Water Metering and Consumption Process & Controls Assessment

May 4, 2016

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Glossary

Accounting Clerk	A staff position within the City which is responsible for water metering and consumption processes reviewed during this project.
Anomaly	When an account experiences a level of water consumption higher than its historical average consumption for a given billing period.
AR5001, AR5002	A type of telemetry device used to read meters. This is a manual process that requires operators to visit houses and collect meter readings through a gun.
AutoRead / Sensus	The system used by the City to translate meter reading information into data that can be imported for consumption invoicing purposes.
Control, Critical Control	The Institute of Internal Auditors (IIA) International Standards glossary defines a control as: any action taken by management, the board and other parties to manage risk and increase the likelihood that established objectives and goals will be achieved. Management plans, organizes and directs the performance of sufficient actions to provide reasonable assurance that objectives and goals will be achieved.

A critical control is one that directly prevents risk factors that could lead to the realization of a specific risk (such as over-allocation of water consumption to an account). |
Diamond	The system used by the City to generate water consumption allocations reflected on invoices for residents.
Materiality	Consumption levels that are 10 cubic meters higher than historical average for a residential account are considered to be material for the purposes of this review.
Operator	A staff position within the City that collects water meter readings and / or performs follow-up on water meter readings, as required.
Resident / Account	A single-family or multi-family household that uses water.
VGB, MXU	A type of telemetry device used to read meters. This is done through radio frequencies that are transmitted as a City vehicle drives around the City and communicates via transponder with a resident's water meter.

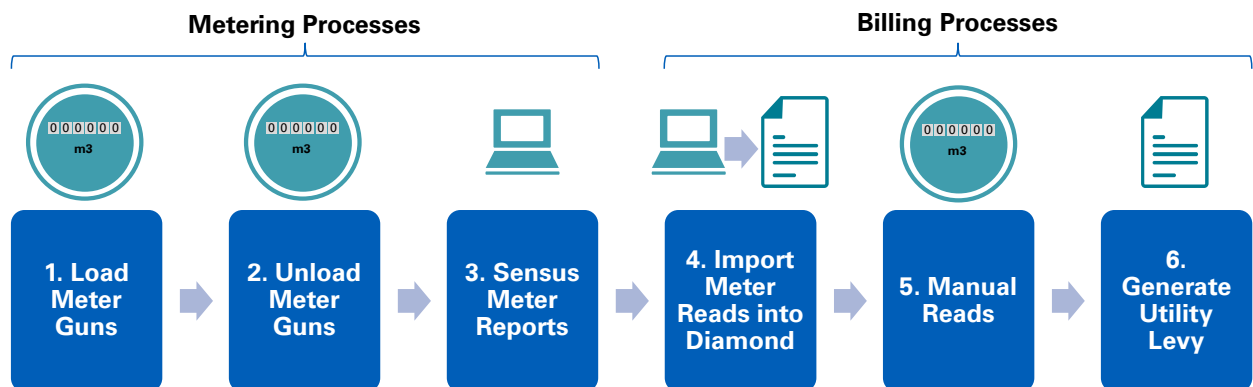# Contents

1   Executive Summary

Introduction

The City of Fort Saskatchewan's Financial Services department engaged KPMG from January to April 2016 to conduct an assessment of the processes and controls related to the City's water metering and consumption processes to identify whether there were any operational, financial, or information technology issues that may be affecting the accuracy and completeness of consumption information reflected in residential water levies.

Our assessment covered the water metering and consumption processes, from the time a meter is read (via telemetry) through to a consumption amount being recorded for an account in order to generate an invoice. We focused our assessment on controls and processes used by the City to *detect, prevent and / or correct potential risk factors that could lead to a material overstatement in a resident's water consumption reflected in an invoice for a given billing period.* We also performed data analytics to support our findings.

Our work specifically excluded the physical inspection of the water distribution system, including residential meters.

Findings – Assessment of the City's Control

As noted in the diagram below, six key processes were identified for the City's water metering and consumption functions.

Metering Processes   **Billing Processes**

| 1. Load Meter Guns | 2. Unload Meter Guns | 3. Sensus Meter Reports | 4. Import Meter Reads into Diamond | 5. Manual Reads | 6. Generate Utility Levy |

Critical controls designed to detect, prevent, and / or correct related risk factors in the six processes were identified. We reviewed and assessed those critical controls that were designed to detect, prevent and / or correct the risk of a material overstatement in a resident's water consumption for a given billing period. A material overstatement has been defined as an anomaly that exceeds an account's average historical consumption levels (from 2009 to 2015) by more than 10 cubic meters.

Based on our assessment in the January – February 2016 billing period, we found no critical control deficiencies for the in-scope processes that could lead to a material overstatement in a resident's water consumption as reflected on an invoice.

Most critical controls are reliant on manual checking and reviews. The manual portion of the review of accounts conducted by the Accounting Clerk requires significant time and relies upon the accuracy of the Clerk over a high volume of information. This is supplemented by some system generated reports; but not all reports are used as effectively as they could be to support the review process.

A summary of the assessment of critical controls is outlined in the table below. The table includes:

■ The name of the in-scope process

■ The degree of inherent risk (degree of risk before controls are in-place) in the process that a residential account could have a material over-statement in consumption (low, medium, high)

■ The City's critical controls in place to mitigate the inherent risk

■ The degree of residual risk that a residential account could have a material over-statement in consumption (low, medium, high), and

■ Our overall assessment of the critical controls.

Further details on our assessment and findings are included in Section 3 of our report.

Process	Inherent Risk	Critical Controls	Residual Risk	Assessment
Load Meter Guns	Med	While there were no critical controls identified within the Load Meter Guns process, the **Staff Estimate** utilized in subsequent processes has been assessed as a compensatory control to this process. When Sensus Meter Reports identify 'no reads' which indicate that an actual reading cannot be gathered, or a meter reading appears to be an anomaly through the manual review process the Accounting Clerk accesses an account's history and utilizes the past six meter readings (excluding outliers) to obtain an average consumption rate. This average is	Low	The Staff Estimate control was tested and assessed as operating effectively in the January – February 2016 billing period. No deficiencies were found in the process that would lead to a material overstatement in a resident's water consumption for a given period.

Process	Inherent Risk	Critical Controls	Residual Risk	Assessment
		added to the account's last meter reading in the previous billing period until an actual physical meter read can be confirmed by an Operator.		
The results from the Staff Estimate Test of Operating Effectiveness are described in Section 3.1.3. Unload Meter Guns	Med	While there were no critical controls identified within the Unload Meter Guns process, the **Staff Estimate** utilized in subsequent processes has been assessed as a compensatory control to this process. See description above.	Low	The Staff Estimate control was tested and assessed as operating effectively in the January – February 2016 billing period. No deficiencies were found in the process that would lead to a material overstatement in a resident's water consumption for a given period.
Sensus Meter Reports	Med	**Staff Estimate** – see description above.	Low	The Staff Estimate control was tested and assessed as operating effectively in the January – February 2016 billing period. The 41 Staff Estimates entered by the Accounting Clerk out of a total of 8,124 residential accounts for the Jan-Feb billing period represented approximately 0.5% of all residential accounts. Therefore, 99.5% of residential account meter readings obtained were actual meter readings. No deficiencies were found in the process that would lead to a material overstatement in a resident's water consumption for a given period.
Import Meter Reads into Diamond	High	**Data Transfer** – data is transferred between *AutoRead* and *Diamond*. System reports are generated and manually checked	Low	The Data Transfer control was tested and assessed as operating effectively in the January – February 2016 billing period.

Process	Inherent Risk	Critical Controls	Residual Risk	Assessment
		to ensure that data is complete and accurate in the billing system. **Meter Turnover Check** – the Accounting Clerk manually reviews a report that flags any accounts where the meter has turned over (i.e. reverted to 0) and investigates and resolves any issues with the meter reading.		The Meter Turnover Check was tested and assessed as operating effectively in the January – February 2016 billing period. No deficiencies were found in the process that would lead to a material overstatement in a resident's water consumption for a given period.
Manual Reads	Med	**Staff Estimate** – see description above.	Low	The Staff Estimate control was tested and assessed as operating effectively in the January – February 2016 billing period. No deficiencies were found in the process that would lead to a material overstatement in a resident's water consumption for a given period.
Generate Utility Levy	Med	**Smartlist Report Verification** – the Accounting Clerk verifies that all accounts have actual meter reads, or that a staff estimate has been entered to ensure that each account will have a meter reading for that billing period.	Low	The Smartlist Report Verification control was tested for completeness and accuracy. Due to the inability to retrieve all reports for the past 5 billing periods, as well as the improper identification of several accounts listed as 'no-reads', this control may not be operating appropriately. However, given this control is a final manual check performed by the Accounting Clerk, the impact for reporting of overconsumption is limited to specific situations (e.g. no-read or system estimate). The Staff Estimate utilized in the manual review of consumption anomalies by the Accounting Clerk in

Process	Inherent Risk	Critical Controls	Residual Risk	Assessment
				place earlier in the process performs a similar function and is considered compensatory to this control.

Findings – Data Analytics

KPMG completed data analysis of the City's historical water metering and water consumption data covering the period from January 2009 to December 2015. The purpose of this was to analyze and identify trends in consumption against a set of variables, including the reasons that consumption anomalies may exist. For the purposes of this analysis an anomaly was defined as any consumption value over an account's average historical consumption (from 2009 to 2015).Anomalies were considered material in the scope of this review when they exceeded 10 cubic meters from an account's average historical consumption level.

