



**DC WATER AND SEWER AUTHORITY  
BOARD OF DIRECTORS  
AUDIT COMMITTEE**

**AGENDA**

Thursday, March 24, 2011  
9:30 a.m.

1. Call to Order	Chairman Timothy Firestine
2. Financial Statements – Year-End Update	John Madrid
3. Communication of Internal Control Related Matters & Associates	Thompson, Cobb, Bazilio
4. <a href="#">Summary of Internal Audit Activity - Internal Audit Status</a>	Joseph Freiburger
5. Committee Agenda for June Meeting	Chairman Timothy Firestine
6. Executive Session	Chairman Timothy Firestine
7. Adjournment	Chairman Timothy Firestine



*Internal Audit Update*

*Audit Committee Meeting*

*March 24, 2011*

The following represents a summary of the activities and achievements since the December 17, 2010 meeting.

## I. **HIGHLIGHTS:**

Performance of scheduled internal audits – Internal Audit performed audit work in five separate audit areas. Two of the projects were totally completed and final reports issued. The remaining three audits are all in the fieldwork stage of completion. Two of the scheduled audits planned for the first quarter of the year (Fixed Assets, Warehouse & Inventory) were postponed until later in the year at the request of Executive Management. In light of the re-scheduling, the audit of the Fire Hydrant Maintenance operations was advanced and is being performed currently.

The projects completed are - Facility Security & Contingency Planning, and Pumping & Storage Water Leakage Review. The three projects in fieldwork stage are – Fire Hydrant Maintenance, Permit Operations, IT Disaster Recovery & Business Continuity Plans. The chart below depicts the planned projects and their status.

**A. Stage of Audits & Special Projects** - The following represents an indication of the stage of completion for each scheduled audit.

PROJECT	PLANNING / SCOPING	FIELDWORK	Draft Report	Final Report
Facility Security & Contingency Planning				
Pumping & Storage Water Leakage Review				
Fixed Assets*				
Warehouse & Inventory*				
IT – Disaster Recovery & Business Continuity Plans				
Permit Operations				
Grant Operations				
Fire Hydrant Maintenance				
IT – Business & Operating Applications				
Engineering – Contractor Management				

Fleet Management				
AMR & Customer Billing				
IT – Vendor Management & Software Licensing				

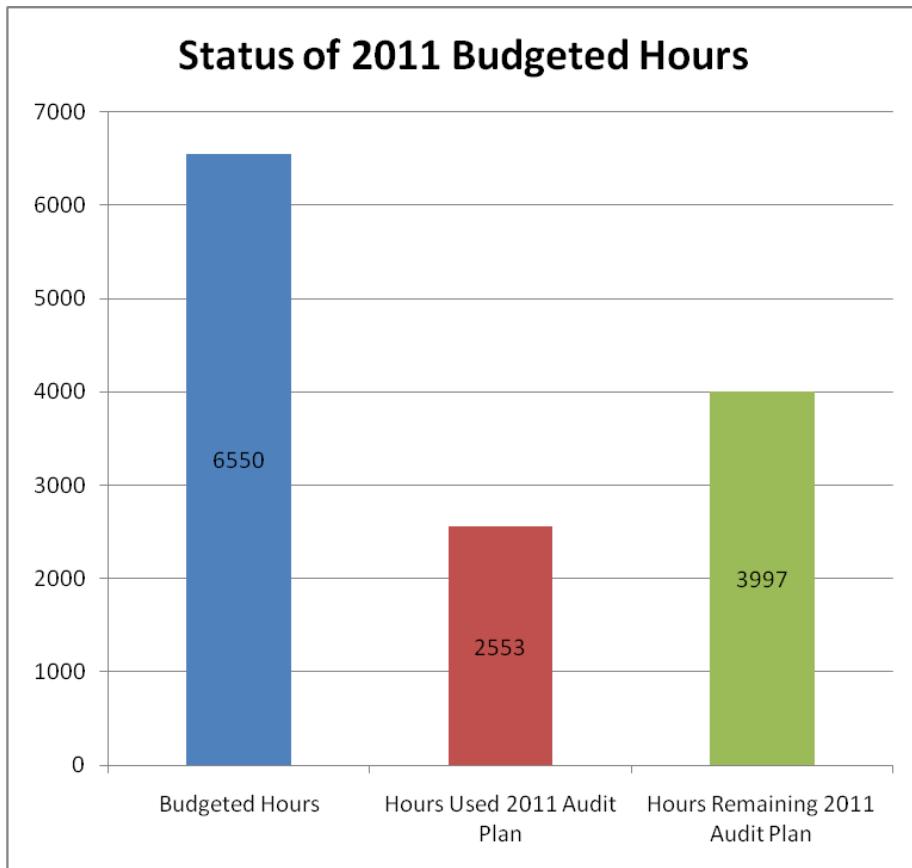
**Note:** Items with “\*” indicates postponed at the request of Executive Management.

