DISTRICT OF COLUMBIA WATER AND SEWER AUTHORITY
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# Automated Meter Reading Project

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**Executive Summary**

In March 2002, the District of Columbia Water and Sewer Authority (DC WASA) began a meter replacement and automated meter reading (AMR) project to replace the approximate 123,000 meters that serve 580,000 customers in the Nation's Capital. DC WASA selected Hexagram's Star Fixed Network for its Automated Meter Reading (AMR) solution.

We believe that DC WASA was the first water utility to implement a fixed network AMR system in the United States. During the initial requirements phase, the more traditional drive-by AMR solutions were examined; however, in the end the decision was made to look forward and employ the newer technology. The AMR project had a lifetime budget of $43.3 million, which included meter replacements, AMR technology, and associated ancillary work required (e.g. pipe, risers, setters, etc.) in order to install the meters. The project was substantially completed in 2007 and the total disbursements were $41 million, $2.3 million under budget.

The AMR project objectives were directed at traditional utility operations, that is,

- Reduce overall cost of service
- Generate more accurate billing
- Replace aging infrastructure
- Standardize meter inventory
- Realign business processes

The AMR project achieved these objectives and much more. The value added services we provided customers through AMR has made DC WASA a leader in advanced meter infrastructure (AMI) in the water industry today. DC WASA expanded upon the core technology to significantly enhance its call center performance, meter maintenance process, account transfer process and billing exception process as a means to lower its cost-of-service. An unintended benefit was customers' acceptance of this technology and, more importantly, their perception of "old-fashioned, personalized service" being offered by DC WASA that the industry as a whole seems to have lost in recent years. The High Use Notification Application (HUNA) we developed through this project is an example of this, where DC WASA provides advanced notice of leaks inside the home before the account is billed, a service unknown to the water industry at the time. Further, by leveraging AMI with our voice and internet technology solutions, we effectively launched several self service options. This enabled us to expand our service hours on a 24x7x365 basis for selected service offerings at minimal cost to the Authority.

**Background**

On March 6, 2002, the District Of Columbia Water and Sewer Authority, (DC WASA) began a automated meter reading (AMR) system and water meter replacement project to replace all residential and commercial water meters throughout the city. DC WASA contracted with United Metering, Inc. (UMI) to implement the AMR system and meter installation project. UMI subcontracted with Hexagram, Inc. to implement and maintain the automated meter reading technology for the duration of the project. UMI also contracted with ABB to supply the meters.

Contractually, UMI had to complete 95% of the residential meter installations within two years of the contract notice to proceed, which they did before March 2004. The large meter installation work was contingent on the Board of Directors approving the regulation that would provide DC WASA ownership of commercial meters. UMI also had to complete the large meter rightsizing study and receive approval of the study's recommendations from DC WASA. In the event that DC WASA proceeded with the residential and non residential installations, UMI was responsible to replace 95% of all meters in the system.

The Board of Directors approved a resolution in January 2003 providing DC WASA ownership of all non residential meters and the meter rightsizing analysis was completed in December 2004. The second phase of the installation project began in earnest in January 2005. It was anticipated that approximately 100 large meters (3" or greater) would not be converted to AMR because there was no meter solution at the time. UMI proposed a mag meter solution for these installations; however, authorization to move forward was conditional on the mag meters obtaining UL and FM certification. The mag meters received UL certification; however, the manufacturer did not obtain FM certification during the evaluation period resulting in DC WASA having no AMR metering solution for approximately 100 large customers.

Under the contract terms UMI was responsible for providing the following

- New ABB meters
- Absolute encoder registers
- AMR system
    - Meter transmitting units (MTUs)
    - Hand-held MTU programming units
    - Hexagram AMR system software
- Meter covers or lids
- Ancillary parts
- Installation service and support

In August 2005 Terasen Utility Services purchased UMI and became contractually obligated to complete the installation project.

## Overview of AMR System

The AMR system is a fixed network system that transmits electronic meter readings using radio frequency and cell phone technology. The meters are standard devices that measure water volumes. As water is consumed, the water pressure activates the water meter and usage is recorded by the meter register. In order to transmit meter readings, the meters need to be equipped with absolute encoder registers. The register provides the interface with the AMR system to allow transmission of a digital reading.

Connected to each water meter register is a Meter Transmission Unit (MTU) that transmits the digital meter reading by radio signal to a Data Collection Unit (DCU) on a defined interval, currently set at two reads per day. MTUs have a unique identification number, which is transmitted along with the meter reading. The MTU may be located outdoors or inside the premise. In either case, there are instances where readings may not be transmitted due to physical obstructions.[1] The MTU can be manually programmed to increase or decrease the transmission interval.

There were 62 DCUs installed during this project strategically located throughout the city. The DCUs function is to store the meter readings transmitted from the MTUs for later transmission to the Network Collection Center (NCC). Each DCU is programmed to make a cellular phone call to the servers located at 810 First Street and transmit the meter readings to the NCC.

The NCC's Star database compares each identification number to each customer account record to ensure that there is a match. There is a one-to-one relationship between the meter and MTU, meaning that each MTU is associated with a specific meter, tied to a specific customer premise. There is a one-to-many relationship between the MCUs and DCUs, meaning that any DCU that has a clear sightline to an MTU can receive a meter reading. As a result, DC WASA is not dependent on any single DCU to obtain a meter reading. DC WASA runs a back end application to ensure that only one reading is used for billing and analytical purposes since multiple DCUs can receive and transmit the same meter reading. Once this process is completed, the meter readings are batched and transmitted to eCIS, which is the outsourced application that DC WASA uses for billing. DC WASA has collected over 350 million meter readings since this project began.

## Billing Process Changes

DCWASA began converting all customers to monthly billing beginning in April 2004. Each account is grouped geographically and is assigned to a specific billing cycle. WASA's billing calendar determines the date of billing.

Ten days before the account is billed, the account is sent through the Meter Reading Download process. This process is initiated by the customer information system (eCIS), which creates a download file of all accounts within a particular billing cycle.

[1] If a vehicle is parked over the MTU, the MTU is under water or any other physical obstruction may prevent the transmission of meter readings from an MTU.

The download file is sent to the NCC to find a valid AMR read. A valid AMR read is a read that is no more than ten (10) days old, and contains no error codes. The NCC also verifies that the premise number and meter serial number match for each account processed. Any premise/meter that does not receive a valid read from the NCC is sent to the MVRS system (hand-held meter reading devices) to be processed as a manual read.

Once all manual reads are completed for a billing cycle, the meter data from all sources is uploaded to eCIS.

**AMR Project Objectives**

The project was a meter replacement and automated meter reading project directed at traditional utility operations. Meter reading costs were high, estimated at $3.00 per read in 2001 dollars. DC WASA billed quarterly and about 77% of the customer bills were based on actual meter readings.

