Others Present:
Frank Roth, Senior Policy Manager	Elaine Hebard
Mark Kelly, Compliance Division Manager	
Katherine Yuhas, Water Resources Manager	
Carlos Bustos, Water Conservation Manager	
Denise Rumley, Water Use Compliance Inspector	
Kerry Bishop, Water Use Compliance Inspector	
Tom Heller, Water Use Compliance Intern	

Item 1 – Call to Order - Note presence of quorum
The meeting was called to order at 4:02 pm by Chair Dave Hill.

Item 2 – Approval of Agenda
Janie Chermak made a motion to approve the agenda. Mike Hightower seconded the motion. The motion passed on a 7-0 vote.

For:	7	Armijo, Bernard, Chermak, Ewing, Hightower, Hill, Verhines
Against:	0	
Excused:	2	McCarthy, Richardson

Item 3 – Approval of April 6, 2017 Action Summary
Amy Ewing made a motion to approve the action summary. Amy Ewing made an amendment that the April 6, 2017 action summary include the motion and amendment from the March 2, 2017 action summary. Mike Hightower seconded the motion and the amendment. The motion passed on a 6-0 vote.

For:	6	Armijo, Bernard, Chermak, Ewing, Hightower, Hill,
Against:	0	
Abstain	1	Verhines
Excused:	2	McCarthy, Richardson

Item 4 – Compliance Division Presentation
Mark Kelly provided an overview of the Compliance Division programs. He discussed the National Pollutant Discharge Elimination System Permit, the Customer Confidence Report, and the water quality laboratory.

Item 5 – Irrigation Budgets / Water Conservation Plan Update
Carlos Bustos provided an overview of the irrigation budget program, water use trends, and water conservation rebates. He also described the current and proposed water conservation programs. The committee participated in an activity to provide input on the proposed programs that will be included in the updated Water Conservation Plan. The committee recommended that the Water Authority focus on the proposed programs in the following order: 1) Public Agency Partnership; 2) Efficient Irrigation Audits; 3) Cooling Towers; 4) Plants Programs; 5) Trees, Outdoor Efficiency Education, Efficiency Programs; and 6) Private Sector Partnership.

Item 6 – Public Comment
Elaine Hebard provided comments to the committee.

Item 7 – Adjournment
The meeting concluded at 6:02 pm.

Aquifer-storage change monitoring in the Albuquerque basin

USGS New Mexico Water Science Center
Jeff Kennedy – jkennedy@usgs.gov
Meghan Bell – mtbell@usgs.gov
Andre Ritchie – abritchie@usgs.gov

In cooperation with the Albuquerque Bernalillo County Water Utility Authority

U.S. Department of the Interior
U.S. Geological Survey

Outline

- **What we're doing:**

Monitoring aquifer-storage changes in the Albuquerque basin at a network of 30 stations.

- **Why we're doing it:**

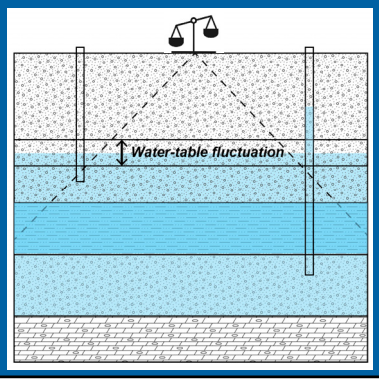
To monitor the groundwater resource and improve the simulation capability of groundwater models.

- **How we're doing it:**

By measuring small changes in Earth's gravitational field (repeat microgravity).

Monitoring aquifer storage-change with repeat microgravity

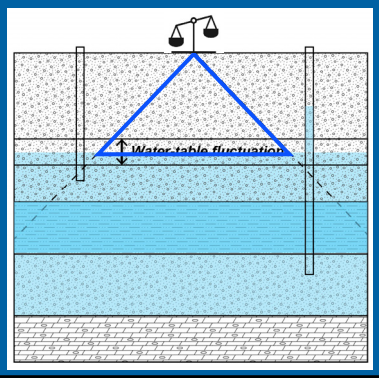
- Gravity at a particular spot depends on the density of a cone-shaped region in the subsurface:
  - *Changes in density = changes in gravity*



USGS

Monitoring aquifer storage-change with repeat microgravity

- Gravity at a particular spot depends on the density of a cone-shaped region in the subsurface:
  - *Changes in density = changes in gravity*



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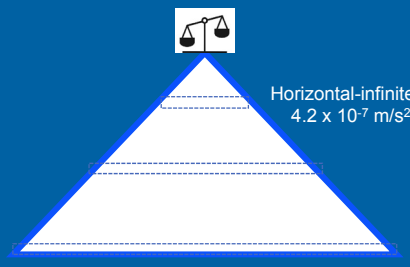


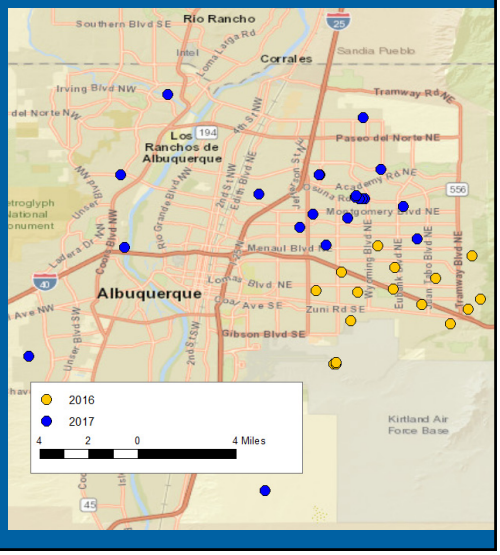
Horizontal-infinite slab approximation:
4.2×10^{-7} m/s^2 = 1 m of free-standing water

USGS

With this approximation, repeat microgravity measures aquifer-storage change in units of "thickness of free-standing water"

What we're doing:

- Regional aquifer-storage-change monitoring network
  - 13 stations established in 2015-2016
  - 18 additional stations established in 2017
    - 5 stations at Bear Canyon
    - Additional stations co-located with wells
- Trying to capture changes in the cone(s) of depression east of I-25