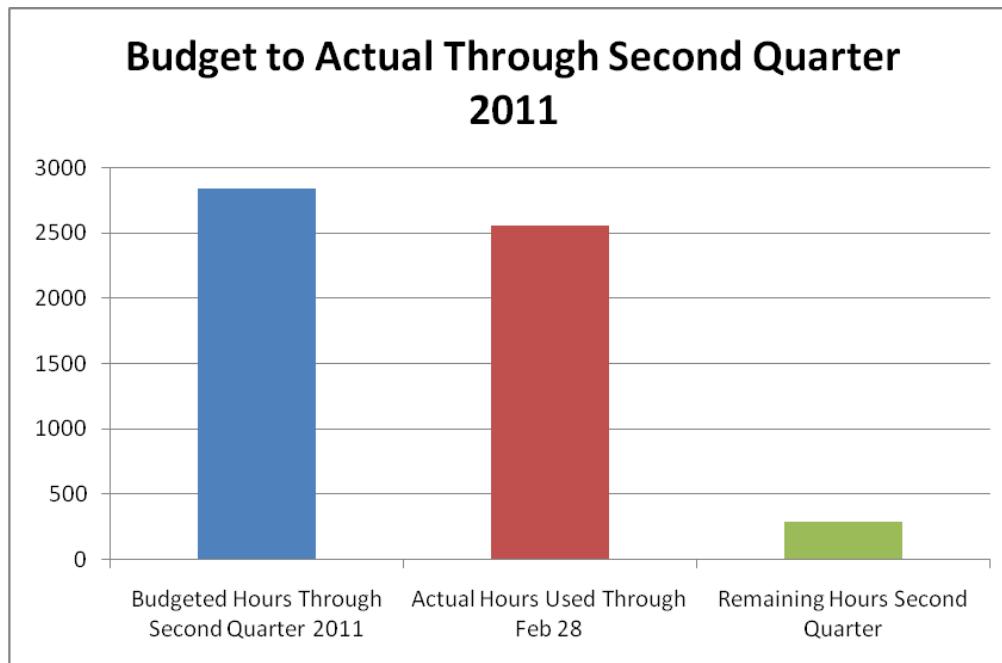
**B. Analysis of key milestone dates** - The following represents an indication of the date of completion of key project milestones.

PROJECT	Start Date	FIELDWORK End Date	Draft Report Issuance Date	Final Report
Facility Security & Contingency Planning	10/8/2010	12/15/2010	12/22/2010	2/18/2010
Pumping & Storage Water Leakage Review	10/27/2010	1/5/2011	1/12/2011	3/1/2010
IT – Disaster Recovery & Business Continuity Plans	2/10/2011			
Permit Operations	1/20/2011			
Fixed Assets*				
Warehouse & Inventory*				
Grant Operations				
Fire Hydrant Maintenance	1/17/2011			
IT – Business & Operating Applications				
Engineering – Contractor Management				
Fleet Management				
AMR & Customer Billing				
IT – Vendor Management & Software Licensing				

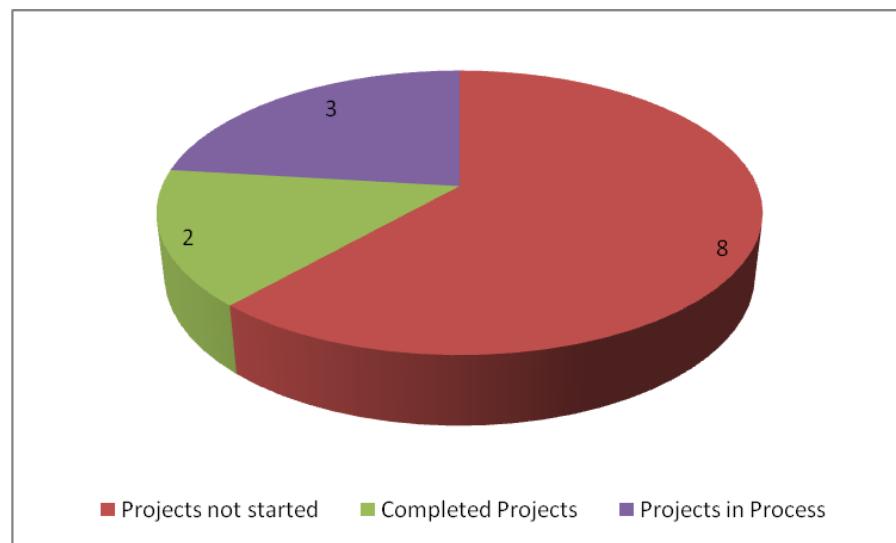
**Note:** Items with “\*” indicates postponed at the request of Executive Management.

C. **Analysis of Hours** – The chart below indicates the actual hours used through February 28, 2011 toward completion of the internal audit plan, along with an indication of the total hours included in the FY2011 plan.





## II. 2011 Audit Plan Status



## A. Completed Projects Since the Last Audit Committee Meeting

### Facility Security and Contingency Planning -

Our overall audit objective was to review and evaluate actions taken to address the security environment at DC Water. Internal audit assessed current security measures and reviewed existing policies and procedures. Internal Audit met with the management of the Departments of Safety & Security and Human Resources to determine their responsibilities in providing, maintaining, and overseeing the security environment at DC Water. Specifically, Internal Audit performed the following:

- Obtained and reviewed existing policies and procedures related to the physical security environment, emergency response, and evacuation of DC Water facilities.
- Evaluated existing policies and procedures to determine relevance, completeness and timeliness.
- Reviewed DC Water's contract with Allied Barton to answer the following based on the contract terms:
  - Do security guards on-site at DC Water meet minimum job qualifications?
  - Do security guards meet minimum training requirements?
  - Do security guards' month-to-month turnover rates meet minimum requirements?
  - Are security guards subjected to semi-annual drug screens and criminal background checks?
  - Do Allied Barton and the Department of Safety & Security perform regular spot checks of facilities?
  - Do Certificates of Insurance covering Allied Barton's security guards meet minimum coverage requirements and are they prepared timely?
  - Is the performance bond provided timely and does it provide sufficient coverage?
  - Is the contractor extension option executed in a timely manner?
- Reviewed and evaluated incident logs maintained by security guards.
- Evaluated various surveillance equipment at DC Water facilities for functionality.
- Reviewed and evaluated the process for issuing, reissuing, and deactivating DC Water access badges for employees and contractors.

Internal Audit concludes that controls within the Safety & Security department need to be improved.

### Pumping & Storage Water Leakage Review -

Internal Audit established four objectives for its review of water leakage/loss mitigation:

- Validate that DC Water is accurately estimating or measuring the magnitude of water loss due to leakage, fire department use, or other factors.
- Evaluate DC Water's water loss mitigation practices currently in existence
- Validate that DC Water is benchmarking its water losses against utilities/cities with similarly aged water distribution systems.
- Validate that DC Water maintains an appropriate level of institutional knowledge to mitigate water loss.