At the time DCWASA did not own or maintain non residential meters. Further, there were no meter specifications established for new installations or retrofits. As a result, non residential customers could select from a wide variety of meter manufacturers and volumetric registers. Prior to this project, non residential meters registered in cubic feet, hundred cubic feet, thousand cubic feet, gallons, thousand gallons and possibly other configurations. In the event the wrong metric was used for billing, there was the inherent risk that usage could be under or over billed for services provided. Further, it was not unusual for customers to receive multiple estimated billings, sometimes over several years, resulting in the majority of customer service contacts being billing related.

The AMR project objectives were directed at traditional utility operations, that is,

- Reduce overall cost of service
- Generate more accurate billing
- Replace aging infrastructure
- Standardize meter inventory
- Realign business processes

**Project Accomplishments and Benefits**

The AMR project has a lifetime budget of $43.3 million. The total disbursements for this project were $41 million and the project was substantially completed under budget by $2.3 million.

Within two years of the project start, over 97% of the residential meters were installed. By this time, approximately 20 approved positions were eliminated from the meter operations area and the actual read rate for billing purposes was about 95%. There was an added benefit in billed consumption as residential consumption increased over 5% per annum primarily because of increased accuracy of the new meters.

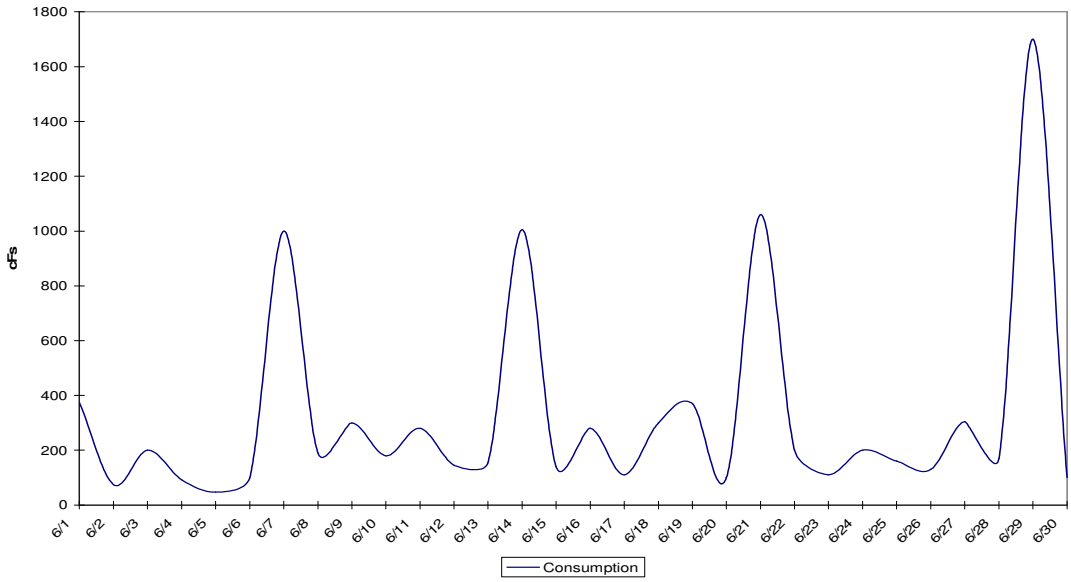
DC WASA bills approximately 123,500 retail customers. Currently, 618 small meters, defined as 2" and less, and 15 large meters defined as 3" or greater remain to be installed giving us a project completion rate of 99.5%.

The project plan anticipated that approximately 100 large meters could not be replaced because of spacing issues in the meter vaults. A mag meter manufactured by ABB Meter, currently AMCO Meter was presented as a possible solution. DC WASA piloted the mag meter with the understanding that it must receive UL and FM certification. The mag meter did not receive the FM certification during the evaluation period requiring DC WASA to find a metering solution for these 100 accounts. We piloted a single jet meter manufactured by Metron Farnier in 2005. This meter proved accurate and fit the spacing limitations we had on some undersized meter vaults. The single jet meter was added to our approved meter list and we successfully solved the metering dilemma that confronted the installation contractor.

During the project implementation, staff quickly identified several process improvements that could easily be implemented by mining the daily AMR data. There was a soft market for products using AMR data between 2003 and 2006 since few utilities were implementing fixed-network systems at the time. This presented an opportunity to implement process improvements by using the 230,000 meter-readings collected each day. High bill complaints caused major operational issues due to the inaccuracies of the old meters and the significant number of estimated readings prior to the project start. As a result, we focused on the call center for the first process improvement.

**Call Center Improvements**

Most successful business process changes begin as a simple idea on how to do something faster, easier or better and the AMR project proved no exception. On certain high bill cases, the manager or billing analyst would download AMR data from the Star database into Microsoft Excel to prepare a graph that would illustrate consumption by day, month or year, if needed, as a means to explain to the customer why there were wide variations in their consumption. The following graph represents the crude analysis of a highly visible high bill complaint using Excel.




In this illustration, the high bill complaint was over the summer 2002 and the graph illustrates daily usage for the month of June. WASA was billing quarterly at the time so the customer's perception was that the new AMR technology resulted in the tripling of his bill over the summer. Many customers had similar complaints and the local media ran with this "consumer issue". The City Council eventually became interested in the high bill complaints and called for the Inspector General to conduct a review. The Inspector General concluded that the new meters were registering accurately and that there was no relationship between reported high bills and meters registering too fast. This finding is consistent with the water industry's experience and DCWASA's random testing of the new meters. However, proven right did not necessarily regain our customers trust.

For most utilities, the beginning read and the ending read are all the customer service representative (CSR) has to work with so a high bill complaint would most likely result in a long telephone call and an inevitable field visit. As the previous illustration shows, the bill may have tripled; however, the problem was determining the reason for increased usage on certain days. The data in the previous illustration allowed us to predict the high usage day making it a simple matter proving that the landscaper contractor visited the property early in the week. However, this crude form of use trend analysis was time consuming to create.

The following series of illustrations shows the evolution of a customer contact at DC WASA by expanding beyond the core AMR technology and establishing the foundation for an advanced metering infrastructure (AMI). The first three illustrations represent the same account.