The following table outlines the key areas that were explored via data analytics and the key findings for each:

Area Explored	Key Findings
Seasonality and Stability of Consumption	The City's aggregated water consumption is variable with seasonal trends – peak usage occurs in July-August and the lowest usage in March-April. As a result, high variation over a single year of billings can be reasonably expected. In reviewing the number of residential consumption anomalies, there were no patterns between years (2009 to 2015) or bi-monthly billing periods; anomalies can occur during any period and do not appear related to seasonal consumption patterns. All accounts experiences some variation in their consumption, with some experiencing higher variation than others.
Water Loss	Water loss is the difference between the volume of water the City purchases and its total consumption. From 2009 to 2015, the City's water loss ranged between a minimum of 2% (2012) to maximum of 7% (2009). Benchmarks for water loss are set at approximately 10% by Environment Canada and the Alberta Urban Municipalities Association; our analysis indicates that for the period from 2009 to 2012, the City's water loss is below this range.

Area Explored	Key Findings
Water Consumption Patterns	For the period from 2009 to 2015, approximately 44% of the account records reviewed for residential consumption had a consumption anomaly; i.e. where the consumption for a period was higher than the account's historical consumption average. The average consumption in the City is 27 cubic meters per billing period per account. No single year had more consumption anomalies than any other.
Meter Telemetry	Four different telemetry devices are used to collect meter readings from the 8,124 residential water accounts in the City. The majority of accounts utilize MXU telemetry with the remaining accounts spread evenly across the other devices. Based on the analysis performed on the meter reads of each device, no single telemetry device appeared to lead to a higher consumption reading.
Age of Meters	The current meters utilized for residential accounts were installed between 1990 and 2015. Approximately 45% of were installed prior to 2000, 30% between 2000 and 2010 and the remaining 25% within the past 5 years. Based on the analysis completed there is no strong relationship between the year a meter was installed and consumption anomalies.
Geographic Locations	Consumption anomalies, meter installation dates and disputed accounts were mapped according to the location of residents and the billing period of dispute. Based on the analysis completed it does not appear that consumption anomalies are related to a specific geographic location of a residence.

Further details on the data analytics results are included in Section 4 of our report.

Findings – Jurisdictional Review

A jurisdictional review was undertaken to identify leading practices in water metering and billing processes. Our review focused on several municipalities including High Level, Leduc and Medicine Hat. The results of our jurisdictional review indicates that water metering and consumption processes and enabling technology at the City does not offer the same functionality other municipalities are employing. The following outlines the key findings from this review:

■ Most municipalities reviewed utilize aspects of metering technology that enable them to:
  – Monitor daily water consumption for each resident
  – Complete automated meter reading, through the use of centralized telemetry towers, and
  – Create system generated checks and flags to identify anomalies in metering consumption
■ Municipalities are beginning to consider and make moves towards consolidating all of their utility operations into a single system for metering and billing – this includes, water, electricity, gas, etc.
■ Most municipalities reviewed invoice residents on a monthly basis.

■ Customer portals are being established to enable residents to log in and view their account, including their daily consumption and their invoices, allows them to pay for their bills, and also enables them to communicate with the City regarding their concerns.

Further details on the jurisdictional review results is included in Section 5 of our report.

Key Recommendations

During the course of our review we identified a number of opportunities that the City should consider to improve its water metering and billing processes, critical controls and customer service.

■ As our review of controls was limited to a single billing period, the City should consider **conducting additional testing** of subsequent billing periods to confirm the effectiveness of its estimate processes.

■ Consider **implementing a system that would assist the City to record and respond to customer inquiries (including complaints)**. This type of technology would allow the City to better record actions taken to address the inquiry, provide an automated work flow and enable a resident to view the status of their inquiry as it is resolved or addressed.

■ **Further configure existing systems** used in the water metering and billing process to **generate reports** that would alleviate the need for the City to rely on manual reviews of consumption and billing records to identify and correct anomalies.

■ Strengthen the current controls in the City's water metering and billing processes through the introduction of a **peer review process to double-check** where anomalies are identified and addressed, and improve **tracking the completion of processes taken** by the Accounting Clerk.

■ Consider a **change in the frequency of the City's meter readings and billing cycles** from bi-monthly to monthly to better enable proactive monitoring of consumption patterns and address disputes closer to when they occur.

■ Consider what, if any, changes the City could make to its **water metering technology** to reduce the use of manual processes (e.g. handheld guns) and increase the use of system-driven processes and automated radio frequency readings.

■ The City should **document its policies and processes** to calculate consumption estimates. This should include guidance on the estimate in relation to a resident's mean consumption.

Further details on each of these are outlined in Section 6 of our report.

As an important next step, the City should assess and prioritize each of these recommendations and develop a work plan to establish accountability and implement these changes.

2 Project Overview

2.1 Background

The City of Fort Saskatchewan (City) has received a number of complaints from residents related to water consumption as reflected on invoices since May 2015. These residents indicate that their invoices are "higher than normal" and may be the result of anomalies with the recording of their water consumption. The matter has been discussed at City Council and in various public forums. In order to identify and address potential discrepancies, the City engaged KPMG to conduct an assessment of the processes and controls related to water metering and consumption to identify whether there are operational, financial, or information technology issues that may be affecting the accuracy and completeness of water consumption information.

Municipalities across Canada are continuing to focus on sustainable infrastructure. The management of water is a critical component of the sustainability agenda. There is significant advantage to conducting periodic reviews of the water distribution and invoicing systems to promote the effective accounting of water consumption.

Various factors can impact water consumption each billing period and year (e.g. weather, recreational usage, etc.). As such, the ongoing assessment of water metering and consumption systems, and ongoing analytics related to consumption can provide the City with insightful information to inform its monitoring and ongoing continuous improvement of the City's water services.

2.2 Scope

Potential issues with water loss and consumption (including monitoring) can arise anywhere in the water eco-system, including in the water distribution infrastructure, the metering system and / or during the allocation of consumption as reflected on a resident's invoice.

The scope of KPMG's assessment from January to April 2016 covered the water metering and consumption processes from the time a meter is read (via telemetry) through to a consumption amount being recorded for an account in order to generate an invoice. This included the review of major work processes and controls in place to confirm that equipment and activities are operating properly and contribute to the accurate allocation of consumption as reflected in invoices (i.e. policies and procedures governing the types of meters used, meter maintenance, meter reading, data management, usage analysis, and levy generation).

Our assessment covered the water metering and consumption processes, from the time a meter is read (via telemetry) through to a consumption amount being recorded for an account in order to generate an invoice. We focused our assessment on controls and processes used by the City to *detect, prevent and / or correct potential risk factors that could lead to a material overstatement in a resident's water consumption reflected in an invoice for a given billing period.* A material overstatement was defined as an anomaly that exceeds an account's average historical consumption levels (from 2009 to 2015) by more than 10 cubic meters.

We also performed data analytics to provide insights into whether other potential anomalies exist elsewhere in the water distribution system.

Our work specifically excluded the physical inspection of the water distribution system, including residential meters.

2.3   Approach

Six key processes, and related critical controls, (outlined below in Section 3) for the City's water metering and consumption functions were identified.

Figure 1: Water Metering and Consumption Processes
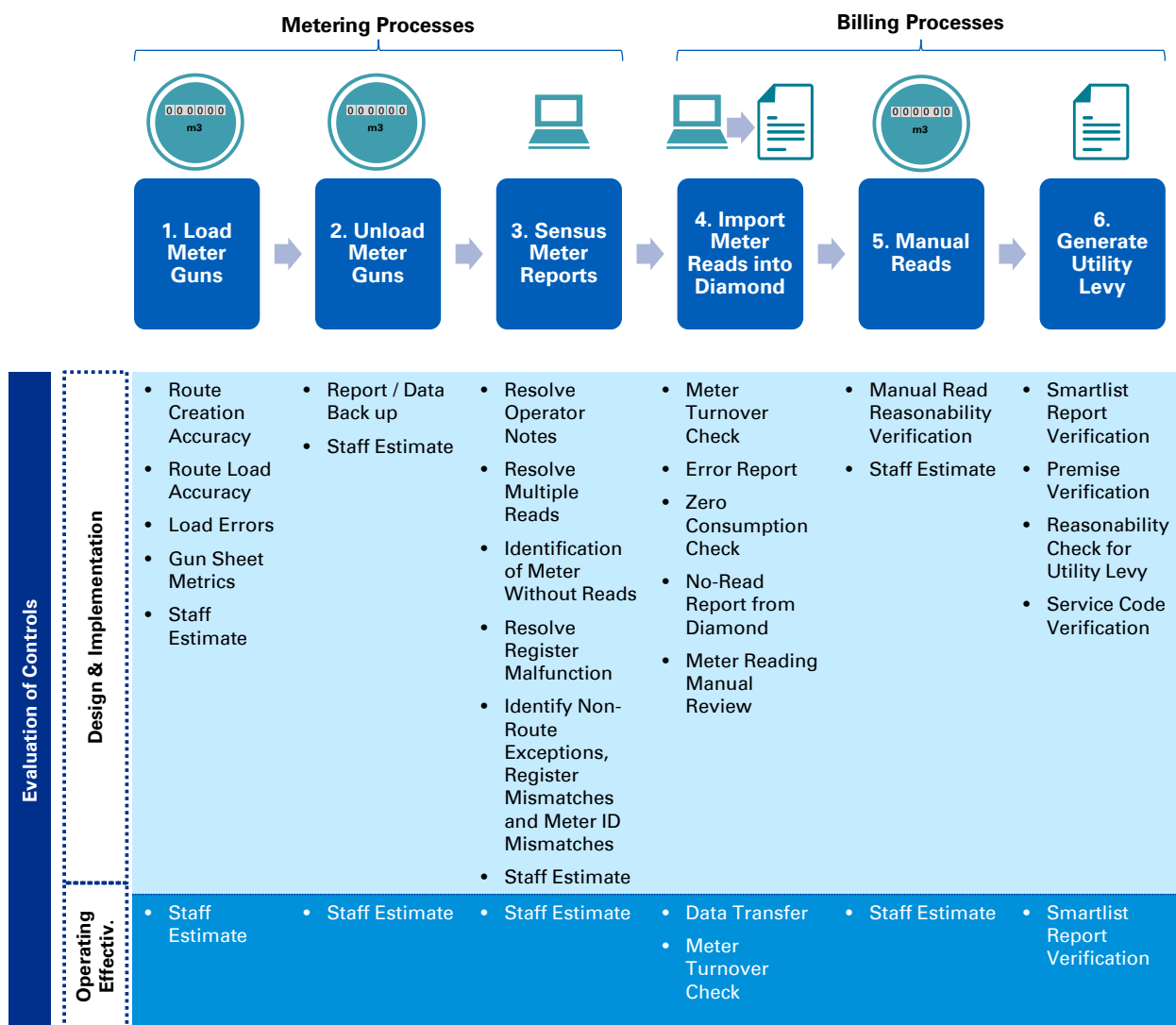
For each process, walkthroughs were performed to identify critical control points and evaluate the design and implementation of these controls.

