

# **Water Meter Reading Process Audit July 2014**

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July 10, 2014

Honorable Mayor and Members of the City Council:

I am pleased to present the Water Meter Reading Process Audit Report. The purpose of this audit was to evaluate the adequacy of the controls associated with the City's remotely transmitted water meters and to evaluate the accuracy of billing resulting from remotely transmitted data.

Management's response to our audit findings and recommendations, as well as target implementation dates and responsible parties, are included in the following report.

We would like to thank the Water Utilities Department and various other City departments for their full cooperation and assistance during this project.

*Lori Brooks*

Lori Brooks, CPA, CIA, CGAP, CRMA  
City Auditor

Attachment

c: Trey Yelverton, City Manager  
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Walter Pishkur, Director of Water Utilities

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# Water Meter Reading Process Audit



Office of the City Auditor

Lori Brooks, CPA, CIA, CGAP, CRMA  
City Auditor

July 10, 2014

## *Executive Summary*

*Billing for remote meters  
is accurate and timely*

*Remote meter efficiency  
gains are evident in  
reduced operating costs*

## *Opportunities for Improvement*

*Enable encryption  
during data transmission*

*Establish policies and  
procedures for remote  
meters*

*Improve data accuracy  
in remote meter software*

*Remedy meter  
malfunctions within a  
specified time period*

*Calculate true cost  
benefit Citywide based  
on actual results*

The City Auditor's Office conducted an audit of the water meter reading process for automated meters. The audit was conducted in accordance with generally accepted government auditing standards. Those standards require that we plan and perform the audit to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions based on our audit objectives. We believe that the evidence obtained provides a reasonable basis for our findings and conclusions based on our audit objectives. The objectives of the audit were to:

- Determine whether automated water meters have increased meter reading efficiency
- Ensure that automated water meters support accurate reporting and billing
- Determine whether sufficient capacity exists to perform a planned citywide expansion in-house
- Verify that the City is realizing the operating efficiencies and effectiveness projected after completing a pilot project

In 2012, the Arlington Water Utilities Department (AWU) administered a pilot project to convert approximately 17,000 residential and commercial accounts to automated meters that could remotely transmit water usage. The initial cost of conversion in the pilot area was approximately \$4.5 million.

Testing performed by the City Auditor's Office indicated that the introduction of remote meters did not result in erroneous or inaccurate billing. Even in cases where the remote meters were not transmitting data, manual controls in place ensured accurate water usage was reflected on customers' bills. The City Auditor's Office calculated that AWU realized labor savings of about \$100,000 in FY2014 compared to costs incurred prior to automation.

The cost recovery of converting the entire city to remote meters is estimated to take twenty or more years. Even though the cost recovery period is lengthy, remote meters and associated software is seen as a needed operational and technological tool to effectively manage water utility resources.

The City Auditor's Office noted that an encryption setting has not been turned on to protect usage data transmitted from automated meters to base stations inside City water towers. Although the transmission does not include any customer specific identifiable information such as name, address, or account number, encryption ensures data integrity and reduces the risk that usage data will be altered for malicious or other purposes.

AWU has not established policies and procedures needed to guide the operation and management of remote water meters. Lack of detailed policies and procedures may hinder operations and could result in inadequate guidance provided to employees who use and service remote meters.

The City Auditor's Office noted that 495 (2.5%) of approximately 18,000 transmitting devices were not properly identified in the Sensus software. The City Auditor's Office noted that AWU did not have a process in place to reconcile the number of meters in enQuesta to the number of meters in Sensus. Also, AWU did not establish procedures related to resolving non-transmitting meters.

The City Auditor's Office determined that the cost-benefit analysis conducted by AWU overstated expected cost savings. While it has been generally accepted that remote technology is necessary, a more accurate cost-benefit analysis should take place in the future to ensure that expected benefits are realized.

These findings and related recommendations are discussed in the Detailed Audit Findings section of this report.

### ***Audit Scope and Methodology***

The audit was conducted in accordance with generally accepted government auditing standards. The following methodology was used in completing the audit:

- Interviewed Water Utilities staff regarding new remote meters
- Visited the pilot area to observe new meters and data receiving units
- Examined the software that processes water consumption data
- Examined how data is transferred to the primary water billing software
- Reviewed billing records to ensure accuracy
- Reviewed ongoing quality assurance methodology to ensure billing accuracy
- Generated exception reports produced from the software that processes remote readings to ensure that Water Utilities staff resolved the exceptions timely
- Extracted data from the remote meter system and billing system for reconciliation
- Extracted Water Utilities budgetary data and past financial records to assess cost vs. benefit