Call Center Illustration 1:

This illustration depicts a meter usage screen from eCIS, which is the customer information system implemented at DC WASA in 2001. The eCIS was considered an advanced application when first implemented.

| Bill Date | Utl | Meter # | Read Date | U/R | Type | Reading | Usage |
|---|---|---|---|---|---|---|---|
| 03/21/2008 | W | 12039740 | 03/21/2008 | R | A | 354.00 | 36.00 |
| 02/26/2008 | W | 12039740 | 02/21/2008 | R | A | 318.00 | 5.00 |
| 01/28/2008 | W | 12039740 | 01/23/2008 | R | A | 313.00 | 6.00 |
| 12/27/2007 | W | 12039740 | 12/19/2007 | R | A | 307.00 | 4.00 |
| 11/27/2007 | W | 12039740 | 11/22/2007 | R | A | 303.00 | 3.00 |
| 10/24/2007 | W | 12039740 | 10/21/2007 | R | A | 300.00 | 5.00 |
| 09/26/2007 | W | 12039740 | 09/23/2007 | R | A | 295.00 | 7.00 |
| 08/23/2007 | W | 12039740 | 08/20/2007 | R | A | 288.00 | 5.00 |
| 07/25/2007 | W | 12039740 | 07/22/2007 | R | A | 283.00 | 3.00 |
| 06/26/2007 | W | 12039740 | 06/21/2007 | R | A | 280.00 | 6.00 |
| 05/23/2007 | W | 12039740 | 05/20/2007 | R | A | 274.00 | 5.00 |

When the customer called Customer Services regarding a high bill, the customer service representative (CSR) would access this meter usage screen shown above. In this case, the call was prompted by a HUNA alert, which will be discussed later. The CSR knows that the usage was based on an actual AMR read, designated by the letter 'A' under the column 'Type'. March's consumption is about 700% higher than average but why? The CSR is reasonably confident that the high usage is not related to meter error and the problem lies somewhere in the customer's home. The customer has an opposing view and believes the problem is with the meter or the reading. This type of call typically lasts 10-minutes or longer because of the money involved and eventually results in a field visit to check the meter. The all-in costs for the initial field investigation are approximately $50.00. If the customer pursues this complaint through the Administrative Hearing process, the costs can be as high as $325.

Illustration 2:

The next illustration shows the same account data; however, the CSR has an additional tool, the AMR Star database.

**Star Data Table**

| **Date** | **Time** | **Reading** |
|---|---|---|
| 3/19/2008 | 6:53:40 PM | 34,583 |
| 3/19/2008 | 6:55:56 AM | 34,337 |
| 3/18/2008 | 6:58:35 PM | 34,087 |
| 3/18/2008 | 6:57:54 AM | 33,829 |
| 3/18/2008 | 5:58:34 AM | 33,829 |
| 3/17/2008 | 7:02:56 PM | 33,581 |
| 3/17/2008 | 6:03:38 PM | 33,581 |

| | |
|---|---|
| 3/17/2008 7:05:01 AM | 33,338 |
| 3/17/2008 6:05:43 AM | 33,338 |
| 3/16/2008 6:12:31 PM | 33,091 |
| 3/16/2008 6:14:30 AM | 32,849 |
| 3/15/2008 7:16:22 PM | 32,599 |
| 3/15/2008 6:17:10 PM | 32,599 |

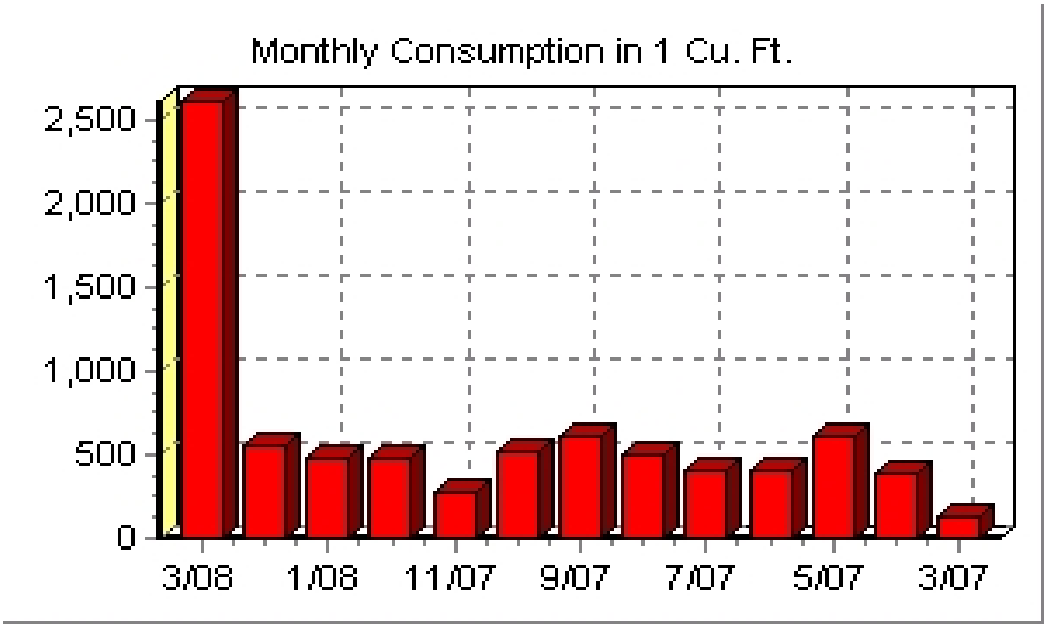
Although the daily meter reading data is useful, the volume of data is overwhelming. It was not unusual to observe CSRs frantically calculating numbers as they talked to customers trying to pinpoint when the changes in consumption occurred. The data needed to be structured and presented to the CSR in a more useful manner.

Illustration 3:

The Excel worksheet discussed earlier sparked an idea that developed into a powerful customer service tool named AMR Graph. The concept was to present the AMR data in a manner to foster an intelligent dialogue between the CSR and our customers. Since there was no prototype in the utility industry, Customer Services established the following program goals for the AMR Graph application.

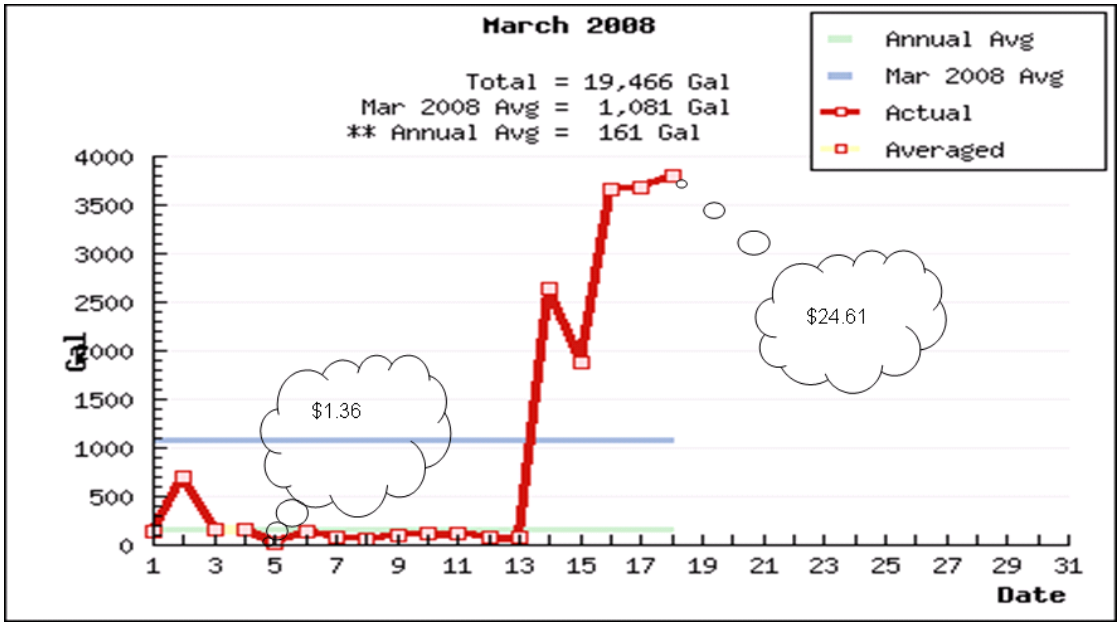
1) Provide customer consumption data illustratively and in digital format to assist CSRs in consumption trends and usage analysis.
2) Improve call center performance
    a. Improve CSR average speed of answer
    b. Increase CSR occupancy rate
3) Reduce field visits by meter technicians