Internal Audit noted that DC Water reasonably estimates and measures the magnitude of water lost to leakage, fire department use, and other factors. Internal Audit also noted that although water loss due to physical leakage from the system appears to have decreased in the period of 2006 – 2010, DC Water’s percentage of non-revenue water has remained roughly the same, at approximately 25% of total purchased water. Although many of these sources of non-revenue water are legitimate uses, we recommend that management make all available efforts to reduce its percentage of non-revenue water where possible, by increasing metering accuracy, minimizing theft, and further detecting and preventing loss through leakage.

Internal Audit also noted that DC Water’s version of the AWWA water audit software being used is an older version than the version currently available. The key difference between versions is the addition of a more granular grading scale for determining validity of estimates and measures against other water entities. We recommend that DC Water evaluate the latest version of the software and determine if it can be implemented.

Ideally, an active leak detection system should be in place to detect leaks early, before they seriously weaken or destroy pipes and surrounding infrastructure. The nature of DC Water’s aging distribution system makes employing any one particular solution difficult, as no single technique is perfectly suited to DC Water’s system’s variety of pipes (both in material and age) and urban location.

DC Water’s move towards implementing active leak detection systems is a step in the right direction which should assist in identifying future pipe replacements and address minor issues before they become major issues. Internal Audit has included the lack of an active system as an issue noted in the audit, and will periodically track the progress of DC Water’s active detection programs as they are implemented.

DC Water does not currently officially benchmark its water leakage data to similar municipalities. The AWWA is currently working on establishing an independent database where various cities’ water audit results can be catalogued and validated by the AWWA itself. Once established, the AWWA could use each municipality’s water results and their validity ranking provided by the audit software to benchmark similar cities against each other, and further identify municipalities using best practices. We recommend that management make every effort to benchmark its own data against comparable water utilities to identify (1) whether DC Water is accounting for various types of authorized and unauthorized loss in a consistent manner, and (2) to assess DC Water’s current system for leak-management in relation to similar utilities.

Finally, we determined that an adequate level of knowledge exists within the organization to address leakage issues, employees are encouraged to attend training and seminars to learn best practices and the issue of leakage and its related damage to infrastructure are acknowledged by Management in the responsible areas.

## B. Audits Currently in Process

IT Disaster Recovery & Business Continuity Plans – This audit is designed to assess the disaster recovery plan (DRP) and business continuity plan (BCP) in place for DC Water operations, and to determine whether the plans are adequately tested on a periodic basis to ensure their effectiveness.

Permit Operations – This audit is designed to evaluate and test the effectiveness of the process used to issue permits to include a review of proper authority, timeliness of processing, and accurate recording of data and funds.

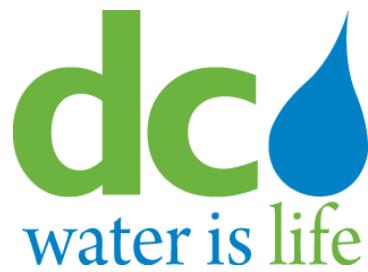
Fire Hydrant Maintenance – The objective of this review is to evaluate and test the process in place to manage and maintain the fire hydrants under the purview of DC Water.

## III. Follow Up

In addition to our work performed relative to the audit projects identified in the 2011 Internal Audit Plan, Internal Audit conducted follow-up activity. During the second quarter of 2011 Internal Audit performed follow up to resolve 61 separate audit issues. The table below summarizes the issues by area of responsibility and the current status of the action plan proposed by Management.

	Chief Engineer	AGM Consumer Services	Chief Financial Officer	General Counsel	Chief Information Officer	AGM Support Services	General Manager	Total
Management Action Plans Completed	1	0	5	4	14	1	2	27
Management Action Plans Implementation Date Not Expired	1	1	1	1	1	19	1	25
Management Action Plans Implementation Date Expired	1	0	0	0	0	7*	1	9
Total	3	1	6	5	15	27	4	61

\*These items mostly relate to action plans in the areas of Safety & Security. This position is currently vacant and Internal Audit will continue to work with the acting Director to obtain required support to verify completion of proposed action plans.



## **INTERNAL AUDIT OF FACILITY SECURITY**

**February 18, 2011**

### **INTERNAL AUDIT STAFF**

Audit Manager: Peter Andresen  
Audit Senior Manager: Dennis FitzGerald  
Audit Principal: Joseph Freiburger

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## I. EXECUTIVE SUMMARY

### Background

As a large utility company, DC Water maintains a Safety & Security Department that is responsible for ensuring a secure working environment for its employees and to provide all facilities with the appropriate security environment to prevent it from unauthorized access and to protect the organization's assets as well as the staff on site. The Department of Safety & Security consists of four authorized positions for security specialist positions (two of which are unfilled positions) and one security manager. This group is led by the newly-filled Director of Safety & Security. Currently, the two security specialists have individual specialized knowledge and are responsible for the following:

- Overseeing security guards and rover patrols provided by Allied Barton (a third party security provider), and
- Ensuring that all DC Water facilities employ sufficient physical safety features in the form of fences, surveillance equipment, and other measures to prevent unauthorized access

DC Water maintains several fresh water pumping stations throughout the Washington, DC metropolitan area and the safety environment surrounding these stations is considered a higher risk area because of potential terrorist activity. Despite this, the physical security environment in the form of fences, surveillance equipment and other security measures has not been maintained as necessary for all facilities at DC Water.

As a result, the Department of Safety & Security has taken steps to improve the physical security environment. However, creating a state-of-the-art physical security environment is extremely complex and cost is of prime concern. DC Water is in the process of engaging a security systems contractor to provide a full spectrum security system review, from an initial vulnerability analysis to the installation of any necessary security measures for each individual DC Water facility, as deemed appropriate.

### Scope

This audit was conducted based on the approved 2011 internal audit plan. Our overall audit objectives included the review, evaluation and compliance with the existing security policies, procedures and guidelines related to security guards, emergency response plans and evacuation plans of DC Water facilities. The audit was initiated in October 2010 and completed in December 2010.

