CITY OF PALO ALTO OFFICE OF THE CITY AUDITOR

December 4, 2017

The Honorable City Council
Palo Alto, California

Policy and Services Recommendation to Accept the Accuracy of Water Meter Billing Audit

The Office of the City Auditor recommends acceptance of the Accuracy of Water Meter Billing Audit. At its meeting on August 22, 2017, the Policy and Services Committee approved and unanimously recommended that the City Council accept the report. The attached report includes updates to Recommendations 1.4 and 2.1 to read, "Explore options for addressing equity when making changes to customer meter size rates and…," "Develop a policy and procedure to transparently report significant, systemic, infrastructure changes to Council ~~for approval~~…," respectively, as well as changes to the City Manager's response from "Partially Agree" to "Agree" for both recommendations.

The Policy and Services Committee minutes are included in this packet.

Respectfully submitted,

Harriet Richardson
Harriet Richardson
City Auditor

ATTACHMENTS:

- Attachment A: Memo to Policy and Services Committee (August 22, 2017) (PDF)
- Attachment B: Accuracy of Water Meter Billing Audit (PDF)
- Attachment C: Policy and Services Committee Meeting Minutes Excerpt (August 22, 2017) (PDF)

Department Head: Harriet Richardson, City Auditor

CITY OF PALO ALTO OFFICE OF THE CITY AUDITOR

August 22, 2017

The Honorable City Council
Palo Alto, California

Accuracy of Water Meter Billing Audit

In accordance with the Fiscal Year 2017 Annual Audit Work Plan, the Office of the City Auditor has completed the Accuracy of Water Meter Billing Audit. The audit report presents 3 findings with 11 recommendations. The Office of the City Auditor recommends that the Policy and Services Committee review and recommend to the City Council acceptance of the Accuracy of Water Meter Billing Audit.

Respectfully submitted,

Harriet Richardson
City Auditor

ATTACHMENTS:

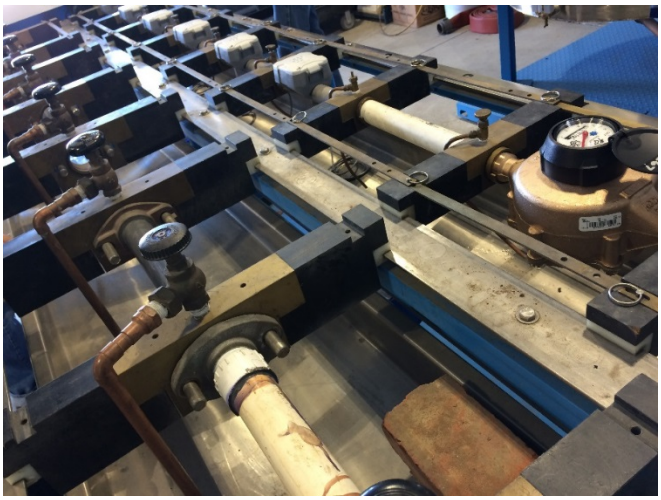
- Attachment A: Accuracy of Water Meter Billing Audit (PDF)

Department Head: Harriet Richardson, City Auditor

CITY OF PALO ALTO

Accuracy of Water Meter Billing Audit

August 16, 2017



Office of the City Auditor

Harriet Richardson, City Auditor
Mimi Nguyen, Senior Performance Auditor
Deniz Tunc, Performance Auditor
Steve Hendrickson, Management Specialist

WATER

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OFFICE OF THE CITY AUDITOR

EXECUTIVE SUMMARY

Accuracy of Utility Water Meter Billing

August 16, 2017

PURPOSE OF THE AUDIT:

To determine if water utility customers were accurately billed for their water meter type, size, and related adjustments.

BACKGROUND:

This audit focused on identifying water meter discrepancies that could result in billing errors, including:

- Accuracy of meter size records among five areas of vulnerability: 1) purchasing record, 2) inventory record, 3) installation record, 4) billing record, and 5) physical meter installed at location.
- A review of water industry standards for water meter accuracy and performance requirements.

REPORT HIGHLIGHTS

Finding 1: CPAU has not adequately prevented, detected, nor corrected water billing errors. (Page 6)

CPAU utility customers are charged monthly for water service based on water consumption and meter size. Finding 1 compiles 577 billing errors, 2.8 percent of 20,633 installed meters, for customers who received adjusted bills because their monthly water meter size charge was billed incorrectly. CPAU previously identified errors for two sets of customers, in December 2014 (Set 1) and June 2015 (Set 2), and adjusted 115 and 126 bills, respectively. We identified 11 additional adjustments that need to be made in Set 1 and corrections to 5 adjustments that need to be made in Set 2. We identified and verified another 213 billing errors and an additional 123 potential errors that we did not verify (Set 3). The verified errors for all three sets total $227,900, which includes $184,000 in underbillings and $44,000 in overbillings. The 123 unverified potential errors include up to $77,000 of underbillings and $46,000 of overbillings. Exhibits 2 and 3 show the location of all three sets of billing errors. Exhibit 4 shows how many customers were under- or overcharged by dollar range and the errors in total dollars.

Undercharges and Overcharges of the 577 Water Meter Billing Errors by Sets

Backbilled /Refund Range	Set 1: CPAU identified and corrected		Set 2: CPAU identified and corrected		Set 3: Audit physically verified		Set 3: Audit physically not verified		TOTAL
Billed	Under	Over	Under	Over	Under	Over	Under	Over	ERRORS
Under $100	5	0	0	0	0	0	0	0	**5**
$100-$199	6	0	14	0	3	89	3	4	**119**
$200-$299	11	0	2	0	0	0	0	0	**13**
$300-$399	4	0	20	0	5	2	3	5	**39**
$400-$499	89	0	11	0	0	0	0	0	**100**
$500-$999	0	0	78	1	82	12	49	17	**239**
Over $1,000	0	0	0	0	14	6	21	21	**62**
TOTAL	**115**	**0**	**125**	**1**	**104**	**109**	**76**	**47**	**577**
APPROX	**$45,000**	**$0**	**$57,000**	**$900**	**$82,000**	**$43,000**	**$77,000**	**$46,000**	**$351,000**

Source: CPAU billing records and auditor's reconciliation of customer errors by backbill/refund range.

Key Recommendations to the City Manager's Office:

- CPAU should review, investigate, and correct water meter record and billing errors.
- CPAU should explore options for addressing equity when making changes to customer meter sizes and establish a policy and procedure for such.
- CPAU should implement a temporary monitoring or reporting system to detect and identify inconsistencies that may result in billing errors, and address these issues when migrating to the new ERP system.

Finding 2: CPAU has installed 1,178 water eMeters throughout the City; however, there are no testing standards and the accuracy, performance, and reliability of these meters are uncertain. (Page 13)

CPAU did not adequately evaluate, test, and transition the new eMeters into the City's Water infrastructure. The American Water Works Association (AWWA), the water industry's authoritative resource, has not established eMeter standards or testing requirements for electronic meters. CPAU batch testing of the eMeters resulted in an 83 percent failure for one or more of the three flow tests. The results also show that many of the eMeters failed at ranges much greater than the accepted +/-1.5 percent.

Key Recommendations to the City Manager's Office:

- CPAU should develop a policy and procedure for transparent reporting of significant, systemic, infrastructure changes to Council for approval.
- CPAU should seek direction and approval from Council regarding the existing installed eMeters and before proceeding further with the installation and use of eMeters or any other electronic meter.

Finding 3: Purchasing of water eMeters did not conform to standardization and sole source policies, and eMeter expenditures were not monitored. (Page 17)

CPAU decided in late 2012 to systematically replace the City's water meter infrastructure to eMeters and did not process a request for new product standardization. ASD Purchasing approved the eMeters as a renewed sole source request, which allowed the eMeters to bypass the purchasing policy and procedures for new products. After the sole source approval, neither CPAU nor ASD Purchasing monitored eMeters expenditures, which resulted in the estimated annual contract amounts being exceeded.

Key Recommendations to the City Manager's Office:

- ASD Purchasing Division should clarify its purchasing policy and procedures for new and renewals of product standardization and sole source, and retrain appropriate ASD and CPAU staff.
- Determine roles and responsibilities and develop a procedure for tracking sole source purchases to prevent the overspending of approved amounts.

TABLE OF CONTENTS

ABBREVIATIONS

ACL	ACL™ Analytics software
ASD	Administrative Services Department
AWWA	American Water Works Association
CCF	Hundred Cubic Feet
CIP	Capital Improvement Project
CPAU	City of Palo Alto Utilities
eMeter	Electronic Meter (Badger E-Series Ultrasonic Water Meter)
ERP	Enterprise Resource Planning
FY	Fiscal Year
SAP	SAP Enterprise Resource Planning System
URR	Utility Rules and Regulations

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INTRODUCTION

Objective

The audit objective was to determine if water utility customers were accurately billed for their water meter type, size, and related adjustments.

Background

The City of Palo Alto operates its own utilities, including electric, fiber optic, natural gas, water, and wastewater services, which are managed through the City of Palo Alto Utilities Department (CPAU).

In Fiscal Year (FY) 2016, annual revenues for the Water Fund totaled $37.6 million for 20,633 installed meters, and 3,809,719 CCF (hundred cubic feet) of water was consumed. CPAU primarily uses the City's SAP Enterprise Resource Planning system (SAP) to store and maintain meter records and to process utility bills and adjustments.

Sample Utility Bill

Exhibit 1 is an excerpt of a sample utility bill issued to customers monthly. The details related to water are: 1) meter number, 2) consumption, and 3) size of meter charge.[1]

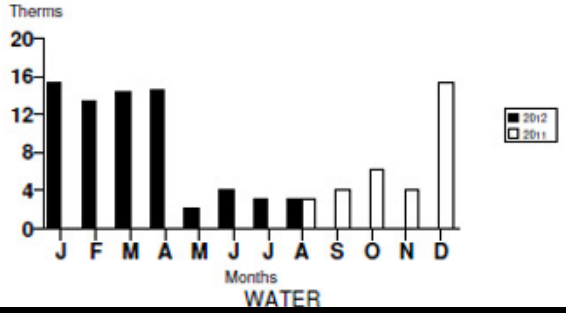
EXHIBIT 1
Sample Utility Bill

Billing Details for Current Period

Meter Reading Information (A = Actual Read E = Estimate Read)						
Service	Meter Number	Meter Reads Current - Prior	Reading Difference	Meter Multiplier	Therm Factor	Units
ELECTRIC	41363	49621A - 48958A	663	1		663 KWH
GAS	54358	737E - 735A	2	1.017	1.027	2.089 THM
GAS	54358	738A - 737E	1	1.017	1.027	1.044 THM
WATER 1	38644	1701A - 1687A	14	1	2	14 CCF

3

WATER	
1 INCH METER MONTHLY CHARGE	27.35
W1 RATE CHARGE	83.72
SEWER	
S1 WASTEWATER	29.31
REFUSE	
ANNUAL CLEANUP DAY	2.17
HOUSEHOLD HAZARDOUS WASTE	1.07



Source: CPAU website http://www.cityofpaloalto.org/civicax/filebank/documents/30586

[1] A full sample utility bill can be found at http://www.cityofpaloalto.org/civicax/filebank/documents/30586 and Appendix 1.

Responsibilities of divisions within CPAU

Four divisions in CPAU have responsibilities that affect water utilities and its customers:

- ***Customer Support Services*** operates a responsive customer call center and manages the mailing of customer bills, inquiries, and complaints, which includes ensuring accurate, clear, and timely meter reading, billing, and credit and collections functions.
- ***Engineering*** develops specifications and approves meters and meter materials for installation and use.
- ***Operations*** tests, installs, and maintains appropriately sized meters and meter materials, and enters the meter size in the billing system.
- ***Resource Management*** manages utility rates, rate schedules, and rate multipliers in the billing system.

Utilities Rules and Regulations and Rate Schedules

Utility Rules and Regulations (URR) and rate schedules are approved and adopted by resolution of the Palo Alto City Council to inform customers of all City utility rules, regulations, and rates. They are publicly posted and updated periodically on the City's website: (http://www.cityofpaloalto.org/gov/depts/utl/about/rules.asp) (http://www.cityofpaloalto.org/gov/depts/utl/residents/rates.asp)

American Water Works Association Guidance

The American Water Works Association (AWWA), founded in 1881, is the largest organization of water supply professionals in the world, and is the authoritative resource on safe water. The AWWA provides standards, manuals, and guides on selecting, installing, testing, and maintaining water meters. The AWWA states that "meter accuracy is influenced in three principal manners:

1) The physical accuracy of the meter as a flow measuring device;
2) The appropriate sizing of the meter to fit the customer's consumption profiles; and
3) The appropriate type of meter to best record the variations in flow."

Scope

This audit is a continuation of and should be used in conjunction with the prior Utility Meter: Procurement, Inventory, and Retirement audit, published in March 2015. That audit reported that data discrepancies and errors occurred because CPAU had not established adequate processes and procedures for organizing and setting up meters in SAP. This included having incorrect, missing or incomplete meter information. There was a lack of procedures to prevent errors and a lack of emphasis on maximizing the use of SAP to ensure the accuracy of customer billings. As a result of those

findings, we included a physical verification of meters at select locations in this audit.

We used billing information to verify the accuracy of the installed water meter size to the meter size billed to the customer. We looked at all water meters billed as of June 2016 that had an installation record that showed a different meter size than the billing record and went onsite to physically verify the meter size. We also reviewed the purchasing process for the electronic meters (eMeter) that are used throughout the City. The eMeter is an emerging technology that uses an ultrasonic technology to measure the amount of water passing through a meter.