The plan was to graph daily meter reading data and to calculate monthly and yearly averages that could be compared to the customer's daily usage. This application could be accessed with eCIS resulting in a form of *show and tell* for the CSR in explaining high usage. The AMR Graph was an immediate hit with the CSRs who, for the first time, could see how varied consumption is over a defined billing period. CSRs sent the AMR Graph printouts to customers via email, mail, or facsimile. The following two graphs show the monthly and daily usage for the same high bill complaint above using AMR Graph.




The monthly data shows the apparent start of the high use and the CSR can click on any month to obtain the daily usage for this account as shown below. By clicking on the March column the daily consumption appeared allowing the CSR to see changes in consumption.

**Daily Consumption**




We added two clouds in this graph for illustrative purposes to show the daily cost for March 5th and March 18th. A toilet leak was determined to be the cause of the high bill, which can be costly to the consumer if not detected.

Illustration 4:

As the daily graph in Illustration 3 shows, the CSR has sufficient information to ask probative questions to help the customer identify the high use without sending out a technician. The following photograph is the application on the CSRs computer screen.

 [2]

As the picture above clearly shows, consumption dropped off significantly after some event took place in the home and the supervisor is illustrating this point to the CSR. One event could be the children home from college for the weekend doing what college students are prone to do – wash many loads of laundry and bathe frequently.

Other discussions can center on home improvements, landscaping, a leaking toilet or a hose left unattended. The point is that the CSR can ask probative questions to help the customer understand the reason(s) for a high bill rather than dispatch field operations to look for non-existent metering problems. Since there was apparent demand for this information, we decided to place this application on the web for customers' use.

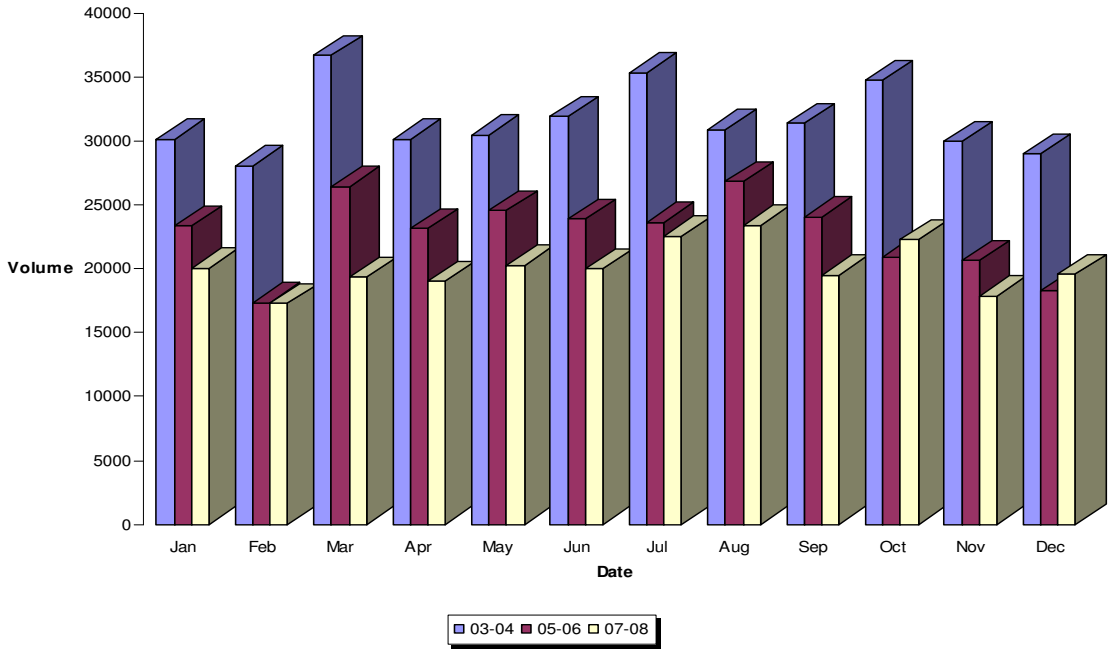
Another AMR benefit was the significant reduction in call volume and high bill complaints. As billing accuracy improved there was a corresponding decrease in call volume. The cost of service for a call center contact can range from a few dollars to as high as $325 when it ends in a bill dispute. The dispute process typically involves two telephone calls, a field investigation, sometimes a meter test, supervisory review and possibly an Administrative Hearing depending on the billed amount.

[2] The photograph above is for illustrative purposes. The application pictured on the monitor is exactly what Customer Services uses; however, it was clearer to show using two large screens with two volunteers pictured above.

The following graph shows the decline in call volume largely due to process improvements developed through AMR.

Call Center Statistics

[3]