DC Water Internal Audit Facility Security

Objectives

Our overall audit objective was to review and evaluate actions taken to address the security environment at DC Water. Internal audit assessed current security measures and reviewed existing policies and procedures. Internal Audit met with the management of the Departments of Safety & Security and Human Resources to determine their responsibilities in providing, maintaining, and overseeing the security environment at DC Water. Specifically, Internal Audit performed the following:

- Obtained and reviewed existing policies and procedures related to the physical security environment, emergency response, and evacuation of DC Water facilities.
- Evaluated existing policies and procedures to determine relevance, completeness and timeliness.
- Reviewed DC Water's contract with Allied Barton to answer the following per contract terms:
  1. Do security guards on-site at DC Water meet minimum job qualifications?
  2. Do security guards meet minimum training requirements?
  3. Do security guards' month-to-month turnover rates meet minimum requirements?
  4. Are security guards subjected to semi-annual drug screens and criminal background checks?
  5. Do Allied Barton and the Department of Safety & Security perform regular spot checks of facilities?
  6. Do Certificates of Insurance covering Allied Barton's security guards meet minimum coverage requirements and are they prepared timely?
  7. Is the performance bond provided timely and does it provide sufficient coverage?
  8. Is the contractor extension option executed in a timely manner?
- Reviewed and evaluated incident logs maintained by security guards.
- Evaluated various surveillance equipment at DC Water facilities for functionality.
- Reviewed and evaluated the process for issuing, reissuing, and deactivating DC Water access badges for employees and contractors.

Summary of Work

Internal Audit concludes that controls within the Safety & Security department need to be improved. Currently applied security measures exist but exhibit substantial operational gaps. There is an immediate need to assess the security environment and develop a plan to describe all desired security actions for DC Water. The Security Department represents a critical element in DC Water's ability to provide security for all employees, equipment and facilities. In order to provide the level of security needed and properly and effectively address exceptions found during the audit, additional security forces should be hired to fill open positions.

DC Water Internal Audit Facility Security

SC&H Consulting

By: \_\_\_\_\_  
Joe Freiburger, CPA, CIA

## II. DETAILED OBSERVATIONS & RECOMMENDATIONS

The existence of internal control gaps could increase the likelihood that future errors or inappropriate transactions would not be prevented or detected. In order to mitigate this risk, we have provided recommendations to remediate the control gaps via the implementation of additional controls or modification of existing controls. However, we also recommend that management consider the cost-benefit of additional controls prior to implementing any changes.

Observation #1	Internal Audit Recommendations	Management Comments
<b>Policies, Procedures and Manuals</b>		
<p>Available security policies, procedures, and Allied Barton's post orders for security guards are generally unorganized and incomplete. In addition, crucial reviews and approvals by the Director of the Department of Safety &amp; Security do not exist in the available security policies, procedures or guidelines. Finally, security policies and procedures guidelines do not comply with best practices.</p>	<p>Internal Audit recommends that the Department of Safety &amp; Security review the security policies, procedures, and post orders, update them to reflect current best practices and ensure that all presented information is well-organized and complete.</p> <p>Finally, Audit recommends that the Director of the Department of Safety &amp; Security review and approve all security policies, procedures, and post orders and evidence this review using a signoff or other documented method.</p> <p><b>Business Owner: Department of Safety &amp; Security</b></p>	<p><b><i>Management's Action Plan and Implementation Date:</i></b></p> <ol style="list-style-type: none"> <li>1. Modify security guard contract with special requirements related to the industry best practices.</li> <li>2. Institute and monitor a training program for the contract officers that would include compliance to federal and local government security and law enforcement regulations.</li> <li>3. Create and update current security policies enterprise wide with the approval of the General Manager</li> </ol>

Observation #1	Internal Audit Recommendations	Management Comments
<b>Policies, Procedures and Manuals</b>		
		<p>4. Create and update security post procedures as it relates to the physical security and operations at each DC Water Facility.</p> <p><b><i>Implementation Date:</i></b> August 30, 2011</p>

Observation #2	Internal Audit Recommendations	Management Comments
<b>Policies, Procedures and Manuals</b>		
<p>Currently, DC Water only has a draft version of an emergency response plan with an incomplete integration of available Allied Barton security forces. Additionally, though DC Water has taken steps to prepare a facility evacuation plan, there are currently no complete, clearly communicated, and actionable evacuation plans in place.</p>	<p>Safety and Security should provide and communicate interim emergency response and evacuation guidelines for all affected DC Water departments. The emergency response plan and an evacuation plan should be finalized as soon as possible and ensure that both plans are developed in accordance with guidelines provided by NFPA, EPA, OSHA, FEMA, and the Emergency Response Guidelines for 2008. The active integration of all security forces provided by Allied Barton into both plans should be included. Each plan should be tested at least annually to ensure functionality.</p> <p><b>Business Owner: Department of Safety &amp; Security</b></p>	<p><b><i>Management's Action Plan and Implementation Date:</i></b></p> <ol style="list-style-type: none"> <li>1. Incorporate the security role in the execution of emergency response.</li> <li>2. Establish a Security Command Center that would ensure communication to all emergencies occurring on DC Water properties.</li> <li>3. Update security procedures to include the proper execution of emergency evacuation at any of the DC Water facilities.</li> </ol> <p><b><i>Implementation Date:</i></b> June 30, 2011</p>