### ***Background***

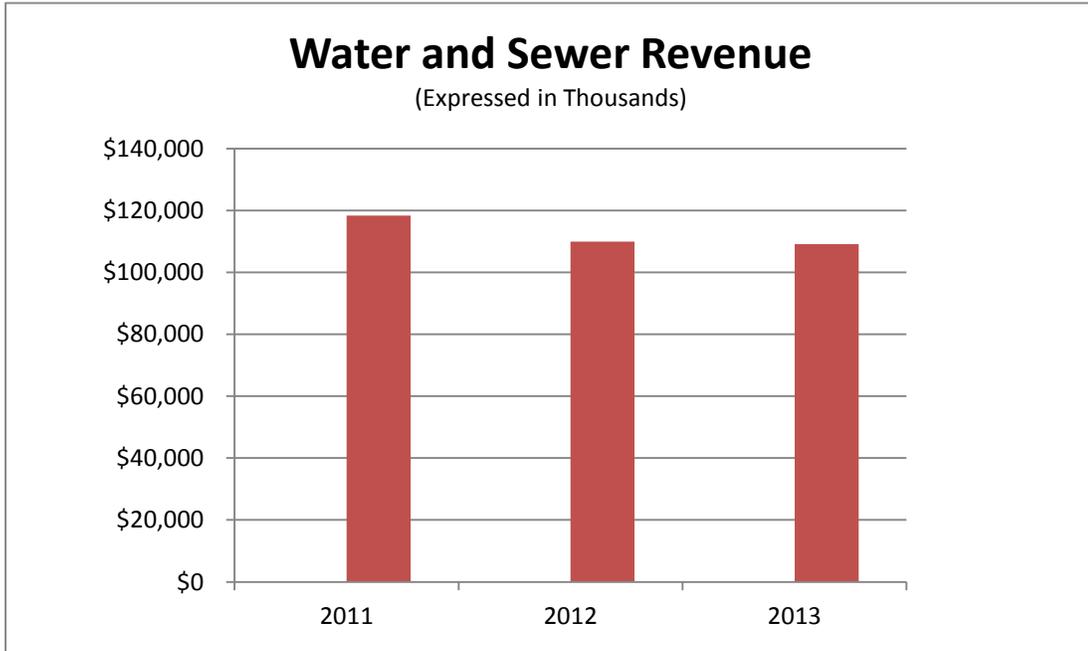
AWU provides water and wastewater (sewer) services to over 100,000 residential and commercial accounts within the city limits. Wastewater services are not provided for residents with septic systems, irrigation only accounts, and some commercial accounts.

Water customer account totals are listed in the table below:

<b>Water Customers</b>		
	<b>FY 2012</b>	<b>FY 2013</b>
Residential	92,945	93,589
Commercial	6,813	6,864
<b>Wastewater Customers</b>		
	<b>FY 2012</b>	<b>FY 2013</b>
Residential	92,287	92,983
Commercial	5,514	5,561

Source: enQuesta billing system data

Water and sewer revenue for FY11 through FY13 is presented below:



Source: City of Arlington CAFRs

**Manual Meter Reading Process**

Water and wastewater services are billed once a month based on 20 billing groups per month Citywide. Prior to automation, each location was visited by a meter reader and the readings were interfaced to the enQuesta water billing enterprise system. In order to increase efficiency and reduce costs, departmental management embarked on a project to automate the meter reading process and make hourly water usage details available to its current customers.

The meter reading process was analyzed by Cognyst Consultants in 2008, to determine if automation would be beneficial. Citywide meter reading productivity, as identified by Cognyst is presented in the table below. The highest cost groups were selected to be the pilot area for remote meters, as discussed later in this report.

Group	Total Meters	Man Days to Read	Reads per Man Day	Cost per Read \$
1	6,287	9	699	.43
2	7,054	10	705	.42
3	7,043	9	783	.38
4	6,315	11	573	.52
5	5,610	11	510	.58
6	5,723	10.3	558	.53
7	5,303	7	759	.39
8	5,077	8.8	577	.52
9	4,813	10	481	.62
10	5,453	9	606	.49
11	5,239	9	584	.51
12	4,605	10	461	.65
13	4,547	10	455	.66
14	4,744	10	474	.63
15	4,494	11	409	.73
16	4,429	10	443	.67
17	3,624	9	403	.74
18	4,861	11	442	.67
19	5,285	10	529	.56
20	5,108	10	511	.58
<b>Total</b>	<b>105,614</b>	<b>195</b>	<b>542</b>	<b>.55</b>

Source: Cognyst Consultants

### Automation Technology

The process to automate consists of the following key technology, components and software:

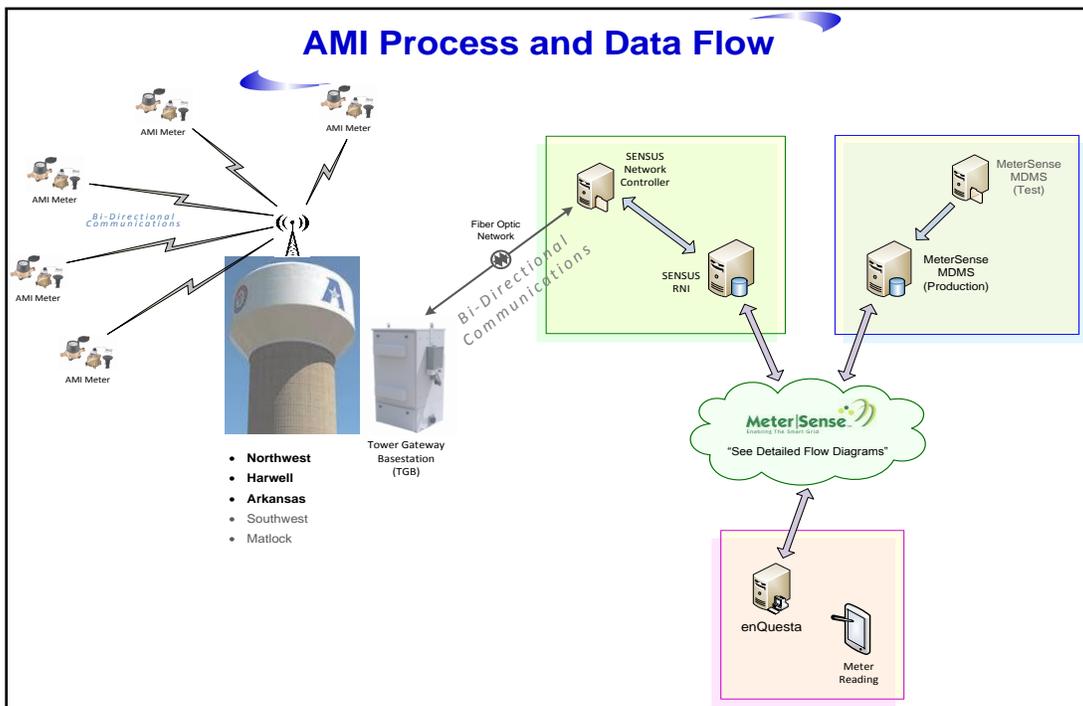
- Sensus Meters – brass water meters produced by the vendor Sensus, which are free of lead and capable of accommodating remote transmission
- Meter Interface Unit (MIU) – A radio transmitter unit that fits on top of the actual brass meter. The MIU provides inbound and outbound access to water measurement and transmits hourly water usage to the TGB unit
- Tower Gateway Base stations (TGB) – data collection units that are housed in five of the City’s water towers. They receive data transmissions from Sensus software.
- Sensus Software – software produced by the meter vendor that is capable of gathering and processing remotely transmitted water usage data from individual meters on the ground. Hourly meter readings are captured and transmitted to the TGB’s every four hours.
- Metersense – software that processes raw data from Sensus meters to be transferred to enQuesta billing software. Raw data is matched with address information, which is matched with customer names in enQuesta. The data is transferred monthly for billing.

- enQuesta – Water billing software by Systems & Software (S&S) that has been in use since 2002. It generates approximately 100,000 water bills for residential and commercial customers each month.

A pilot area within City limits was selected to install the new water meters with remote transmission capability at a cost of \$4.5 million. The pilot area consisted of slightly more than 17,000 residential and commercial customers and included four billing groups. The implementation included replacing older water meters with new Sensus water meters, which include an attached remote transmission unit. The remote transmission units are not compatible with older water meters. The installation contract was awarded to Pedal Valve Inc. after a competitive bidding process. Implementation was completed in approximately 14 months.

Water meter readings transmitted from individual residences and businesses are received by collector units (TGB units) that are housed in five water towers located throughout the City. The software managing the collector units is Sensus, which was provided as part of the initial implementation contract. The data is sent to the enQuesta billing system and processed to generate monthly utility bills.

The diagram below shows the process map for remote water meters:



Source: Arlington Water Utilities

Going forward, management intends to convert the remaining water meters in the City to remote meters within a ten-year timeframe. The plan is to convert approximately 9,000 meters each year, to be installed by Meter Maintenance staff. In the meantime, replacement and new construction meters will be fitted with remote technology. The technology infrastructure required to process citywide

remotely transmitted data is already in place, implemented as part of the initial cost and the pilot project.

The table below details the total cost of \$4,435,990 associated with the pilot area implementation, as shown in the project bid document:

Meter size	No. of meters	Unit cost meter	Salvage credit	Net cost	Total meter Cost	Unit cost MIU	Total Cost MIU	Installation Costs	
								Per Unit	Total
5/8" X 3/4"	15,034	\$74	\$2	\$72	\$1,082,448	\$96	\$1,443,264	\$45	\$676,530
1"	761	\$113	\$2	\$111	\$84,471	\$96	\$73,056	\$45	\$34,425
1.5"	456	\$236	\$8	\$228	\$103,740	\$96	\$43,776	\$300	\$136,800
2"	676	\$351	\$11	\$340	\$229,840	\$96	\$64,896	\$300	\$202,800
3" comp.	47	\$1,469	\$37	\$1,432	\$67,280	\$96	\$4,512	\$485	\$22,795
4" comp	54	\$2,551	\$66	\$2,485	\$134,163	\$96	\$5,184	\$485	\$26,190
<b>Total</b>	<b>17,028</b>				<b>\$1,701,942</b>		<b>\$1,634,688</b>		<b>\$1,099,360</b>

Source: Documentation for Bid 10-0126

The grand total also includes the technical infrastructure implemented citywide, such as receiver stations (located in water towers), software (i.e. Sensus and Metersense), and required computer hardware. The cost of the technology infrastructure was included in the unit costs.