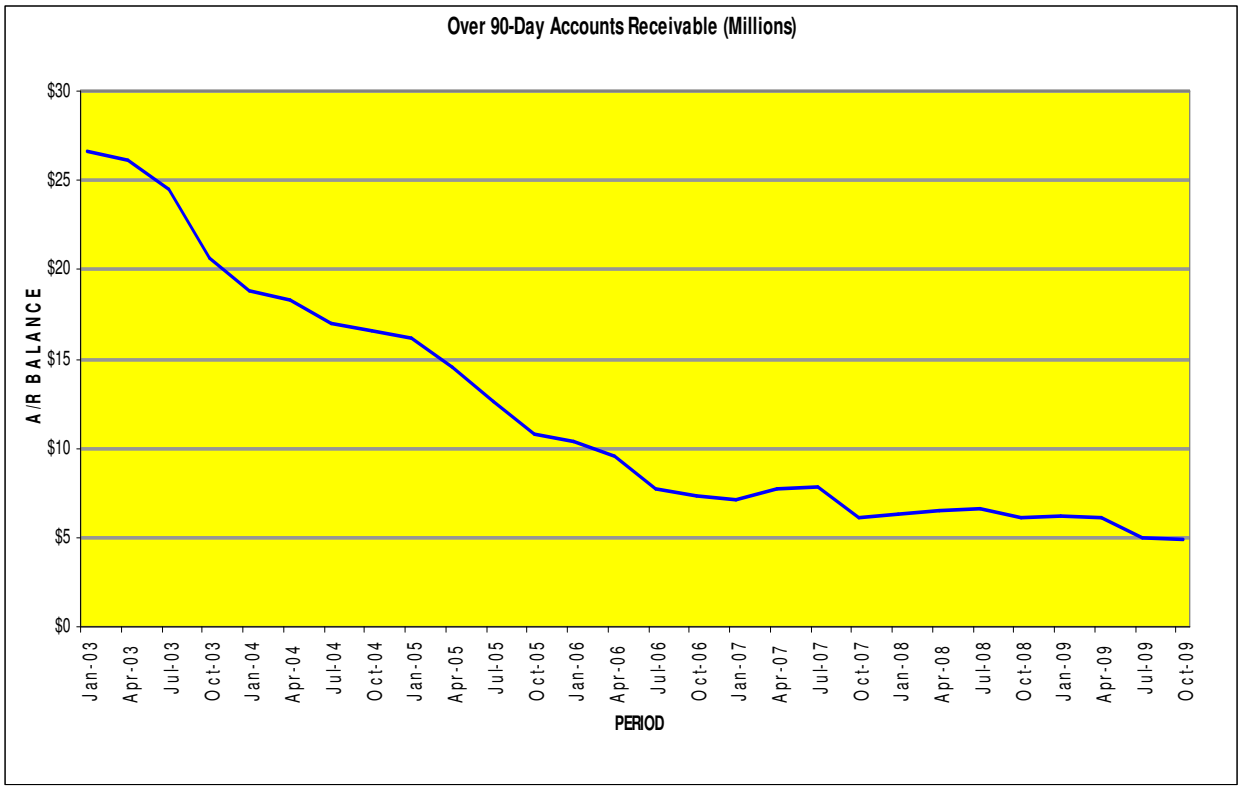

This decline in volume translates into hard operational savings for the call center and field operations. Before AMR, the call center achieved its performance metric of 85% response within 40 seconds 66% of the time. Today it is a rare event when the performance metric is missed despite a larger customer base and fewer employees to respond to these contacts. Total call time has improved by over 33% from more than six minutes to approximately four minutes. Lower talk time translates into higher Customer Service Representatives (CSRs) occupancy rates and lower transactional costs.

## Arrears Management Improvements

DC WASA had a poor track record in Collections. Its 90-day receivables exceeded $25 million at the start of the AMR project. Today, 90-day receivables are at an all

[3] For illustrative purposes we show call volumes through 2008 because of the addition of process notification. Process notification is an outbound calling program that is designed to have customers call-in to DC WASA's Customer Services to make payment plans on past due bills.

time low at under $5 million. AMR played a part in this success by improving meter accuracy and billing. Further, AMR enabled DC WASA to switch to monthly billings, which contributed to our collections success. Smaller monthly bills are easier to pay and coupled with process improvements made in Meter Operations more employees could focus on collections. The following graph illustrates our collections success.




## Meter Operations Improvements

Organizational Design

As a result of the AMR implementation, we consolidated meter operations in 2004 establishing three job classifications where there were nine classifications. The new organization design established two units within meter operations. The small meter operation defined as meters 2" or less was serviced by a single field technician. The large meter operation defined as meters 3" or larger were serviced by a 2-person crew comprised of a Meter Technician 1 and Meter Technician 2. The expectations of both operations were to make a single visit to a customer location and do everything the first time, every time.

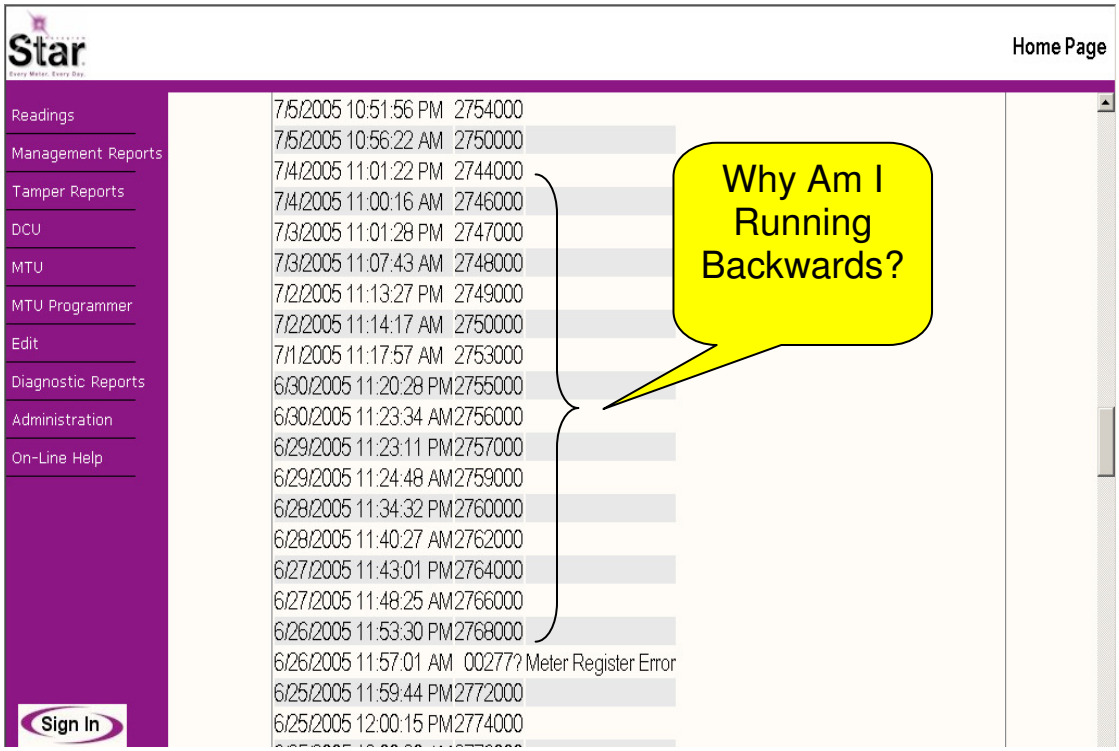
Meter Maintenance

By leveraging investments in AMR technology, GIS and asset management, DC WASA laid the foundation for its advanced meter infrastructure (AMI). This foundation enabled DC WASA to establish a meter maintenance program that

intelligently performs root cause analysis before sending field crews to individual locations for suspected problems. An example is multiple meter transmitting unit (MTU) repairs. The traditional process required a site visit by a meter technician to determine the cause of each MTU failure. The technician would examine the MTU connections to the meter, check the wiring for possible damage, ensure that the unit was not submerged by water in the meter vault or pit, and, if all else fails, reprogram the MTU or replace it.