Observation #3	Internal Audit Recommendations	Management Comments
<b>Contract with Allied Barton</b>		
<p>The contract with Allied Barton for Fiscal Year 2011 was not executed until December 2, 2010 (within Fiscal Year 2011). Additionally, required Certificates of Insurance and coverages to be provided by Allied Barton were not finalized until December 17, 2010. A performance bond required for Fiscal Year 2011 was not available until November 23, 2010 (again, within Fiscal Year 2011).</p>	<p>Internal Audit recommends that DC Water should ensure a valid contract with Allied Barton is in effect for all periods in which they provide security services. Contract execution delays should be covered by interim contracts. The Procurement Department should ensure that required Certificates of Insurance and a performance bond are valid for the full contract period and are in compliance with specific contract requirements.</p> <p><b>Business Owner: Procurement</b></p>	<p><b><i>Management's Action Plan and Implementation Date:</i></b></p> <p><b><u>EVENT DATE</u></b></p> <p>RFP Advertised: Fifth Month of FY</p> <p>RFP Available Fifth Month of FY</p> <p>Pre-Proposal Conference Fifth Month of FY</p> <p>RFP Closing Date: Fifth Month of FY</p> <p>Proposal Evaluation Sixth Month of FY</p> <p>Oral Presentation Sixth Month of FY</p> <p>Selection / contract award Seventh Month of FY</p> <p>Secure Certificates of Insurance and a performance Bond Seventh Month of FY</p>

Observation #3	Internal Audit Recommendations	Management Comments
Contract with Allied Barton		<p>Obtain Budget approval for contract Seventh Month of FY</p> <p>Activate the new contract Twelfth Month of FY</p> <p><b><i>Implementation Date:</i></b> September 30, 2011</p>

Observation #4	Internal Audit Recommendations	Management Comments
<b>Contract and Security Guards</b>		
<p>The Department of Safety &amp; Security does not perform periodic reviews of Allied Barton's Special Police Officer (SPO) and rover patrol records to ensure contract compliance.</p>	<p>The Department of Safety &amp; Security should establish a specific plan to perform spot checks of SPOs and rover patrol documents provided by Allied Barton. Any open positions within the department should be filled to meet the associated staffing need.</p> <p><b>Business Owner: Department of Safety &amp; Security</b></p>	<p><b><i>Management's Action Plan and Implementation Date:</i></b></p> <p><b><u>PLAN</u></b></p> <ol style="list-style-type: none"> <li>1. Daily spot inspections of the SPOs and documents executed by the contract Shift Supervisor.</li> <li>2. Monthly random inspections (3) performed by the contract security company.</li> <li>3. Quarterly random inspections (6) of SPOs and documents performed by the DC Water Security Personnel.</li> <li>4. Semi-Annual Audit of Inspections and documents executed by the DC Water Security Manager</li> </ol> <p><b><i>Implementation Date:</i></b> July 25, 2011</p>

Observation #5	Internal Audit Recommendations	Management Comments
<b>Contract with Allied Barton</b>		
<p>It was noted that reviews of SPOs and rover patrol activity performed by Allied Barton in which exceptions were identified are not reviewed by the Department of Safety &amp; Security for potential contract violations. Additionally, resolution of exceptions is not being verified.</p>	<p>The Department of Safety &amp; Security should perform a meaningful review of spot check reports for SPOs and rover patrols conducted by Allied Barton and make certain that exceptions are properly resolved. In addition, the department should track, identify and maintain spot check reports for SPOs.</p> <p><b>Business Owner: Department of Safety &amp; Security</b></p>	<p><b><i>Management's Action Plan and Implementation Date:</i></b></p> <ol style="list-style-type: none"> <li>1. Repair and replace existing security patrol equipment.</li> <li>2. Upgrade and manage the patrol management system.</li> <li>3. Purchase and repair all equipment related to documented patrols.</li> <li>4. Create a monthly patrol report to verify contract compliance.</li> </ol> <p><b><i>Implementation Date:</i></b> April 25, 2011</p>

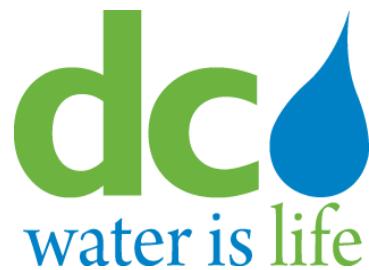
Observation #6	Internal Audit Recommendations	Management Comments
<b>Contract with Allied Barton</b>		
<p>Allied Barton does not perform contractually-required semi-annual reviews for its assigned SPOs relative to drug screens and criminal background investigations. Allied Barton also has not met its obligation to provide the Department of Safety &amp; Security with these related reports.</p>	<p>The Department of Safety &amp; Security should require Allied Barton's management to adhere to all contract requirements including providing reports to the Department of Safety &amp; Security on the results of semi-annual reviews of drug screens and criminal background investigations.</p> <p><b>Business Owner: Department of Safety &amp; Security</b></p>	<p><b><i>Management's Action Plan and Implementation Date:</i></b></p> <ol style="list-style-type: none"> <li>1. Quarterly contract review to verify 50% of the guard force undergone drug screening and background investigation.</li> <li>2. Perform semi-annual reviews of 100% of the guard force for verification of contract compliance.</li> </ol> <p><b><i>Implementation Date:</i></b> March 31, 2012</p>

Observation #7	Internal Audit Recommendations	Management Comments
<b>Contract with Allied Barton</b>		
<p>Neither the Department of Safety &amp; Security, nor Allied Barton's management have engaged in an on-going activity to ensure that every SPO receives all the required training and possesses all qualifications as stipulated by the contract with DC Water.</p>	<p>The Department of Safety &amp; Security should ensure that all SPOs provided by Allied Barton receive all minimum training and meets minimum qualifications as stipulated in the contract. The Department of Safety &amp; Security should increase their staffing to be able to enforce compliance with Allied Barton's contractual requirements.</p> <p><b>Business Owner: Department of Safety &amp; Security</b></p>	<p><b><i>Management's Action Plan and Implementation Date:</i></b></p> <p><b><u>PLAN</u></b></p> <ol style="list-style-type: none"> <li>1. Conduct quarterly DC Water security post training for new and reprimanded SPOs.</li> <li>2. Institute a monthly audit ensuring that all SPOs assigned to the contract have been properly trained in accordance to the contract.</li> </ol> <p><b><i>Implementation Date:</i></b> January 31, 2012</p>