Methodology

To accomplish our audit objective, we:

- Conducted a risk assessment to identify and prioritize utility billing risks and conducted preliminary field work with CPAU staff to narrow the scope of work.
- Referred to the previous Utility Meters: Procurement, Inventory, and Retirement Audit, issued in April 2015, and used the knowledge gained to identify areas of risk and concern.
- Interviewed and obtained information from CPAU staff responsible for processing and adjusting utility bills, rate and rate schedules, meter reading, and the City's SAP system to gain an understanding of the relevant data, system configurations, workflows, policies, and procedures.
- Extracted billing invoice and water meter data from SAP and used ACL™ Analytics software (ACL™) to match and compile one complete data set.
- Reviewed manuals, published audit reports, and industry expert presentations to determine industry use and confidence level of water eMeters.
- Discussed the testing, installation, and use of eMeters with other utility companies to compare and determine industry opinion regarding the use of electronic meters and their standards.
- Participated in meetings with Badger, manufacturer of the eMeters, and Mars, the water meter test bench vendor, to obtain an opinion regarding the adequacy of the City's meter testing procedures and to discuss eMeter concerns.
- Met with CPAU staff to discuss the audit results and to identify the cause(s) of the billing errors.

Sampling methodology

We initially selected a statistical sample of meter records, by address, for all meters – electric, gas, and water – installed as of June 2016. Using the MaCorr (www.macorr.com) statistical calculator, we selected a 95 percent confidence level, 5 percent confidence interval, and population of 75,000 meters. This yielded a statistical sample of 383 meters, of all types, by customer address.

In coordination with CPAU staff, we preliminarily began to verify the accuracy of these meters by address and subsequently narrowed the focus of this audit to only water meters.[2] During the early stages of our physical verification and analysis of water meters from our sample, we identified a specific type of error - meter size - which led us to generate a report from SAP that identified all water meters that had an installation record that showed a different meter size than the billing record. We physically verified the actual meter size of the 540 meters listed on the SAP report.

We reviewed the City's water meters records and focused our analysis on identifying discrepancies that could result in billing errors. We inspected the water meters that had discrepancies between any of the following:

1. The Meter Shop's and Purchasing's ***purchased water meter records***.
2. The ***inventory records*** that show the receiving and stocking information of the water meters
3. The ***installed water meter records*** by meter material number, serial number, model number, meter size and type description, and installation location.
4. The June 2016 ***final billing records***, by meter number, billing rate type, and charges for meter size.
5. The ***physical meter*** installed at the location by meter size and meter type.

We reviewed the City's and water industry standards for water meter accuracy and compliance with performance requirements. We also reviewed the utility billing workflow process for quality control and quality assurance procedures that would help prevent, identify, verify, and correct billing errors.

[2] We will review the accuracy of electric and gas billings in a later audit.

We did not verify the individual parts and components of the water meter and instead assumed that the register was the same size as the meter.[3] Our visual inspection of the meter size was based on the manufacturer's model number or the register number.

Data reliability

We combined reports from SAP, ACL™, and Excel to assess the accuracy and completeness of water meter size data and interviewed staff who were knowledgeable about the data. We identified data reliability concerns that became the focus of our audit. These concerns are addressed in the audit findings.

Compliance with government auditing standards

We conducted this audit in accordance with our FY 2016 Annual Audit Work Plan and generally accepted government auditing standards. Those standards require that we plan and perform the audit to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions based on our audit objectives. We believe that the evidence obtained provides a reasonable basis for our findings and conclusions based on our audit objectives.

We would like to thank management and staff in the Utilities Department, particularly the Utilities Customer Service Division, and the Administrative Services Department-Purchasing Division for their time, cooperation, and assistance during the audit process.

[3] The displacement meters used by CPAU have a seated register unit that can be opened for repairs, recalibration, or replacement. The registers used should be the same size as the base of the meter for accurate and efficient functionality.

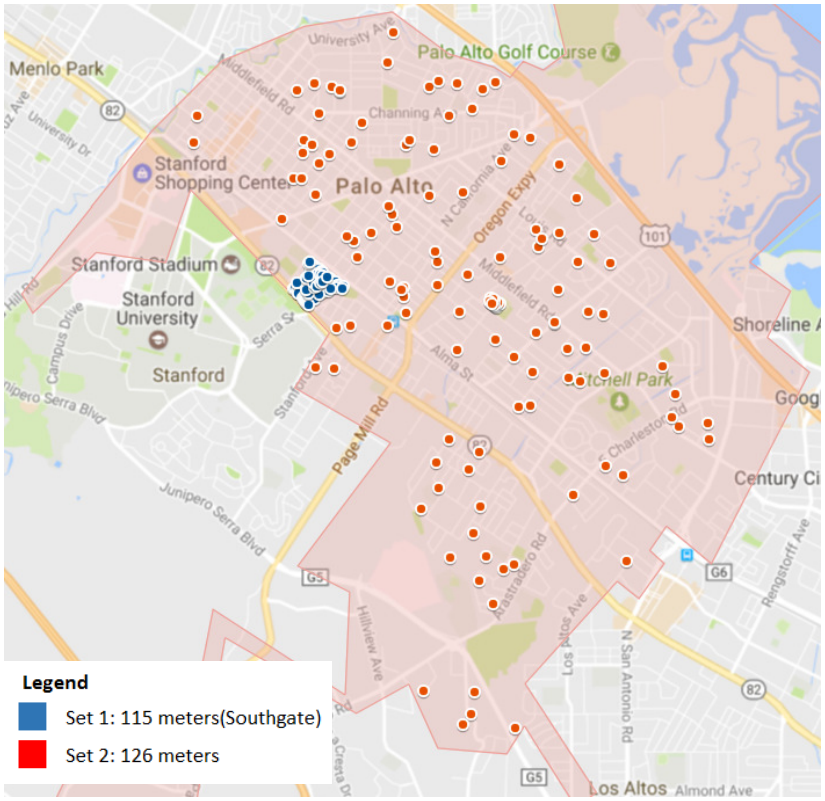
Finding 1

CPAU has not adequately prevented, detected, nor corrected water meter billing errors.

Summary

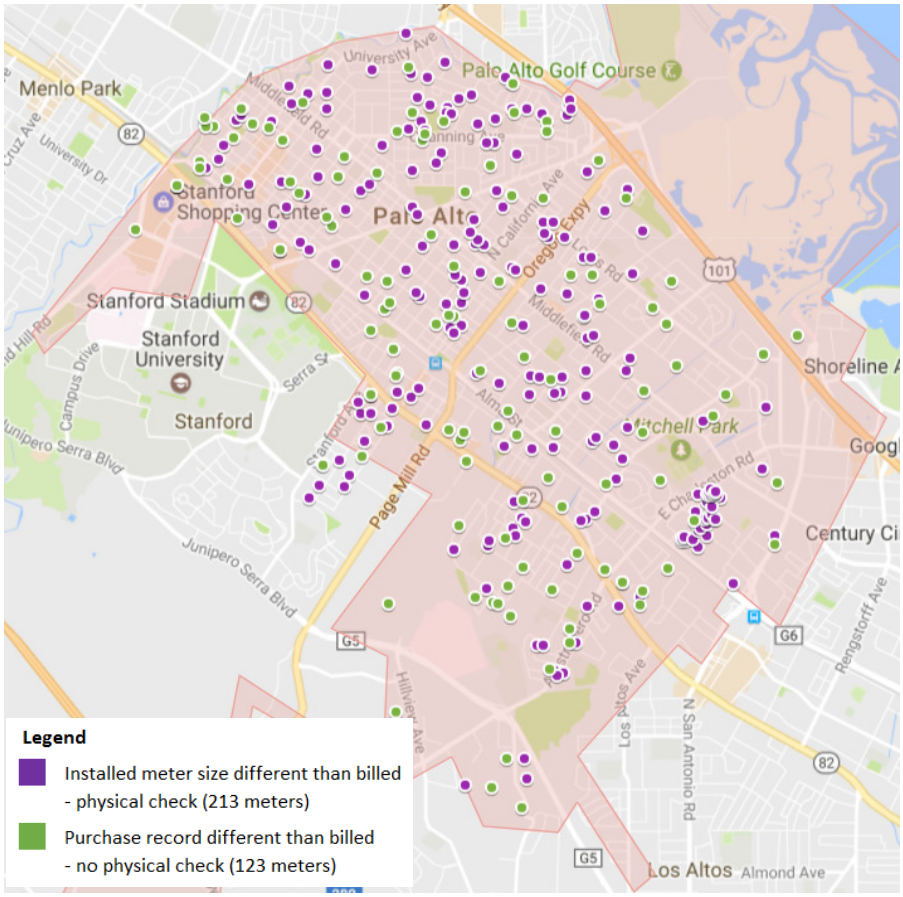
CPAU utility customers are charged monthly for water service based on water consumption and meter size. Finding 1 compiles 577 billing errors, 2.8 percent of 20,633 installed meters, for customers who received adjusted bills because their monthly water meter size charge was billed incorrectly. CPAU previously identified errors for two sets of customers, in December 2014 (Set 1) and June 2015 (Set 2), and adjusted 115 and 126 bills, respectively. We identified 11 additional adjustments that need to be made in Set 1 and corrections to 5 adjustments that need to be made in Set 2. We identified and verified another 213 billing errors and an additional 123 potential errors that we did not verify (Set 3). The verified errors for all three sets total $227,900, which includes $184,000 in underbillings and $44,000 in overbillings. The 123 unverified potential errors include up to $77,000 of underbillings and $46,000 of overbillings. Exhibits 2 and 3 show the location of all three sets of billing errors. Exhibit 4 shows how many customers were under- or overcharged by dollar range and the errors in total dollars.

EXHIBIT 2
Map of Water Meter Billing Errors Identified and Corrected by CPAU



Source: CPAU billing records and auditor's reconciliation of customer errors, by address, plotted on Google Maps.

EXHIBIT 3
Map of Additional Water Meter Billing Errors Identified During Audit



* Four purple and two green locations are not represented in the map. These are located in the lower half of the map in the foothills area.

Source: CPAU billing records and auditor's reconciliation of customer errors, by address, plotted on Google Maps.

EXHIBIT 4
Undercharges and Overcharges of the 577 Water Meter Billing Errors by Set

Under-/ Overbilling Range	Set 1: CPAU Identified and Corrected		Set 2: CPAU Identified and Corrected		Set 3: Audit - Physically Verified		Set 3: Audit – Potential Errors; Not Physically Verified		TOTAL ERRORS
Billed	**Under**	**Over**	**Under**	**Over**	**Under**	**Over**	**Under**	**Over**	
Under $100	5	0	0	0	0	0	0	0	**5**
$100-$199	6	0	14	0	3	89	3	4	**119**
$200-$299	11	0	2	0	0	0	0	0	**13**
$300-$399	4	0	20	0	5	2	3	5	**39**
$400-$499	89	0	11	0	0	0	0	0	**100**
$500-$999	0	0	78	1	82	12	49	17	**239**
Over $1,000	0	0	0	0	14	6	21	21	**62**
TOTAL ERRORS	**115**	**0**	**125**	**1**	**104**	**109**	**76**	**47**	**577**
TOTAL VALUE	**$45,000**	**$0**	**$57,000**	**$900**	**$82,000**	**$43,000**	**$77,000**	**$46,000**	**|$351,000|**

Source: CPAU billing records and auditor's reconciliation of customer errors by backbill/refund range.

Our audit of utility meter procurement, inventory, and retirement, which we published in March 2015, focused on the importance of having accurate meter data to ensure accurate customer billings. This finding focuses on demonstrating the effect of inaccurate meter data by showing how it affected customer billings and identifying the root causes.

Set 1, November 2014: 115 errors in the Southgate neighborhood (blue dots in Exhibit 2)

In November 2014, CPAU notified 115 customers in the Southgate neighborhood that it had been charging the lower monthly flat rate for a 5/8-inch meter rather than the rate for the 1-inch meter that was actually installed. Southgate has 235 homes. A City meter reader identified the initial error in February 2014 at a single service location. CPAU staff investigated and determined that the error was the result of a major capital improvement project (CIP) completed in 1998. The CIP project involved replacing and upgrading the main water line and upgrading some customers' water meters from 5/8-inch to 1-inch meters. CPAU backbilled customers a total of $45,000 in errors. See blue dots in Exhibit 2 and the detailed breakdown of Set 1 under- and overbillings in Exhibit 4. CPAU's efforts were incomplete:

- CPAU did not correct prior billings for 11 of the 115 customers. These billing adjustments should have been made to cover the three-year retroactive period to be consistent with other customer adjustments and the City's policy for retroactive billing.
- CPAU did not identify or correct another billing error in the Southgate neighborhood but this address was not part of the CIP project.

Meter sizing not consistently applied

Equity should be considered when changing meter sizes or setting meter rates. This is of particular concern because the differences in fixed meter size charges have increased significantly over time. Before 2011, the monthly difference was $1.50 between a 5/8-inch and 1-inch meter ($5.00 versus $6.50); however, in 2017 the monthly difference is $17.49 ($16.77 versus $34.26). Although the difference was not significant when CPAU upgraded the Southgate water meters, it has become significant over time. This raises the question of whether two neighbors in similar homes, right across the street from each other, should be paying different meter rates. If so, should the difference be as significant as it has become. It also raises a question of whether CPAU should have looked at the impact of that difference on residents when it first noticed the meter errors in Southgate.