Meter Operations was able to pinpoint geographical areas that had multiple MTU failures by loading no read service orders into GIS. The plotted failures were heavily concentrated in small geographic areas pointing to the data collection unit (DCU) as the possible source of the MTU errors. Technicians relocated the DCUs to a higher elevation and the MTU problem quickly subsided. This process effectively eliminated the need to send a field technician to each customers premise.

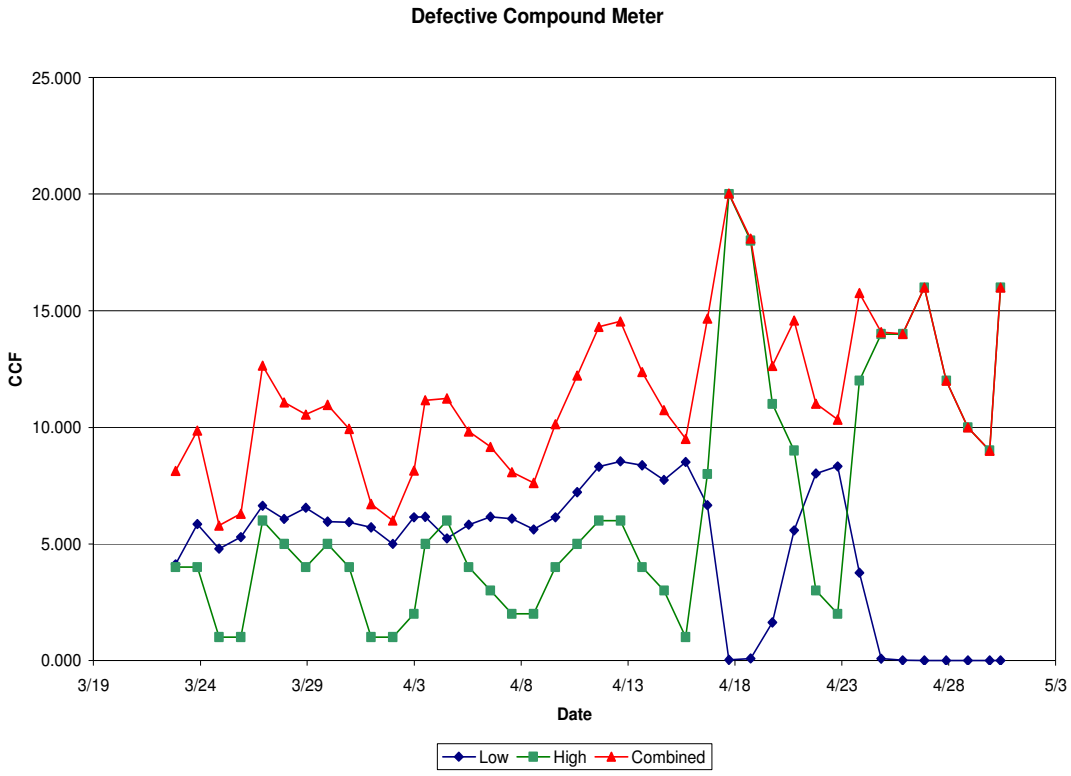
AMI also helped identify metering problems that largely go unnoticed in most utilities as shown in the following illustration.




This meter began running backwards for about nine days in the billing cycle, before moving forward. Our investigation determined that this large campus was supplied water from different pressure zones. One meter did not have a backflow preventer on the service allowing water to pass through the meter backwards. The customer was making major infrastructure repairs to their internal distribution system and, as they diverted water to supply the remaining part of the campus, water began passing

through the downstream meter from the wrong direction. Fortunately, this condition did not result in a cross connection to the water distribution system; however, the meter spinning backwards represented lost revenue. The daily AMR readings helped identify this condition.

AMI also identified a problem with the low flow registration on compound meters. The following chart illustrates the high flow registration and the intermediate and low flow registration of a typical compound meter. The billing process combines the two readings to bill total consumption at each facility. As the chart illustrates the usage increased during the billing period, which is consistent with historical usage during warmer weather for this account.



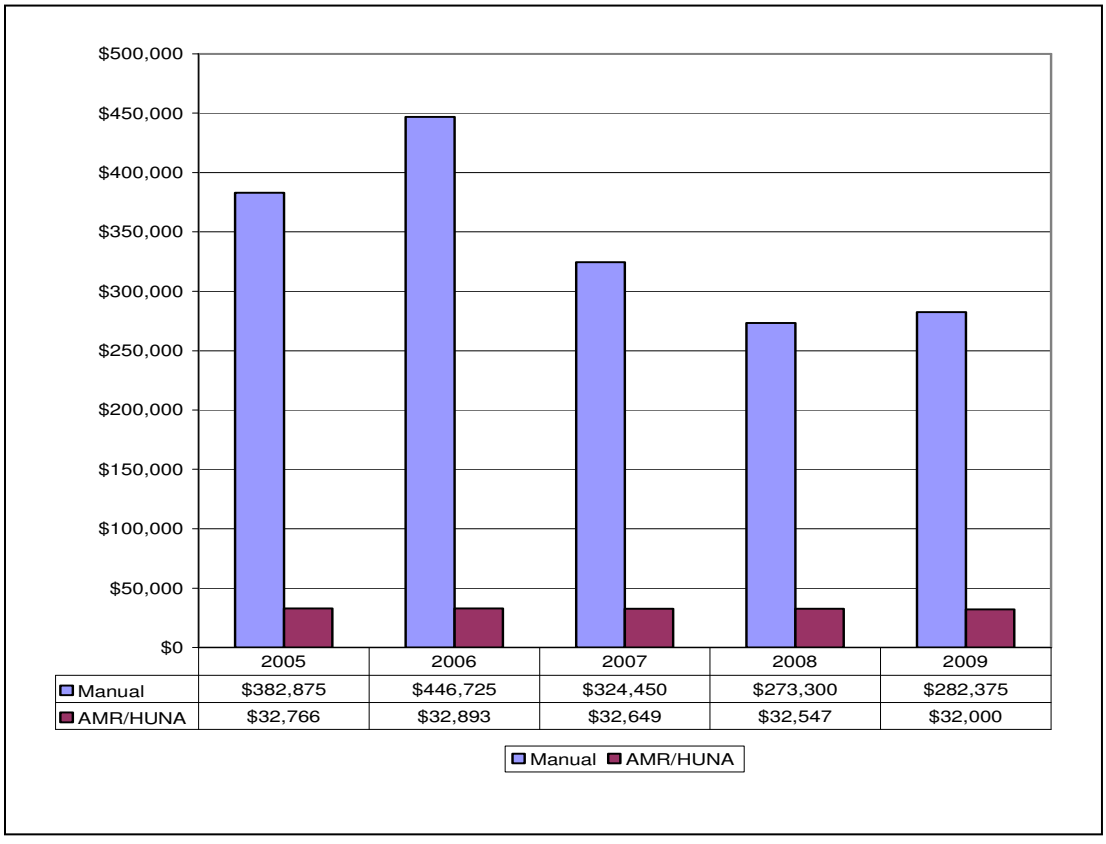

The chart also shows that low flow side of the compound meter (Blue Line) stopped registering on April 24. Most utilities would not detect this condition because they do not have the data. From a revenue perspective, this "miss" can translate into hundreds of thousands of dollars depending on the number of defective meters.