Controls, as defined by the Institute of Internal Auditors, are *any action taken by management, the board and other parties to manage risk and increase the likelihood that established objectives and goals will be achieved. Management plans, organizes and directs the performance of sufficient actions to provide reasonable assurance that objectives and goals will be achieved.*

A critical control is one that detects, prevents and / or correct risk factors that could lead to a material overstatement in a resident's water consumption as reflected in an invoice for a given billing period. Only those controls identified as critical through our review were tested for how effective their designs and / or operations were.

Documentation, staff interviews, and process walkthrough information collected were used to inform the control assessment, according to the following steps outlined in Section 3. A list of documentation reviewed and a list of the staff interviews performed is included in Appendix 2.

Figure 2: Control Assessment Process
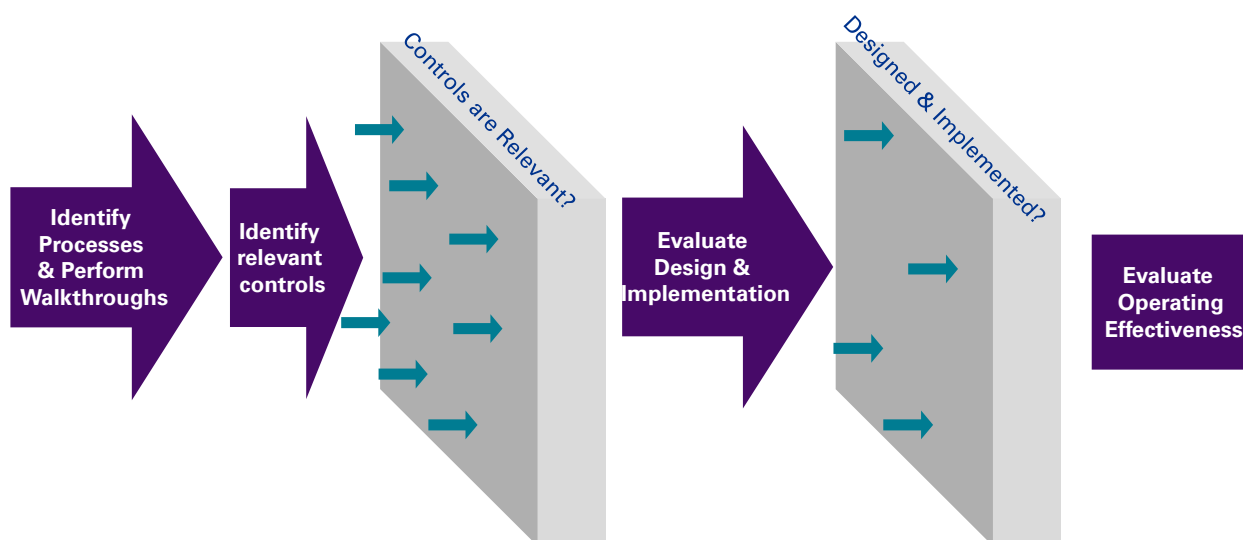
Water metering and consumption processes were mapped and verified through interviews with the City's staff who are involved. Walkthroughs were conducted to identify where relevant controls exist in each process.

Once critical controls, that would detect, prevent and / or correct a material overstatement in a resident's water consumption reflected in an invoice for a given billing period, were identified, we evaluated the design and implementation of those controls. Controls that appeared to be designed and implemented effectively were subsequently evaluated for operating effectiveness.

The remainder of this report defines the critical controls that were reviewed and our assessment of their ability to *detect, prevent and / or correct potential risk factors that could lead to a material overstatement in a resident's water consumption reflected in an invoice for a given billing period.*

3 Water Metering and Consumption – Processes and Critical Controls

3.1 Water Metering Processes and Controls

3.1.1 Load Meter Guns

Process Overview

The City utilizes a variety of meter and telemetry devices to obtain residential water consumption readings. The meters utilized by the City are Sensus Meters.

The first type of telemetry system utilized is radio meters. Under this system telemetry devices collect the readings from a resident's meter apparatus using a radio frequency; the technologies that the City utilizes for this are called MXU and VGB. MXU is currently used in approximately 3,500 households while VGB is used in approximately 1,800 households; the VGB system is relatively newer and is predominantly found in the City's newer developments.

For these systems, the City's Accounting Clerk downloads the routes onto a USB device, which is then imported onto a tablet in an Operator's vehicle to collect the readings from radio frequency. One route is created for each of MXU and VGB. This radio frequency technology allows the readings to be collected at a quicker pace than the handheld, proximity read devices.

The second type of telemetry system utilized are Automatic Remote Read Technology (AR5001 / AR5002). Approximately 2,900 households utilize the AR system; this system is being phased out by the City and residents will subsequently be moved to the MXU and VGB systems.

The AR5001 / AR5002 metering requires the use of a 'gun' to obtain a proximity reading from a resident's meter; one gun is used for each of AR5001 and AR5002. The City's Operator must take the gun within a relative proximity of the meter to allow the reading to be collected.

Guns are programmed for a specific route (i.e. a list of households where a meter reading will be taken) and the system marks the households that require a reading with dots above the houses; these disappear once a reading is collected by an Operator.

The City's Accounting Clerk creates the routes in *Diamond*, the billing software utilized by the City. The Accounting Clerk then enters the route information into a Microsoft Excel file called the *Gun Sheet Spreadsheet* and transfers them to a system called *AutoRead*, from which they are loaded into the gun.

In the *Gun Sheet* spreadsheet, the date that the guns were loaded and the number of meters that were loaded into the routes are recorded. For the handheld guns, there are 19 routes completed on AR5001 and 12 routes on AR5002.

In some cases, meter readings cannot be obtained with the handheld guns or by the radio system. These readings must be taken manually, and are tracked on excel spreadsheets called the Route 33 and Route 33 jail sheets.

Process Controls

■ **Route Creation Accuracy**: This control ensures that the routes created in *Diamond* contain all of the residential meters that require a reading. This includes confirming that each of the handheld routes have the appropriate sub-routes programmed (as retrieved from the *Gun Sheet* spreadsheet.) This control is designed to ensure that operators are given the correct routes. This is a general control.

■ **Route Load Accuracy**: This control confirms that the created routes and all the meters requiring a reading are successfully imported into *AutoRead* from *Diamond*. Routes are created in *Diamond*, when the meter reading data is imported back from *AutoRead* after the guns have been unloaded. *Diamond* indicates which accounts did not receive a reading, which would trigger the Staff Estimate.

■ **Load Errors**: This control enables the system to check for any errors in the importing of the data into the guns from *AutoRead*; this may include incorrect meter ID, no meter ID for account, etc. Load errors are addressed by the Accounting Clerk, where no readings are returned, the Accounting Clerk performs a Staff Estimate.

■ **Gun Sheet Metrics**: The *Gun Sheet* spreadsheet tracks the date the guns were loaded, and how many meters per technology system type. Under this control the Accounting Clerk compares month to month metrics for a reasonability test. VGB meter numbers are expected to increase, whereas MXU and handheld meter numbers are expected to decrease, as older systems are replaced by newer technology. This is a general control.

■ **Staff Estimate:** The purpose of this control is to create a staff estimate when a reading for an account has not been obtained, or the reading is identified by the Accounting Clerk as a potential error (i.e. the reading does not following a normal consumption pattern for the account; this is identified during the Accounting Clerk's meter read manual review described in section 3.2.1).

> The formula for the staff estimate utilizes consistent methodology at any stage of the process, it is created from an account's average historical water consumption.

> The Accounting Clerk accesses the account's history, and utilizes the past six meter readings (excluding any outliers to mitigate the risk that any of the past 6 meter readings are inaccurate) to obtain an average consumption rate. This average is then added to the account's meter reading from the previous billing period. All estimates are made manually by staff.

The results from the Staff Estimate Test of Operating Effectiveness are described in Section 3.1.3.

Other controls in the City's water metering and consumption processes are relied upon to ensure that the actual meter read is correct. Based on the manual review completed by the Accounting Clerk (as per section 3.2.1) it is assumed that any anomalies in consumptions are corrected prior to invoicing for consumption.

Potential Risk Factors

Inherent Risk	Controls	Residual Risk
The Guns and Radio Reading Devices may be loaded with the incorrect routes. Not all required routes are loaded; therefore houses may be missed and	The **Staff Estimate** will be applied or an actual meter read will be obtained from an operator if a meter reading is not available.	Houses without actual readings have their readings estimated utilizing the **Staff Estimate** by the Accounting Clerk. This procedure is described in Section 3.1.3. The **Staff Estimate** was tested and assessed as operating effectively.