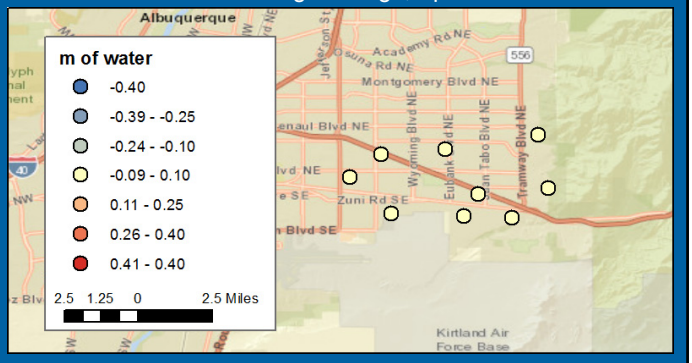


USGS

What we're doing:

- **Regional monitoring network**

Storage change, April 2016 to June 2016



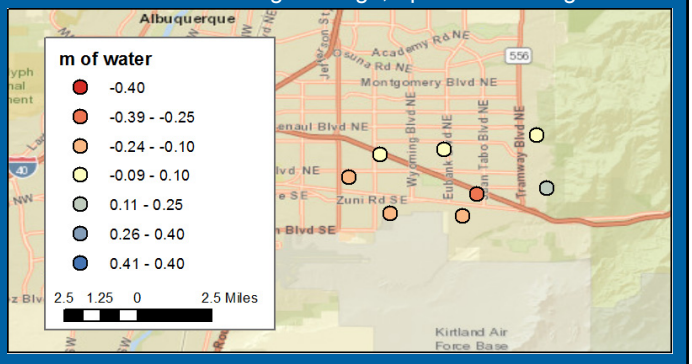
USGS

Kennedy, J.R., and Bell, M.E., 2017, Repeat microgravity data from Albuquerque and Bernalillo County, New Mexico, 2016-2017. U.S. Geological Survey data release, https://doi.org/10.5066/F73F4NH4.

What we're doing:

- **Regional monitoring network**

Storage change, April 2016 to August 2016



USGS

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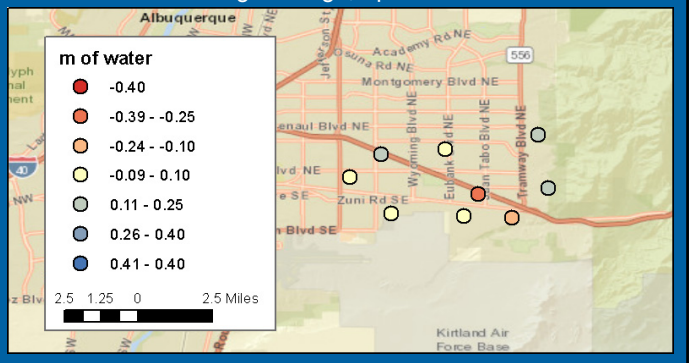
What we're doing:

- **Regional monitoring network**

Storage change, April 2016 to December 2016



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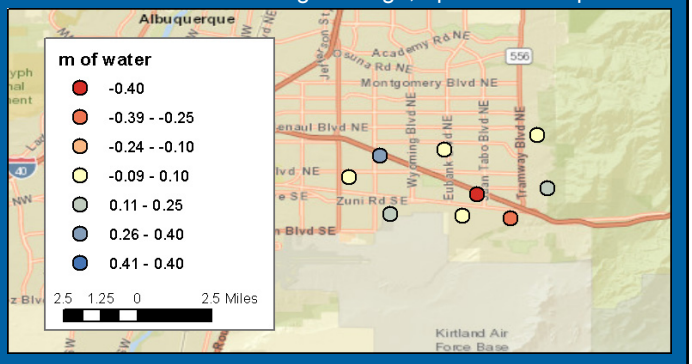
What we're doing:

- **Regional monitoring network**

Storage change, April 2016 to April 2017



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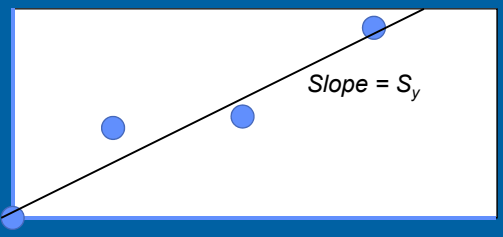
What we're doing:

- **Specific-yield determination**
  - S_y = volume of water released (or stored) per unit change in water-table elevation per unit area of aquifer
  - In other words, effective porosity
- **If 4.2 x 10^{-7} m/s^2 = 1 m of free-standing water…**

Change in aquifer-storage (thickness of free-standing water)

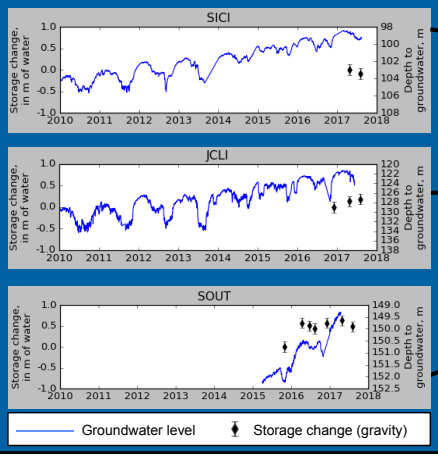


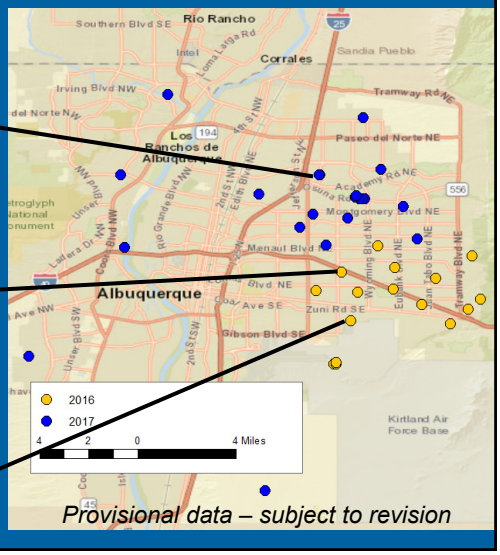
Change in groundwater level

USGS

What we're doing:

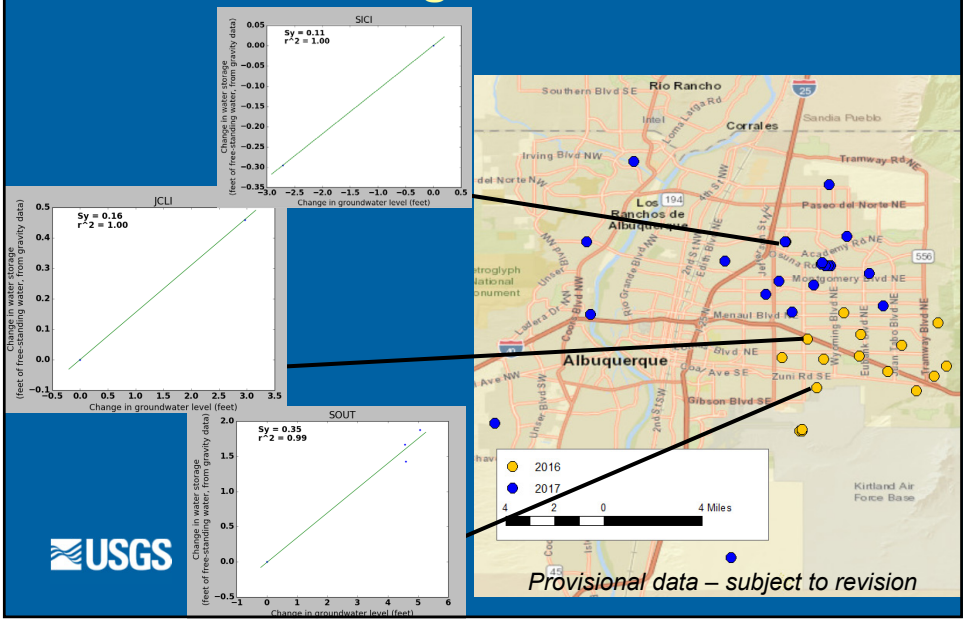
- **Specific-yield determination**





Provisional data – subject to revision

What we're doing:



USGS

Why we're doing it:

Groundwater levels

- Easy to measure.
- Difficult to get started if drilling is required.
- Are a proxy for storage changes, but limited by heterogeneity and well design/condition.
- Only measures change at the water table.

Repeat microgravity

- Harder to measure.
- Measurements are at the land surface.
- Direct measurement of storage change.
- Integrates storage-change throughout the subsurface.

USGS

Why we're doing it:

- For monitoring
  - Maps of storage change can be interpreted qualitatively
  - But, gravity is also a quantitative measurement: data are relative to a constant, unchanging datum.

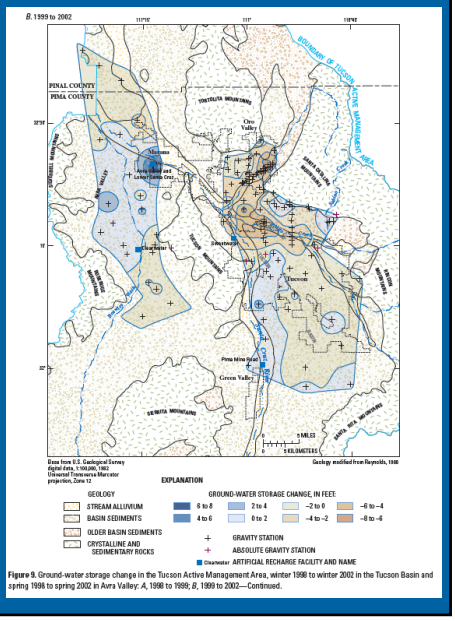


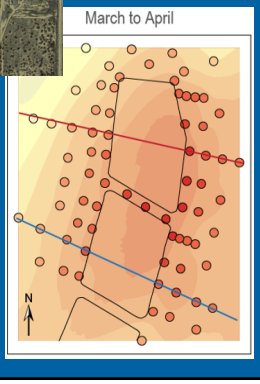
Figure 9. Ground-water storage change in the Tucson Active Management Area, winter 1998 to winter 2002 in the Tucson Basin and spring 1998 to spring 2002 in Avra Valley: *A*, 1998 to 1999; *B*, 1999 to 2002—Continued.

Gravity change in the Tucson Basin

USGS

Why we're doing it:

- For monitoring
  - Maps of storage change can be interpreted qualitatively
  - But, gravity is also a quantitative measurement: data are relative to a constant, unchanging datum.

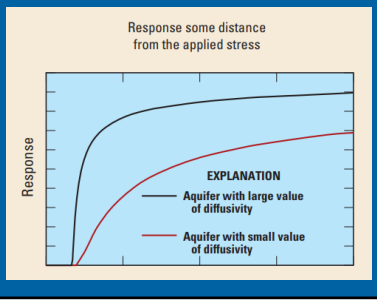


Gravity change at Tucson Water recharge facility

USGS

Why we're doing it:

- For modeling
  - McAda, 2002:
    - *"Specific yield is a sensitive property probably because it is a larger component of aquifer storage than specific storage is."*
    - *"The model is most sensitive to lower than calibrated values of hydraulic conductivity, specific yield, and horizontal anisotropy for zone 2…"*
- Hydraulic diffusivity (transmissivity/storativity) determines the rate at which pumping/recharge propagates through the aquifer

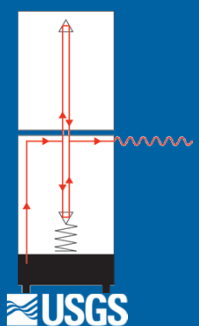


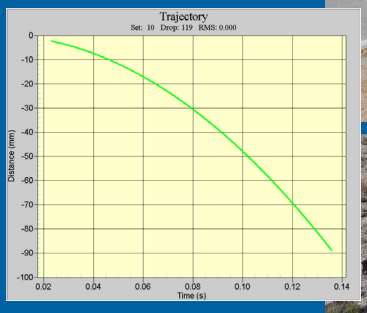
Streamflow depletion by wells—Understanding and managing the effects of groundwater pumping on streamflow
U.S. Geological Survey Circular 1376

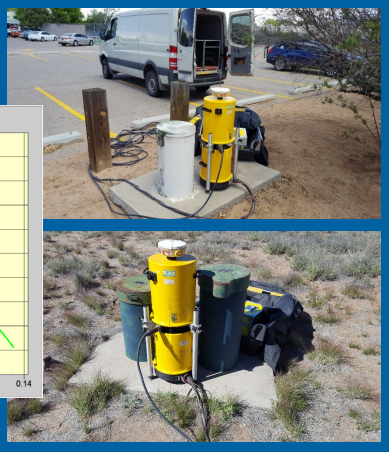
USGS

How we're doing it:

- Absolute gravimeter (*a dropper)*
  e.g., 9.79240353 m/s²







USGS

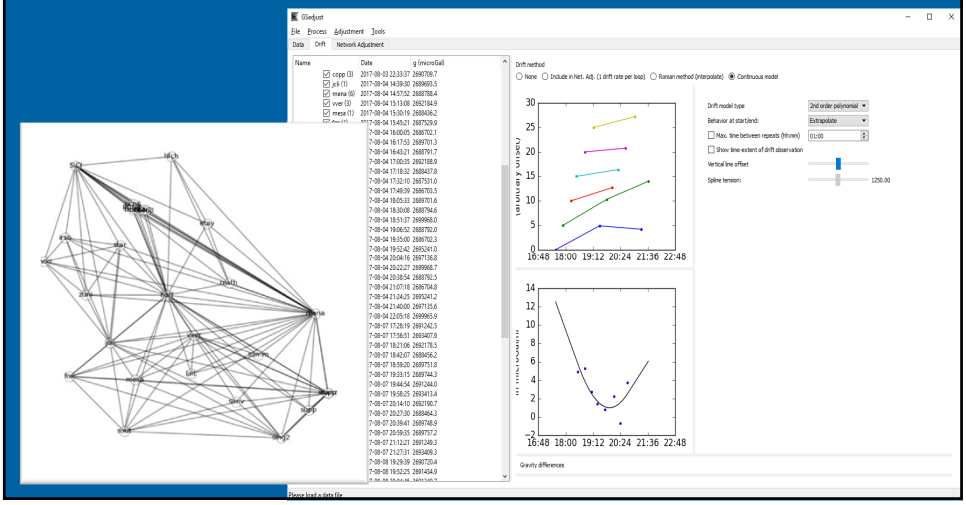
How we're doing it:

- Relative gravimeter (*a spring*)

USGS

How we're doing it:

- Absolute- and relative-gravity observations are combined using "network adjustment"



Limitations

- Gravity measurements aren't as precise as we would like
  - Long time-series and large water-level changes are helpful
- Delayed drainage and compaction can cause subsidence and overlapping signals
  - InSar/GPS/extensometer data in "Land subsidence and recovery in the Albuquerque Basin, New Mexico, 1993–2014", SIR 2017-5057, indicates small amounts of uplift 2005-onward
- Soil moisture monitoring
- New measurement technology

USGS

Conclusion

- In cooperation with the Albuquerque Bernalillo County Water Utility Authority, USGS has established a 30-station gravity network to monitor aquifer-storage change
  - 5-station network at Bear Canyon recharge channel
  - 1 station at Drinking Water Treatment Plant injection well
- The network complements and augments the groundwater-level monitoring network
- Surveys carried out 3 times per year; annual data releases
- A Scientific Investigations Report is planned for the end of 2018
- The project is carried out by the USGS Southwest Gravity Program, http://go.usa.gov/xqBnQ

USGS

Albuquerque Bernalillo County
Water Utility Authority

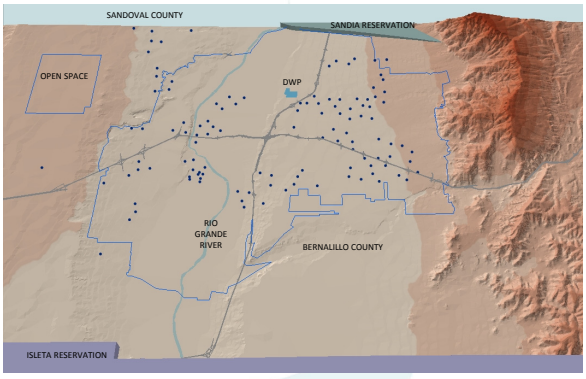
Water Loss

Angelique Desiree Maldonado
Water Use Compliance Supervisor
Albuquerque Bernalillo County Water Utility Authority

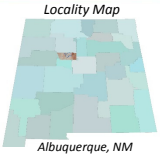
Albuquerque Bernalillo County
Water Utility Authority

Introduction

Water Authority's Areas Served



Locality Map



Albuquerque, NM

- The Albuquerque Bernalillo County Water Utility Authority (Water Authority) is situated within the Middle Rio Grande Watershed, Albuquerque Reach
- The largest water utility in New Mexico, serving in excess of 636,000 customers

Water Loss

State and regional water utility regulatory agencies require water loss reports. These reporting programs aim to evaluate regional water loss, encourage utilities to proactively pursue water loss control, and defensibly allocate financial and educational resources to mitigating water loss.

Water loss reporting requirements vary from stand-alone reported water loss totals to annual submission of complete American Water Works Association (AWWA) audits.

Water Use Accounting

'The Office of the State Engineer has implemented state-of-the-art water use accounting in partnership with New Mexico drinking water suppliers to assess real water leakage, lost revenue, and conservation potential. The methodology utilized is based on the American Water Works Association, Water Loss Control Committee recommendations and software.'

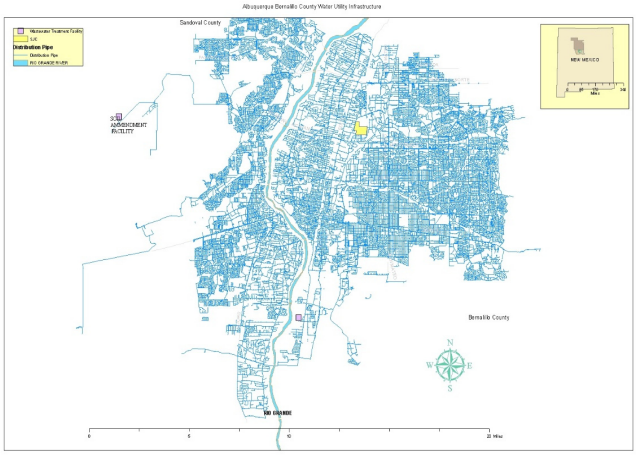
http://www.ose.state.nm.us/index.php

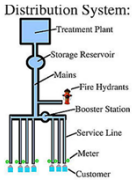
Albuquerque Bernalillo County Water Utility Authority

Albuquerque Bernalillo County Water Utility Authority

Scope

- Source Water: Surface water, GW wells
- 3387 miles of Distribution Pipe, 60 storage reservoir tanks, 46,017 valves, 18,563 hydrants
- In excess of 212,000 customer accounts