The typical high/low usage check post billing would not flag this account since total consumption was increasing consistent with prior year's historical averages. However, AMI flagged the no read condition on the low flow side of the meter. Since low flow consumption can account for 3% to 5% of total revenue in commercial and multi family buildings we needed to make sure that this was not a systemic problem. Further analysis identified additional compound meters that were not registering on

the low flow side and we worked closely with the manufacturer to identify and correct the defect.

Another AMR benefit is lower costs associated with the new customer connect process, a major cost driver for the utility due to account turnover in the Nation's Capital. Since DC WASA's customer relationship is with the property owner, the new account is not established until the property transaction is completed. In the past, field service technicians obtained an ending read for the property transfer, sometimes shutting the meter off depending on the time interval needed between purchase and occupancy. A crew would later be dispatched to turn the meter on after the new account was established or to obtain an in-reading.

Today, almost every transaction is done electronically. The CSR accesses AMR's Star database for the out-read for the previous owner and the in-read for the new owner, virtually eliminating the need for field visits for the new customer connect process. The following graph depicts annualized cost of service savings for this one transaction type. Blue columns are costs associated with the former manual process based on the number of new turn on/turn off transactions. The maroon columns are actual costs.




| | 2005 | 2006 | 2007 | 2008 | 2009 |
|---|---|---|---|---|---|
| Manual | $382,875 | $446,725 | $324,450 | $273,300 | $282,375 |
| AMR/HUNA | $32,766 | $32,893 | $32,649 | $32,547 | $32,000 |

**The High Use Notification Application (HUNA) Process**

HUNA is the next generation improvement to AMR Graph. HUNA leveraged the existing AMR Graph and alert system used to alert customers of work in the area to provide proactive notification of meter anomalies using email or telephone calls. HUNA is a web-based application using Microsoft SQ-L database and PHP coding. The HUNA process runs every morning through an AMR download obtained from the STAR AMR database. The core functionality of HUNA can be broken down into three functions: generating notifications, sending notifications, and reporting notifications.

Generating notifications

DC WASA has automated jobs that run daily calculations on customer water usage. An example is Daily Average Consumption, which is the average water a customer used during the specified time-period. Customers' previous days meter usage is compared to the annual daily average consumption and the current month's daily average consumption to determine if there are any spikes in consumption.

When daily consumption exceeds the annual daily average consumption for four consecutive days, DC WASA will alert customers of a potential problem. The high usage parameters are configurable so that DC WASA can optimize high usage detection without generating false alarms.

Sending Notifications:

DC WASA has two methods of notifying customers of high usage:

1) Electronic mail message (Email). An email will be sent to the customer provided we have their email address **and** the customer has not opted out of the HUNA process or has not selected an alternative delivery method (telephone). Email notifications are sent at 9:55 AM, 365 days a year.

2) Interactive Voice Response (IVR). Phone call notifications are queued up in the IVR during normal business hours (M-F) beginning at 10:20 AM. The intent is to allow the customer to speak to a CSR, if needed.

The method of contact depends on customer preference.

Reporting Notifications

There are weekly HUNA reports (Email and IVR) that focus on the results of the notification. We omitted the customer information for privacy reasons but this illustration shows a report used by management to monitor HUNA contacts for emails.

dc water is life

## HUNA Email Summary

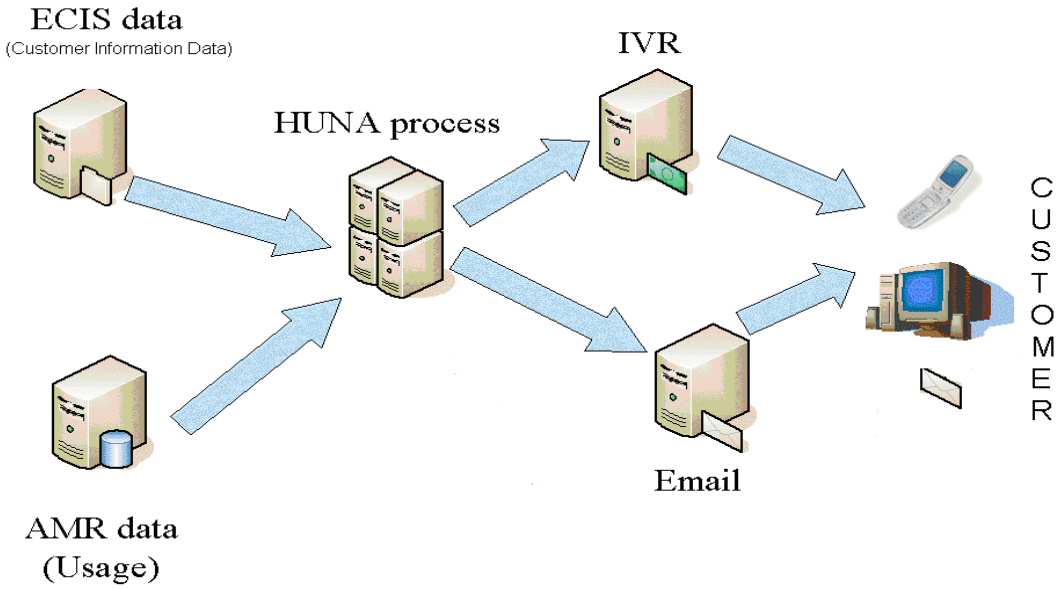
**Start Date:** 7/12/2011

**End Date:** 7/18/2011

| Total Emails: | 23 |
|---|---|

| Email DateTime | Premise Number | DC Water Account Number | Notification ID | High Usage Start Date | High Usage End Date |
|---|---|---|---|---|---|
| 2/11/2011 9:57 | 31 3 | 20 2 | 23980 | 2/6/2011 | 2/9/2011 |
| 2/11/2011 9:57 | 31 0 | 13 9 | 23962 | 2/6/2011 | 2/9/2011 |
| 2/11/2011 9:57 | 30 3 | 18 8 | 23964 | 2/6/2011 | 2/9/2011 |
| 2/11/2011 9:57 | 30 0 | 8 1 | 23965 | 2/6/2011 | 2/9/2011 |

The following illustration is a representation of the HUNA process and the applications that support this service.