CPAU's Rules and Regulations 15 that was in effect during the CIP project said, "In order to render utility service to all customers at standard rates and under *equitable* [Auditor's emphasis] and nondiscriminatory service conditions, the City will serve all premises directly …" Although that language was deleted when Rules and Regulations 15 was updated in July 1998, AWWA guidance states that one of the three principals influencing meter accuracy is "the appropriate sizing of the meter to fit the customer's consumption profiles." AWWA also addresses the need to "charge each customer equitably." Because CPAU was not able to provide a reasonable explanation to us for the upgrade of some, but not all customers to a 1-inch meter, we question whether they considered equity to customers when they made the change. There is no policy or process for determining, documenting, and notifying customers of changes to their meter size and the resulting effect on their rates or whether changes in meter rates consider equity for customers who live in similar homes but have different meter sizes.

Set 2, June 2015: 126 errors throughout Palo Alto neighborhoods (red dots in Exhibit 2)

CPAU adjusted another 126 customer bills in June 2015 for incorrect monthly meter size charges. CPAU described these incorrect billings in the notification letter to customers as the result of "a meter replacement that was completed years ago." CPAU replaced 5/8-inch water meters with a larger 1-inch meter and did not change the monthly meter size charge in the billing system. Of the 126 customers, 1 was overbilled $900 and 125 were underbilled a total of $57,000, for a total of |$58,000| in errors. The net effect to the water utility, after correcting the billings, was a $56,000 increase in revenue. See red dots in Exhibit 2 and the detailed breakdown of Set 2 under- and overbillings in Exhibit 4.

CPAU incorrectly processed 5 (4 percent) of the 126 billing adjustments. The customers received adjusted bills, but CPAU did not change the meter rate for future charges; therefore, the billings continued to be incorrect after the billing adjustment. Although all 5 have an incorrect bill code rate, 3 of the 5 also have meter purchasing or inventory records that do not match the physical meter size.

Set 3, Finding: 213 additional errors (purple dots in Exhibit 3)

We identified 213 (39 percent) of the 540 meters that we physically inspected where the size did not match the customer billing.[4] See purple dots in Exhibit 3 and the detailed breakdown of under- and

[4] The meter sizes we selected for visual inspection were 5/8-inch, 3/4-inch, 1-inch, 1-1/2-inch, and 2-inch; however, billing adjustment calculations included a few meter sizes larger than 2-inch.

overbillings in the Set 3 – Physically Verified column in Exhibit 4. Of the 213 customers, 109 were overbilled a total of $43,000 and 104 were underbilled a total of $82,000, for a total of |$125,000| in errors.

Most of the errors are due to 1) Manual data entry being required at four data entry points by different groups because SAP was not configured for full system integration, which created opportunities for error, and 2) a lack of monitoring processes to compensate for this control weakness. Examples of the causes for the errors include:

- The Meter Shop changed a water meter to a different size but did not notify Customer Service/Billing to change the customer's billing rate.
- Meter Shop staff did not or could not verify the meter record information in SAP and assumed the size of the meter being installed was correct in the inventory records when they physically replaced a meter.
- Customer Service staff changed the rate code for the meter size in SAP, although we were unable to determine the reason why.

123 potential errors based on meter size discrepancies stated in the meter badging records versus the billing records (green dots in Exhibit 3)

We verified 15,548 (75 percent) of the 20,633 installed meter records against the Meter Shop's meter badging records and the Administrative Services Department's (ASD) purchasing records. 123 (0.8 percent) of the 15,548 installed water meters did not have meter badging records that matched the inventory record or the billing record and, therefore, are potential billing errors. We discovered these errors after completing our field work and did not physically inspect these meters. See green dots in Exhibit 3 and the detailed breakdown of under- and overbillings in the Set 3 – Not Physically Verified column in Exhibit 4. Of the 123, 47 customers were overbilled a total of about $46,000 and 76 customers were underbilled a total of about $77,000. The combined total potentially represents |$123,000| in errors.

We could not verify 5,085 (25 percent) of the City's 20,633 meter records because CPAU did not have the meter badging records or matching purchasing records prior to 1995.

Data reliability concerns for 677 record discrepancies for meters larger than 2 inches

Although we did not physically inspect water meters larger than 2 inches, we identified 677 meter record discrepancies related to fire service and hydrant meters. The meter record discrepancies and inconsistencies consists of:

- Meters not assigned to a customer.
- Incorrect classification of meter material type.
- Incorrect bill code rate to size of meter in inventory records.
- Different meter sizes in different record fields in SAP for the same meter number.

Although most of these data errors will not result in a billing adjustment because they are fire service and hydrant meters, CPAU should investigate further and correct both the billing, if erroneous, and the data records to ensure data accuracy when CPAU migrates data to a new customer information system. As CPAU makes corrections and improvements, they should refer to CPAU Utilities Rule and Regulation 15: Metering, which states that "An accurate record will be kept by CPAU . . . such record will be the basis for determination of any bill rendered for Service."

Quality assurance is lacking for systemic issues that occur prior to the billing process

Quality Assurance, making sure you are doing the right things the right way, is lacking for the water meter process and there is little accountability or oversight over the workflow process.

Most of these errors occurred well before reaching the billing process and could have been prevented if manual controls and/or oversight reporting was in place to compensate for not having various modules of SAP integrated. A thorough cleaning of CPAU's meter data records, combined with implementing monitoring controls as preventive measures, are needed to eliminate future billing errors. Many of our concerns were also identified in the prior meter audit, Utility Meters: Procurement, Inventory, and Retirement. Both audits identify:

- A requirement for the same data to be entered multiple times due to a lack of full system integration in SAP and workflow process integration, which increases the potential for errors.
- A lack of work coordination and communication between the various CPAU divisions.
- Unclear roles and responsibilities.
- A lack of training for staff involved in meter activities.
- Unreliable and inconsistent meter data.
- A lack of processes and procedures for preventing, detecting, and correcting errors.

In response to a status report request to Council regarding the error Sets 1 and 2, CPAU staff stated that the "Utilities Billing

Division has been working with our meter shops to implement a new business process for meter replacements. We are providing additional staff training, focusing on quality control, and renewing procedures for periodic quality assurance investigations. These billing adjustments are part of our overall process of improving data accuracy in the billing system." Additionally, the Utilities Water Meter Shop has improved its process for removing and replacing meter installation records in the SAP system. This process change appears to have significantly minimized the potential for future errors. We recognize and commend CPAU for the changes and enhancements made thus far and encourage CPAU to continue with their efforts to further address our concerns.

Recommendations

We recommend that the CPAU:

1.1. Correct the billing errors identified.

1.2. Investigate each of the 123 water meters that do not match the meter purchasing record, determine if a record or billing correction is required, and correct accordingly.

1.3. Review and correct the meter record errors identified for meter sizes larger than 2 inches.

1.4. Explore options for addressing equity when making changes to customer meter size rates and establish a policy and process for determining, documenting, and notifying customers of changes to their meter size and, if appropriate, the rate change associated with the new meter size.

1.5. With the understanding that CPAU will be migrating to a new Enterprise Resource Planning (ERP) system:

   a. Implement a temporary monitoring or reporting system to identify record discrepancies that may result in billing errors and correct as discrepancies are identified.

   b. Ensure that the new ERP system will have automated controls in place to prevent such discrepancies and identify them if they do occur.

Finding 2

CPAU has installed 1,178 water eMeters throughout the City; however, there are no testing standards, and the accuracy, performance, and reliability of these meters are uncertain.

Summary

CPAU did not adequately evaluate, test, and transition the new eMeters into the City's Water infrastructure. The American Water Works Association (AWWA), the water industry's authoritative resource, has not established eMeter standards or testing requirements for electronic meters. CPAU's batch testing of the eMeters resulted in an 83 percent failure for one or more of the three flow tests. The results also show that many of the eMeters failed at ranges much greater than the accepted +/-1.5 percent.

eMeters: an emerging technology in water meters

In October 2013, CPAU began replacing displacement meters with Ultrasonic E-Series meters (eMeter), with the intent to eventually replace all existing meters with the eMeter. By July 2016, 1,178 eMeters, representing 5.7 percent of all water meters, were installed at customer locations and used to measure water usage for billing purposes.

Electronic meters are an emerging technology and do not yet have broadly accepted industry standards for testing or customer billing. The eMeter uses an ultrasonic technology while the commonly used displacement meter relies on the water passing through the meter.

No water industry standards for electronic meters and inconsistent engineering specifications

The AWWA is the authoritative resource on safe water, and provides standards, manuals, and guides on selecting, installing, testing, and maintaining water meters. The AWWA does not currently have a standard for eMeters, and based on their knowledge, a standard on electronic water meters for revenue applications does not exist. As a result of not having any standards, there are also no testing standards for assessing the accuracy and performance of eMeters.

Nevertheless, CPAU has been testing the eMeters using the AWWA standards established for, and a test bench designed for, displacement water meters. The City's Engineering Water Specifications require the use of eMeters, while the Engineering Standards (Section 02660-2.04) inconsistently state that "Water meters shall be of the cold water displacement type and shall comply with AWWA Standard C700 . . ." and its testing guidelines." CPAU did not adequately evaluate, procure, test, nor obtain correct approval, and transition the new eMeters into the City's Water infrastructure, as further discussed in Finding 3.

CPAU did not test eMeters timely and did not use adequate testing standards

CPAU purchased the first batch of eMeters in August 2013 and proceeded to install them despite the lack of standards. Although CPAU policy states that they are to randomly select and test 10 percent of each batch of meters within one day of receipt, the first test log data for eMeters did not occur until almost two years after receipt of the first shipment. Of 21 eMeter shipments received, which contained a total of 1760 eMeters, CPAU tested only 100 eMeters - 3 in 2015 and 97 in 2016. CPAU tested 76 (77 percent) of the 97 eMeters in July and August 2016, during the time of this audit. Exhibit 5 shows that:

- CPAU tested meters in only 10 (50 percent) of the 21 shipments and none in any of the 11 other shipments.
- CPAU tested less than 10 percent of the meters in 7 of the 10 shipments that it tested.
- CPAU did not test the majority of meters in the 10 shipments until 86 to 815 days after receipt; it tested only 7 (0.7 percent) of the 1,025 meters in the 10 shipments within one day of receipt.

EXHIBIT 5
Number and percentage of water meters tested by shipment

Meter Shipment	Number of Meters in Shipment	Number of Days to Inspect	Number of Meters Tested in Shipment	Percent of Meters Tested in Shipment
1	32	815 days	2	6%
2	28	465-795 days	8	29%
3	267	715-743 days	13	5%
4	30	703 days	2	7%
5	64	574 days	3	5%
6	30	416 days	3	10%
7	100	290-442 days	8	8%
8	400	86-360 days	8	2%
9	20	1 day	1	5%
10	54	1-151 days	52*	96%
Total	1025		100	

NOTE: CPAU did not test any of the 735 meters from the 11 other shipments, per the 10 percent random sampling procedure required for new water meter shipments.

* CPAU tested 6 of the 52 meters within one day of receipt; the remaining 46 meters were not tested until at least five months later.

Source: Purchasing delivery records of purchased eMeters and CPAU water meter testing records.

83% of 100 eMeters tested did not pass one or more of three required flow tests

Water meters are tested for low, medium, and high flow, and according to Utilities staff, meters must pass all three tests before being installed. Utilities Rule and Regulation 11, in alignment with

AWWA standards, requires meters to test within a +/-1.5 percent error tolerance; otherwise it fails. CPAU compares its test results with the manufacturer's test results and passes a meter if it is within 0.03 percent of the manufacturer's test results.

CPAU tested the water meters using an inadequate test bench, and 83 of 100 eMeters tested failed one or more of the three required flow tests. Many of the eMeters failed at ranges much greater than the accepted +/-1.5 percent, and CPAU did not have the manufacturer's test results. Exhibit 6 shows the number of tests that failed beyond the 1.5 percent acceptable tolerance level, in 0.5 percent increments, based on CPAU's testing of the eMeter using a water test bench that is compliant with standards for testing displacement, not electronic, water meters.

EXHIBIT 6
Number of Meters That Failed Testing, in 0.5 Percent Increments

FAILS beyond the 1.5 percent acceptable tolerance level	**0.5% or Less**	**0.51% to 1.0%**	**1.01% to 1.5%**	**1.51% to 2.0%**	**2.01% to 10.0%**	**10.01% or More**
Of the 100 eMeters tested, 224 low, medium, and high failed test results*	54	61	51	25	23	10

* The 224 failed test results may be within any of the three test flow categories (low, medium, or high). The percent fail is an absolute number, which may be above or below the 1.5% acceptable tolerance level.

Source: CPAU, Meter Shop water meter test results.

Due to the lack of electronic meter standards and meter testing standards, it is difficult to fully determine the accuracy and testing results for calculating the full effect. At the time of the audit, 16 of the 83 failed meters were retired, 9 were installed, and 58 were waiting in inventory to be installed.

In accordance with CPAU's Rule and Regulation 15 on Metering, "any customer may secure a test of the accuracy of the Meter serving the Customer's Premises . . . the Customer has the right to require that the test be made in their presence . . . no Water Meter will be placed in Service or allowed to remain in Service if it is found to have an error in registration in excess of one and a half percent (1.5%) under condition of normal operation." Because of the lack of test standards and a test bench for eMeters, CPAU would not be able to provide such a service, nor could anyone else, if the intent is to meet AWWA standards.

Working with the eMeter manufacturer and the test bench vendor toward resolution

The eMeter manufacturer claims accuracy and reliability of the eMeter based on their testing, despite the lack of AWWA standards. The manufacturer also indicated, however, that they custom manufactured a part for their water test bench to reduce or eliminate turbulence. This manufactured part has not been approved nor certified by the test bench vendor, and CPAU is not able to duplicate the manufacturer's test results.

The City Manager's Office and CPAU have been working collaboratively with the eMeter manufacturer and the test bench vendor. Both have made site visits to CPAU's Meter Shop and met with CPAU staff to discuss the City's concerns and review the City's meter testing procedures. Although the manufacturer and vendor have made strides to understand the City's concerns, and the City has decided to discontinue future installation of eMeters and return eMeters held in stock, 1,178 eMeters remain installed despite not having standards or test requirements.

