

## Appendix A

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### Malcolm Pirnie Scope of Work



**SCOPE OF WORK**  
**MWDOC Water Loss Management Program Assessment**  
**Potable Water System Audit**  
**March 26, 2008**

**Task 0: Administration and Management**

The Consultant's Project Manager and primary contact for this project will be Stephen Davis, Vice President in Malcolm Pirnie's Irvine Office. The project management task entails the following:

- Coordination with the Municipal Water District of Orange County (MWDOC) Project Manager and other MWDOC designated staff and coordination with staff from the City of Huntington Beach, the City of Brea, the Laguna Beach Co. Water District, the City of Tustin, and Moulton Niguel Water District
- Coordination of meetings and conference calls with MWDOC and utility staff
- Preparation and distribution of meeting minutes
- Preparation of monthly email project progress updates
- Invoicing

**Task 1: Collect and Review Relevant Audit Data**

Malcolm Pirnie, Inc. project staff will meet with MWDOC staff to kick off the project. This initial meeting will review the project scope, data requirements, budget, and timeframe for project execution.

Malcolm Pirnie, Inc., in conjunction with MWDOC staff, will plan for and hold a project kick-off meeting with the five participating water utility systems. During the meeting, Malcolm Pirnie, Inc. will:

- Explain the IWA/AWWA water auditing purpose, context, and procedures;
- Review the project scope, budget, and timeframe; and
- Answer questions that the utilities have about the data needs and project approach.

Malcolm Pirnie, Inc. will generate a list of data needed to complete an annual IWA/AWWA water audit for the five member utilities based on a selected annual time period and will provide the list to MWDOC for distribution to the participating water systems. Malcolm Pirnie, Inc. will coordinate with MWDOC and the participating systems to obtain this data. The list will include the following types of data:

- Water Supply Sources
- Water Supply Cost
- Water Supply/Production Quantities
- Water Billing Data
- Unbilled Authorized Water Consumption

- Retail Water Meter Information
- Water Billing Systems and Services
- Water Rate Structure
- Distribution System Description and Operating Characteristics
- Water Leak History and Management Program

Malcolm Pirnie, Inc. will organize and format the data provided by each system for consistency with the IWA/AWWA auditing procedure format. Malcolm Pirnie, Inc. will also perform an initial analysis of the data to identify inconsistencies and develop a list of follow-up questions.

### **Task 2: Complete data analysis and formatting for the IWA/AWWA water audit software**

To complete an annual IWA/AWWA water audit for each utility water system, Malcolm Pirnie, Inc. will do the following:

- Input data gathered in Task 1 to the IWA/AWWA standard water audit spreadsheet software for each of the five participating systems.
- Based on the initial results of the spreadsheet software analysis, identify gaps and errors in the data and work with each agency to improve the completeness and accuracy of the data.
- Since the IWA/AWWA water auditing process is iterative, develop each agency's water audit, sequentially enhancing audit data and results. Malcolm Pirnie, Inc. will coordinate with agency staff to revise the initial audit until a high degree of confidence in the results is attained within the limits of project budget.
- Using the results of the software analysis, Malcolm Pirnie, Inc. will identify the following:
  - Data gaps,
  - Sources of non-revenue water,
  - Value of real and apparent losses, and
  - Cost-benefit ratio for potential corrective measures, if required.

### **Task 3: Conduct "Unbilled Authorized Water Consumption" Review and Analysis**

The City of Tustin audit for 2004/2005, performed for the MWDOC Water Loss Management Program Assessment reported in March 2007, indicated a large percentage of total loss to the "Unbilled Authorized Water Consumption" category of the universal water balance adopted by IWA/AWWA. This use category includes fire hydrant flushing, fire hydrant testing, main flushing, internal uses, irrigation of utility properties, street cleaning, etc. This task will focus on individual utility water use quantification methods for this category of typically unmetered water uses and will compare and analyze individual approaches with reported approaches and results for other similarly situated

utilities. Recommendations to improve the accuracy of losses estimated for this category will be made.

#### **Task 4: Conduct Leakage Management Program and Systems Operation Review**

Review of each utility system's leakage management program and systems operations will be based on the data obtained in Task 1, the results of the data analysis in Task 2, and the completion of a component analysis for each system.