Inherent Risk	Controls	Residual Risk
readings are not obtained.		Therefore the likelihood of this occurring is low.
The *Gun Sheet* spreadsheet is an unprotected Excel document located on a shared drive, accessible by a number of City staff. This could result in values being accidentally overwritten by another staff, altering the route information and potentially resulting in residences that do not obtain a reading.	There are no specific controls designed to verify the content in the Gun Sheet Spreadsheet. However, the **Staff Estimate** will be utilized for the accounts without meter readings; If the routes were altered by someone who had tampered with the Excel sheet, some residences may not obtain a reading. This would prompt the Staff Estimate process to be used.	Houses without actual readings have their readings estimated utilizing the **Staff Estimate** by the Accounting Clerk. This procedure is described in Section 3.1.3. The **Staff Estimate** was tested and assessed as operating effectively. Therefore the likelihood of this occurring is low.

Assessment of Design and Implementation

To evaluate the critical controls identified in the context of the scope of our review, KPMG observed the loading of guns (and USB devices) in a walkthrough with the Accounting Clerk.

This included observing the loading of the AR5001 and AR5002 guns, as well as the USB devices for the MXU and VGB routes. KPMG also observed the Accounting Clerk's checking of load errors when the upload to the meter reading devices was completed, the recording of the date telemetry meter readers were loaded, and the number of meters per *AutoRead* to the *Gun Sheet* spreadsheet.

Assessment of Operating Effectiveness

The results from the Staff Estimate Test of Operating Effectiveness are described in Section 3.1.3.

3.1.2 Unload Meter Guns

Process Overview

Loaded guns (AR5001, AR5002) and USB data devices (MXU, VGB) are taken by the City's Operators to collect the meter readings on the created routes.

While the MXU and VGB routes require only a few days for the Operators to collect and return with the meter reading data, the process for collecting the readings for the AR5001 and AR5002 takes approximately 2 weeks to complete.

Once the AR5001, AR5002, VGB and MXU devices return from the field, the information is ready to be imported into *AutoRead* by the Accounting Clerk. AR5001 and AR5002 are loaded into the handheld gun

dock, which connects the gun to the AutoRead system into which the Accounting Clerk imports the meter readings. Similarly, the USB device containing the meter reading data from the VGB and MXU routes is connected to the computer system through a USB port, and the Accounting Clerk utilizes AutoRead to import the meter readings. The unloading of the meter reading devices will only take approximately ten to fifteen minutes maximum per route. When the data is imported, *AutoRead* generates the Sensus Meter Reports and a copy of the collected meter data is saved on the City's shared drive.

Additional information on the Sensus Meter Reports is in section 3.1.3.

Controls

The following controls were noted for the The results from the Staff Estimate Test of Operating Effectiveness are described in Section 3.1.3.

Unload Meter Guns process:

■ **Report / Data Backup:** Reports generated by *AutoRead* are backed up and saved to the City's shared drive. The meter reading data for the period is also stored on the City's shared drive to have the original source data on file if required. This control is only a precaution against data loss, rather than designed to prevent a material overstatement in a resident's water consumption reflected in an invoice for a given billing period.

■ **Staff Estimate:** The purpose of this control is to manually create a staff estimate when a reading for an account has not been obtained, or the reading is identified by the Accounting Clerk as a potential error (i.e. the reading does not following a normal consumption pattern for the account; this is identified during the Accounting Clerk's meter read manual review described in section 3.2.1). The Staff Estimate process has been described in Section 3.1.1.

The results from the Staff Estimate Test of Operating Effectiveness are described in Section 3.1.3.

Potential Risk Factors

Inherent Risk	Controls	Residual Risk
IT or system failure may result in the meter readings unable to be transferred from the Guns / USB devices into *AutoRead*.	**System configuration control:** Accounts without readings are flagged in *AutoRead* through the Meter Sensus Reports described in Section 3.1.3 *AutoRead* reports indicate which meter data was transferred from the Guns into *AutoRead* successfully. Accounts without readings will be identified as requiring a staff estimate or the operator obtaining a reading.	Houses without actual readings have their readings estimated utilizing the **Staff Estimate** by the Accounting Clerk. This procedure is described in Section 3.1.3. The **Staff Estimate** was tested and assessed as operating effectively. Therefore the likelihood of this occurring is low.

Assessment of Design and Implementation

To test the design and implementation of the control noted above, KPMG performed a walkthrough of the process to unload the meter reading devices.

KPMG observed the Accounting Clerk import the information from the USB devices (for MXU and VGB) into *AutoRead*. This included: overriding the previous meter readings from the last billing cycle in *AutoRead*; the system noting the number of meters read compared to the total number of meters on the route; the generation of *AutoRead* reports; and the back-up of the reports and data to the City's shared drive. If errors are identified in the import of data, the Sensus Meter Reports will identify the error on the appropriate report, and the Accounting Clerk will rectify the error based on which report it was identified through, as described in Section 3.1.3. KPMG also observed the same import process for both the AR5001 and AR5002 handheld guns into *AutoRead.*

The backup data was not utilized any further in the process, and it was explained to KPMG that this data is saved as a precaution, to have a record of the original data.

Assessment of Operating Effectiveness

The evaluation of the Staff Estimate was tested as part of section 3.1.3.

3.1.3 Sensus Meter Reports

Process Overview

Once meter readings have been imported into *AutoRead* a series of reports are generated by the system and used by the City's Accounting Clerk to validate the meter readings after they are imported into *Diamond*. The *AutoRead* system creates a separate set of reports for the MXU / VGB telemetry system and AR5001 / AR5002 telemetry system, to highlight potential issues that require action to update and verify the meter readings for each. Each of the reports display accounts that are associated with the potential error that the report is highlighting, and the Accounting Clerk performs certain actions for each report type to rectify the issue, as described below.

In addition to those noted below, reports are also used for meter maintenance purposes. These *AutoRead* reports assist in the monitoring of the need for meter maintenance. These reports are designed to identify issues in the collection of the meter readings; such as whether any accounts have been unable to obtain a meter read for two consecutive billing periods. If issues are identified through these reports, Operators will be assigned to inspect the meter and assess whether meter maintenance or replacement is required. Older meters (e.g. AR5001, AR5002, and MXU) are replaced by a VGB meter; on average each meter has an approximate lifespan of 25 years.

The following are the common reports generated for both telemetry systems:

■ **Master Route:** The report lists of the meter readings of all the accounts on the route. This information can be used to verify information when manually checking readings later.

■ **Low Exception:** This report highlights those accounts with unusually low consumption below 3 cubic meters. During our review we noted that the settings on this report have not been configured to flag consumption at this level. As a result the report shows the majority of the meter readings on it and does not provide value to the City in terms of identifying meter readings with anomalies.

■ **Non-Read Exception:** This report lists all of the meters that did not obtain a reading. The report is compared with one generated by *Diamond* (see section 3.2.1) to identify the accounts that did not receive a meter reading and identifies the need for a staff estimate.

■ **Register Malfunction:** This report depicts those readings where a digit was unable to be read by a telemetry device, as noted by a '?' in the place of the digit on the reading. This error requires the Operator to obtain another actual meter reading, or the Accounting Clerk to utilize a staff estimate for the digit.

The following are the unique reports generated for the AR5001 / AR5002 telemetry system:

■ **Marked Location:** This report identifies where Operators have marked a specific location in the system with notes to assist in the data collection process. This could include information such as a dog on site, among others.

■ **Route Note:** This report identifies where Operators have entered notes to inform the Accounting Clerk about necessary actions that need to be taken regarding an account; including meter malfunctions. Typically a route note involves a subsequent investigation into a meter issue, or will result in a new meter being installed through the initiation of a work order, described in Section 3.2.3. If an actual meter read was not able to be taken due to the issue identified in the route note, the accounts on this report will require a staff estimate for the meter reading.

■ **Multiple Read:** This report identifies the accounts that have multiple readings recorded during the meter reading process. These multiple reads are typically attributed to human error, such as an operator pulling the trigger too many times on a touchpad. While *AutoRead* recognizes that multiple reads have been taken for an account, only one of the readings is utilized to indicate the consumption amount, since the multiple readings obtained are the exact same reading. If at least one successful reading has been taken for an account with multiple reads, the Accounting Clerk will not take any action. However, if no reading is entered, the Accounting Clerk will provide a staff estimate.

The following are the unique reports generated for the MXU / VGB telemetry system:

■ **Register Mismatch:** This report identifies the accounts where the system expected one type of read, but obtained another. This may occur when a touch read has been collected, as opposed to a radio read. Often no action is required from the Accounting Clerk on accounts that are flagged this way, as the reading obtained is the actual meter reading from that meter.

■ **Non-Route Exception:** This report identifies any meter readings on the MXU / VGB routes from meters on similar frequencies that do not belong to the route or to the City. The Accounting Clerk will verify that none of these readings are related to City accounts.

■ **MXU Worksheet:** This report identifies accounts without meter readings, including the information on the Non-Read Exception Report. It also includes information as to why the reading was unable to be taken (e.g. bad read, no responses from MXU, non-route readings, register malfunctions, manual readings, Radio-Reads, and work performed). Using this report the Accounting Clerk highlights the accounts that an additional read must be gathered for, and provides this to Operators to obtain an accurate reading prior to the invoicing of consumption.

■ **Meter ID Mismatch:** This report identifies the accounts where a meter ID does not have the required frequency information to enable a reading. The Accounting Clerk will manually enter the MXU from the Operator.

Controls

The following controls were noted for the Sensus Meter Reports process:

■ **Resolve Operator Notes:** The Marked Locations and Route Note reports gives operators the ability to attach notes to a location with information relevant to data collection, such as why a reading was not obtained. The Accounting Clerk must take action to these notes to resolve any issues that may prevent an inaccurate meter reading, such as ensuring the proper maintenance is taken.