Albuquerque Bernalillo County Water Utility Authority

Background

Water loss

<table>
<tr><td rowspan="2">Volume from Own Sources (corrected for known errors)</td><td rowspan="3">System Input Volume</td><td rowspan="2">Water Exported (corrected for known errors)</td><td colspan="3">Billed Water Exported</td><td rowspan="2">Revenue Water</td></tr>
<tr><td rowspan="6">Water Supplied</td><td rowspan="2">Authorized Consumption</td><td>Billed Authorized Consumption</td><td>Billed Metered Consumption</td></tr>
<tr><td>Billed Unmetered Consumption</td></tr>
<tr><td rowspan="2">Water Imported (corrected for known errors)</td><td rowspan="2">Unbilled Authorized Consumption</td><td>Unbilled Metered Consumption</td><td rowspan="6">Non-Revenue Water (NRW)</td></tr>
<tr><td rowspan="4">Water Losses</td><td>Unbilled Unmetered Consumption</td></tr>
<tr><td rowspan="2">Apparent Losses</td><td>Unauthorized Consumption</td></tr>
<tr><td>Customer Metering Inaccuracies</td></tr>
<tr><td>Systematic Data Handling Errors</td><td rowspan="2">Real Losses</td><td>Leakage on Transmission and Distribution Mains</td></tr>
<tr><td>Leakage and Overflows at Utility's Storage Tanks</td><td>Leakage on Service Connections up to the point of Customer Metering</td></tr>
</table>

Source: AWWA 2016.

- 2009- The Water Authority began conducting a full comprehensive water audit.
- 2010-The Water Authority began using the AWWA Standardized water Audit software and participating in the Water Audit Data Initiative data validation process

Albuquerque Bernalillo County Water Utility Authority

Goals and Objectives

- Capture and quantify water loss events in order identify the frequency and volume of losses, identify where these losses are occurring and to achieve water distribution system optimization.

- The Water Authority is addressing two questions:

1) "What is the Water Authority's potential to save real water?"

2) "Is it worth it for the Water Authority to invest in additional Water Loss Control strategies to reduce real water lost through the distribution system?"

Albuquerque Bernalillo County Water Utility Authority

Framework

Water Budget and Loss Control Program

Problem Identification

Monitor and Assess supply/demand

Real Loss Reduction Strategy

Top Down Water Audit

AWWA Water Audit Software

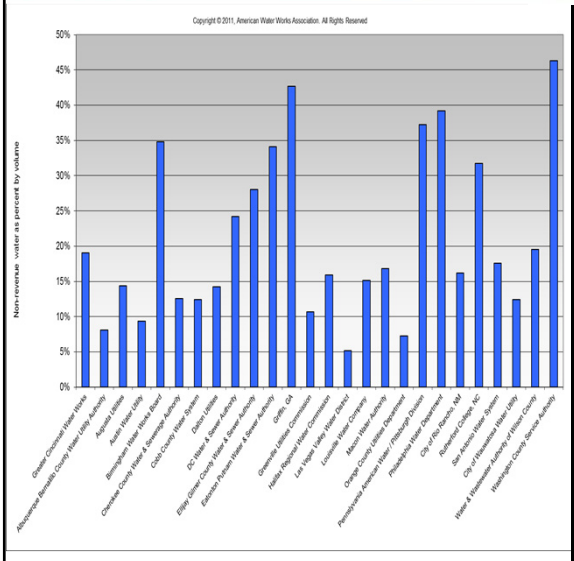
Problem Solving

Component Analysis of Real Losses

Evaluation of least cost Real Loss reduction strategy

Albuquerque Bernalillo County Water Utility Authority

Data Initiative



AWWA Field	ABCWUA Data		
Own Sources	San Juan-Chama	Groundwater wells	Non-System Wells
Billed Metered Consumption (includes water exported)	CCB data	AMI data	METER DRIFT FROM PM TESTING
Billed Unmetered Consumption	Estimated billed volumes/meter stop	Unmetered Parks	CUSTOMER READS
Unbilled Metered Consumption	WELL WASH	ARSENIC TREATMENT	RESERVOIR STORAGE
Unbilled Unmetered Consumption	FIRE FIGHTING	RESERVOIR/LINE DRAIN/FLUSH	EVAPORATION
Unauthorized Consumption	THEFT	ILLEGAL CONNECTIONS	METER BYPASS
Customer Metering Inaccuracies	CANCELLED CCB ADJUSTMENTS	FROZEN CCB ADJUSTMENTS	METER ERROR
Systematic Data Handling Errors	METER READING ERRORS	BILLING ERRORS	CUSTOMER REPORTING
Leakage on Transmission and/or Distribution Mains	VOLUMES FROM LEAKS	VOLUMES FROM MAIN LINE BREAKS	VOLUMES FROM SERVICE LEAKS

Albuquerque Bernalillo County Water Utility Authority

Benchmarking

- M36 Water Audits & Loss Control Programs
1. Water Balance
2. Controlling Real Losses
- G200 AWWA Distribution Standard
1. Distribution System Management
2. Facility Ops and Maintenance

Water Distribution System Failure Data Collection

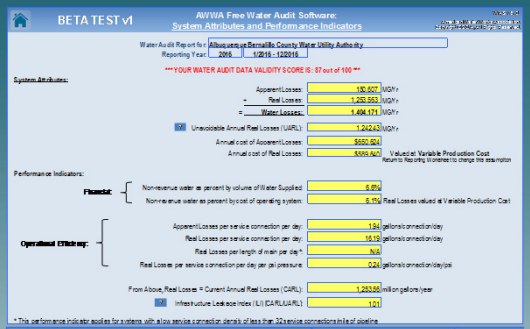
INSTRUCTIONS AND DATA FIELD NAMES AND DEFINITIONS

Purpose of this Tool: Drinking water utilities supply water through underground piping systems. Such systems - sooner or later - incur failures in the form of leaks and breaks (ruptures) in distribution and customer service piping. In order to reliably maintain distribution systems to convey water to their customers, water utility personnel should carefully document data on the occurrences of failures in their system. **The use of this spreadsheet for collecting data is not required.** This tool offers guidance to water utilities in the form of a standardized format to document failure events; thereby generating the appropriate data to execute a reliable leakage component analysis. The results of a leakage component are used to develop effective leakage control strategies for the water utility. Utilities that carefully document all failure events have a means to define failure trends occurring in their system.