When CPAU makes decisions about water meters, it should consider the accuracy and reliability of the meter for its customers collectively. This is consistent with AWWA guidance, which states that "Accurate water measurement is the means by which water utilities produce revenue to cover expenses, charge each customer equitably, prevent waste of water, and minimize the load on wastewater facilities."

Recommendations

We recommend that the CPAU:

2.1. Develop a policy and procedure to transparently report significant, systemic, infrastructure changes to Council, and update any CPAU Rules and Regulations that may not reflect current practice or policy.

2.2. Seek direction and approval from Council before proceeding further with the future installation of eMeters or any electronic meters.

2.3. Determine if the 1,178 installed eMeters should be uninstalled and replaced with the original displacement meter and if billing adjustments are required.

Finding 3

Purchase of water eMeters did not conform to standardization and sole source policies, and eMeter expenditures were not monitored.

Summary

CPAU decided in late 2012 to systematically replace the City's water meter infrastructure to eMeters and did not process a request for new product standardization. ASD Purchasing approved the eMeters as a renewed sole source request, which allowed the eMeters to bypass the purchasing policy and procedures for new products. After the sole source approval, neither CPAU nor ASD Purchasing monitored eMeters expenditures, which resulted in the estimated annual contract amounts being exceeded.

How the new eMeters passed the approval process

The City's Purchasing policy allows a product, such as a water meter, to be purchased exclusively through one vendor and bypass the competitive solicitation process. This is called Product Standardization and Sole Sourcing. This process requires staff in the requesting department to demonstrate that the product is necessary for the health, safety, or welfare of the City or that a significant cost savings can be realized. The Purchasing Division in ASD reviews and validates the requests before approving it as a sole-source product. Product standardization is typical of products that have been used by the City and proven to be effective and efficient in its product, maintenance, repair, modification, and training. Sole source allows the requesting department to purchase the approved standardized product from one vendor.

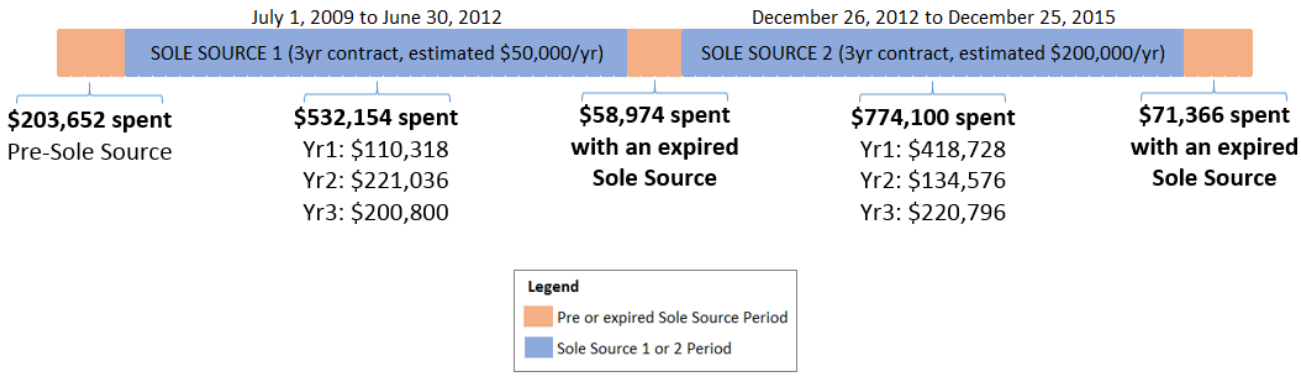
CPAU had an existing product standardization for water displacement meters, which met the Purchasing policy justification requirements and was valid through June 30, 2012. In late December 2012, Utilities Engineering submitted a request to renew the sole source and included three eMeters that Purchasing had not previously approved as a standardized product. The eMeters should have been submitted as a separate request for a new product standardization before being sole sourced.

As a result, the request did not undergo the typical rigorous new product review and scrutiny. The eMeters had not yet been used or proven within the City's water infrastructure. Both Purchasing and the City Manager's Office approved the standardization renewal request for the purchase of displacement meters and eMeters from one vendor for $200,000 per year for three years, from December 26, 2012, to December 25, 2015.

A sole source that existed prior to the renewal was approved for an estimated cost of $50,000 per year over three years, from July 1, 2009, to June 30, 2012, for an estimated total of $150,000. The second sole source, which included the eMeters, was approved for an estimated cost of $200,000 per year over three years, from December 26, 2012, to December 25, 2015, for an estimated total of $600,000.

Exhibit 7 shows 1) that the actual spending exceeded the estimated costs of both sole sources, 2) sporadic spending by year within the second sole source, and 3) spending that occurred without a sole source.

EXHIBIT 7
Timeline of eMeter Purchases



Source: SAP purchasing records

We discussed our concerns with ASD Purchasing Division staff regarding the processing of these eMeters and they acknowledged our concerns. They have made efforts to educate their staff by discussing this example at their staff meeting and are beginning to retrain staff.

Recommendations

We recommend that the ASD Purchasing Division:

3.1. Clarify its purchasing policy and procedures for new and renewals of product standardization and sole source.

3.2. Retrain appropriate ASD and CPAU staff on Purchasing policies and procedures, and completion of required forms.

3.2. Determine roles and responsibilities and develop a procedure for tracking sole source purchases to prevent the overspending of approved amounts.

APPENDIX 1 – Sample Utility Bill

CITY OF PALO ALTO UTILITIES

Account No.: XXXXXXXX
Due Date: Aug-29-2012
Amount Due: $253.88

Amount Enclosed $ . .

FIRST LAST
PO BOX 9999
PALO ALTO CA 94302

City of Palo Alto Utilities
P.O. Box 7026
San Francisco, CA 94120-7026

XXXXXXXX0000253880

CITY OF PALO ALTO UTILITIES

Customer name: FIRST LAST
Service address: 250 HAMILTON AVE PALO ALTO CA 94301

Due date: Aug-29-2012
For billing information, call: 650.329.2161

Account Number	Service Period	Service Days	Meter Read Date	Approx. Next Read Date	Statement Print Date
XXXXXXXX	07/11/2012- 08/07/2012	28	08/07/2012	09/06/2012	Aug-08-2012

Billing Summary

PREVIOUS BALANCE		$221.83	
PAYMENT(S) - THANK YOU		221.83	
BALANCE FORWARD			**$0.00**
CURRENT CHARGES	**UNITS**	**AMOUNT**	
ELECTRICITY	663 KWH	81.23	
GAS	3.13 THERMS	12.33	
WATER	14 CCF	111.07	
SEWER		29.31	
REFUSE		23.69	
STORM DRAIN		11.73	
UTILITY USERS TAX		10.22	
RATE ASSISTANCE		-25.70	
TOTAL CURRENT CHARGES			253.88
TOTAL AMOUNT DUE			$253.88

* Reminder to all customers: Accounts paid late will be subject to penalty charges.

We also accept Visa online at https://myutilitiesaccount.cityofpaloalto.org

Page 1

Paying Your Bill

For your convenience, your utilities bill may be paid:

By Mail
Please enclose the bill stub and mail to
City of Palo Alto Utilities
P.O. Box 7026
San Francisco, CA 94120-7026

At Civic Center
Revenue Collections
250 Hamilton Ave., 1st Floor
Open Monday – Friday
Normal Business Hours

Night Depository
Walk Up, Civic Center Plaza
Drive Up,
Civic Center Garage, A Level

Online
Sign Up for My Utilities Account
and pay online at:
https://myutilitiesaccount.cityofpaloalto.org

Billing Details for Current Period

Meter Reading Information (A = Actual Read E = Estimate Read)

Service	Meter Number	Meter Reads Current - Prior	Reading Difference	Meter Multiplier	Therm Factor	Units
ELECTRIC	41363	49621A - 48958A	663	1		663 KWH
GAS	54358	737E - 735A	2	1.017	1.027	2.089 THM
GAS	54358	738A - 737E	1	1.017	1.027	1.044 THM
WATER	38644	1701A - 1687A	14	1		14 CCF

ELECTRIC	
E1 COMMODITY	47.34
E1 DISTRIBUTION	31.57
E1 PUBLIC BENEFITS	2.13
STATE ENERGY SURCHARGE	0.19
RATE ASSISTANCE - ELECTRIC	-20.26

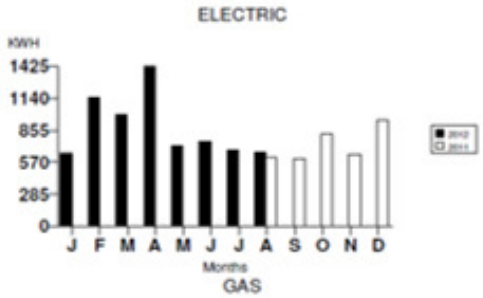
GAS	
G1 ADMINISTRATIVE FEE SUMMER	0.03
G1 COMMODITY CHARGE SUMMER	0.99
G1 PA LOCAL DISTRIB. SUMMER	1.22
G1 TRANSPORTATION SUMMER	0.21
MONTHLY CUSTOMER CHARGE	9.88
RATE ASSISTANCE - GAS	-3.09

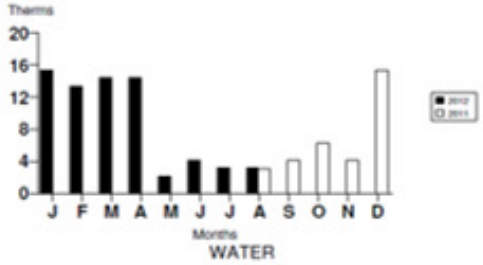
WATER	
1 INCH METER MONTHLY CHARGE	27.35
W1 RATE CHARGE	83.72

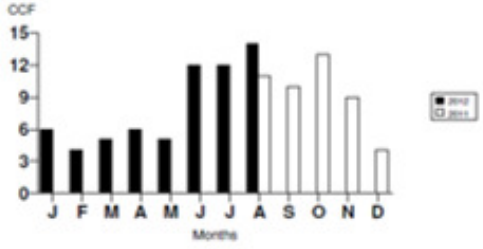
SEWER	
S1 WASTEWATER	29.31

REFUSE	
ANNUAL CLEANUP DAY	2.17
HOUSEHOLD HAZARDOUS WASTE	1.07
R1, MINICAN, 1X/WK	13.79
STREET SWEEPING	6.66

STORM DRAIN	
D1 STORM DRAIN	11.73
RATE ASSISTANCE - STORM DRAIN	-2.35







Log-in to https://myutilitiesaccount.cityofpaloalto.org for a history of your usage and utility charges.

XXXXXXXX

Utilities and Community Announcements

You may have seen these trucks around town and wondered what was going on:

- **MANESCO**---City contractors are checking gas pipelines for leaks as part of our ongoing maintenance program. The workers survey the City in sections and always carry City ID. www.citypaloalto.org/gasleaksurvey
- **HYDROMAX**---City contractors are conducting sewer inspections to check for gas line crossbores. They also carry City ID. www.cityofpaloalto.org/safeutility
- **PG&E**---has several projects underway to inspect, repair or replace sections of its natural gas transmission lines running though town. Stay updated on locations and progress at www.cityofpaloalto.org/safeutility

It's dangerous to mess with your meters! Handling meters for any reason requires proper training and tools. Avoid injury *and* paying for damaged meters by having us do the job. **Emergency?** Call (650) 329-2579 and we'll have someone out right away. **Less urgent?** Make an appointment by calling (650) 329-2161.

Toilets aren't trash cans and sinks are the wrong place for fats, oil and grease. Avoid the expense and hassle of sewer back-ups! **If a sewer back-up occurs, before you call a plumber, remember to call the City first at (650) 496-6995.** We will come out right away, determine the blockage location and verify it is safe to clear it out.

Check out our progress toward Zero Waste! Call us for details at (650) 496-5910 or visit www.zerowastepaloalto.org/progress-report to get an update and perhaps even find more ways you can join the effort.

Got Bugs? Get Answers! Make your garden and home safe for kids and pets. You can visit www.ourwaterourworld.org to learn the most effective, least-toxic methods to rid your garden and home of snails, aphids, ants, rodents and other pests. Click on "Ask the Expert" to get personal answers to your specific questions.

Visited the City website recently? You're in for a treat! Now that the newly-designed, easier-to-navigate version has been launched, you'll be able to find what you need. You also can use My Palo Alto to tailor the information you view to match your interests! We welcome your comments or suggestions, so visit www.cityofpaloalto.org today!

Your Average Daily Consumption and Cost Table

		ELECTRIC		GAS		WATER	
MONTH	SERVICE DAYS	KWHS PER DAY	DOLLARS PER DAY	THERMS PER DAY	DOLLARS PER DAY	GALLONS PER DAY	DOLLARS PER DAY
07/2012	29	23.5	2.87	0.11	0.34	309.52	2.92
06/2012	33	23.0	2.78	0.13	0.33	272.00	2.27
05/2012	29	24.7	3.08	0.07	0.28	128.97	1.07
04/2012	33	43.2	6.30	0.44	0.77	136.00	1.05
03/2012	30	33.2	4.56	0.48	0.84	124.67	1.03
02/2012	28	40.9	5.91	0.48	0.85	106.86	0.98
01/2012	33	19.7	2.22	0.47	0.81	136.00	1.05
12/2011	29	32.8	4.48	0.53	0.92	103.17	0.94
11/2011	28	22.8	2.75	0.15	0.39	240.43	2.02
10/2011	34	24.1	2.97	0.18	0.41	286.00	2.20
09/2011	30	20.1	2.27	0.14	0.37	249.33	1.70
08/2011	28	21.8	2.58	0.11	0.34	293.86	2.02
08/2012	28	23.7	2.90	0.11	0.44	374.00	3.97

CITY OF PALO ALTO
UTILITIES

APPENDIX 2 – City Manager's Response

CITY OF PALO ALTO

MEMORANDUM

DATE: August 15, 2017

TO: Harriet Richardson

Cc: Jim Keene
Lalo Perez

FROM: Ed Shikada

SUBJECT: Follow-up on the Water Billing Audit

The City of Palo Alto Utilities Department (CPAU) is committed to reliable, accurate meter readings and utility billing, and recognizes that accuracy is important in every step of the utility meter to cash billing cycle. We appreciate the City Auditor's extensive work in the preparation of this audit and acknowledge that the audit has identified a number of significant issues, in some cases developed over decades, which will require focused and coordinated effort to address.