- **Resolve Multiple Reads for a Single Meter ID:** The Multiple Read Report flags meters that show up with multiple readings. Most often these are caused by human error. The Accounting Clerk will manually review these accounts to ensure an accurate reading is utilized by assessing the account history and verifying that the consumption appears to reflect historical levels.

- **Identification of Meter ID's Without Reads:** The Non-Read Exception report from *AutoRead*, the No-Read Report from *Diamond*, and the MXU Worksheet from *AutoRead* identify the accounts that do not have a read associated with an account for a given billing period. The Accounting Clerk will compare the reports from *AutoRead* and *Diamond* and mark down the no-read accounts on the MXU Worksheet, which is then given to the Operators. Operators then return to these meters to try to obtain another reading. If no read is able to be obtained after this attempt, the Staff Estimates of the readings by the Accounting Clerk will be utilized.

- **Resolve Register Malfunction:** The Register Malfunction report indicates that one of the meter digits was unable to be read and shows up as a '?' in the report. This requires a staff estimate of the digit to capture consumption as accurately as possible. This control identifies the meter reads that require a staff to estimate one of the digits and mark the meter read as a 'staff estimate'.

- **Identify Non-Route Exceptions, Register Mismatches and Meter ID Mismatches:** These controls assist in identifying meter readings that do not belong on the route, when a reading is a different type than expected, and accounts that have meter ID's requiring updates in Diamond (i.e. meter replaced, new installation, etc.).

- **Staff Estimate:** The purpose of this control is to create a staff estimate when a reading for an account has not been obtained, or the reading is identified by the Accounting Clerk as a potential error (i.e. the reading does not following a normal consumption pattern for the account; this is identified during the Accounting Clerks meter read manual review described in section 3.2.1). The Staff Estimate was described in Section 3.1.1.

Potential Risk Factors

Inherent Risk	Critical Controls	Residual Risk
Reports identify a number of potential anomalies in the meter readings; as a result some accounts may have incorrect readings or no readings taken at all.	**Staff Estimate approach** will be applied or an actual meter read will be obtained from an operator if a meter reading is not available for the accounts identified in the Sensus Meter Reports.	If an estimate is made above the actual consumption of a household then an overstatement of the resident's water consumption and bill could occur for the period. However, the Staff Estimate was tested and assessed as operating effectively. Therefore the likelihood of this occurring is low.

Based on the Generate Utility Levy process review, the residual risk that a material overstatement in a resident's water consumption reflected in an invoice for a given billing period could occur is low.

Assessment of Design and Implementation

KPMG conducted a process walk-through with the Accounting Clerk to verify controls had been identified, and to verify the critical control identified in this process.

It was observed that *AutoRead* automatically generated the relevant reports, noting that only those reports that were applicable would be generated. The Accounting Clerk printed the reports to assist in the manual review process, and saved them to the City's shared drive.

KPMG observed that these reports highlight and trigger the need for a Staff Estimate, or for the Operator to return to the meter to obtain an actual reading. Therefore, the Staff Estimate was identified as a critical control point that is designed to detect, prevent and / or correct potential risk factors that could lead to a material overstatement in a resident's water consumption reflected in an invoice for a given billing period.

Assessment of Operating Effectiveness

To evaluate the operating effectiveness of the Staff Estimate, a sample of 20 out of the total 40 estimates (out of a total of 8,124 residential accounts) entered by the Accounting Clerk into accounts for the January-February 2016 billing period was assessed to see whether these followed the Staff Estimate methodology and whether these estimates were reasonable. Only 0.5% of residential accounts required Staff Estimates, with 99.5% of residential accounts obtaining an actual meter reading. The January – February 2016 billing period was assessed within the scope of KPMG's assessment of the meter reading and consumption processes.

Our sample included those readings that were marked as 'staff' or 'service' estimates, as these labels are utilized by the Accounting Clerk in *Diamond* to indicate that a staff estimate has been performed.

To perform our assessment we completed the following steps:

■ We obtained the most recent report from *Diamond* that contained all staff and service estimates for the January-February 2016 billing period, within the identified assessment period for process walk-throughs as agreed upon by the City.

■ We reviewed a sample of 20 estimates from this report. Our sample size was selected from a total 41 estimates that were made during the billing period. (The 41 staff estimates entered by the Accounting Clerk for the Jan-Feb billing period represented approximately 0.5% of all residential accounts).

■ For each estimate entered into the 20 residential accounts included in our sample, we reviewed the consumption history for the past six billing periods for that specific client account, and calculated the estimated consumption based on the methodology used by the City (i.e. the average of six prior billing periods).

■ For the number of differences between the estimate and our calculated value, we inquired with the Accounting Clerk as to the reason behind the differences, which are described below in our observations from the assessment.

Differences between our calculation and the City's estimate were immaterial i.e. less than or equal to 0.001). Our assessment revealed that the majority of the estimates (70%) were correctly noted.

As a result, this control was applied consistently during the January – February 2016 billing period and generated consumption levels that appeared reasonable relative to the review of the past consumption history.

During our assessment the following observations were noted:

■ For new accounts without prior consumption histories, the Accounting Clerk will enter an estimate ranging from 5 to 10 cubic meters, which is lower than the average consumption for an account (per billing period) of 27 cubic meters (as calculated from consumption data from 2009-2015).

■ When an estimate is marked as a 'service estimate' as opposed to a 'staff estimate' KPMG observed the Accounting Clerk utilizes a new policy, effective October 2015, designed to prompt the resident to respond as follows:

– For accounts with abnormally low consumption levels over several (2-3) billing periods that do not reflect prior consumption history or other anticipated meter maintenance errors, the Accounting Clerk and Operators will attempt to contact the resident (by phone or contact card at the door) to request a meter inspection. If a response is not provided after several attempts at contact, the Accounting Clerk will enter a slightly higher consumption than what the meter was reading as the City believed there may be an error with the meter and requires access to the property to assess whether the system is working correctly.

– By entering a slightly higher consumption (KPMG observed the Accounting Clerk entering consumption estimates approximately 2 – 5 cubic meters above actual read consumption levels), the intent was to encourage the account holder to call in; this method is only utilized after other methods, such as the notifications and notices left at a resident's home have not worked.

3.2 Water Consumption Processes and Controls

3.2.1 Import Meter Reads into Diamond

Process Overview

The City utilizes *Diamond* to create bills for residential water consumption. Meter readings are imported into *Diamond* from the reading software, *AutoRead*, by the City's Accounting Clerk. During this import process *Diamond* will automatically flag any errors associated with the data.

The Accounting Clerk manually reviews the data imported to check and correct anomaly readings by performing a reasonability test. This includes a manual review of the meter readings in *Diamond* to determine whether anomalies such as high / low / missing consumption levels are present; this is the second check performed (see section 3.1.3).

Each billing period, the Accounting Clerk produces the following reports generated from *Diamond* for each route (AR5001, AR5002, VGB and MXU) to assist with this manual review:

■ **No-Read Report:** This report depicts all of the accounts that did not obtain a meter reading, for various reasons including (but not limited to): reading not received by telemetry device, meter frequency information not entered into system, operator unable to access meter to obtain a reading, meter malfunction, etc. The Accounting Clerk compares this report to the Non-Read Exception report (see section 3.1.3) from *AutoRead*, to verify that accounts without a meter reading have been accounted for between the two types systems. Once this is verified, accounts without reads are given to Operators to attempt to obtain an actual read for the second time.

■ **Turnover Report:** Accounts with readings that indicate that a meter has 'turned over' during the billing period are listed in this report. A meter turnover indicates that the digits have reached the maximum value and reset to the lowest value (i.e. all zeros). As part of this report, the Accounting Clerk will verify if the readings were close to the maximum in the previous cycle to ensure that there are no errors with the meter. Typically, residential meters do not have high enough consumption levels to create a turnover in the billing period, so this indicates to the Accounting Clerk that the reading should be checked and may require a staff estimate.

■ **Zero Consumption Report:** Accounts without consumption reported will appear on this report. This means that the account did receive a reading, and the consumption had not changed since the previous period. For most accounts, this is unusual activity, as it is expected that each household will

consume some water in any billing period. However, there are circumstances, such as when a house is without tenants, or it is a unit currently being developed, etc. where zero consumption is reasonable. The Accounting Clerk will review these accounts and may provide a staff estimate if zero consumption is deemed unreasonable.

Per our inquiry with Accounting Clerk, the review of the reports generated from *Diamond*, as well as the manual review of high / low consumption levels and a general review for meter reading anomalies, are performed to determine the accuracy of the water consumption billed to the resident.

Subsequent to this manual review, the Accounting Clerk will post the meter readings to the appropriate account in *Diamond*. The Accounting Clerk is then able to generate a Utility Levy and prepare bills as described in section 3.2.3.

Controls

The following controls were noted for the Import Meter Reads into Diamond process:

- **Error Report:** This control is used to highlight items that *Diamond* marks as 'errors' and that require corrective action The error list is populated by accounts that have errors in their meter read dates, and will be generated for each route imported into Diamond these errors are present. Since this report does not identify anything related to consumption levels, it is unlikely to prevent a material overstatement in a resident's water consumption reflected in an invoice for a given billing period.

- **Zero Consumption Report:** This control is used to highlight accounts that had zero consumption for the given billing period, and will be generated for each route that obtains accounts with zero consumption levels. The Accounting Clerk accesses the account history to verify if this is a pattern or an anomaly. If there has been zero consumption for more than 2 months the account is further investigated. This control is linked to the Staff Estimate tested in section 3.1.3.

- **Meter Turnover Check:** Through this control the Accounting Clerk investigates if the consumption is normal based on the turnover result; this report is generated for each route that obtains accounts with meter read turnover indicated. If a pattern of turnover is not present and this occurs for more than 2 months, further investigation is undertaken. This control was identified as a critical control, as it directly relates to the risk of preventing a material overstatement in a resident's water consumption reflected in an invoice for a given billing period. A meter turnover could result in a significant overbilling to a resident if left uncorrected. This test has been described in the Test of Operative Effectiveness below.