Management reported the following benefits of implementing remote transmission water meters:

- Lower meter reading costs
- Improved customer service with better customer education, timely use of data, and on-line availability of remotely transmitted water usage data
- Enhanced data collection facilitating initial and final meter readings
- Better conservation efforts through additional leak detection capabilities

### **In-House Installation Capacity**

The City Auditor's Office attempted to review the existing capacity of the Meter Maintenance Division to ensure that the City has the capacity to install approximately 9,000 new remote meters annually as part of the citywide expansion project. The review focused on examining the current workload, shown as work orders in enQuesta. The Meter Maintenance Division has installed and retrofitted approximately 1,600 remote meters since the contractor completion of the pilot area in 2012. However, not all of the work orders associated with remote meter installation and retrofits are accurately documented in enQuesta. The work order system malfunctioned when work crews attempted to access the system via their mobile computers, resulting in the inability to save work order data. Detailed work order data was not available to determine the incremental time required to complete the retrofitting of remote meters. The City Auditor's Office was therefore unable to verify the capacity needed to complete the retrofitting and installation of automated remote meters.

It is expected that sufficient capacity may exist. As documented in work order information for FY2013, approximately 2,000 hours were expended on jobs related to regular meter installs and meter related work orders conducted as part of routine replacements. Another 3,400 hours were

expended on tasks such as initial and final meter readings required for new and vacating residents. The need for manual initial and final reads are expected to decrease with the introduction of remote meters, thus creating additional capacity that can be diverted for new meter installations and other services.

Management committed to retrofitting 8,000 meters with transmitter units by the end of FY2014. The units requiring retrofitting are recently installed, remote-capable Sensus meters that do not have the required radio transmitter units. As of the end of February 2014, in-house crews had retrofitted 1,600 units. The Meter Services Division experienced a shortage of meter box lids, which resulted in installation delays. According to AWU management, the City is now installing and retrofitting remote-capable meters and transmitters at a pace that will allow the City to complete the established goal by the end of FY2014.

## ***Detailed Audit Findings***

### **I. Remote water meter data transmissions are not encrypted.**

The software that transmits data from individual households and businesses are encryption enabled; however, the encryption feature is not currently utilized. Encryption capabilities are standard in the AMI (Automated Meter Infrastructure) software.

Remotely transmitted data includes water usage, MIU numbers and register numbers. The data is transmitted to primary receiver locations (TGB's) that are housed in City water towers. Data transmission from the water towers takes place through the City's network and fiber infrastructure and is eventually sent to the enQuesta water billing system. Encryption is recommended by the vendor and generally accepted security guidelines for public utility transmissions and is practiced by many electric, water and gas utility entities nationwide.

According to AWU technical staff, full encryption was not configured because there was no personally identifiable customer information transmitted. Staff also noted vendor assistance would be necessary to configure the algorithm and decryption keys, to ensure accurate data transfer to the enQuesta billing system. According to AWU staff, encrypting the data may impact battery life and result in increased costs.

Customer names and addresses are not transmitted to the receiver locations. The transmitted data is not associated with specific customer accounts, until the register number is associated with an enQuesta customer account behind the City's firewall protection. Even though an immediate risk of disclosure does not exist, encryption would ensure transaction integrity and reduce the risk of usage data being altered. When usage data is transmitted in plain text, data interceptors can be used to alter data for malicious or other purposes.

#### ***Recommendation:***

1. The Director of Water Utilities should seek AMI software vendor assistance to enable data encryption features and ensure encrypted data is transmitted and received accurately.

### **II. Policies and procedures specific to remote meter operations do not exist.**

Policies and procedures, specific to administration of remote meters, are not currently being utilized by AWU. Documentation provided shows only installation instructions for remote meters and transmitter units derived from vendor product documents.

AWU has not established policies and procedures that govern remote meter operations and daily administration, including the following:

- Introduction to technology
- Expected performance standards
- Error identification
- Timely remedial action

- Quality assurance activity
- Standards for vendor involvement

Remote water meters have been operational since November 2012, but policies and procedures have not been developed. Introduction of new technology and equipment usually requires a grace period to determine operational details and the effects of the new technology. However, since the product has been in use for over a year, a formalized methodology approved by senior management is warranted.