System Input Volume	Authorized Consumption	Billed Authorized Consumption	Billed Metered Consumption	Revenue Water
			Billed Un-metered Consumption	
		Unbilled Authorized Consumption	Unbilled Metered Consumption	
			Unbilled Un-metered Consumption	
	Water Losses	Apparent Losses (Commercial Losses)	Unauthorized Consumption	Non Revenue Water (NRW)
			Customer Meter Inaccuracies and Data Handling Errors	
		Real Losses (Physical Losses)	Leakage in Transmission and Distribution Mains	
			Storage Leaks and Overflows from Water Storage Tanks	
			Service Connections Leaks up to the Meter	

AWWA Comprehensive Water Audit

This spreadsheet-based water audit tool is designed to help quantify and track water losses associated with water distribution systems and identify areas for improved efficiency and cost recovery. The Non-Revenue Water is also calculated.



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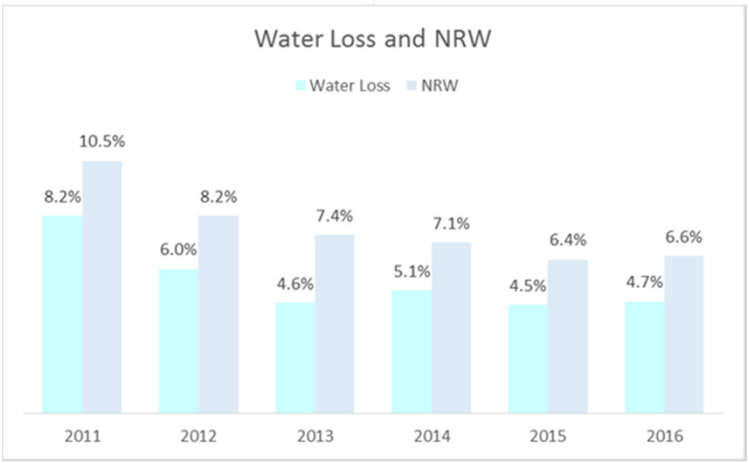
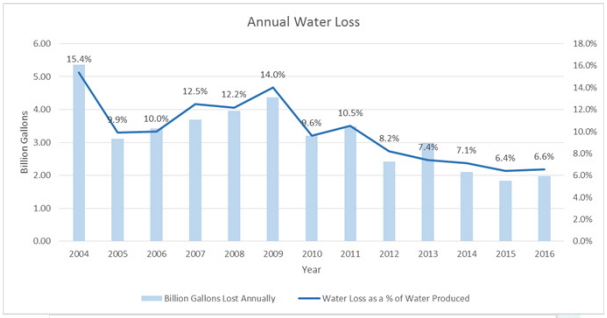
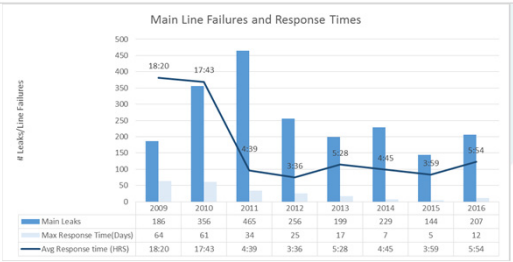
Water Loss vs NRW



Albuquerque Bernalillo County Water Utility Authority

Performance Indicators





4.2.4 Water Loss:

- 4.2.4.1 Documented annual goal for amount of water loss
- 4.2.4.2 Response Program
- 4.2.4.3 Leakage

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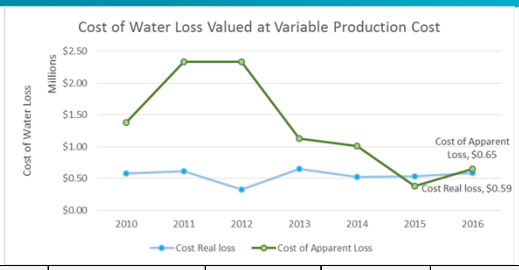
Performance Indicators



Year	Cost Real loss	Cost of Apparent Loss	Total Cost(M$)	Data Validity	UARL(MG)	NRW % by Vol
2010	$583,024.28	$1,379,227.74	$1.96	74%	1,143	9.6%
2011	$617,346.50	$2,331,757.73	$2.95	72%	1,204	10.5%
2012	$331,596.46	$2,339,138.75	$2.67	74%	970	8.2%
2013	$653,325.55	$1,130,096.14	$1.78	76%	1,366	7.4%
2014	$526,096.01	$1,008,189.31	$1.53	78%	1,079	7.1%
2015	$531,272.32	$379,594.40	$0.91	86%	1,085	6.4%
2016	$589,640.18	$650,623.54	$1.24	87%	1,242	6.6%

Key Performance Indicator	# Utilities	Average	Range
NRW as a % by volume	21	22.60%	6.8% - 45.5%
NRW Total Cost	21	$5.81	$.04 - $42.97
Water Audit Validity Score	21	74.97%	52.28% - 89.72%

Validated Water Audit Data for Reliable Utility Benchmarking (AWWA)

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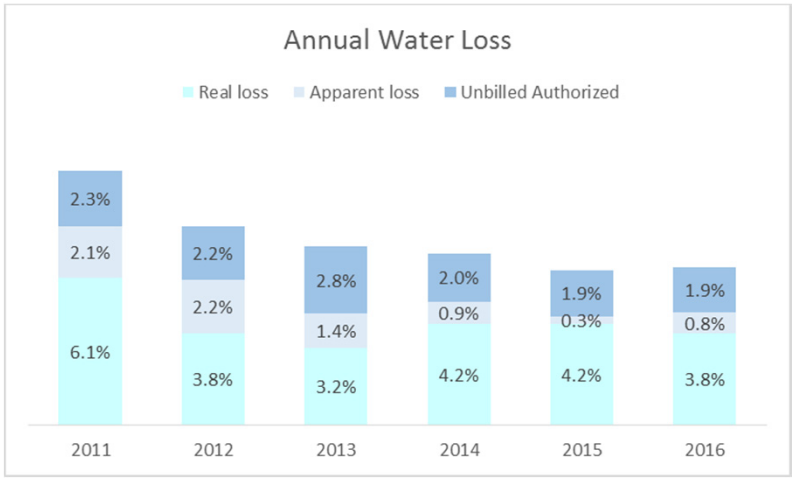
Success measures