Customer feedback to this application has been tremendous. Customers appreciate the advance notification, which allows them to investigate the problem and make repairs before the bill is rendered. We included some actual customer feedback of the HUNA process substituting generic names and addresses for privacy considerations. A sample email message is also included for reference.

Customer Feedback

1) From: “Any" anycustomer@starnet.com 01/23/2007 10:10 AM
To: "DCWASA Customer Service" <custserv@dcwater.com>
Subject: RE: DCWASA: High Usage Detected at your Address

How about that? I'm impressed with WASA.

2) From: Customer, David [mailto:david_customer@fanniemae.com]
Sent: Wed 7/18/2007 2:19 PM
To: Customer Service
Subject: Very Good You all get an A for your AMR Usage History report.

3) From: Yenie Customer [mailto:yenielecustomer@gmail.com]
Posted At: Friday, July 06, 2007 9:17 AM
Posted To: WEB-Customer Service
Conversation: Recent customer service call
Subject: Recent customer service call

Hello, On June 27 and 28, we called for assistance with our water issues at 1207 Constitution Avenue, NE. We received prompt and amazing service. The customer representative on the phone was very polite and responsive. The technicians who came out were very patient and informative. We were so pleased with DC Water and Sewer Authority's customer service. I unfortunately do not remember the names of any of the individuals we interacted with, but if there is any way of tracking them down, please thank them for us!!! Thanks again for delivering customer service that exceeded our expectations!

DC WASA’s EMAIL Message

Dear Valued Customer:

The District of Columbia Water and Sewer Authority DC WASA) implemented an automated meter reading (AMR) system to improve its service delivery to you. DC WASA collects daily AMR readings, which helps us, monitor and track usage across the entire distribution system. One extended benefit of AMR is the ability to trend your usage to help detect potential problems. Few, if any water utilities are providing this service today.

Between {start date} and {end date}, we observed a significant increase in your daily usage that may be indicative of a problem with your internal plumbing or higher weekend usage. We strongly urge you to check your internal fixtures such as a toilet, sink, or water heater to ensure there are no leaks. You should also check your outside hose bib for leaks. This email message is not meant to alarm you; however, leaking fixtures left undetected can cost consumers hundreds of dollars over the course of a month. If you have any questions please contact our customer service professionals at (202) 354-3600 and they will gladly assist you.

Please reference premise number when calling.

Thank you,
DC Water Customer Service

Most utilities perform this check after the billing process run, but before bills are sent to customers. Conversely, HUNA's alert feature notifies customers of metering anomalies as they happen while there is time for the customer to address the problem or at least be aware of the problem before bill shock occurs. Currently, we know of no utility in North America that provides this service across all rate classifications. DC WASA leveraged investments in automated meter reading (AMR) technology; voice and data technology, and web enabled application development tools to deliver this premium service at minimal cost to the utility and its rate-payers. In fact, the development costs have been more than offset by the reductions in operating expenses since HUNA was deployed.

Where in the water industry a single running toilet left undetected can result in a $500 monthly bill, the consumer benefit is obvious. Direct benefits to DC WASA were reductions in call volume, field investigations and administrative hearings, all costly processes when examined on a per transaction basis. In addition, we significantly enhanced our meter maintenance process, account transfer process and billing exception process as a means to lower our overall cost-of-service. An unintended benefit was customers' acceptance of this technology and, more importantly, their perception of "old-fashioned, personalized service" being offered by DC WASA that the industry as a whole seems to have lost in recent years.

An added benefit to the customer is the availability of information for trend analysis and conservation measures. Today a customer can log on to the *My Account* feature at www.dcwater.com and access their consumption history. Meter reading downloads are available with the click of a mouse. Larger institutions can also install sub metering at their facilities and DC WASA's application can capture these readings too. An industrious facility manager can use this application to monitor their entire water consumption and structure a conservation program that can translate into real savings in both consumption and water and sewer expense. Overall, this project was a win-win for the utility and the customer.

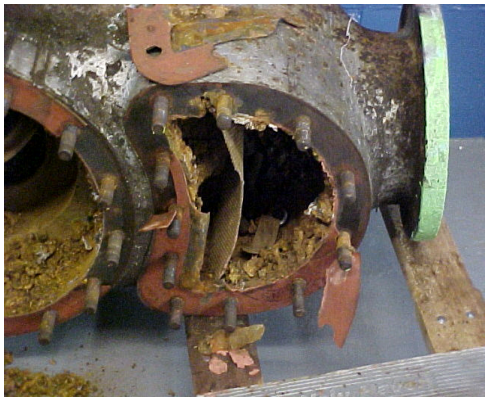
**Lessons Learned**

There were clearly issues during the AMR project. The first was the installation contract language. There was no specific contract language addressing performance for the large meter installations. Large meter installations represent less than 5% of all meters and the contract language specified at least 95% of all system meters had to be installed without differentiating between small meters and large meters. We spent an inordinate amount of time with the contractor making sure that a significant percentage of large meters were installed under this contract before they substantially completed the project.

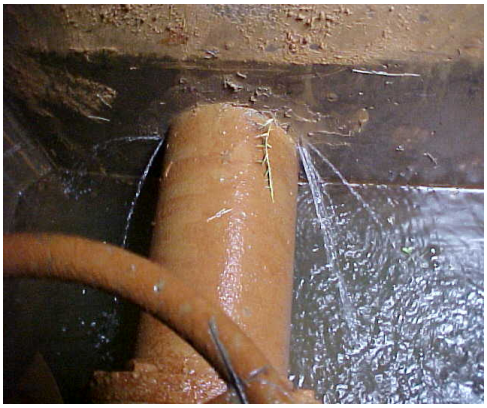
The second issue was access rights. We made up to 13 contacts with customers without installing meters. The time spent setting up appointments, rescheduling appointments, being denied access to the meter became challenging. Access issues seriously delayed this project's completion.

The third issue was the condition of the aging infrastructure. Many installations required significant ancillary work in order to install a meter that was not anticipated during the project start. In a few cases, it became cost prohibitive to install a meter because of the infrastructure conditions. However, there were many examples where we installed a meter at a considerably higher cost because of the condition of the infrastructure. The following photographs illustrate this point.

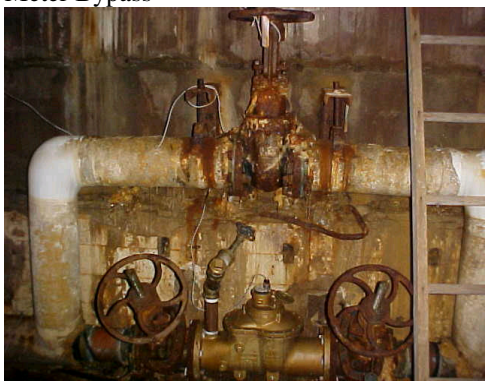
Meter



Meter Vault



Meter Bypass



Meter Support Deficiencies