Lack of detailed policies and procedures may hinder operations and could result in inadequate guidance provided to employees who use and service remote meters. For example, non-transmitting meters have been out of operation for periods exceeding six months (see table on pg. 12) and require manual intervention to obtain meter readings used for billing. Policies and procedures do not exist detailing when, how, or why these meters should be serviced. Detailed instructions can also provide guidance as to when to seek vendor assistance and contract compliance, associated with servicing failed equipment.

***Recommendation:***

2. The Director of Water Utilities should ensure that formal policies and procedures are established to guide the operation and management of remote water meters.

**III. Meter data in Sensus and Metersense systems are inconsistent.**

Sensus and Metersense software are the primary components of the remote data transmission network for AWU. When meters are installed, AWU staff records the meter number, transmitter (Meter Interface Unit) number and the GIS coordinates in the Sensus software. Meter data is then sent to the Metersense software, where the information is matched with water usage data and address. Metersense transfers customer water usage data to enQuesta for the generation of monthly bills.

To ensure remote meters on the ground are related to a billing account in enQuesta, the City Auditor's Office reconciled MIU numbers in the Sensus software to the MIU numbers in the enQuesta billing system. A total of 495 (2.7%) unmatched MIU numbers were found among the 18,700 MIU units listed in Sensus. The City Auditor's Office reviewed Sensus and enQuesta data and noted the following:

- Five records in the enQuesta billing system consisted of duplicated MIU numbers. The five MIU numbers were associated with more than one property. Research showed the exceptions were attributed to human data entry errors. Because the correct register numbers were associated with the enQuesta accounts, there were no resulting billing errors.
- Installed MIU's, per Sensus, were actually recorded as warehouse inventory in enQuesta. The associated address from Sensus was recorded in enQuesta with another MIU number and correct bills were generated.

- Installed MIU's, per Sensus, were actually scrapped due to malfunctions, per enQuesta. In these cases, the associated address from Sensus is recorded in enQuesta with a new MIU number, resulting in two records for the same location in Sensus and Metersense.
- Installed MIU's, per Sensus, were actually MIU's placed in leak detector units inside the primary water mains, and not associated with a billing account. These units were not specifically identified as leak detector units.

During the review of unmatched MIU's, the City Auditor's Office noted GIS coordinates for installed meters in Sensus were associated with property addresses not identified as having remote capable meters. Attempts to decipher the recorded GIS coordinates to locate the correct physical addresses were unsuccessful.

Data transferred and fed into another system requires synchronization based on a primary data element. The primary data element identifies each record in both of the systems. In this case, the property address is the primary data element. Parts and components installed at each property periodically require replacement, resulting in more than one record per property address. Data (such as prior water usage) associated with each component requires integration of such to the same primary record, as is being done in enQuesta. As the City moves forward with conversion to remote water meters, uniformity of records will provide ease of tracking data to its source, provide easy access to historical data associated with the property, and link billing records based on component identification back to transmitting sources.

It appears that Sensus and Metersense software do not specifically identify components that are in inventory or scrapped status. The software also does not specifically identify meter components that are not used to generate bills, such as the units installed at leak detector points in water mains. The billing software, enQuesta, lacks data field controls, which prevent use of component identification in more than one account.

***Recommendations:***

3. The Director of Water Utilities should coordinate with Sensus and Metersense software vendors to ensure that the software can accurately identify water meter components that are in scrapped, inventory and non-billing status.
4. The Director of Water Utilities should coordinate with the enQuesta software vendor to introduce application controls to their software that would prevent entry of water meter component numbers to more than one account.
5. The Director of Water Utilities, with assistance from Sensus software vendor, should determine how accurate GIS coordinates could be obtained for each meter location and conduct testing in the field to ensure accuracy.

**IV. Some remote meters are malfunctioning for extended periods.**

Remote meters transmit hourly water usage data. Transmissions are recorded in Sensus and Metersense software and then transferred to the enQuesta billing system prior to the bill generation

date. Review of the transmission status recorded in Metersense indicated that some meters are not transmitting water use data for extended periods. Results as of December 2013 are summarized below:

<b>Number of Meters</b>	<b>Days Since Transmission</b>
101	180 days +
81	90 – 180 days
74	30-90 days

The Meter Maintenance Division has not established specific criteria for transmission outage service levels. Even though the percentage (256/18,000) of non-transmitting meters is low (1.5%), a methodology is needed to rectify them within a reasonable period.

The City Auditor's Office reviewed a sample of non-transmitting meters. The following was noted by AWU:

- Wires deliberately pulled from the transmitter unit
- Malfunctioning transmitter units (MIU's)
- Damage caused by lawn mowers or other machinery

Billing activity for these accounts was not affected by the non-transmitting meters. Meter reading crews had obtained the list of non-transmitting meters and physically visited them each month to obtain a reading and enter the water usage directly into enQuesta.