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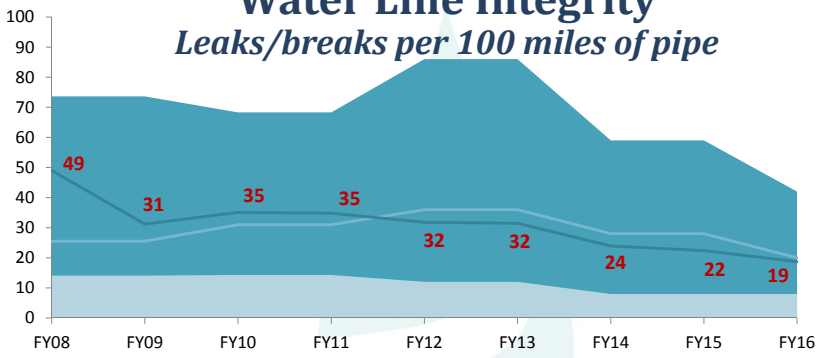
Success measures

Water Line Integrity

Leaks/breaks per 100 miles of pipe



Lower Values Desirable

OPTIMIZATION CRITERIA METRICS

General Notes

During the development of the optimization criteria, the expert workgroups developed metrics (objective performance indicators) to track the degree to which the distribution system is optimized. The group developed three core criteria to assess whether the distribution system is optimally managed. These are: (a) Chlorine Residual, (b) Pressure Management, and (c) Main Breaks/Leaks.

This worksheet specifies the values assigned by the utilities for the Main Breaks and Leaks criteria and provides detailed descriptions about the criteria.

Criteria Utilized in Formulas

Criteria	Type	Numeric Input	Units	Description
Main Breaks/Leaks	<=	35	Events	Maximum number of events per specified length per time period
	Per	100	Miles of Pipe	Specified length of pipe
	Per	1	Year	Specified time period to consider

WRF-4109 Distribution Optimization Criteria

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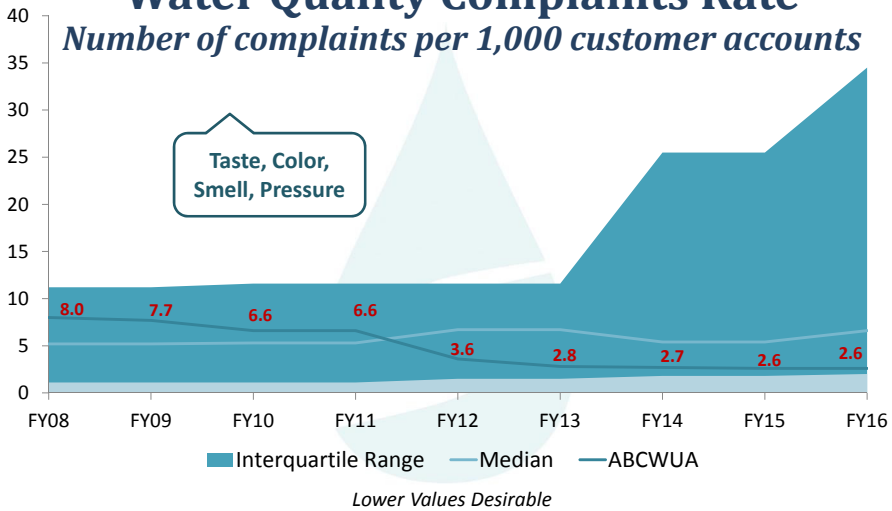
Success measures

Water Quality Complaints Rate

Number of complaints per 1,000 customer accounts



Lower Values Desirable

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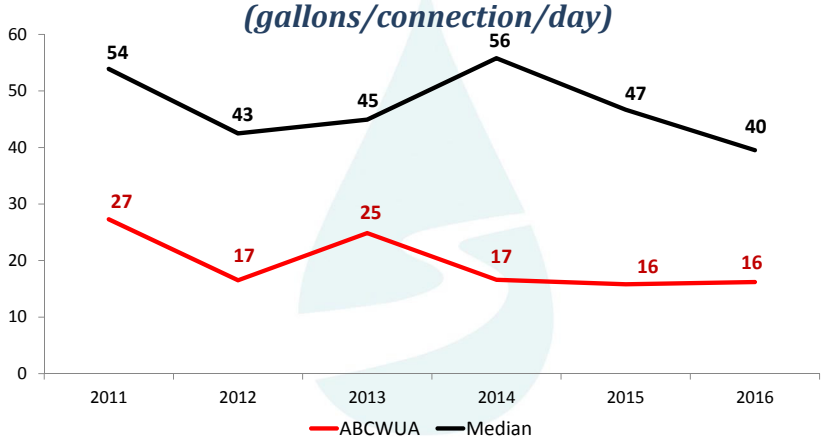
Success measures

Water Loss

System Leakage Losses per service connection per day (gallons/connection/day)



Lower Values Desirable

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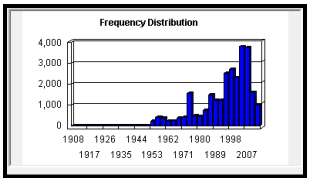
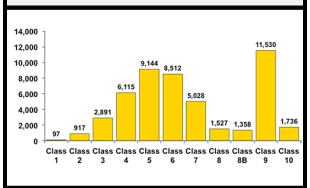
4.2 Distribution System Management Programs

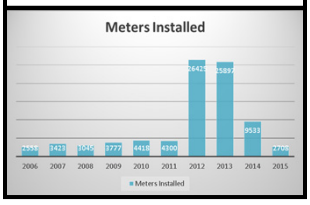
- 4.2.5 Valve exercising and replacement
- GPS Program for Data Capture; 46,017 Valves, Avg. age~19
- Spatial Accuracy

- 4.2.6 Fire Hydrant maintenance and testing
- I.S.O. Public Protection Classifications
- Hydrant Flow tests according to AWWA M17

- 4.2.8 Metering
- Source Meter calibration
- AMI on ~30% of customer endpoints
- Testing frequency according to AWWA M6