- **No-Read Report from Diamond:** Through this control reports between *Diamond* and *AutoRead* are compared to ensure that all no-read accounts have a meter read entered. This report will be generated for each route that obtains accounts without meter readings. Operators will attempt to collect a reading from the accounts identified on this list, however, if a reading is still unavailable a staff estimate is used. This control is linked to the Staff Estimate tested in section 3.1.3 and was tested through that process.

- **Meter Reading Manual Review:** Through this control the Accounting Clerk manually checks the meter readings for anomalies for each route within the billing period. Where issues are found, staff estimates are entered until Operators bring back an actual read for the meter. This control is linked to the Staff Estimate tested in section 3.1.3 and was tested through that process.

Potential Risk Factors

Inherent Risk	Controls	Residual Risk
Readings that are imported into *Diamond* do not match the readings imported into *AutoRead* from the guns, with the data collected from the meters by Operators.	**Data Transfer Process**: *Diamond,* through the Error Report, will flag accounts that appear to have errors resulting in differences between the two systems, for example, if a meter has not yet been registered in *Diamond* or discrepancies in meter read dates.	The Data Transfer Process was tested and assessed as operating effectively in the January – February 2016 billing period. Therefore the likelihood of this occurring is low.
Meters that have 'Turned Over' represent a large consumption by the account, which is usually not typical for a residential account. *Diamond* indicates that a turnover has occurred, but this may not be a representation of the actual consumption, which could lead to potential overbilling based on inaccurate consumption reading.	**Meter Turnover Check**: *Diamond* flags meter turnover as anything where the digits are lower than the last read.	The Meter Turnover Check was tested and assessed as operating effectively in the January- February 2016 billing period. Therefore the likelihood of this occurring is low.

Based on the Import Meter Reads into Diamond process review, the residual risk that a material overstatement in a resident's water consumption reflected in an invoice for a given billing period could occur is low.

Assessment of Design and Implementation

To assess the design and implementation of the critical controls in the Import Meter Reads into Diamond process we performed a walkthrough of the import process.

The Accounting Clerk was observed importing the meter reading data from *AutoRead* into *Diamond*, including the creation of a batch for the current billing period, the review of the error report from *Diamond*, as well as the generation and printing of the various reports noted above.

The Accounting Clerk was observed performing the manual review process. The Accounting Clerk manually reviewed each account that the Turnover and Zero Consumption reports flagged, to verify whether these events had actually occurred.

Assessment of Operating Effectiveness

Data Transfer Process

The operating effectiveness of the data transfer between *AutoRead* to *Diamond* was assessed. To perform the assessment the following steps were completed:

■ The Master Route report from *AutoRead* was obtained for the January-February 2016 billing period

■ The total number of records was determined and compared with the total number of records present in *Diamond* to evaluate the completeness of the data transfer

■ To assess the accuracy of the data transfer, 20 sample of consumption readings out of the 8,124 residential consumption accounts were selected from *AutoRead* and compared to the consumption value depicted in *Diamond*.

We observed that the number of records in the *AutoRead* reports matched the number of records that were imported into *Diamond*. Each of the consumption levels from the account samples reviewed between *AutoRead* and *Diamond* matched. Based off of the accounts sampled, the Data Transfer Process appeared to be operating normally for the January – February 2016 billing period.

Meter Turnover Check

The operating effectiveness of the Meter Turnover Check control identified in the Import Meter Reads into Diamond process was assessed. To perform the assessment the following steps were completed:

■ The Turnover Report generated from Diamond when the routes were imported was obtained for the January-February 2016 billing period from the Accounting Clerk.

■ For each account where a turnover was identified, the Accounting Clerk's treatment of the turnover as either a valid turnover or an error was observed. To determine whether a turnover is valid, the Accounting Clerk assessed previous account consumption history to assess whether consumption levels for this account have historically been high enough to constitute meter turnover. Since the Turnover Report only includes a limited number of accounts during each billing period, we reviewed all of the accounts highlighted in the billing period for the assessment.

■ The reasonability of the treatment for the turnover meter reading was assessed. This included a verification of the action taken, and through an assessment of the prior meter reading and the history of the account's consumption.

Of the 15 meters where a turnover was noted, only 2 were identified as valid due to being a high consumption account. The remaining accounts did not experience a valid turnover; the meter reading was recorded as either the same, or slightly less, which triggered the system to identify the meter as a turnover.

For the 13 accounts that were not valid turnovers, the Accounting Clerk was asked to identify the action taken to rectify the error.

■ The first error type was that several meter readings are the same every billing period, signifying that the meter readings may not have been able to be obtained from the telemetry system. To correct this

error the Accounting Clerk was observed manually entering an estimate for consumption for these accounts, which resulted in the system recognizing that the read obtained was less than the prior billing period and marked the account as a turnover. The Accounting Clerk monitors / follows-up on the account experiencing these turnovers by contacting the resident. Based on our observation and understanding of the process this approach appears to be reasonable.

- The second error type was accounts with low utilization; the system identifies this it as a turnover. A potential cause of this error is backflow, where the water flows backwards through the pipes and causes the meter reading to be slightly lower than the previous reading. The Accounting Clerk identified these accounts by the previous meter reading for the account. This error was corrected by changing the previous read to match the current read, resulting in zero consumption. Based on our observation and understanding of the process this approach appears to be reasonable.

- The last error type was for one account that was flagged as having its meter installed backwards; the system identifies this as a turnover. To correct this the Accounting Clerk switched the previous and the current reads, to give the correct consumption levels in the system. Based on the account's consumption history, this approach appears be reasonable.

In addition, based on our assessment we also noted the following:

- While *Diamond* has the ability to generate a high / low consumption report, the current reporting is not properly configured to provide this information.

- The manual review of the readings requires a significant time commitment by the Accounting Clerk.

3.2.2 Manual Reads

Process Overview

Occasionally it may not be possible for Operators to collect meter reads. The need for a manual review is indicated by accounts where operators could not obtain a meter reading, which could result from changes to the property by the homeowner or environmental factors preventing access for the Operators, meter accounts not yet linked to a resident's account for new residences or move-ins, etc. It is still preferable to obtain an actual meter reading as opposed to making an estimate. This may be done by an Operator or by the resident calling into the City with their meter reading. In both cases the values are provided directly to the Accounting Clerk.

The Accounting Clerk records the Operator meter readings in *Diamond* and record the source of the reading in the appropriate data fields. Once this is complete, the Accounting Clerk will update the meter read date to the next scheduled reading date.

It is standard practice for the City to repair / replace meters if there are reading difficulties for two consecutive billing periods. In addition, the majority of manual reads are related to commercial / industrial water meters, rather than residential.

Controls

The following control was noted for the Manual Reads process:

- **Manual Read Reasonability Verification:** Through this control the Accounting Clerk conducts a reasonability verification of the readings during a manual review process. The assessment is based on whether or not a manual reading for the account seems reasonable based on the account's historical consumption. Where there is a question regarding the reasonableness of the manual read, the Accounting Clerk will enter in a Staff Estimate for the period, while further investigation is completed.

Potential Risk Factors

Inherent Risk	Controls	Residual Risk
An Operator made an error in the manual reading, recording, or reporting of the meter read resulting in over-reporting of consumption.	The **Staff Estimate methodology** of assessing historical consumption is utilized by the Accounting Clerk to verify the manual read obtained from the Operator. Manual reads in residential settings may only be needed on a limited basis.	The Staff Estimate was tested and assessed as operating effectively in the January – February 2016 billing period. Therefore the likelihood of this occurring is low.
Data from the manual meter readings could be entered incorrectly into *Diamond* by the Accounting Clerk.	The **Staff Estimate methodology** of assessing historical consumption is utilized by the Accounting Clerk to verify the manual read obtained from the Operator. Manual reads in residential settings may only be needed on a limited basis. Manual meter readings are either received from an Operator on paper or over the phone from a resident.	The Staff Estimate was tested and assessed as operating effectively in the January – February 2016 billing period. Therefore the likelihood of this occurring is low.
Residents may make an error in reading and reporting their meter to the City.	The **Staff Estimate methodology** of assessing historical consumption is utilized by the Accounting Clerk to verify the manual read obtained from the Operator. Manual reads in residential settings may only be needed on a limited basis. Manual meter readings are received over the phone from a resident.	The resident reports an incorrectly high reading to the Accounting Clerk, resulting in an overstatement of consumption reflected in the invoice for a given billing period. If the reading given to the Accounting Clerk is incorrect, this cannot be validated until the next time an Operator retrieves a meter reading for the account. This can then be back-billed or applied a credit, if the reading was incorrect.

Assessment of Design and Implementation

We performed a walkthrough of the Manual Reads process with the Accounting Clerk. The manual meter readings that were collected by the Operators were reviewed by the Accounting Clerk against the historical consumption of the account for verification.

During the January-February 2016 billing period several residential meter readings required a manual reading. The Accounting Clerk was observed assessing the manual readings received and questioning their accuracy. As a result, the Accounting Clerk requested the Operators to retrieve a second manual reading, while a Staff Estimate was entered.

Based on our assessment this process is designed and implemented in a way that would verify the accuracy of the manual meter readings obtained. Manual readings that do not appear correct to the Accounting Clerk, based on patterns of consumption for an account, may require an additional manual read.

Assessment of Operating Effectiveness

We did not perform an assessment of effectiveness for the controls in the Manual Reads process as in the event that a read is unable to be collected and / or appears unreasonable a Staff Estimate is entered. Our assessment of the Staff Estimate (section 3.1.3) concluded that this control was operating effectively in the January – February 2016 billing period.