Once the entire City is converted to remote transmitting meters, lack of timely resolution of non-transmitting meters can result in productivity loss. The number of meters expected to malfunction, based on the causes listed above, is also expected to increase. Once the entire city is converted, management has projected elimination of the meter reading function, reducing the capacity to manually read the non-transmitting meters.

***Recommendations:***

6. The Director of Water Utilities should require establishment of policy and procedures associated with resolving malfunctioning meters within parameters based on business needs.
7. The Director of Water Utilities should ensure malfunctioning water meters are remedied within a specific period of time, and involve the equipment vendors as necessary.

**V. Management's cost benefit projections were inaccurate.**

In June 2008, AWU presented the Regional Policy and Municipal Infrastructure Committee with a potential automated water meter reading solution. Management utilized a consultant study conducted in 2008 to determine whether such a solution was financially beneficial for the City. The study, conducted by Cognyst Consultants, listed the following objectives for a potential remote meter reading system:

- Reduce meter reading costs

- Reduce the volume and/or duration of calls handled by Customer Service
- Reduce the number of meter reading related field visits by Meter Service Workers
- Streamline customer service processes and enhance customer service levels
- Reduce arrears and bad debts, reduce adjustments, reduce theft of service, and improve data for forecasting and facilities planning
- Increase COA’s billed-for revenues, and reduce unaccounted-for water
- Enforce and generally enhance the effectiveness of conservation efforts

AWU recommended the City negotiate and execute a contract for the purchase and installation of a \$4.8 million AMI system in April 2011. AWU noted the system offered tools that would enhance water conservation capabilities, monitor water usage patterns, and improve business processes related to meter reading and customer billing. The staff report also noted the proposed AMI system “will help reduce the amount of unaccounted-for water through leak detection capabilities and will increase accuracy related to customer billing.” Based on these potential benefits, the Mayor and City Council authorized management to proceed with the AMI system on a pilot basis. The staff report noted the City intended to evaluate the AMI system for possible future expansion.

At the conclusion of the pilot project, AWU made a presentation to the Mayor and City Council regarding the evaluation of the pilot project and the development of a future strategy. In addition to the financial benefits outlined below, AWU noted that the AMI system provided future capabilities for pressure monitoring and remote shut-off.

AWU management prepared the schedules below to summarize AMI investment costs and operating savings. The first year (2012) cost of \$4.5 million was based on vendor installation of citywide infrastructure and approximately 17,000 automated meters. Costs for subsequent years were estimated based on installation of approximately 9,000 meters per year by in-house staff.

<b>AMI Investment</b>											
Calendar Year	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Years in Service		1	2	3	4	5	6	7	8	9	10
Meters	\$ 1,575,000	\$ 132,000	\$ 180,000	\$ 180,000	\$ 180,000	\$ 180,000	\$ 180,000	\$ 180,000	\$ 180,000	\$ 180,000	\$ 180,000
Meter Installation	585,000										
AMI Equipment	1,575,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000
AMI Installation	585,000										
Project Admin	180,000										
	\$ 4,500,000	\$ 1,132,000	\$ 1,180,000	\$ 1,180,000	\$ 1,180,000	\$ 1,180,000	\$ 1,180,000	\$ 1,180,000	\$ 1,180,000	\$ 1,180,000	\$ 1,180,000
<b>Total Investment - All Years</b>	<b>\$ 16,252,000</b>										

Source: AWU Staff

Management’s projected cost savings for the upcoming 20 years is presented in the two tables below. Labor reductions reflect the various categories of positions (meter reading, meter services and customer service employees) identified based on projections initially made by Cognyst Consultants.

<b>Operating Cost Savings</b>											
Category	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
FTE		1.5	3.5	5.5	7.5	9.5	11.5	13.5	15.5	17.5	20
Labor Savings	\$ 82,500	\$ 192,500	\$ 302,500	\$ 412,500	\$ 522,500	\$ 632,500	\$ 742,500	\$ 852,500	\$ 962,500	\$ 1,100,000	
Vehicle and Related Savings	26,000	26,000	52,000	52,000	78,000	78,000	104,000	104,000	130,000	156,000	
	\$ 108,500	\$ 218,500	\$ 354,500	\$ 464,500	\$ 600,500	\$ 710,500	\$ 846,500	\$ 956,500	\$ 1,092,500	\$ 1,256,000	
<b>Total Operating Cost Savings -</b>	<b>\$ 6,608,500</b>										

Source: AWU Staff

Water meters are expected to have a lifecycle of 20 years. Management has projected cost savings going forward to the year 2032:

<b>Operating Cost Savings</b>											
Category	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	
FTE	20	20	20	20	20	20	20	20	20	20	
Labor Savings	\$ 1,100,000	\$ 1,100,000	\$ 1,100,000	\$ 1,100,000	\$ 1,100,000	\$ 1,100,000	\$ 1,100,000	\$ 1,100,000	\$ 1,100,000	\$ 1,100,000	
Vehicle and Related Savings	156,000	156,000	156,000	156,000	156,000	156,000	156,000	156,000	156,000	156,000	
	\$ 1,256,000	\$ 1,256,000	\$ 1,256,000	\$ 1,256,000	\$ 1,256,000	\$ 1,256,000	\$ 1,256,000	\$ 1,256,000	\$ 1,256,000	\$ 1,256,000	
<b>Total Operating Cost Savings 20 Yr</b>	<b>\$ 19,168,500</b>										