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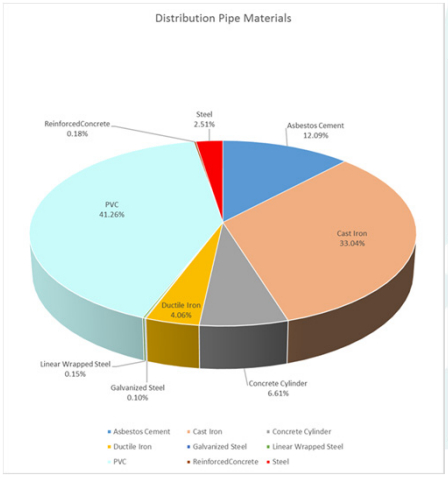
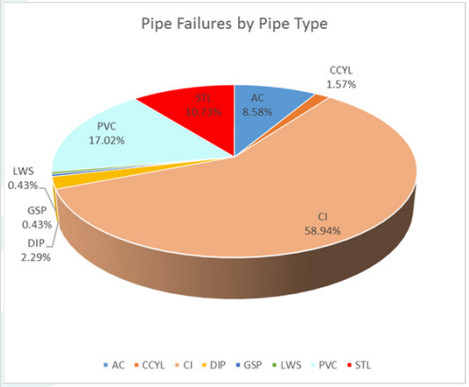
4.3.3 Pipeline Rehab and Replacement





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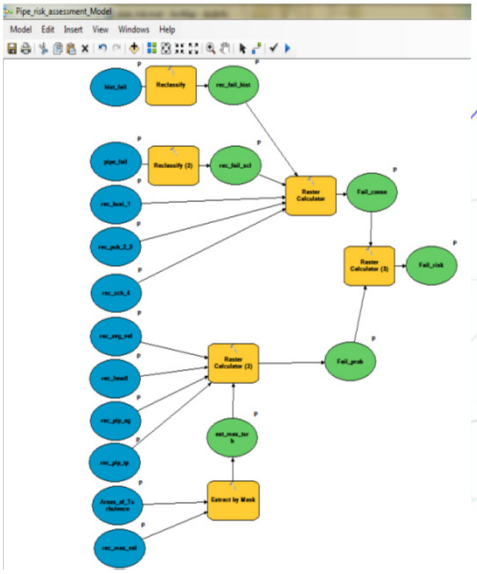
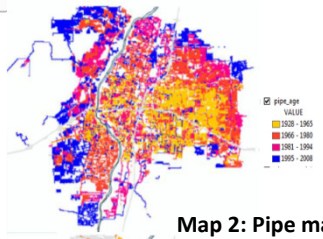
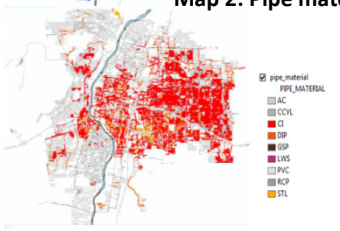
Failure Risk Modelling



Map 1: Pipe age



Map 2: Pipe material



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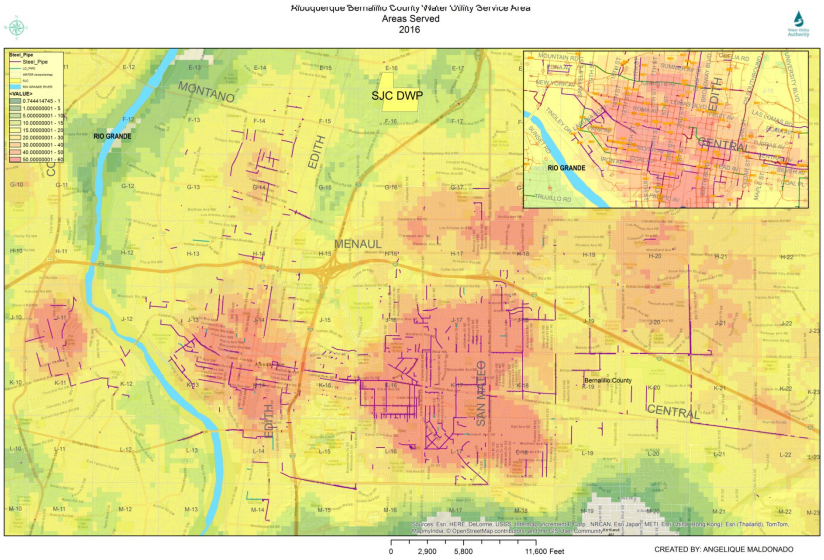
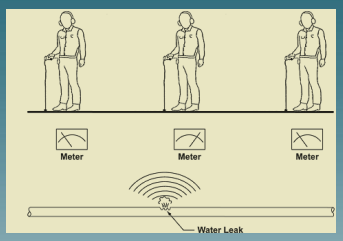
Targeted Leak Detection



Leak Detection



- 350 units
- 500ft apart

Quarter	Miles Surveyed	Miles Patrolled	Leaks Located	Estimated water saved from Leak Detection
1st	169	517	21	27,415,296
2nd	114	437	17	21,039,768
3rd	478	517	44	41,285,880
4th	225	676	19	21,707,280
Total	986	2,148	101	111,448,224

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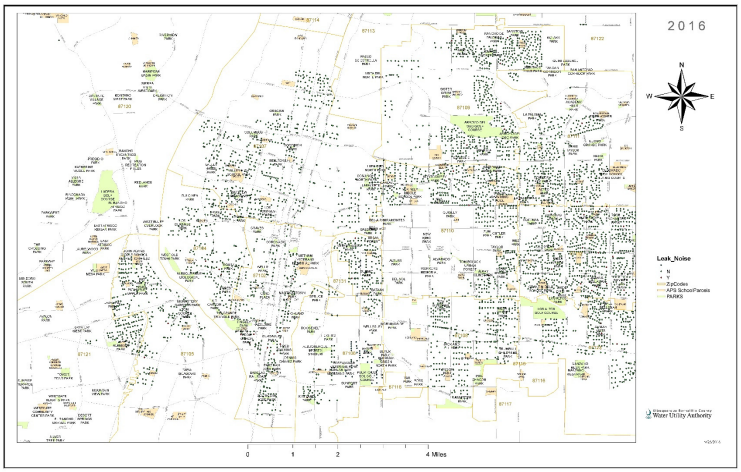
Leak Detection Manual Survey



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Conclusions

- Water Loss Control has reduced water loss by 3.38 billion gallons/year since 2004
- Water Audit Data validity has increased from 74% to 87% since 2010
- Field crews have reduced response times to line failures by 30% since 2009
- Water Quality complaints have been reduced by 33% since 2008