Observation #8	Internal Audit Recommendations	Management Comments
<b>Physical Facility Security</b>		
<p>Internal Audit identified DC Water facilities that should be protected by fencing and/or other security measures; however the required measures were not in place.</p> <p>Additionally, some existing fences were found to be in need of repair.</p> <p>Internal Audit also observed non-functional or missing surveillance equipment at several DC Water facilities.</p>	<p>The Department of Safety &amp; Security is aware of the substantial shortcomings regarding the security environment at DC Water. As a result, the department is in the process of engaging a company specializing in providing security measures for all DC Water facilities. The company, once engaged, will provide services from an initial vulnerability analysis to a final turnkey project for each individual DC Water location. This process from start-to-end is estimated to require five years at a minimum to complete. Internal Audit suggests that DC Water prioritize security actions and improve the current security environment as soon as possible in the interim until the conclusion of the full facility security overhaul.</p> <p><b>Business Owner: Department of Safety &amp; Security</b></p>	<p><b><i>Management's Action Plan and Implementation Date:</i></b></p> <p><b><u>PLAN</u></b></p> <ol style="list-style-type: none"> <li>1. Activate Security Integrator contract (3/1/11)</li> <li>2. Award contract to a company that would provide FY budget for ten years, VA, RA, and the prioritization of all DC Water infrastructures. (6/30/11)</li> <li>3. Implement the recommendations sited by the company (FY11-FY12)</li> </ol>

Observation #9	Internal Audit Recommendations	Management Comments
<b>Employee Badges</b>		
<p>The Department of Safety &amp; Security does not consistently deactivate access badges for terminated employees. Internal Audit identified 60% of terminated employees in its test sample that did not have the access badge cancelled.</p>	<p>The Department of Safety &amp; Security should ensure that information on terminated employees from the Department of Human Resources is processed correctly and that all badges for these employees are forwarded to the Department of Safety and Security for deactivation to prevent unauthorized access to DC Water's facilities.</p> <p><b>Business Owner: Human Resources Department</b></p>	<p><b><i>Management's Action Plan and Implementation Date:</i></b></p> <ol style="list-style-type: none"> <li>1. Develop an exit employee / contract interview.</li> <li>2. Establish a procedure whereby HR or contract company provides a 24 hr. termination report to the Security Manager.</li> <li>3. Develop procedures to ensure employee &amp; contractor ID card deactivation and bar notice when appropriate.</li> </ol> <p><b><i>Implementation Date:</i></b> June 30, 2011</p>

Observation #10	Internal Audit Recommendations	Management Comments
<b>Contractor Badges</b>		
<p>There are no consistent procedures for deactivating badges for contractors that completed their assignment at DC Water.</p>	<p>Individual departments using outside contractors should be responsible for the notification of Security when removal of access is necessary.</p> <p>Additionally, the Department of Safety &amp; Security should maintain a list of all outside contractors performing work at DC Water and follow up with individual departments when an outside contractor completed their assignment to ensure proper deactivation of badges.</p> <p>In addition, Card Readers should be installed at all main entrances at DC Water facilities to prevent and better control unauthorized access to DC Water facilities.</p> <p><b>Business Owner: Department of Safety &amp; Security, DETS, DMS, DFS and all other affected DC Water departments</b></p>	<p><b><i>Management's Action Plan and Implementation Date:</i></b></p> <ol style="list-style-type: none"> <li>1. Establish communication tools with contract company where the employees possess a DC Water ID card.</li> <li>2. Enforce procedures on obtaining all non-commissioned contractor ID cards.</li> <li>3. Institute security requirements in all contracts re: return of contractor ID cards.</li> </ol> <p><b><i>Implementation Date:</i></b> June 30, 2011</p>



## **INTERNAL AUDIT OF PUMPING & STORAGE – WATER LEAKAGE**

**March 1, 2011**

### **INTERNAL AUDIT STAFF**

Staff Auditor: Per Eggers

Senior Auditor: John Suire

Audit Manager: Dennis Fitzgerald

Audit Principal: Joseph Freiburger

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DC Water Internal Audit of Pumping & Storage: Water Leakage

## I. EXECUTIVE SUMMARY

### Background

DC Water distributes water to the District of Columbia and surrounding area via a complex network of transmission mains and other pipes of various size and material. As with most municipal water systems, DC Water's system experiences a percentage of water loss due to leakage from the pipes, either at joints where two pipes meet, or through holes and cracks in the pipes (including major main breaks). Several factors contribute to leakage in DC Water's system:

- **Age of the system** – the District's system's average age is approximately 75 years, with some mains as old as 150 years
- **Types of soil native to the area** – several areas of the District have soils which are naturally corrosive to certain types of materials
- **Composition of Materials Used in the Construction of pipes** – some materials are more susceptible to corrosion, cracking, and breaking than others
- **Weather** – ground can shift during freeze and thaw cycles, which can damage pipes

Water leakage contributes to financial loss in two ways. First, potential revenue is lost because the leaked water is not billed to a customer. Second, leaks contribute to infrastructure damage and destruction through erosion (in the case of a small leak) and from sudden application of pressure (in the case of a serious main break). DC Water is responsible for fixing infrastructure damage caused by leaks and breaks in its system. In 85% of the instances in which repairs are completed the average cost is \$6,000 per repair. Additionally, 10% of these repair costs average between \$18,000 to \$23,000 per repair. Finally, the most extreme repairs relative to major main breaks with severe infrastructure damage (5% of repairs) can cost upwards of several hundred thousand dollars.

To quantify the amount of water lost to leakage, as well as other real and apparent losses (generally defined as Non-Revenue Water, or (NRW), DC Water performs an annual and quarterly water audit using a format created by the International Water Association (IWA) and American Water Works Association (AWWA). The AWWA is regarded as an authoritative source for information related to water distribution in the United States, and their audit format is meant to provide a standard which can one day be used to compare NRW across similar municipal systems. Values used in the water audit are a combination of metered measurements and estimates, particularly in the case of DC Fire Department's water usage for fire-fighting. The ultimate product of the water audit is an identification of **Infrastructure Leakage Index** (ILI), which serves as a performance indicator of real (physical) water loss from the water distribution system.