Source: AWU Staff

In their analysis, management did not include software and technology costs associated with operating the remote water meter system. Total annual technology costs are presented below:

<b>Annual Technology Costs</b>	
<u>Item</u>	<u>Amount</u>
Sensus Software annual maintenance	\$17,500
Metersense software annual maintenance	16,500
Network infrastructure cost	3,000
Database and operating system cost	3,000
Server hardware replacement	21,000
<b>Annual Total</b>	<b>\$61,000</b>

Source: AWU

Based on the above, for the 20-year period, total technology costs will exceed \$1.2 million. Because this significant cost was excluded from management’s analysis, the City Auditor’s Office reviewed projected costs and benefits to verify the decision to proceed with an AMI system was justified.

While various exceptions were noted, the City Auditor's Office concluded that conversion to an AMI system was warranted. The City Auditor's Office noted the following during its review of management's projected costs and benefits:

- Labor savings projected for Meter Maintenance and Customer Service workers may not be realized due to potential new challenges that remote meters may cause. New meters may need more human servicing due to equipment malfunction or intentional damage, and residents may place more customer service calls with complaints. The impact due to AMI is difficult to forecast in the future. Management projected \$192,500 in labor savings for 2014. However, the City Auditor's Office calculated actual savings of only \$101,136 through the end of FY2014. The calculated savings only reflect reductions in the Meter Reading Division, as reductions for other divisions are projected for the future.
- The \$2.36M projected vehicle and other cost savings for the 20-year period appears to be overstated. The consultant identified seven Meter Reading vehicles and two Meter Maintenance vehicles to be eliminated gradually. The City Auditor's Office calculated each vehicle to cost approximately \$8,521 per year on average, which includes vehicle replacement cost, fuel, maintenance and repairs. A reasonable vehicle related savings for the 20-year period amounts to approximately \$1.03M vs. the \$2.36M projected.
- Overall, recovery of \$16.25M in remote meter costs projected by management appears to require 20 years of operations. The projected AMI system costs include initial pilot area costs and incremental costs of in-house installation of remote meters citywide.
- Customers will not be able to access detailed water usage data on-line until the summer of 2014. The website is currently being tested. Customers will be required to log in using established credentials in order to examine their hourly water usage data.
- Management projected the future possibility of remote turn-on and shut-off capabilities for remote meters. Activation of the stated feature would require powering each remote meter. The cost associated with setting up a power grid to power each meter makes this functionality unfeasible.
- As noted by management in previous presentations, remote meters are capable of detecting lack of compliance to water conservation efforts, such as watering yards during times it is disallowed. According to management, AWU has not utilized the AMI system for this purpose to date. However, management acknowledges that future circumstances may result in a decision to utilize the AMI system to verify compliance to conservation efforts.

The cost figure projected for the annual in-house installation of approximately 9,000 new remote meters to convert the entire city includes only incremental costs. Management projected the vendor installation cost per unit to be \$265 and in-house installation cost per unit of \$120 per unit for the remaining expansion. The \$120 represents the cost of the transmitter unit only. The actual meter, labor to install, and vehicle costs are already budgeted in the Meter Maintenance Division organization code and not included in the analysis. The vendor cost of \$265 represents all costs, including the cost of one-time citywide technology infrastructure. The expected vendor cost per unit would be less for subsequent installations. As noted in the background section of this report, AWU

does not have specific timekeeping data related to the installation of the remote meters and transmitters. Therefore, the City Auditor's Office was unable to determine if external crews could install the automated meters more efficiently than City crews. An accurate full-cost comparison of in-house to external costs is needed to determine what, if any, cost savings would be realized.

Studies to determine the full benefit of the pilot area implementation have not been conducted. Management has not determined whether pilot implementation has resulted in reduced customer service or meter maintenance costs. Such research would provide more reliable cost-benefit calculations in the future.

Although the remote meter investment cost recovery is projected to be 20 years or more, research conducted by the City Auditor's Office does indicate many utility companies around the country are moving to remote meter technology. It is viewed as a necessary tool to manage utilities in the future as water is expected to become a scarce commodity, evidenced by sustained droughts experienced across parts of the country.

***Recommendations:***

8. The Director of Water Utilities should consider computing an all-inclusive cost for in-house conversion of the remaining remote meters and compare to vendor quotes, to determine if outsourcing the conversion function would result in cost savings.
9. The Director of Water Utilities should accurately assess net benefits realized as a result of citywide remote meter installation and project future savings based on actual results.

