

**LOS ANGELES DEPARTMENT OF WATER AND POWER
Distribution System Water Loss Audit and Component Analysis**

Final Progress Report

Agreement Number: R11AP35310
 End Date: September 30, 2013
 Contact Person: Penny Falcon
 Phone: 213-367-4647
 Email: penny.falcon@ladwp.com
 Reporting Period: April 1, 2012 to September 30, 2013

Fourth Reporting Period – Summary of Work Completed

Progress Achieved	
<u>Deliverable</u>	<u>% Complete</u>
<i>Competitive Bidding Schedule:</i>	
Planning Phase*	100%
Solicitation Phase	100%
Evaluation and Selection Phase	100%
Award and Contract Execution Phase	100%
<i>Analysis Scope and Schedule:</i>	
Preliminary Tasks**	100%
Task 1: Validation of System Input Volumes	100%
Task 2: Validation, Standardization, and Confirmation of Consumption Volumes: Field Testing and Data Analysis	100%
Task 3: Identification and Classification of Apparent Losses and Component Analysis of Apparent Losses	100%
Task 4: Preparation of AWWA Water Balance	100%
Task 5: Component Analysis of Real Losses	100%
Task 6: Economic Optimum Volume of Apparent Losses	100%
Task 7: Leak Detection/Real Loss Reduction and Field Quantification of Savings	100%
Task 8: Economic Optimum Volume of Real Losses	100%
Task 9: Recommendations for Economically Viable Strategies Against Real and Apparent Losses	100%
Project Management and Reporting Tasks**	100%

**The Planning Phase took place prior to the U.S. Bureau of Reclamation (USBR or BOR) Funding Agreement start date of Sept. 28, 2011 and is not included in the Analysis of Costs for this Project.*

***These Tasks were not specified in the BOR Funding Agreement but are in the Agreement between the Los Angeles Department of Water and Power (LADWP) and Water Systems Optimization, Inc. (WSO)*

Project Milestones and Timeline

For this fourth and final reporting period, the Project has met all of the expected milestones and timelines. The Project is 100% complete. The following is a summary of all project tasks:

Preliminary Tasks: WSO held a kick-off meeting with LADWP managerial and supervisory staff to discuss the scope of work for the Water Loss Audit and Component Analysis Project and expected staffing and data needs. The kick-off meeting was followed by three stakeholder meetings with Water Operations, Customer Services, and Water Distribution staff. Deb Whitney from the BOR attended the kick-off

meeting and the Customer Services stakeholder meeting. WSO also prepared a Kick-Off Meeting & Stakeholder Meeting Technical Memorandum (TM) and Project Implementation Plan as a part of the Preliminary Tasks.

Task 1: LADWP's system input volume data was provided to WSO. There are three sources of potable water for the City of Los Angeles: LADWP imported aqueduct water, imported water purchased from the Metropolitan Water District of Southern California (MWD), and locally pumped groundwater. Accompanied by LADWP staff, WSO visited the flow meters located at the major water sources for the Fiscal Year 2010-2011; these included meters on the Los Angeles Aqueducts, meters at the major MWD connections, groundwater well meters, and meters at the Los Angeles Aqueduct Filtration Plant (LAAFP) and the Jensen Treatment Plant. WSO also considered calibration and testing schedules and procedures for the flow meters to determine meter accuracies. WSO completed a Task 1 TM validating all LADWP system input volumes.

Task 2: LADWP's customer billing system consumption data was provided to WSO, who has queried the data and categorized the consumption volumes into billed metered and un-metered volumes, and authorized un-billed metered and un-metered volumes. WSO provided a list of meters that were either under-sized or over-sized for the amount of consumption that was occurring over Fiscal Year 2010-2011, and LADWP is following-up on this to increase meter reading accuracies. WSO completed a Task 2 TM that confirmed consumption volumes.

Task 3: WSO analyzed LADWP's customer demand volumes for idiosyncrasies and whether meters on service connections were sized appropriately to capture the typical amount of flow through the connection. LADWP staff also performed bench tests on a random sample of 1,000 small meters (2" and smaller) and recorded pass/fail results. This information was used to determine meter accuracies. Furthermore, WSO met with LADWP staff to discuss LADWP's meter reading process and data handling and transfer procedures. WSO completed a Task 3 & 6 combined TM that summarized the apparent loss volumes and economic analysis of apparent losses.