According to the AWWA, municipalities with ILIs between 1.0 and 3.0 are regarded as top performers in leakage control. Those with ILIs between 3.0 and 8.0 are relatively efficient at managing leakage in their system, with those closer to 3.0 significantly outperforming those closer to 8.0. Utilities which are closer to 8.0 are generally found in water rich areas, where water is easily obtained.

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Those with ILIs greater than 8.0 may not be effectively utilizing water as a resource.

The AWWA format breaks down NRW into the following categories:

- **Apparent Losses**
  - Unauthorized consumption
  - Customer metering inaccuracies
  - Data handling errors
- **Real Losses**
  - Leakage on transmission and/or distribution mains
  - Leakage and overflows at utility's storage tanks
  - Leakage on service connections

For the last four years, DC Water's NRW, is as follows (values for 2007 calculated by Internal Audit using data and method provided by DC Water):

<i>Category (all values in MG)</i>	<i>2007</i>	<i>2008</i>	<i>2009</i>	<i>2010</i>
Water Purchased	41,687.4 9	40,755.4 0	39,997.9 0	38,589.0 0
Unbilled Authorized Consumption	673.94	713.57	745.37	687.96
Unauthorized Consumption	132.63	132.63	132.63	132.63
Customer Metering Inaccuracies	632.98	613.43	588.24	581.44
Data Handling Errors	834.78	1471.58	2520.33	2497.26
Real Losses	7832.20	7220.74	6667.39	5685.81
Total Non-Revenue Water	10106.53	10151.95	10653.96	9585.1

Taking these values as a percentage of total water purchased yields the following data:

<i>Category</i>	<i>2007</i>	<i>2008</i>	<i>2009</i>	<i>2010</i>
Water Purchased	100.00%	100.00%	100.00%	100.00%
Unbilled Authorized Consumption	1.62%	1.75%	1.86%	1.78%
Unauthorized Consumption	0.32%	0.33%	0.33%	0.34%
Customer Metering Inaccuracies	1.52%	1.51%	1.47%	1.51%
Data Handling Errors	2.00%	3.61%	6.30%	6.47%
Real Losses	18.79%	17.72%	16.67%	14.73%
Total Non-Revenue Water	24.25%	24.92%	26.63%	24.83%

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Using this data, DC Water has calculated its Infrastructure Leakage Index values as follows:

	2007	2008	2009	2010
ILI	10.41	9.60	8.84	7.54

Internal Audit identified two noteworthy trends in the data. The first is that real losses in DC Water's distribution system appear to have gone down over time. However, even though real losses to the system have gone down, total non-revenue water as a percentage of water purchased has stayed at approximately the same (25%) percentage of total purchased water over the last four years.

DC Water has traditionally addressed the detecting and repairing of leaks as broken mains are reported and identifying and replacing pipes due to age and suspected corrosion characteristics, but not necessarily by actively seeking out leaks for repair before they become severe. There are currently two different groups within DC Water working to implement more robust active leak detection systems – the Department of Engineering and Technical Services (DETS) for leaks in large-diameter water mains, and the Department of Water Services (DWS) for small-diameter water mains.

Both groups will be fielding processes for identifying and locating leaks in each type of main:

- **Large-Diameter Mains**

DETS tested two technologies: **Sahara** and **SmartBall**. Both are similar technologies, and involve insertion of a spherical instrument package into the main itself. The tethered Sahara system appeared to be the most promising. DETS will be performing a study to assess the best method for large-diameter main leak detection. Implementation of an active-detection system is included in the Pipe Condition Assessment Program on the 2010-2019 CIP, and will be completed by February 2014.

- **Small-Diameter Mains**

Water Services will be testing the **Aclara STAR ZoneScan** and **Itron MLOG Radio** systems. Both systems are similar, and “listen” for leaks using sensors attached to small diameter mains. The trial for both systems is scheduled to begin in 2Q 2011, with a full rollout to be determined based on the results of the trial.

### Scope

This audit was conducted as a part of the approved 2011 internal audit plan. The audit was initiated in October 2010 and completed in February 2011. The audit included a review of DC Water's current magnitude of water leakage, water audits conducted since FY 2007, any currently existing leak detection system at DC Water, and any planned detection systems.

Internal Audit conducted walkthroughs with individuals involved with all stages of leak detection, measurement, and reporting. We used the results of these walkthroughs to determine what types of processes exist at DC Water to mitigate water loss due to leakage.

## DC Water Internal Audit of Pumping & Storage: Water Leakage

Internal Audit also researched best practices as established by the American Water Works Association and compared those practices to DC Water's processes. Finally, we quantified the financial impact of water leakage.

### **Objectives**

Internal Audit established four objectives for its review of water leakage/loss mitigation:

- Validate that DC Water is accurately estimating or measuring the magnitude of water loss due to leakage, fire department use, or other factors.
- Evaluate DC Water's water loss mitigation practices currently in existence
- Validate that DC Water is benchmarking its water losses against utilities/cities with similarly aged water distribution systems.
- Validate that DC Water maintains an appropriate level of institutional knowledge to mitigate water loss.

### **Summary of Work**

Internal Audit noted that DC Water reasonably estimates and measures the magnitude of water lost to leakage, fire department use, and other factors. As stated in the Background section, Internal Audit also noted that although water loss due to physical leakage from the system appears to have decreased in the period of 2006 – 2010, DC Water's percentage of non-revenue water has stayed roughly the same, at approximately 25% of total purchased water. Although many of these sources of non-revenue water are legitimate uses, we recommend that management make all available efforts to reduce its percentage of non-revenue water where possible, by increasing metering accuracy, minimizing theft, and further detecting and preventing loss through leakage.

Internal Audit also noted that DC Water's version of the AWWA water audit software being used is an older version than the version currently available. The key difference between versions is the addition of a more granular grading scale for determining validity of estimates and measures against other water entities. We recommend that DC Water evaluate the latest version of the software and determine if it can be implemented.