We are equally committed to transparency and responsibility in the work required. As such, this memorandum provides an overall outline and organization of the work ahead. In summary, this work consists of the following focused areas:

- Preventing, detecting, and correcting water meter billing errors
- Filling key staff positions
- Ensuring consumer confidence in meter accuracy

While recognizing the work ahead, it should nonetheless be acknowledged since the last (2015 Utility Meter) audit, Utilities and Administrative Services have established new policies, procedures and processes to improve consistency and accuracy of meter record keeping and utility billing. Utilities has placed additional emphasis on employee training and implemented new quality control to enhance operational efficiency and mitigate errors. As noted in the new audit, these process changes have significantly minimized the potential for future errors.

Preventing, detecting, and correcting water meter billing errors

The City owns approximately 74,000 meters serving three utilities: electric, gas and water, and there are 33 different sizes and 121 different types of meters across the three utilities. The audit covered 20,600 water customers and identified 577 errors over a 20 year span, many of which have already been corrected. All utilities will have occasional billing errors due to the high volume of billing transactions. In Palo Alto, the existing SAP implementation requires extensive manual entry through a sequence of complex transactions to record meter procurement, transfer to inventory, installation, and linking to a

customer account. Given the complexity of metering systems and rate schedules, human errors are admirably low but inevitable. Our organization must therefore focus on avoiding errors to the extent possible, in combination with systemic checks to regularly detect and correct errors. We are very supportive of systemic improvements to eliminate or at least reduce errors where possible, recognizing that at some point avoiding errors alone becomes cost-ineffective and that when dealing with historical records, fields that affect billing are the priority for correction.

Prior to the 2015 audit, there was not an established system for regularly reconciling water meter-related databases as a check for errors in the billing system. A monthly reconciliation has now been established; however, given this process remains labor intensive and based on the results of this audit is apparently still not catching all error types. We welcome the auditor's review and recommendations for this error correction system.

With respect to the meter inventory and installation process, since the 2015 Utility Meter Audit staff has reengineered business processes, added quality assurance controls and developed a comprehensive SAP meter training guide. This has resulted in the low number of recent errors. Approximately 50% of the errors (Sets 1 and 2) were identified and corrected by Utilities prior to this audit.

Incorrect billings were caused by inconsistencies between meter size and billing rate records. This was the specific subject of the 2015 Utility Meter Audit. As noted above, systems have now been improved. It should further be acknowledged that at the time most of the meters were installed with incorrect size records, meter size represented a small portion of the metered utility bill. While the major driver of utility bills is customer consumption, the billing impact of incorrect size records has grown significantly over the past few years. Below is a table of the monthly service charge for 5/8-inch meter and 1-inch meter and the number of errors by fiscal year.

Rate Effective Date	Monthly Service Charge			
	5/8"	1"	Difference in rate per meter size	# of Errors
7/1/95 - 6/30/99	$ 4.00	$ 4.50	$ 0.50	167
7/1/99 - 6/30/03	$ 5.00	$ 5.63	$ 0.63	30
7/1/03 - 6/30/07	Service Chage incorporated into usage			20
7/01/07 - 9/30/11	$ 5.00	$ 6.50	$ 1.50	249
10/1/11 - 6/30/12	$ 10.00	$ 13.00	$ 3.00	30
7/1/12 - 6/30/13	$ 13.74	$ 27.35	$ 13.61	42
7/1/13 - 6/30/14	$ 14.67	$ 29.18	$ 14.51	37
7/1/14 -6/30/15	$ 15.54	$ 31.58	$ 16.04	2

From 1995 to 2007, the monthly difference ranged from $0.00 to $0.63 between a 5/8-inch meter and 1-inch meter, thus the billing differential was relatively small. Approximately 500 (86%) of the errors occurred prior to 6/30/12, when the meter rate differential was $3.00 or less. The increase in differential between the 5/8" and 1" monthly service charge is now determined through a rigorous cost of service analysis, reflecting fixed costs to provide high quality and reliable water services.

The audit's questioning of utility practices regarding changes to meter sizes is based on a unique situation that occurred 22 years ago and does not reflect current policy or process. In 1995, the

Southgate neighborhood cited in Set 1 received a water main replacement project where some water meters were relocated from rear yards to fronts. The water main replacement project abandoned mains behind properties and placed all new mains in the street. This resulted in some properties having significant service relocation from the back of the house to the front resulting in a much longer pipe from the meter to the house connection. Meters that were relocated from the back to the front of the house were upgraded from 5/8-inch to 1-inch to account for various anticipated pressure losses (longer connection pipes, elevation changes, pipe fittings). The 5/8-inch meters that were previously located in the front yard remained 5/8-inch because there was insignificant pressure impact. The situation arising out of Southgate was a unique case. Current practice for capital improvement projects is to replace meters within the project with the same sized meters.

Following the Southgate review, CPAU staff reconciled meter databases and discovered errors in water meter charges for approximately 125 customers (Set 2) in various parts of the City. These customers were erroneously undercharged for water service based on the size of the meter installed at their home. Approximately 60% or 74 accounts were the result of a service upgrade requested by the customer.

Finally, the 2015 audit was followed in 2016/17 by system reviews for other parameters such as fire services and specific sizes of meters, reviewing all 20,600 water meters in the City. As a result, staff has identified an additional 204 customers with incorrect water meter charges. These customers were either erroneously overcharged (104 customers) or undercharged (100 customers) for water service based on the size of the meter installed at their home (Set 3 – Physically Verified). Staff has physically inspected the other 123 meters identified in the audit (Set 3 – Not Physically Verified) and has confirmed 84 of the 123 accounts are being erroneously billed.

These circumstances, particularly the current billing differential resulting from the 1994 Southgate water main replacement project, raises a legitimate concern regarding the rates applied to similarly situated residents. Staff is currently reviewing policy options for addressing this issue going forward, and will develop options such as consolidating the fixed rate for 5/8" and 1" meters or establishing a special rate for consideration by the city council. These next steps notwithstanding, I remain concerned with how this information is presented in the audit. Maps provided as Exhibits 2 and 3 give the reader an impression that errors are widespread. This is extremely misleading given that cumulative errors represent less than 3% of CPAU water meters.

At this point, Utilities staff is confirming the specific addresses and errors cited in the audit. Staff will then take immediate actions to contact customers and update accounts as well as reconcile past charges. For the undercharge or backbill scenario, staff will develop options for the Council to modify current billing policy and eliminate backbilling for utility-caused errors under certain circumstances.

Staff agrees that quality assurance was lacking for systemic issues prior to the 2015 meter audit. Since then, staff has invested tremendous effort and resources to improve data accuracy in the billing system. Staff has developed new business procedures and quality assurance controls for the meter lifecycle from procurement to installation, operation, and retirement. Since the 2015 meter audit, there have only been 2 new water meter billing errors identified in the audit - a significant improvement that deserves recognition. Staff acknowledges that other errors have happened post-2015 meter audit but they have been identified and corrected as part of the daily meter to cash business process. The audit clearly points out the importance of routine reconciliations among databases, and staff is establishing a schedule and assignment of this function.

Recognizing the numerous longstanding practices involved in this issue, Utilities anticipates pursuing the following specific actions:

1. Potentially affected customers will be notified of this audit pending city council review, and that further information will be provided as it becomes available.
2. Staff will develop a recommendation for City Council review to address meter charges and backbilling for the affected customers through applicable policy revisions.
3. The procedure for monthly reconciliations of meter changes will be reviewed to ensure it comprehensively detects potential error sources across procurement, inventory, activity, and billing databases.
4. Staff will monitor the ongoing procurement for a new customer information system and enterprise resource planning system to ensure system requirements continue to prioritize minimizing manual entry through integration across databases and automated data entry.

Filling key staff positions

It should further be noted that the efforts made since the 2015 audit and resulting improvement in billing records have occurred despite staffing challenges in the water meter shop. Water meter installers are subject to significant repetitive motion, especially in their knees, and over the last twelve years all water meter repairers have experienced either extended disability leaves or transferred to other jobs. There are currently two positions designated for the water meter shop but only filled at most one for several years. The two positions have been vacant for the past six months. Other staff members have been backfilling these positions and assisting with meter testing, replacements, and new services.

The City has proposed modifying the water meter technician classification to a combination water/gas meter technician to encompass a broader range of duties and skills. This proposal is pending consultation with the SEIU bargaining unit.

Two related vacancies existing among management positions, the Water/Gas/Wastewater (WGW) Operations Manager and the Water/Gas/Wastewater Engineering Manager. Both these positions have open recruitments ongoing, but are known to be difficult to fill particularly given the absence of an approved Memorandum of Agreement with the UMPAPA bargaining unit and associated market-based compensation adjustments.

Key action items:

- Complete consultation with SEIU regarding revision to water meter technician classification
- Fill key vacant positions: water/gas meter technicians, as well as WGW operations and engineering managers
- Review and update as needed roles and responsibilities for key staff involved in ensuring meter accuracy, including procurement, inventory, testing, installation, and billing records management.

Ensuring consumer confidence in meter accuracy

When the WGW standards were updated in 2012, the Water Engineer reviewed the metering standards to determine what meters met the current needs and could be adapted to the future modernization of the system to a fully automatic meter reading and data system. Engineering considerations included fire

code changes, the anticipated modernization to advanced metering, the lighter weight and potential to reduce worker injuries.

E-Meters were very new in the market in 2013 when CPAU made them the standard. These meters use ultrasonic technology which is an established method for measuring water and other flows in pipelines (ultrasonic meters are used on high volume gas customers in the City). As the technology was new for residential water services and no specific testing methods were established, the existing accuracy standards for positive displacement meters were used for specifying the meters until standards from the AWWA are finalized. It is expected that a final standard for testing of E-meters will be available at the end of 2017. The new standards are not expected to change the accuracy requirements from those expected of the positive displacement meter with the exception that there will likely be an extended range of accuracy for low flows given the City test bench not being properly configured for these ultrasonic meters.

The audit correctly points out that a number of systemic failures occurred in the move to E-meters as the new standard. This includes inconsistency between the procurement authorization and the equipment actually purchased, and lack of testing upon delivery. In fact, until mid-2015, the City did not have an operating water meter test bench so staff relied on the manufacturers testing procedures.

The audit citation of an 83% test rate failure is not appropriate, given that the City test bench has been acknowledged as not being properly configured for these ultrasonic meters. A sampling of meters was sent to the manufacturer for testing and retested on two different test benches, in all cases the sampled meters were within accuracy limits. Our independent test bench manufacturer has also been engaged.

Nonetheless, we agree that the transition to e-meters was not executed appropriately. While Palo Alto prides itself on innovation and being on the leading edge, in this case there was inconsistency between purchasing approval granted and actual purchases. We have therefor discontinued installation of new e-meters and are developing a plan for supplemental testing and customer communications to ensure consumer confidence in CPAU's meter reading and billing practices.

In order to ensure consumer confidence in their bills and specifically e-meter reading, staff will take the following actions:

1. All customers with e-meters installed will be immediately notified of this audit, and that additional information will be provided as available.
2. Procurement and installation of e-meters will remain suspended until adoption of an AWWA standard for testing and the availability of independent test resources (either in-house or contracted).
3. Staff will address any accuracy concerns with e-meters already installed. At a minimum, any request for removal of an e-meter will be completed at no cost to the customer.

Thank you for the opportunity to provide my thoughts on this important issue. While recognizing that we have work ahead, none of this can diminish the hard work done by the men and women of the Utilities Department every day. To the contrary, this issue illustrates the importance of the conscientious and accurate work done by our staff throughout the department, such as in engineering (equipment selection), operations (field installations), customer support (billing), resource management (rate setting) and administration (technology applications). Our staff throughout the department take seriously their responsibilities, and contribute their best every day for the people of Palo Alto.

APPENDIX 2 – City Manager's Response

The City Manager has agreed to take the following actions in response to the audit recommendations in this report. The City Manager will report progress on implementation six months after the Council accepts the audit report, and every six months thereafter until all recommendations have been implemented.