3.2.3 Generate Utility Levy

Process Overview

Before the City begins allocating water consumption as reflected on invoices (i.e. Utility Levies), work orders for the billing period are posted in *Diamond* by the Accounting Clerk.

Work orders may include a change of customer, change of a meter, the shutting of off water for an account, meter repairs and maintenance, installations on new builds, etc. Work orders can be identified as required through the water meter and consumption process, or through customer initiated actions (e.g. move to a new home). The Accounting Clerk sorts work orders to identify those that may require immediate action during the given billing period.

The Accounting Clerk posts work orders into Diamond as they are created. The work orders need to be posted prior to the generation of the utility levy, to ensure that the information from the work orders is included in the invoices for the billing period.

Subsequent to this, the process of generating utility levies begins. A utility levy is generated from the meter reading to a resident registered on the account. The Accounting Clerk checks to ensure that all accounts have a reading associated with them.

In addition, the Accounting Clerk also works to ensure that the resident contact information for the account is correct.

The utility levy is then generated through *Diamond* to determine the water consumption charges for the billing period that will be mailed to residents. The Accounting Clerk creates batches and enters the information for the billing period and verifies this. This process takes approximately three hours. Once generated, the bills are sent by the Accounting Clerk to the Senior Accountant and PDF's of the bills are

printed. This may take several days, and bills are typically mailed to residents 2 to 3 days after their creation.

Controls

The following controls were noted for the Generate Utility Levy process:

- **Smartlist Report Verification:** This control uses the Smartlist report to assist the Accounting Clerk in verifying that all accounts that were identified as not having received a reading have Staff Estimates generated for them, and that all System Estimates have been replaced by a Staff Estimate. This control was identified as a critical control, as all accounts that have not obtained a reading from the telemetry devices require a Staff Estimate to be entered. System Estimates may not be reasonable or applied in a consistent manner, which could result in potential overstatement of consumption for some residential invoices.

- **Premise Verification:** This control uses a Smartlist report to ensure that the residential address and number of premises associated with an account are updated and accurate. Each account must have information on how to send invoices to the resident. This control is designed to identify whether billing information is available for the account. It is not designed to prevent a material overstatement in a resident's water consumption as reflected in an invoice for a given billing period.

- **Reasonability Check for Utility Levy:** This control is completed once a utility levy is generated for an account. The Accounting Clerk manually reviews each account to ensure that no levy amounts appear abnormal. This manual review is less robust than the processes previously described section 3.2.1.

- **Service Code Verification:** Through this control the Accounting Clerk verifies that the service codes for the accounts are appropriate. For each fixed residential account (F062) there must be a corresponding consumption service code (W062). This is not a critical control, as it is not designed to prevent a material overstatement in a resident's water consumption as reflected in an invoice for a given billing period.

Potential Risk Factors

Inherent Risk	Controls	Residual Risk
Accounts may not have readings, or they may have system estimates in place which do not follow the staff estimate methodology.	The **Smartlist Report Verification** approach utilizes reports generated from Diamond to flag system estimates. System estimates do not follow the same methodology as the staff estimate and must be changed to the formula for consistency.	The Smartlist Report Verification was tested and system estimates identified were resolved, therefore it was assessed as operating effectively in the January – February 2016 billing period. Therefore the likelihood of this occurring is low.
The utility levy generated does not correspond with the actual usage as portrayed by the	The Accounting Clerk manually reviews the levies generated from *Diamond* through a **Reasonability Check** after batch is posted	Data used to calculate the levy may be overstated for a given billing period. While this control was not tested, we believe the presence of other critical controls in the water metering and

Inherent Risk	Controls	Residual Risk
meter reading in *Diamond*.	to flag abnormally high or low levy amounts.	consumption processes, such as the Staff Estimate, Data Transfer, and Meter Turnover Check, perform a similar enough function to be considered compensatory to this control.

Based on the Generate Utility Levy process review, the residual risk that a material overstatement in a resident's water consumption reflected in an invoice for a given billing period could occur is low.

Assessment of Design and Implementation

We performed a walkthrough with the Accounting Clerk of the controls noted above. Through this we observed the Accounting Clerk utilize the various Smartlist reports to verify and confirm consumption levels.

Reads are able to be marked according to different descriptions (e.g. system estimate). For those accounts that had reads as anything other than actual or staff estimates, we observed the Accounting Clerk assess the account information and either verify why the reading had been marked with a specific description, and / or if it needed to be changed.

We also observed the generation of the utility levies and the resulting review for reasonability. Our assessment is that this was not a control as there was no formal 'review' process or documentation of the review of the utility levies generated. The review solely consisted of the Accounting Clerk scanning the levy list to ensure that no extremely high or extremely low amounts appeared.

In addition, our review focused on the point at which consumption was reflected on a utility levy.

Assessment of Operating Effectiveness

We assessed the operating effectiveness of the Smartlist Report Verification control identified in the Generate Utility Levy process. To perform our assessment we completed the following steps:

- Reports for the last five billing cycles were obtained (May-June 2015, July-August 2015, September-October 2015, November-December 2015, and January-February 2016). All of the reports were available, except the September-October 2015 report. The Accounting Clerk was unable to locate the report for this period and indicated that it may not have been generated.
- The reports were examined to determine whether there were any no-read accounts or system estimates noted on these reports to verify that all accounts requiring staff estimates received them.

We found for three reports that all accounts with no-read or system estimates had been resolved by the Accounting Clerk.

For one report, November to December 2015, there were two accounts appearing as 'no-read' without explanation. Upon further investigation these accounts had Staff Estimates entered into *Diamond*. In our follow-up, the Accounting Clerk noted that the report may have been run before the estimates for those accounts were input.

While three of the four reports provided by the Accounting Clerk had resolved the identified no-read and system estimates, based on our assessment of the operating effectiveness the control may not be working appropriately. As a result, there are potential implications that no-reads or system estimates left unresolved in accounts may result in reporting of overconsumption for some residents. The impact is limited to when a meter reading is unable to be obtained, or a system estimate is generated. .

Due to our assessments undertaken for the January – February 2016 billing period, the presence of other critical controls in the water metering and consumption processes, such as the Staff Estimate, Data Transfer, and Meter Turnover Check, perform a similar function and are compensatory to this control.

4   Data Analytics

KPMG conducted an analysis of the City's historical water meter and consumption data (2009 to 2015) to analyze consumption patterns and trends across different variables. This assessment was conducted to identify anomalies in consumption, comparing complainants and other residents, and identify potential causes in overstatements of consumption.

For the purposes of analytics, an anomaly was defined as any consumption value over an account's average historical consumption (from 2009 to 2015). An anomaly has been defined as material in the scope of this review if it exceeds the account's historical consumption levels by greater than 10 cubic meters.

Our analytics focused on answering the following questions:

■ Does seasonal consumption of water and related billing follow a standard pattern?

■ Is monthly water consumption relatively stable year over year, when examined over a period of years?

■ Are there indications of water loss within the City?

■ Are there patterns in water consumption and that are out of the ordinary for the City over a period of time?

■ Do consumption anomalies have any relationship to meter telemetry?

■ Do consumption anomalies have any relationship to the age of the meter hardware?

■ Do water consumption anomalies have any relationship or correlation to certain factors such as geographic location of the residence?

■ Do anomalies in water consumption correlate with complaints?

4.1.1   Seasonality and Stability of Consumption

As depicted in Figure 3, the City's aggregated water consumption pattern is variable with seasonal trends. As a result, high variation among residents over a single year of billings can be reasonably expected.

Figure 3: City Water Consumption 2009 to 2015
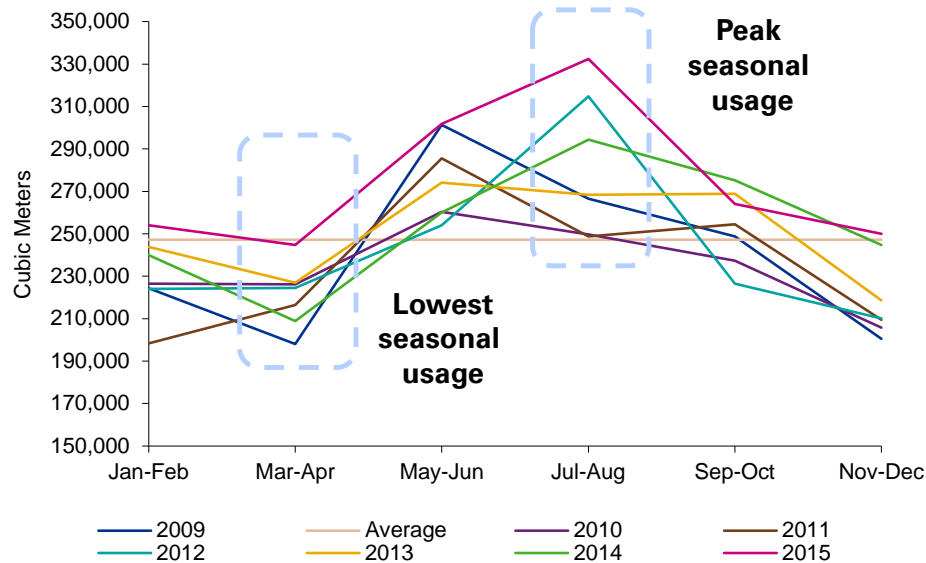
Overall, 2015 was the highest year for water consumption in the City; with the summer (July-August) recording the highest consumption over the period of time that we reviewed. During the July-August 2015 billing cycle the City received 13 of the 27 disputed bills.

July-August 2015 had the lowest rainfall and was the second warmest compared to the July-August period of other years from 2009 to 2014[1], potentially contributing to increased water consumption for the period for many residents.