Task 4: Based on all of the information on system input volume, demand volume, apparent losses, and real losses gathered from Tasks 1, 2, 3, and 5, WSO has prepared a draft AWWA Water Balance for Fiscal Year 2010-2011 and has used their AuditSolve software to further firm their results. WSO completed a Task 4 TM that summarized the water balance calculations.

Task 5: LADWP's leak report and repair data was provided to WSO. The initial dataset provided included main leaks and service leaks between the main and the curb. Further analysis of LADWP's various databases revealed even more leak data in the following categories: service leaks between the curb and meter box, meter leaks, and meter boxes that were flooded due to leaking meters or connections. WSO completed a Task 5 TM that summarized the component analysis of real loss volumes.

Task 6: WSO assessed the economic optimum strategies for reducing apparent losses in LADWP's distribution system. LADWP's large meter overhaul and maintenance schedule was analyzed, and WSO presented recommendations on optimizing large meter overhauls for meters with the highest consumption volume. WSO also reviewed apparent losses from meter inaccuracies versus the amount of revenue lost and provided recommendations based on results. Task 6 results were consolidated into the Task 3 & 6 combined TM.

Task 7: LADWP staff recommended three small system elevation zones, which included between 22-47 miles of pipelines in each area, for the District Metered Areas (DMA) analysis. The three zones, or DMAs, were the 517 elevation zone in the Boyle Heights neighborhood of Los Angeles, the 540 elevation zone in the Westwood neighborhood of Los Angeles, and the 1960 elevation zone in the Tujunga neighborhood of Los Angeles. The 517 and 540 zones have older pipe ages and were expected to have a higher failure rate. LADWP staff purchased insertion magnetic meters to be installed at the regulator stations in each area to monitor all inflows to the areas. These meters arrived later than anticipated on March 6, 2013, and were installed by LADWP staff within one week. Some problems arose after installation, which required troubleshooting of the meter equipment and further delayed the project. Once the problems were

resolved, LADWP moved forward with the analysis. Data was collected from the insertion meters to characterize the system input volume into the DMAs, and LADWP staff manually read all customer meters in the DMAs to determine the demand volume. Leak detection was performed in each of the DMAs to determine any leaks that do not surface and are not known (“unreported leaks”). LADWP staff promptly repaired all leaks once they were discovered. WSO completed a Task 7 TM that summarized the DMA analysis.

Task 8: Based on results of the component analysis of real losses analyzed in Task 5, WSO assessed the economic optimum strategies for reducing real losses in LADWP’s distribution system. The strategies assessed included pressure management and the cost-effectiveness of an ongoing active leak detection program. WSO completed a Task 8 TM that summarized the economic analysis of real losses.

Task 9: Using results and recommendations from Tasks 1-8, WSO prepared the Task 9 TM, summarizing the recommendations for the entire project. These results and recommendations have been incorporated into the Final Report, which was completed.

Additionally, WSO prepared monthly reports and invoices under the Project Management and Reporting Tasks. WSO and key LADWP staff held regular project management meetings to discuss ongoing tasks and overall schedule. All invoices for the contract were paid prior to September 30, 2013. A final training session for LADWP staff on WSO software and analysis techniques will be held on October 28, 2013.

Water Savings

This project has confirmed that LADWP has a distribution system that performs well with low water loss. For the audit year of 2010-2011, LADWP’s water loss was only 5.2%. However, this Project has identified several components in the water system that can be improved to save water and costs.

The water savings from this Project will be in the reduction of real and apparent losses that together comprise the 5.2% water loss for the 2010-2011 Fiscal Year. For that year, real losses were estimated to be 18,776 acre-feet (AF) in volume, which was 3.48% of the total system input volume (SIV). LADWP reduced the real loss volume by 4,325.87 AF (0.80% of total SIV) by repairing all reported leaks. Hidden losses of 2,434.06 (0.45% of total SIV) were reduced slightly through the DMA task, but will continue to be reduced upon the implementation of LADWP’s active leak detection program.