Recommendation	Responsible Department(s)	Agree, Partially Agree, or Do Not Agree and Target Date and Corrective Action Plan	Status
Finding 1: CPAU has not adequately prevented, detected, nor corrected water meter billing errors.			
We recommend that CPAU:			
1.1. Correct the billing errors identified.	Utilities	**Concurrence: Agree** **Target Date: November 2017** **Action Plan:** Utilities staff is confirming the specific addresses and errors cited in the audit. Staff will then take immediate actions to rectify the overcharge situation by contacting the customers and updating their accounts with the correct meter charge as well as reconciling the incorrect charges for the past three years. For the undercharge or backbill scenario, staff plans to recommend Council approval to modify current meter billing policy and eliminate mandated customer backbilling for utility-caused metering errors under certain circumstances.	
1.2. Investigate each of the 123 water meters that do not match the meter purchasing record, determine if a record or billing correction is required, and correct accordingly.	Utilities	**Concurrence: Agree** **Target Date: November, 2017** **Action Plan:** Staff has completed an initial inspection of the 123 meters in the field. Staff will need to conduct further investigation on a few of the accounts to confirm meter type, pipe connection size, and dial register. Thus far, staff has confirmed 84 water meters did not match the meter or billing record. Staff will take the necessary actions to rectify the overcharges and undercharges.	
1.3. Review and correct the meter record errors	Utilities	**Concurrence: Agree**	

Recommendation	Responsible Department(s)	Agree, Partially Agree, or Do Not Agree and Target Date and Corrective Action Plan	Status
identified for meter sizes larger than 2 inches.		**Target Date: December 2018** **Action Plan:** In preparation for the new CIS Utility billing system and potential advanced meter deployment, staff will consider an in-house or contract service audit of the three metered services (electric, gas, water). Staff will also review and update as needed roles and responsibilities for key staff involved in ensuring meter accuracy, including procurement, inventory, testing, installation, and billing records management.	
1.4. Explore options for addressing equity when making changes to customer meter size rates and establish a policy and process for determining, documenting, and notifying customers of changes to their meter size and, if appropriate, the rate change associated with the new meter size.	Utilities	**Concurrence: Agree** **Target Date: July 2018** **Action Plan:** The audit's questioning of utility practices regarding changes to meter sizes is based on a unique situation that occurred 22 years ago and does not reflect current policy or process. The situation arising out of Southgate was a unique case and staff does not agree that this or other meter replacement practices raise equity issues. With regard to differential rates for different meter sizes, staff is currently reviewing policy options for addressing this issue going forward, and will develop options such as consolidating the fixed rate for 5/8" and 1" meters for consideration by the City Council.	
1.5. With the understanding that CPAU will be migrating to a new ERP system: a. Implement a temporary monitoring or reporting system to identify record discrepancies that may result in billing errors and correct as discrepancies are identified.	Utilities	**Concurrence: Agree** **Target Date: December 2019** **Action Plan:** a. Staff has established a monthly reconciliation report to monitor and identify inconsistent billing and meter attributes which will ensure comprehensive detection of potential error	

Recommendation	Responsible Department(s)	Agree, Partially Agree, or Do Not Agree and Target Date and Corrective Action Plan	Status
b. Ensure the new ERP system will have automated controls in place to prevent such discrepancies and identify them if they do occur.		sources across inventory, meter change activity, and billing databases. b. Elimination of redundant manual entry has already been identified as a system requirement for the new CIS system. Staff will monitor the ongoing procurement for a new customer information system and enterprise resource planning system to ensure system requirements continue to prioritize minimizing manual entry through integration across databases and automated data entry.	
Finding 2: CPAU has installed 1,178 water eMeters throughout the City' however, there are no testing standards, and the accuracy, performance, and reliability of these meters are uncertain.			
We recommend that CPAU:			
2.1. Develop a policy and procedure to transparently report significant, systemic, infrastructure changes to Council, and update any CPAU Rules and Regulations that may be outdated to current practice or affected by policy changes.	Utilities	**Concurrence: Agree** **Target Date: Immediately** **Action Plan:** Major infrastructure changes are presented to Council for approval. However, standards are technical documents that provide the general conditions and specifications for the construction of the Water Gas and Wastewater System. Updates to standards are subject to multiple levels of professional review including engineering, procurement and legal. Updated standards will be communicated to Council as informational when substantive.	

Recommendation	Responsible Department(s)	Agree, Partially Agree, or Do Not Agree and Target Date and Corrective Action Plan	Status
2.2. Seek direction and approval from Council before proceeding further with the future installation of eMeters or any electronic meters.	Utilities	**Concurrence: Agree** **Target Date: Ongoing** **Action Plan:** Procurement and installation of e-meters will remain suspended until adoption of an AWWA standard for testing and the availability of independent test resources (either in-house or contracted). It is expected that a final standard for testing of E-meters will be available at the end of 2017. The new standards are not expected to change the accuracy requirements from those expected of the positive displacement meter with the exception that there will likely be an extended range of accuracy for low flows. It should be noted the E-Meters is a specific product line, and mechanical meters may also have electronic components.	
2.3. Determine if the 1,178 installed eMeters should be uninstalled and replaced with the original displacement meter and if billing adjustments are required.	Utilities	**Concurrence: Agree** **Target Date: July 2018** **Action Plan:** All customers with e-meters installed will be immediately notified of this audit, and that additional information will be provided as available. For eMeter testing, staff will send a sampling of eMeters to independent testing companies to determine if they are performing per manufacturer specification, and based on these results will determine next steps. In addition, the Water Meter Shop has staffing challenges and does not currently have the resources required to undertake this replacement project. At this time, staff will continue to monitor the meter reads for irregularities of both the installed positive displacement and eMeters as part of the billing exception process. Staff is also developing a customer plan for addressing any	

Recommendation	Responsible Department(s)	Agree, Partially Agree, or Do Not Agree and Target Date and Corrective Action Plan	Status
		accuracy concerns with the e-meters already installed.	
Finding 3: Purchase of water eMeters did not conform to standardization and sole source policies, and eMeter expenditures were not monitored.			
We recommend that ASD Purchasing Division:			
3.1. ASD Purchasing to clarify its purchasing policy and procedures for new and renewals of product standardization and sole source.	ASD	**Concurrence: Agree** **Target Date: December 2017** **Action Plan:** Staff will update the policy and coordinate with stakeholders to ensure the policy is clear and easy to follow. Staff will then finalize the policy and disseminate to departments.	
3.2. ASD Purchasing to retrain appropriate ASD and CPAU staff on Purchasing policies and procedures, and completion of required forms.	ASD	**Concurrence: Agree** **Target Date: January 2018** **Action Plan:** In conjunction with 3.1 staff will provide training.	
3.3. ASD Purchasing to determine roles and responsibilities and develop a procedure for tracking Sole Source purchases to prevent the overspending of approved amounts.	ASD	**Concurrence: Agree** **Target Date: March 2018** **Action Plan:** The SAP system does not currently provide an automated check on sole source spending. Staff will evaluate whether the system can be configured to allow for this. If not, staff will implement manual procedures to track sole source spending.	

APPENDIX 3 – Auditor's Comments Regarding City Manager's Response

We acknowledge the efforts put forth by CPAU over the past two years and encourage them to continue with their commitment toward reliable and accurate metering and billing. We appreciate CPAU's acknowledgement of our work and audit findings.

We would like to reiterate, however, a few key points:

- The audit objective was accomplished and concludes that there is a need to look at accuracy at a systemic level, not just specific to the narrow scope of this audit. Although the current audit represents a cumulative error of only 2.7% of all water meters installed, the audit focused on a single type of error and does not identify all types of possible water meter errors. It also did not address meter reading errors. Moreover, CPAU continues to identify billing errors as it reviews and researches records and billings.
- The billing errors are not isolated to "a unique situation that occurred 22 years ago," and the same type of billing error is found throughout the City and is not contained to one neighborhood as originally stated by CPAU. The maps provided in Exhibits 2 and 3, the errors shown in Sets 2 and 3, and the chart of errors provided by CPAU demonstrate that the errors are widespread.
- Root causes of incorrect billings include a lack of processes and controls in key business areas, which increases the risk and exposure for inaccuracies. It is not limited to the SAP implementation in 2009 and its complexities, meter data management and inconsistencies, or inconsistencies between meter size and billing rate records.
- The billing errors we found were among all meter sizes within our scope of under 2-inches, not just between 5/8-inch and 1-inch meters as calculated. Focusing on just 5/8-inch and 1-inch meters minimizes the significance of the audit findings. The price increase over time, from July 1, 2007, to present, and the charge differential between the sizes over time, is significant. The chart below shows the increase in charge by size and calculates, within a range by size differential, the cost of an error by month and over 10 years.

Rate period	5/8-inch	3/4-inch	1-inch	1-1/2-inch	2-inch
7/1/2007	$5.00	$5.00	$6.50	$12.27	$19.37
Present	$16.77	$22.60	$34.26	$63.40	$98.37
Increase	**$11.77**	**$17.60**	**$27.76**	**$51.13**	**$79.00**

Range of difference in meter size error = ***$5.83 to $67.23 monthly per error***
If the error persisted for 10 years, the cost of error = ***$699.60 to $8,067.60 per error***

- Looking forward toward the City's selection and migration to a new ERP system and CPAU's Customer Information System Utility billing system, the emphasis on improved process and systems integration, accurate and reliable data management, and the application of automated controls should be strongly considered. It is important that, to the extent possible, identified system limitations and data errors do not carry over from SAP into the new system.

  Our concern regarding the use of any electronic meter (eMeter) is based upon industry standards accepted and published by the American Water Works Association (AWWA). The AWWA, which was founded in 1881, is the largest organization of water supply professionals in the world and is the authoritative resource on safe water. The AWWA provides standards, manuals, and guides on selecting, installing, testing, and maintaining water meters. The AWWA states that "meter accuracy is influenced in three principal manners:
  1) The physical accuracy of the meter as a flow measuring device;
  2) The appropriate sizing of the meter to fit the customer's consumption profiles; and
  3) The appropriate type of meter to best record the variations in flow."

  Approximately 94 percent of the 21,000 water meters throughout the city are positive displacement meters, and the CPAU's Water Gas Wastewater Engineering standards has for years and continues to cite AWWA as

the standard. However, AWWA has not yet adopted a standard for eMeters and, therefore, does not have a standard for testing the accuracy and performance of eMeters.

We acknowledge that the manufacturer performs testing on each meter and has claimed that the meters tested within the allowed variance. However, the manufacturer is using a displacement meter test bench that it modified to test the eMeters. Because there are neither industry standards for eMeters nor for testing the accuracy and performance of eMeters, CPAU (or any third party vendor) has no reliable method to verify the accuracy of the City's eMeters because we also have no way to verify the reliability of the manufacturer's modified test bench.

Lastly, CPAU partially agrees with two of our recommendations:

1) Recommendation 1.4 – Explore options for addressing equity when making changes to customer meter sizes and establish a policy and process for determining, documenting, and notifying customers of changes to their meter size and, if appropriate, the rate change associated with the new meter size.

   CPAU's response, in their memo and action item, appears to be consistent with our recommendation; however, they state "partially agree."

2) Recommendation 2.1 – Develop a policy and procedure to transparently report significant, systemic, infrastructure changes to Council for approval, and update any CPAU Rules and Regulations that may be outdated to current practice or affected by policy changes.

   CPAU's response states that "major infrastructure changes are presented to Council for approval." However, CPAU's decision to change from displacement meters to eMeters was a major infrastructure change that was not presented to Council for approval. The only process that would allow for such transparency is the purchasing process, based on a not-to-exceed purchasing authorization. The purchasing process is insufficient for providing Council the information necessary to approve significant, systemic, infrastructure changes.

We support CPAU's key action plan and targeted work to prevent, detect, and correct water meter billing errors, and ensure consumer confidence in meter accuracy. We will continue to provide assistance, by review and recommendations, as requested by CPAU.

POLICY AND SERVICES COMMITTEE TRANSCRIPT EXCERPT

Special Meeting
August 22, 2017

Chairperson Wolbach called the meeting to order at 6:06 P.M. in the Community Meeting Room, 250 Hamilton Avenue, Palo Alto, California.

Present: DuBois, Kniss, Kou, Wolbach (Chair)

Absent:

Agenda Items

2. Accuracy of Water Meter Billing Audit.

Chair Wolbach: Moving onto Item Number Two, the accuracy of water meter billing audit. Again, I'll look to the City Auditor to begin or to defer to another member of Staff.

Harriet Richardson, City Auditor: We will begin as soon as she gets that pulled up here.

Chair Wolbach: Take your time.

Ms. Richardson: Ok, there it is, ok.

Vice Mayor Kniss: I want to make sure we've got everything we need. Is the one marked number two have everything in it?

Chair Wolbach: (Inaudible)

Vice Mayor Kniss: Ok, good because it said there was another one coming and I don't know whether (inaudible)…

Ms. Richardson: It was in your Packet last week.

Vice Mayor Kniss: Ok, good. Great.

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Ms. Richardson: And the Audit, do you have the Audit Report itself? Ok.

Vice Mayor Kniss: Apparently, I'm all set.

Ms. Richardson: Ok.

Chair Wolbach: Go ahead and introduce yourself.

Ms. Richardson: Harriet Richardson, City Auditor and with me is Mimi Nguyen. She was the Senior Performance Auditor who worked on this audit, along with Deniz Tunc who has left our office. He accepted a Management Analyst position with the San Mateo County Sheriff's Office. So, I'll go ahead and start and then I will turn it over to Mimi. The objective of our audit was to determine if water utility customers were accurately billed for their water meter type, size, and related adjustments. We answered four questions to address the subject, the first one was -- are meters by their serial or badge number, size and type correctly billed to the customer? The second question was, are billing adjustments identified and adjusted correctly and the third question was, are the water meters used to measure consumption working effectively and according to standards? The fourth question was do utilities have a quality assurance quality control process to prevent, detect and correct billing errors from occurring. The American Water Works Association (AWWA) is – establishes the guiding principles that we use to inform our audit. The AWWA is the largest organization of water supply professionals in the world and the authoritative resource on safe water. Its Standards Committee provides standards, manuals, and guides on selecting, installing, testing and maintaining water meters. They have three principle manners for – that they say should be used to measure meter accuracy. The first is the physical accuracy of the meter as a flow measuring device. The second is the appropriate sizing of the meter to fit the customer's consumption profiles and the third is the appropriate type of meter to best record variations in the flow. This Audit should be used in conjunction with our prior Audit that we published in March 2015 and that was an audit of utility meters and it was the procurement inventory and retirement cycle. That audit focused on the importance of having accurate meter data to ensure accurate customer billings. This audit focused on verifying that actual billing errors and determining the root causes of data inconsistencies. There is a little bit of overlap between the audits – the two audits as you'll see as Mimi gets into some of the discussion. We focused specifically on identifying billing errors that resulted in a discrepancy in the meter size records in any of five areas. The first was the purchasing record, the second was the inventory record, the third was the installation record, the fourth was the billing record and the fifth was the physical meter installed at the location. Running a report,

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Mimi identified 540 discrepancies that could potentially result in billing errors. So I'm going to turn it over to Mimi now and she'll talk about what she found when she did her work.