**CITY OF ARLINGTON  
WATER METER READING PROCESS  
AUDIT RECOMMENDATIONS AND RESPONSES**

AUDIT RECOMMENDATION	CONCUR/ DO NOT CONCUR	MANAGEMENT'S RESPONSE	RESPONSIBLE PARTY	DUE DATE
1. The Director of Water Utilities should seek AMI software vendor assistance to enable data encryption features and ensure encrypted data is transmitted and received accurately.	Concur	Encryption is one of a number of security features embedded in the AMI system. Encryption is intended to serve as protection for sensitive data. In its current configuration, the AMI system does not send account detail or customer data, merely raw readings. There is no reference to location or past consumption. These are stored behind the City firewall and therefore not included in the transmissions. Encryption requires additional network overhead in order to implement. The AES-256 encryption feature is intended for use in potential future applications designed to remotely operate distribution assets. Currently there is no sensitive data being transmitted and no remotely operating assets. Water Utilities will review potential benefits and impacts from fully enabling the encryption feature, including system performance and battery life.	Bob Lemus, Utilities Information Services Manager	October 2014
2. The Director of Water Utilities should ensure that formal policies and procedures are established to guide the operation and management of remote water meters.	Concur	Written policies and procedures are necessary. Written instruction for programming new installations have been created and will continue to be developed and improved as the work management system is adjusted to optimize data capture for the AMI registers and radios. Personnel utilizing the hardware for AMI programming have each been through multiple training sessions in classroom and in the field with the vendor's instructors.	John Norman, Meter Services Manager	January 2015

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3. The Director of Water Utilities should coordinate with Sensus and Metersense software vendors to ensure that the software can accurately identify water meter components that are in scrapped, inventory and non-billing status.	Concur	EnQuesta is the system used to record all of the meter activity and correctly identifies the status for each meter. Water Utilities is constantly working with the enQuesta vendor to improve processes and performance. Water Utilities will continue to seek ways to improve this process in order to maintain data uniformity across systems.	Bob Lemus, Utilities Information Services Manager	June 2015
4. The Director of Water Utilities should coordinate with enQuesta software vendor to introduce application controls to their software that would prevent entry of water meter component numbers to more than one account.	Concur	EnQuesta is the system of record. It currently prevents the entry of more than one meter number per account. We are currently exploring the same functionality for register numbers and will evaluate the cost for any required modification.	Bob Lemus, Utilities Information Services Manager	January 2015
5. The Director of Water Utilities, with assistance from Sensus software vendor, should determine how accurate GIS coordinates could be obtained for each meter location and conduct testing in the field to ensure accuracy.	Concur	The four hundred sets of questionable coordinates out of 22,000 will be purged from the system. We will repopulate the four hundred as time allows. We will review and validate coordinates once per year going forward.	Bob Lemus, Utilities Information Services Manager	October 2014

**CITY OF ARLINGTON  
WATER METER READING PROCESS  
AUDIT RECOMMENDATIONS AND RESPONSES**

AUDIT RECOMMENDATION	CONCUR/ DO NOT CONCUR	MANAGEMENT'S RESPONSE	RESPONSIBLE PARTY	DUE DATE
6. The Director of Water Utilities should require establishment of policy and procedures associated with resolving malfunctioning meters within parameters based on business needs.	Concur	The recommendation refers to meters having appeared on the non-communicating check list. There are currently fewer than 30 that are beyond 30 days. We will review and trouble-shoot the non-communication list in tandem with the billing cycle each month and any malfunctioning equipment will be replaced/repared within 30 days.	John Norman, Meter Services Manager	July 1, 2014
7. The Director of Water Utilities should ensure malfunctioning water meters are remedied within a specific period of time and involve the equipment vendors as necessary.	Concur	We have a warranty specified in the contract and we enforce the warranty with the vendor.	John Norman, Meter Services Manager	Ongoing
8. The Director of Water Utilities should consider computing an all-inclusive cost for in-house conversion of the remaining remote meters and compare to vendor quotes to determine if outsourcing the conversion function would result in cost savings.	Concur	The Utility is changing meters by use of contracted labor as part of planned Water and Sewer Renewal projects. These are estimated to total 3,000 meters per year. Therefore, installation of the 9,000 AMI compatible meters per year is not an added cost but is an extension of existing practices – augmented by use of contracted labor. The current installation rate is over 300 per week, more than sufficient to achieve target installation objectives. We will do an analysis and strongly consider using a third party in the future to accelerate the program if the business case is favorable.	John Norman, Meter Services Manager	October 2014

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 WATER METER READING PROCESS  
 AUDIT RECOMMENDATIONS AND RESPONSES**

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9. The Director of Water Utilities should accurately assess net benefits realized as a result of citywide remote meter installation and project future savings based on actual results.	Concur	We have assessed the benefits, and are reducing meter read labor and vehicle usage. We will continue to utilize actual results to predict future savings.	John Norman, Meter Services Manager	September 2015