Ideally, an active leak detection system should be in place to detect leaks early, before they seriously weaken or destroy pipes and surrounding infrastructure. The nature of DC Water's aging distribution system makes employing any one particular solution difficult, as no single technique is perfectly suited to DC Water's system's variety of pipes (both in material and age) and urban location.

DC Water's move towards implementing active leak detection systems is a step in the right direction which should assist in identifying future pipe replacements and address minor issues before they become major issues. Internal Audit has included the lack of an active system as an issue noted in the Audit, and will periodically track the progress of DC Water's active detection programs as they are implemented.

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DC Water does not currently officially benchmark its water leakage data to similar municipalities. The AWWA is currently working on establishing an independent database where various cities' water audit results can be catalogued and validated by the AWWA itself. Once established, the AWWA could use each municipality's water results and their validity ranking provided by the audit software to benchmark similar cities against each other, and further identify municipalities using best practices. We recommend that management make every effort to benchmark its own data against comparable water utilities to identify (1) whether DC Water is accounting for various types of authorized and unauthorized loss in a consistent manner, and (2) to assess DC Water's current system for leak-management in relation to similar utilities.

Finally, we determined that an adequate level of knowledge exists within the organization to address leakage issues, employees are encouraged to attend training and seminars to learn best practices and the issue of leakage and its related damage to infrastructure are acknowledged by Management in the responsible areas.

SC&H Consulting

By: \_\_\_\_\_  
Joe Freiburger, CPA, CIA

## II. DETAILED OBSERVATIONS & RECOMMENDATIONS

The existence of internal control gaps could increase the likelihood that future errors or inappropriate transactions would not be prevented or detected. In order to mitigate this risk, we have provided recommendations to remediate the control gaps via the implementation of additional controls or modification of existing controls. However, we also recommend that management consider the cost-benefit of additional controls prior to implementing any changes.

Observation #1	Internal Audit Recommendations	Management Comments
<p><b>Observations:</b></p> <p>Internal Audit noted that DC Water does not currently have an active leak detection program in place, but has tested or is currently testing 4 different active leak detection systems. Currently, DC Water repairs leaks incidentally through normal pipe maintenance schedules and when a leak breaks the surface, often as a main break.</p> <p>An active leak detection program in which leaks are actively sought out so that resultant damage can be prevented before it becomes substantial is regarded as an industry best practice.</p> <p>There are several reasons attributed to DC Water not yet having an active system in place:</p>	<p><b>Recommendation(s):</b></p> <p>Internal Audit recommends that DETS and Water Services continue with their respective active leak detection pilot programs for large-diameter and small-diameter mains, and evaluate new systems if the four included in the pilot are found to be inadequate.</p> <p>Additionally, we recommend that efforts be made to reduce the overall percentage of non-revenue water where possible, including theft reduction, increasing meter accuracy, and aggressive leak reduction.</p>	<p><b>Management's Action Plan and Implementation Date:</b></p> <p>Management agrees that we need to explore different leak detection technologies and develop more aggressive programs to reduce the pump sold delta that currently exists. We will be deploying leak detection units from Itron and Aclara sometime in April 2011 to expand the leak detection pilots we have previously run for small diameter mains. Meanwhile, we will continue to explore leak detection technologies in the marketplace to address this issue for large diameter mains.</p>

Observation #1	Internal Audit Recommendations	Management Comments
<ul style="list-style-type: none"> <li>• Active systems can be very costly</li> <li>• Finding a system which works consistently given the District of Columbia's aging and varied water system has proven a challenge</li> <li>• Not all systems are capable of pinpointing the exact location of a leak, which can lead to costly infrastructure repairs when a detector yields a false-positive</li> </ul> <p>Damage caused by long term leakage can vary in cost ranging from several thousand dollars to several hundred thousand dollars depending on the location of the damage and its magnitude, and revenue lost to leakage can cost several million dollars a year. Leakage and its associated damage can also contribute to a negative perception of the organization, especially when coupled with future water rate increases.</p> <p>DC Water's real system loss through leakage is part of the volume of water which DC Water designates as "non-revenue water," which also includes legitimate usage, such as fire-fighting and meter error, and illegitimate usage, such as customer theft.</p>	<p><b><i>Business Owner(s):</i></b></p> <p><i>AGM Consumer Services</i></p> <p><i>Director, Department of Engineering and Technical Services</i></p>	

Observation #1	Internal Audit Recommendations	Management Comments
The percentage of non-revenue water to purchased water has remained approximately 25% between 2006 and 2010, and represents a significant amount of potential revenue for the organization.		

Observation #2	Internal Audit Recommendations	Management Comments
<p><b>Observations:</b></p> <p>Internal Audit noted that DC Water's version of the AWWA Water Audit software is not the most current version available. The latest version includes a granular grading scale which helps a municipality determine the validity of its measurements and comparability of its estimates in relation to best practices data collection methods.</p> <p>The key difference between versions is the more granular validity grading scale.</p> <p>The calculation of water loss is not altered by using different versions; however, using the latest software version will allow DC Water to determine the validity of its data.</p>	<p><b>Recommendation(s):</b></p> <p>Internal Audit recommends that DC Water implement the latest version of the AWWA Water Audit software.</p> <p>DC Water should also adopt measures to benchmark its water audit results against statistics from similar municipalities and organizations and ensure that its accounting for the various categories is consistent with these organizations.</p> <p><b>Business Owner(s):</b></p> <p><i>Office of the Chief Financial Officer</i> <i>AGM Consumer Services</i></p>	<p><b>Management's Action Plan and Implementation Date:</b></p> <p>Management agrees with the observation that DC Water's version of the AWWA Water Audit software is not the most current version available. However, management does not believe that the current version of the software provides enough value to incur the time and effort to migrate to it. Management will evaluate later versions to determine if enough modifications are included to warrant migration to them.</p> <p>Management agrees to establish a peer group of utilities to ensure that its accounting for the various categories of leaks is consistent with these organizations.</p>