Mimi Nguyen, Senior Performance Auditor: Thank you. Mimi Nguyen, Senior Performance Auditor, we found three findings in our review here and the first finding that Utilities did not adequately prevent, detect, nor correct water billing errors. Finding 2, utilities did install 1,178 E-Meters throughout the City, however, the E-Meters do not have industry standards or testing standards and the accuracy in performance and reliability of these E-Meters are uncertain. The third finding was that the purchase of these E-Meters did not conform to standardization and sole source policies and the E-Meter expenditures were not monitored. For finding one, our next two slides show how we identified the data discrepancies and the actual billing errors in SAP by looking at those five areas that we identified in the background slide. In this slide here, it shows that the E-Meter was purchased and also received into inventory as a one inch meter. We know that the E-Meter is identified as a one inch meter because the material number that is assigned to it, which is 028802 is a one inch meter. The serial badge number assigned the meter is 58817 and this meter number lets us track this meter through its entire life cycle. On this next slide, as we tracked the meter number 58817 through SAP, this slide shows that the one inch meter was installed in May 2014 replacing a 5/8-inch meter. You can see this in the change in the material number in the last row of number three and in this specific example the reason for changing the meter from a 5/8-inch to a one inch might be valid. However, the change in the step number three did not trigger a change in the price class which would have affected the billing to the customer. So, it remained as the 5/8-inch billing rather than being changed to a 1-inch bill. The work flow process did not catch the upgraded meter size and there was no manual controls or oversight to identify and correct this type of error. So, there were other variations of errors like this example that resulted in meter size billing errors; this is just one example. In—after physically inspecting and reviewing the records of all of the 520 data discrepancies that we looked at, we found that 213 of them actually resulted in billing errors. These errors were across various meter sizes as shown in this table here and although the audit report says it's a two-point seven percent error rate, we were really unable to determine a true error rate due to the various types of discrepancies in the meter data records and the various types of billing errors. The audit really attempted to identify root causes for this single type of error, not just the data discrepancies itself. We looked at addressing systemic changes that need to be made to ensure that future errors of this type are reduced or completely eliminated. It also emphasizes the need to bill customers accurately, both for the service provided as well as the equipment that they are receiving. The map here shows the location of all

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the errors that were identified as the one, two and three sets in our report. You'll see that they are not isolated and they are not contained to any one area. The meter size errors are not only widespread by location throughout the City but also in the type of data inconsistencies and the causes. So, following the audit, the Utilities Department did find an additional 204 errors – same type of errors so not only do the billing errors need to be corrected but also the data, where possible, to ensure that accurate data is migrated when utilities implement its new customer information system. So, moving to findings two and three, we have it consolidated on this slide here. Utilities did not adequately evaluate, test and transition E-Meters into the City's water infrastructure and the purchase of the E-Meters did not conform to the City's Standardization and Sole Source Policies and E-Meter expenditures were not monitored. It's important to recognize that ninety-four percent of all City water meters are positive displacement meters. The utilities water – Gas, Waste, Water and Engineering Standards do cite the AWWA as the standard for this type of meter. The AWWA however, does not have standards for the E-Meters and they don't have standards for testing and they don't have the testing method that's independent of the manufacturer. The manufacturer does test each meter and they've claimed that the meters do pass within the tolerance level – the error tolerance level but the manufacturer does test the E-Meters on a displacement meter test bench that is modified. So, because there are neither industry standards for E-Meters for testing the accuracy and performance of the E-Meters, neither utilities nor any other third party vendor has a reliable method for verifying the accuracy of the City's E-Meters. Also, we do not have a way to verify the reliability of the manufacturer's modified test bench. For findings one and two, this slide summarizes eight recommendations and you know the Utilities Department, based on these recommendations, it focuses the Utilities Department on improving the accuracy of water meter rate billings and ensuring the reliability of E-Meters prior to buying or installing any more of them. Utilities agrees with six of the recommendations and partially agrees with two of the recommendations, which are recommendation numbers 1.4 and 2.1 on Appendix Two, Pages 28 and 29. We question utilities partial agreement with those two recommendations because their response appears to be consistent with our recommendation and does not specifically say what in the recommendation they do not agree with. Regarding finding three, this slide summarizes three recommendations to the Administrative Services Department, specifically the Purchasing Division, that focuses on ensuring that the products go through the appropriate vetting process before being approved as a standardized item or sole source purchase and that sole source purchases are tracked to prevent overspending of approved amounts.

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Ms. Richardson: So, we support the Utilities Action Plan and their targeted work to prevent, detect and correct water meter billing errors and we note that they have already started taking action to do so and also, to ensure that consumer confidence in the meter accuracy. We also support ASD's action plan to strengthen its procedures regarding sole source purchases and note that they also have already started taking action to implement those recommendations. We have a recommendation – a recommended motion that Policy and Services Committee recommends that the City Council accept the utilities accuracy of water meter billing audit and that concludes our presentation and we are able to answer any questions you might have.

Chair Wolbach: Any public speakers on this? Any questions or comments from my Colleagues? I have a couple but I will defer, go ahead, Tom.

Council Member DuBois: Just so I'm clear, so in the past when we detected this we – do we refund the money to the people who were overbilled and collect the money from people that were unbilled?

Mr. Shikada: Yes, we have a window of, I think it's three years, correct? For both, the refunds as well as back charges and in the case of where there's balance owed by the customer that we can work on a payment plan through which that can be done.

Council Member DuBois: So, are we consistently applying what we did then to these new ones?

Mr. Shikada: We have, one of the issues that we identify though is in specifically this capital project that was completed in 1994 where there were changes to the valve size based upon the capital project – the construction of a new water main. That we –at the time the differential between the price for a 5.8-inch valve and a 1-inch was fifty cents and so there were logical reasons to upsize the valve. Since that time though the differential in valve – in price – the fixed price on a monthly basis has increased to roughly $17 per month. So, given how at the time the decision made sense but in hindsight, now 23–22-23-years later the differential as big as it is, we do want to take a look at that differential. So, that's an issue that we will be coming back to City Council with. As the Council Members know, our rates are set based on a pretty rigorous or extremely rigorous cost of service analysis that takes into account the various components of this system. So, we really want to ensure that as we bring back options for the Council, that we've looked at not creating more of an issue than exist in order to address on what appears to be a disparity; again, in hindsight.

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Council Member DuBois: So, are you saying that for that one neighborhood, we would treat it differently than for areas found in other parts of the City?

Mr. Shikada: That's where we're looking more deeply into it. Given that it looks like that capital project, the construction project was a one-time situation where a water main replacement actually resulted in a meter…

Council Member DuBois: That's the Southgate project?

Mr. Shikada: …exchanges – yes, that's correct.

Council Member DuBois: But that's only a subset of the errors, right?

Mr. Shikada: Correct. So that's the one circumstance under which we want to look more closely at it and where it might be justifiable to do something different, such as come up with a special rate, given the circumstances that led to those meter change outs. Otherwise to your initial point, the back billing and the refunding would apply.

Council Member DuBois: Ok, then it looks like there's a little back and forth about whether it was mostly about that project. If there was a more systemic error, have you guys agreed on a path I guess moving forward?

Mr. Shikada: I think quite frankly, I will just speak for myself and behalf of the Utilities Department and City Administration. The issue that we really took issue with was the description of the concern as an equity issue and the decision for how the meter changes were made. From Staff perspective, we really don't see that as an equity issue. It was really again, justifiable at the point in time that the decision was made and so it was really more of the characterization than anything else. With respect to – and I think beyond that, it may either be a misinterpretation or miscommunication in terms of whether how that disagreement played out because again, to your point, we do believe that there are systemic issues with the potential for human error to just exist indefinitely. Once an error was made when the installation was done, since that time and really as a result of the audit so giving credit to the City's Auditor's Office, we've now implemented regular checks. So, we've now implemented monthly reconciliation of the installation with the billing records. Now that said, it is a highly labor-intensive process so as we're going through it, there's still the potential for human error to be a part of what we need to look for. So, all of that leads to the other recommendation which is as the new Customer Information System is part of the Enterprise Resource Planning System is put together, that we really need to maximize

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the automation and minimize the likelihood that human manual data entry leads to these errors that can't be corrected later.

Ms. Richardson: I want to add something to that last comment. If you look back at Slide 4, those five different areas that we listed on Slide 4. The five different places where there could be a discrepancy, in SAP each of those are a manual point of entry and best practice is a single point of entry and that's what Ed was referring to when we're talking about the new Customer Information System. There would be a single point of entry, you enter it once and it carries through to all the different places where that meter number is used for billing and so you should automatically have a significant reduction in the error rate by only having to enter it once.

Council Member DuBois: So, I have some questions about E-meters. I assume we switched to E-Meters for a reason so what are the benefits of the E-Meters?

Mr. Shikada: Let me make sure I cover some of those, let's see. The decision was really made in 2013 and let me certainly acknowledge, as was pointed out in the audit, that there was a flawed process in how the decision was made to proceed with that. In mismatch between the initial approval and then what was purchased so the standardization and then implementing it as a new standard really wasn't – was not done correctly. With that said, the rationale for going to the E-Meters related to one, the lighter weight of the meters themselves so they are actually easier to install or remove the E-Meters. Part of for us would be worth going through is a bit of an understanding of the meters themselves. The suggestion E-Meters sounds very high tech…

Council Member DuBois: Is it like you can read the value remotely?

Mr. Shikada: Not in and of itself. The fundamentally – it's actually a brand name or a series of the types of meters that are labeled E-Meters. The primary difference is it's not mechanical in the way that it measures the water going through. It's ultrasonic so it does pings; effectively a little sonar system in there that allows the pinging to detect the rate of water flowing through the pipe. So that's the primary difference, it's the method by with (crosstalk) (inaudible)…

Council Member DuBois: Does it save us money in terms of reading water meters?

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Mr. Shikada: It could in the long term. It sets it up for what would subsequently require the transmitter in order to remote read, as well as then to have the data collection. So, it's really – fundamentally it's simply the method by which the water measurement is taken as the primary difference. That said the – recognizing that we have had a history of injuries among the meter technicians who do the installations and removals, that going to the lighter weight, it is easier to handle a meter and that was a part of the decision. I'm not seeing my notes in terms of other rationale so if Staff wants to reinforce any other reasons for that. As well as, really, the expectation that because relative to the solid state, the – really experienced that mechanical meters have in that they slow down over time and that would not be an issue with the E-Meters. So that would allow for a more consistent recording going into the future and then the last piece is, to your point, that when we do implement smart meter technology overall, this model of the meter could be retrofitted for the purpose of the automated read.

Council Member DuBois: That's kind of my main concern, I guess the Report says that we're going to put them on hold but if we're going to move to smart meter scenarios, is it really worth putting them on hold if standards are really going to come out this year? Should we just continue to acknowledge that there's an issue there but continue to install E-Meters.

Mr. Shikada: The other option that we are looking at is simply not installing anymore and so…

Council Member DuBois: But I'm saying that if you did want to go back and add the transmitter, why install meters that can't be upgraded?

Mr. Shikada: Right, so again we could just hold off on installing new meters. We do have a regular replacement schedule for meters that may be 20-years old as an example. So, in anticipation of the new standard coming out relatively quickly, we would put a hold on the routine replacement until the standard is complete. Assuming that's coming together in a timeframe that we believe makes sense and at the same time, we do place a very high priority on consumer confidence in the meters that are installed. While we're in this period before there's the independent methodology established and that we can implement that either in-house or through third party testing labs. For that reason, we believe that it would be prudent not to proceed with installing anymore.

Council Member DuBois: So, Staff is really comfortable with that?

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Mr. Shikada: Yes.

Council Member DuBois: It's not a big deal to put these on hold?

Mr. Shikada: Correct, correct. I think that given the relatively short timeframe in anticipation, that holding on installing new should be fine in terms of any risk associated. If there are mechanical problems with other meters, then since those would be a one off replacing those with mechanical meters would be the approach in the short term.

Council Member DuBois: Thank you and then – so I guess you're just really asking us to accept this Motion not to – I guess there's agreement on moving forward and we're just accepting the Report tonight?

Ms. Richardson: That's generally the approach, yes. I guess the one thing that I would ask us to look at is whether those partially agrees based on the response should be changed to agrees. The responses do read like they agree and I'm not sure what isn't…

Council Member DuBois: Well, before we go there…

Mr. Shikada: Just objecting to the equity term.

Council Member DuBois: Before we go there, it looked like you had an update on E-Meter.

Mr. Shikada: Oh yes, just one other rationale for going to the E-Meters is that the technology has a better sensitivity to extremely low flow. So to the extent that our residents are implementing more and more water conservation, that it allows us to have a more accurate read out at that low end.

Council Member DuBois: Ok, thank you.

Mr. Shikada: There is a picture in the presentation – let me see.

Chair Wolbach: Yeah, Liz.

Vice Mayor Kniss: Yeah on Slide 10. If I may, I'm kind of looking for some show and tell here.

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Ms. Richardson: (Crosstalk) Then the Executive Summary on…

Vice Chair Kniss: When we have meetings like this, is it possible to bring these devices with you?