Apparent losses were estimated to be 8,577.69 AF during Fiscal Year 2010-2011, which was 1.59% of the total SIV. LADWP is planning to reduce meter under-registration by replacing specific types of meters identified through the Project that are the least accurate. For example, by overhauling the 5/8” x 3/4” Trident customer meter class, LADWP can save up to 1,460.47 AF (0.27% of total SIV). Additionally, an overhaul of all meters 3” and larger can save LADWP up to 733.98 AF (0.14% of total SIV). Furthermore, findings from the DMA task showed there was a high potential of reducing unauthorized consumption by monitoring the consumption on private fire service meters on a regular basis. Though almost all of the time, fire service meters would be expected to register zero consumption, the DMA task recorded 206,543 gallons of consumption from this class of meters in the three zones over a one week period. Since unauthorized consumption volume has not been characterized by LADWP, the AWWA estimate of 0.25% of total SIV was used; however, findings from the DMA task suggest unauthorized consumption from fire services alone could be as high as 2,192.19 AF, and reduction of these losses could save up to 0.41% of total SIV.

Overall, through implementation of measures recommended by the Project, LADWP is expected to reduce its water loss and have a resulting water savings of up to 11,146.57 AF, or 2.07% of total SIV. This is approximately equal to the 2% water savings that was anticipated for this Project.

Summary of Costs

LADWP is requesting reimbursement from BOR for this reporting period for work performed by WSO under Contract #47079-2. The Project is proceeding on budget, and \$119,000.00 was spent on Contract costs during this reporting period, which is almost exactly the third reporting period estimate of \$119,012.00. Total Contract Costs over the entire project amounted to \$314,925.00. LADWP is submitting a reimbursement request this period for \$35,154.56, which is exactly the amount anticipated during the last reporting period. LADWP spent \$365,199.55 on in-kind labor costs during the fourth reporting period, and a grand total of \$1,404,841.19 over the entire project timeline. Per the Grant Funding Agreement, BOR will be reimbursing for Contract costs only for this Project.

Analysis of Costs for the Second Reporting Period Water Loss Audit and Component Analysis Project April 1, 2013 to September 30, 2013

Cost Item	Amount	USBR Share* (16%)	LADWP Share (84%)
<i>Labor, Equipment, Materials, and Other In-Kind Costs:</i>			
Salaries and Wages	\$127,882.44	\$0.00	\$127,882.44
Fringe Benefits	\$54,845.35	\$0.00	\$54,845.35
Equipment and Materials**	\$10,629.28	\$0.00	\$10,629.28
Other Charges**	\$87,997.04	\$0.00	\$87,997.04
Total In-Kind Costs	\$281,354.11	\$0.00	\$281,354.11
<i>Contract Costs:</i>			
Professional Services Agreement #47079-2	\$119,000.00	\$35,154.56	\$83,845.44
Total Costs Oct. 1, 2012 to Mar. 31, 2013	\$400,354.11	\$35,154.56	\$365,199.55
Prior Claimed Costs (Reporting Periods 1, 2 & 3)	\$1,104,487.08	\$64,845.44	\$1,039,641.64
Current Claimed Costs (Reporting Period 4)	\$400,354.11	\$35,154.56	\$365,199.55
Total Claimed Costs since Sept. 28, 2011	\$1,504,841.19	\$100,000.00	\$1,404,841.19

**Though BOR will reimburse for Contract costs only, Salaries and Wages and Fringe Benefits are included in the Cost Share percentage. BOR is reimbursing up to \$100,000 of the \$300,000 Contract costs, so BOR's share percentage of the Contract costs is 33.3%, whereas BOR's percentage for reimbursement of Labor costs is 0%. During the final reporting period, the 33.3% BOR share of Contract costs exceeds the \$100,000 total grant funding, so the amount requested for this period reflects the remaining funds available.*

***Equipment and Materials costs, along with Other Charges (such as resurfacing and maintenance work), were not originally estimated in the Funding Agreement. However, these charges have occurred due to work performed in Tasks 3 and 7. LADWP has included these costs to show the full amount of in-kind charges being expensed; these charges do not affect BOR's reimbursement share or total.*