Malcolm Pirnie, Inc. will review the information gathered from each system in Task 1 regarding water distribution system leak history, leak detection, and leakage management programs, including:

- Type of leakage management program.
- Type of leakage detection program.
- Inventory of number/type/volume of leaks, plus spatial distribution over last 5 years, if available.
- Average time to repair leaks.
- Cycle for full system leak detection.
- Number of permanent or temporary noise listening stations, if any.
- Annual expense for leak detection.
- Annual expense for leak repair.

To refine the leakage data obtained during the top-down water audits in Task 2, Malcolm Pirnie, Inc. will perform component analysis. Component analysis, as defined in the AWWA Manual M36, 3<sup>rd</sup> Edition, is a technique which models leakage volumes based upon the nature of leak occurrences and durations. While component analysis is still largely a desktop exercise, it requires additional data beyond what is used in Task 2. Malcolm Pirnie, Inc. will conduct telephone interviews and meetings with the five participating systems, if needed, in order to obtain information to perform a component analysis for each system. Data that may be needed includes:

- Number of annual report leak and break events on water mains and customer services
- Average flow rates for reported leaks/breaks at the current average system pressure
- Average run time (the sum of average awareness, location, and repair times) assigned to each leakage type
- Cost of a leak detection survey intervention (\$/mile of mains)
- Average Rate of Rise of unreported leakage

Following completion of the component analysis, Malcolm Pirnie, Inc. will summarize each agency's results. Malcolm Pirnie, Inc. will then recommend improvements to each leak management program based on the following criteria:

- Economic impact of real losses from leaks to the system over five-year period, as determined in Task 2
- Quantity of component volumes of leakage (reported leaks, unreported leaks and background leakage)

### **Task 5: Perform Relevant Field Measurement Activities**

Based on the results of Task 4, Malcolm Pirnie, Inc. will recommend field measurements to verify results of Task 4, to increase understanding of the causes of water loss, and to help assess cost-effectiveness of potential water loss reduction activities. Potential field measurement activities include:

- Testing source and customer meter accuracy
- Recording time of day metered water flow for weekly summer and winter periods to characterize the customer water usage distribution patterns
- Establishing District Metering Areas to monitor and quantify real losses for portions of a distribution system

If Malcolm Pirnie, Inc. determines that meter accuracy testing or time of day flow recorders will be necessary, equipment will be obtained by MWDOC staff. Malcolm Pirnie, Inc. may hire a MWDOC-approved subcontractor to perform field measurement activities. For data collected through field measurement activities in this task, Malcolm Pirnie, Inc. will perform statistical analyses to determine the confidence levels in the various data obtained. Malcolm Pirnie, Inc. will use the sample size and variance in order to determine the confidence in the results for the entire metered population of interest.

### **Task 6: Prepare Retail System Water Audit Reports**

Based on the results of Tasks 1 through 5, Malcolm Pirnie, Inc. will document water audit results and findings for each of the participating utilities.

### **Task 7: Provide Recommendations for Follow-Up Activities for Improved Water Loss Management**

Malcolm Pirnie, Inc. will recommend activities, based on the results of Tasks 1 through 6, to reduce apparent and real water losses and to assess the economic feasibility of water loss reduction activities.

### **Task 8: Complete Project Report**

Malcolm Pirnie, Inc. will prepare a draft report to MWDOC documenting the following:

- Data collected from each of the five systems
- Results of IWA/AWWA water audit software analysis for each system
- Summary and assessment of leakage management program for each system
- Field data collection results and analysis

- Recommendations for follow-up activities for water loss management program assessment and implementation.
  - Implications for water savings for all of MWDOC's utility members
- Malcolm Pirnie, Inc. will seek comments on the draft report from MWDOC and from the five participating systems and will incorporate these comments into the final report.

**Deliverables:**

Draft and Final Report incorporating results from the prior tasks

**MWDOC Water Loss Management Program Assessment  
Potable Water System Audits  
Project Schedule**

Task	Description	2008												2009						
		Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	
0	Administration and Management																			
1	Collect and Review Relevant Audit Data																			
2	Complete Data Analysis and Formatting for IWA/AWWA Water Audit Software																			
3	Conduct "Unbilled Authorized Water Consumption" Review and Analysis																			
4	Conduct Leakage Management Program and Systems Operation Review																			
5	Perform Relevant Field Measurement Activities																			
6	Prepare Retail Water System Audit Reports																			
7	Provide Recommendations for Follow-Up Activities for Improved Water Loss Management																			
8	Complete Project Report																			

Note: Schedule anticipates a Notice to Proceed date of April 7, 2008.