Mr. Shikada: Yes, we should have thought of that but did not, but we would be certainly happy to do that if that's desired at the full Council. Just to give you a sense of scale, the displacement meter as it's labeled here is the mechanical meter. It's about this big, we're talking about either a 5/8 or 1 inch.

Vice Mayor Kniss: That's the one that most residences have?

Mr. Shikada: Correct, it's either 5/8 or 1 inch; let's see, I remember the numbers – I think we have about – is it about 15,000 of the 5/8 -inch and about – is it 1,000 or less of the 1 inch? 1,000 of the 1 inch so relatively speaking there are a lot more of the 5/8-inch meters than the one inch. That's actually the test bench so that's the set up that exists on the municipal services center on the yard. So next year, we will make sure they put that on the tour so you can see where the meters are actually lined up and they're tested. They go through a low flow test, a moderate flow test, and a high flow test and we compare the reading on the meter to the measured quantity of water that goes through. Our standard procedure is to test ten percent as they come in. At the time that the majority of the errors happened, we actually did not have a functional test bench in place. There were some moves that were happening at the yard and as a result, it was not operational. I believe we might have also not had water meter techs at that time due to attrition or moving people to other positions. So, for a number of reasons, this was not done correctly and so we've now put the systems and people back in place although we still do have vacancies in the water meter tech classifications, as well as a couple of the key management positions that would be responsible for overall management of this as a program.

Vice Mayor Kniss: So less specific and more general, how many people do you get who call mentioning their water bill and how high it is and how awful? Is – I hear that a lot as a Council Member and people say, you can't believe what my water bill was, it was unbelievable.

Mr. Shikada: I know that (crosstalk)…

Vice Mayor Kniss: I usually tell them to call you, Ed.

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Mr. Shikada: Absolutely and they do. Now that said, I'd like to say that there are at most a handful a year that actually have unusually high and by unusually high I'll say two or three 'x' of their normal monthly amount. There are, I'm sure more frequent complaints raised about smaller increases but we also have on an ongoing basis what's called an implausible check. So as the meter readers go out, they – whether it be through data entry, error or simply for some reason unusually high reads. The system does flag a read that just doesn't seem in range and so those will result in follow up from Staff to the customer.

Vice Mayor Kniss: Would there be any way to tell, I don't know how smart this E-Meter is if you are away – if you had gone somewhere and something overflows. Your washer overflows, which it just recently did with a friend, are there any indications that we get something is amiss in somebody's house or is that just you wait till you come home?

Mr. Shikada: Well, not the E-Meters do provide the ability to identify some unusual flow that suggests that there is a leak. We haven't implemented all of the features including the transmittal or transmission of the information so we're not there yet but that is the path we're on and where we would like to get. If nothing else, this does point out with your example, the potential that the technology and the automation have to improve not only the accuracy but also the quality of the services that are provided to catch leaks as an example. We do have a prior referral on the topics of leaks that Staff is working on and we hope to bring back to Council within the next month or two. At the same time, our issue with E-Meters points out that how we tackle and how we deal with the implementation of the technology is as important as the technology itself. So, both in terms of the issue of standards, how we do the procurement and the piece that wasn't discussed at all here is the communication to customers to ensure that – we learned from issues that Pacific Gas and Electric (PG&E) had when it rolled out smart meters and that communication is an integral part of how we would deal with the roll out.

Vice Mayor Kniss: It interesting that you have so few complaints so it must be that we get the complaints and then no one actually does anything about it.

Mr. Shikada: Well, I wouldn't say that. There's quite a bit of follow up.

Vice Mayor Kniss: I think probably they just look at their water – two or three people did it in the last week. I don't know whether we've done something different but have said my gosh, my water bill was and it was;

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they were astronomical numbers. Maybe people have relaxed and started watering in the summer because there was more water this year and suddenly they said we can water the yard, the lawn, the flowers, whatever it might be. Did you see any of those uptakes or upticks this summer?

Mr. Shikada: Yes, we are actually – yes, we did and part of it is to your example, irrigation systems – sprinkler systems that hadn't been used either both over the winter or through the entire drought and so as a result, being turned back on and finding breaks. So those have definitely led to an uptick this year. I suspect this issue will lead to an uptick as well as there's more public awareness of this meter billing issue and so I, unfortunately, hate to say it but you may get more calls and emails as will we. We're absolutely endeavored to deal with those directly and as quickly as possible. Part – I'm sorry one last thing on the E-Meters that I do want to note that it is our plan expecting that some customers will simply say they don't want to have these E-Meters installed, that we will remove those at the utility's expense, not the customer's expense on request.

Vice Mayor Kniss: It's such a – it's so fascinating because you deal with such an absolutely essential item in our lives and in our budget and we have incredibly good water; I mean no question about that. There is a cost to that and I'm afraid we may have lost some of our drought awareness policies and I frankly, am sorry Jerry Brown decided to get rid of those for the reasons that were stated. It's too bad we didn't keep those in place and continue those good policies we had for four years, five years? For quite some time so that's just an editorial comment but I've often thought we were all on such a good path where we were going to have water resistance and take out our lawns and so forth and so on. In some places that actually happened but in many places, it didn't. That's it, that's my editorial comment.

Chair Wolbach: Lydia, do you have any questions or comments at this time?

Council Member Kou: Ed, when you said that the transmittal of the flow from the E-Meters, does that – can that be arranged to go to the customer or is that usually to utilities and then utilities has to communicate to the customer?

Mr. Shikada: Let's see, we did have a pilot program that was ongoing for some period of time that set up notifications that would allow a residence I believe to receive that directly. I think it's a question about how we can figure it when we go forward with the roll out of smart meter systems and I suspect that it should be able to be configured so that the customers

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themselves would receive that notice but we just haven't gotten to that point yet.

Council Member Kou: What are some of the reasons that they don't like – they don't want to have E-Meters installed?

Mr. Shikada: Well, you know I think right now the issue is the testing and the availability of independent third-party testing and the standards through which those tests would be conducted. The – I'll say an unfortunate fact is that we do have some residences that are concerned about the technology and having that including the transmission capability be adjacent to their home, concerns about RF radiation as the case may be. So being sensitive to those, we do get requests or concerns that say just keep those smart meters away from my home.

Council Member Kou: Will Utilities do testing of those to prove – to show – have data to show that there isn't electric-magnetic fields or any of those sorts of stuff in order to help…

Mr. Shikada: I think we'll provide as much information as we can when we're ready to go with the full roll out. I suspect that there will be some residents who are not convinced in any case and I think we should be able to provide allowance for that; at least in the short term to accommodate their preferences.

Council Member Kou: Thank you.

Chair Wolbach: I have a couple questions, just first on those two recommendations where the response from Staff was partially agreed; 1.4 and 2.1 on Pages 28 and 29 that are summarized in the audit. Just any more clarity that City Auditor Staff can provide about that – about those two – about 1.4 and 2.1? Where the – we're hearing slightly different takes here and I wanted to bring it back to the Auditor Staff having heard from the City Manager Staff.

Ms. Richardson: Correct, so in 1.4 if you look at our recommendation and you look at the second part up their response, the first part is really commentary, the second part of what are they going to do and it's really directly addressing the recommendation. So, that's why we – well, if you are agreeing to look at that differential, why do you partially agree instead of just agree so that was really our concern with that one.

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Chair Wolbach: So, take let's take that for a moment and turn back to City Manager's Staff and Utilities Staff and ask do you – also a question about moving forward. Is there an interest in resolving the disagreement or further communication before this comes to full Council?

Mr. Shikada: I think we could certainly have further discussion of it and not to negotiate on the record here but my suggestion…

Chair Wolbach: Right, I don't want to do that here but I want to ask – I like that there is maybe room for further discussion. I'm wondering procedurally if that can be done between this meeting and this coming to Council and whether we need to put that in a motion or whether Staff can do that? I'm also looking at the City Attorney's Staff for direction and guidance on the procedure?

Terence Howzell, Principal Attorney: There – I think that could be done at a later time but they were maybe – is there negotiating happening right now?

Ms. Richardson: No, no, no…

Mr. Shikada: Just a suggestion.

Ms. Richardson: We have actually done that on a previous audit and I believe it was the Workers Compensation Audit, where there was a little bit – Policy and Services actually asked us to go back and before it went to Council they had an updated response to those questions.

Mr. Howzell: That's my recollection as well, there was some harmonizing that done prior to it going to Council.

Chair Wolbach: So, when it comes times for motion, I think we may include this suggestion that be attempted. Then…

Council Member DuBois: Could you repeat…

Chair Wolbach: Well, I haven't made a Motion yet. My concern is that there is, I'm about to turn to the second one just to see if it's the same issue, on recommendation 1.4 City Staff says that they partially agree in the report, City Auditor looks at the response and says, my read of it is, you guys aren't just partially agreeing but you're totally agreeing so what's the issue? So, in order to have greater clarity and have everybody on the same page when this comes to full Council when it comes time for a motion, I'd like us to

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provide direction that allows the Auditor's Staff and City Manager's Staff to collaborate and try to find the resolution of that area of potential disagreement. Let's turn then to 2.1 and I want to again turn back to the City Auditor and do you think this is another area where there maybe – is there anything more we can say about this one? Is this another where you feel that you are actually on the same page or is there a true disagreement here?

Ms. Richardson: I think we are somewhat on the same page. I think maybe the differences are informational and we're thinking a little bit more like making Council more aware than just in an informational report. What we're looking at is ok, if you're going to make a significant change to infrastructure by going from displacement meters to some sort of an electronic meter, that would be something that Council would want to – it's a major infrastructure change to us and that Council would want to be aware and have some discussion. I think that they are saying that they do inform Council but they are saying that it's more informational so there may be a little bit of a disagreement on how it's done but I think the general concept of informing Council is the same.

Chair Wolbach: Any other response to that, which just again, your take on what we're looking at here and how these are categorized as agree or partially agree from the City Manager Staff.

Mr. Shikada: I would just echo what the City Auditor said in terms of the distinction is really the recommendation states pretty explicitly to bring it forward to Council for approval. From Staff's standpoint the definition or sort of the threshold at which it changes is significant or systemic. On a daily basis, it can be a variety of interpretations so that's where we would prefer not to lock into the requirement for approval without a clear definition of where that threshold for significances is.

Chair Wolbach: Are you worried about setting a precedent essentially?

Mr. Shikada: Or quite frankly an ongoing audit finding that doesn't close, which does happen; no offense.

Chair Wolbach: I understand the desire for clarity and being able to have identifiable problems and action plans for resolving them. I think we would all agree you don't want something that can't be resolved for which there's no clear path towards resolution. Moving on, I guess more commentary than a question unless there's any more that anyone on Staff – City Manager Staff or the City Auditor's Office about finding three. I'll just say that this is

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one that I found pretty concerning but I appreciate that it's been discussed, been identified, I appreciate that there's no – there seems to be no disagreement here about a path forward and that we're looking to get this resolved within the next seven months.

Ms. Richardson: I would say that I would agree that they are already working towards that and have already started making some changes so I think that one's on a path already to be completed as their schedule indicates.

Chair Wolbach: In general, I had some questions or heard enough concerns raised about purchasing and procurement etc. in the City and so I think that this is a step in the right direction. I do appreciate, again the work is done from the Auditor's team and the City Manager's team to really address this and resolve it expeditiously. With that actually, since I was suggesting a tweak to the Motion, if it's alright with my Colleagues I'd like to try my hand at a Motion on this one which is…

Vice Mayor Kniss: Before you do that, can I just one general question?

Chair Wolbach: Please.

Vice Mayor Kniss: Do we – in situations where they have been overcharged, do we give a credit or do we actually give a refund?

Mr. Shikada: It is typically a credit.

Vice Mayor Kniss: Ok, so it just goes onto the next bill…

Mr. Shikada: Correct.

Vice Mayor Kniss: …and they are charged less. I think that must be fair more effective than…

Mr. Shikada: It's certainly far more efficient.

Vice Mayor Kniss: …than sending money back.

Mr. Shikada: Believe it or not we have cut checks for less than a dollar and it's been odd.

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Vice Mayor Kniss: So, our practice is credit them for the next time. Thanks.

Chair Wolbach: Alright, so as for attempting a Motion, I'll move the Staff recommendation with a slight change and that would be that Policy and Services Committee recommend that the City Council accept the utilities accuracy of water meter billing audit and that between this meeting and this coming to full City Council, that the City Auditor's Office and the City Manager's Office attempt to resolve disagreements on recommendations 1.4 and 2.1, if possible.

Vice Mayor Kniss: Second.

MOTION: Chair Wolbach moved, seconded by Vice Mayor Kniss to recommend the City Council accept the accuracy of Water Meter Billing Audit and direct the City Auditor's Office and City Manager's Office to attempt to resolve the disagreements on recommendations 1.4 and 2.1 before this goes to the City Council.

Chair Wolbach: I think I've spoken to my Motion if anyone has questions feel free to ask me to clarify but otherwise I'll forgo further comments at this time. Would you like to speak to your second?

Vice Mayor Kniss: I only think that this is a really good conversation and I'm glad that we've had it. I'm glad that we did this audit and Ed, I'm pleased that you're in the role that you're in; I feel comfortable about it. I just think our water is so precious and we sometimes don't pay enough attention to it and how it's dispersed and tracked and so forth. I really appreciate your presentation tonight and thank you and I've forgotten your first name.

Ms. Nguyen: Mimi.

Vice Mayor Kniss: Mimi, thanks, Mimi.

Chair Wolbach: Any other questions or comments on the Motion? Seeing none. Alright, all in favor? Alright, that passes unanimously. Thank you.

MOTION PASSED: 4-0