In reviewing the number of residential anomalies (i.e. consumption over the resident's historical average) in each billing period from 2009 to 2015 (see Figure 4), there are no major deviations in the pattern between year or billing period. This would seem to indicate that anomalies can occur during any period and do not appear related to seasonal consumption patterns.

1 Based on weather data obtained from Environment Canada

Figure 4: Proportion of Anomalies by Billing Period
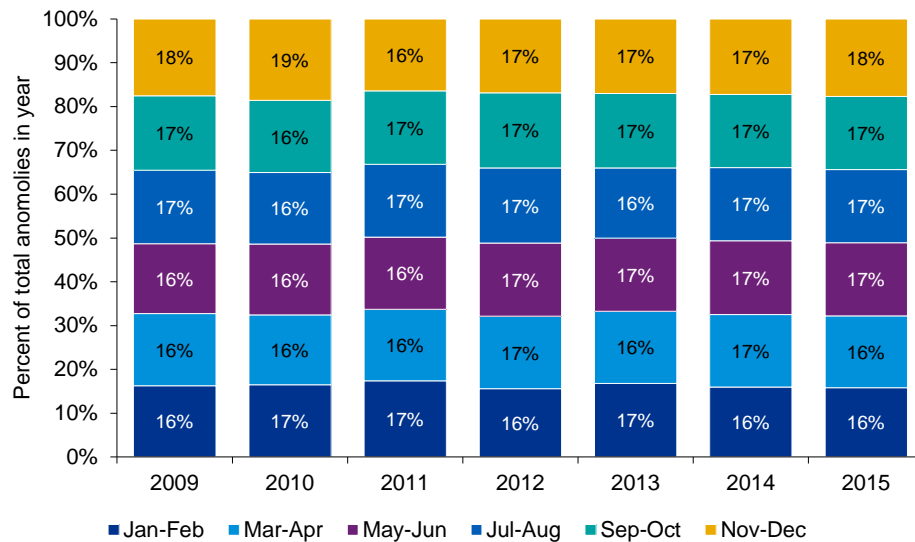
To further understand the stability of consumption we also calculated the standard deviation of each account's historical consumption. The standard deviation indicates how spread out the consumption (i.e. the distance between the minimum and maximum consumption recorded across each account from 2009 to 2015). This was done to understand how much variation exists in each account's pattern of consumption.

As per Figure 5, all accounts experience some variation in their consumption, with more than 8% of accounts having a large variation (i.e. a standard deviation of more than 26 cubic meters).

Figure 5: Consumption Standard Deviation (2009 to 2015)
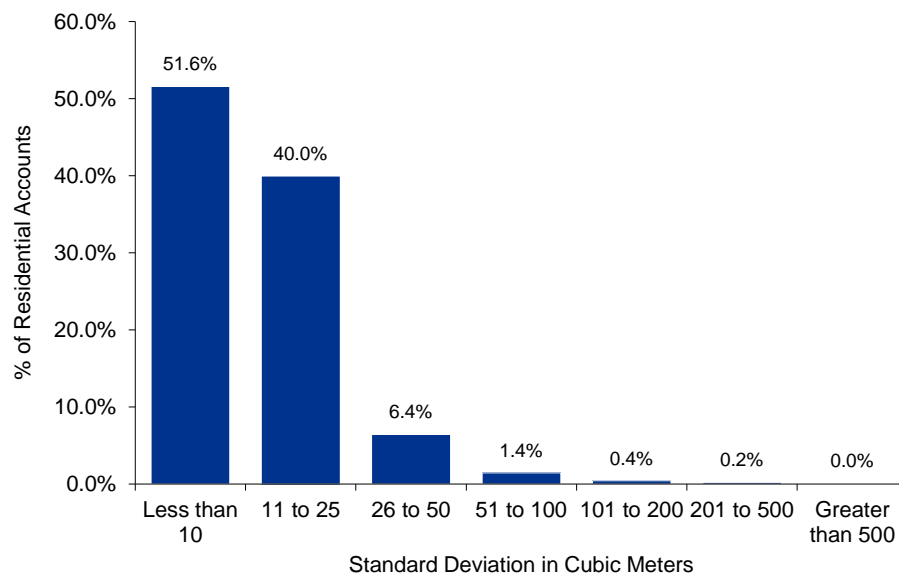
Conclusion

Based on the analysis performed there is a seasonal pattern of water consumption for the City. It would also appear that consumption by account is relatively variable with some accounts experiencing higher swings than others.

4.1.2   Water Loss

Figure 6 depicts the City's water loss, which is the difference between the volume of water purchased and the total consumption across residential, commercial and industrial.

While every municipal water system does tend to leak or have some volume of water loss, the amount can vary across municipalities. In 2009, Environment Canada estimated that on average 10.1% of water from municipal systems across Alberta, was unaccounted for. Further to this, the Alberta Urban Municipalities Association set a goal of 10% for water loss[2] in 2014 for Alberta's urban municipalities, which includes the City.

The City's water loss appears variable each year, with the highest water loss occurring in 2009 at just under 7% of the total purchased volume. In 2015, the City's water loss was 5% of the total purchased volume, well below the benchmarks outlined above.

This non-revenue / unaccounted for water is an important indicator of the condition and efficiency of the City's overall water system. This non-revenue water includes all unmetered consumption which consists of construction water usage, fire hydrants, other authorized unmetered consumption, and real losses from leaky infrastructure.

Figure 6: Total Water Purchase, Consumption and Loss 2009 to 2015
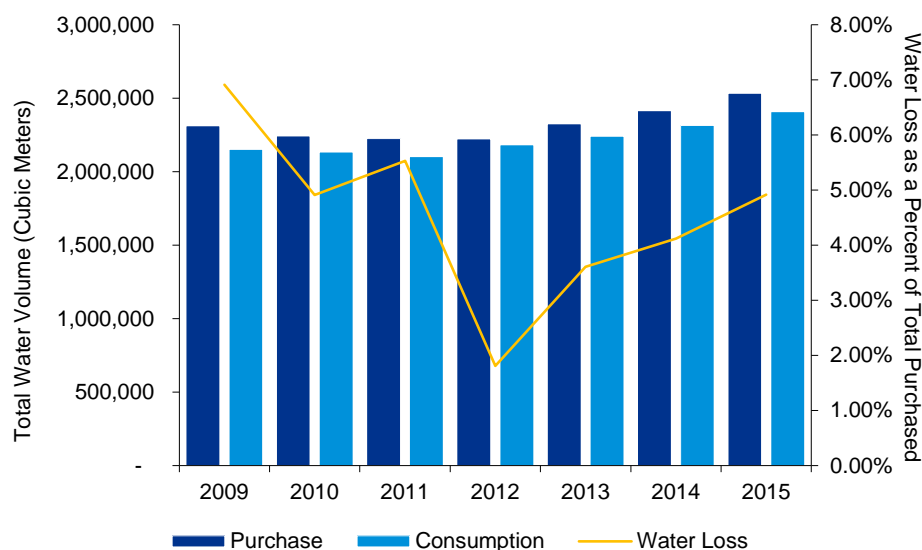
Conclusion

Based on the analysis performed there is water loss within the City. However it is not related or contributing to overstatements of consumption for some residents; if this was the case we would expect total consumption to be noted higher than the total purchase of water.

4.1.3   Water Consumption Patterns

We defined a consumption anomaly where an account's consumption for a given period was larger than its historical average. Using this definition, 44% of the records we reviewed relating to residential consumption in the City between 2009 and 2015 were considered anomalies. Anomalies have been defined as material where they exceed historical consumption levels by greater than 10 cubic meters.

As per Figure 7, over the six year period reviewed 67% of these anomalies were related to overconsumption of less than 10 cubic meters, and 0.9% were related to overconsumption of more than 100 cubic meters. This is despite the fact that average consumption for a residential dwelling is approximately 27 cubic meters per billing period, or 31 cubic meters when multi-family dwellings are included.

Figure 8 breaks these anomalies further by year. Based on this analysis the proportion of anomalies follows a similar pattern, suggesting that no single year experienced any higher consumption anomalies than others.

Figure 7: Water Consumption Anomalies by Overconsumption Amount (2009 to 2015) - All
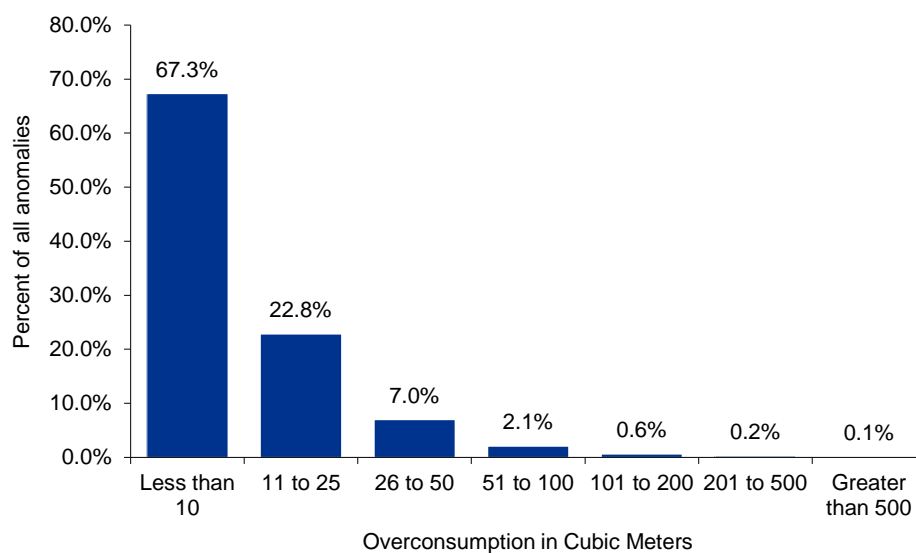
Figure 8: Water Consumption Anomalies by Overconsumption Amount (2009 to 2015) – By Year
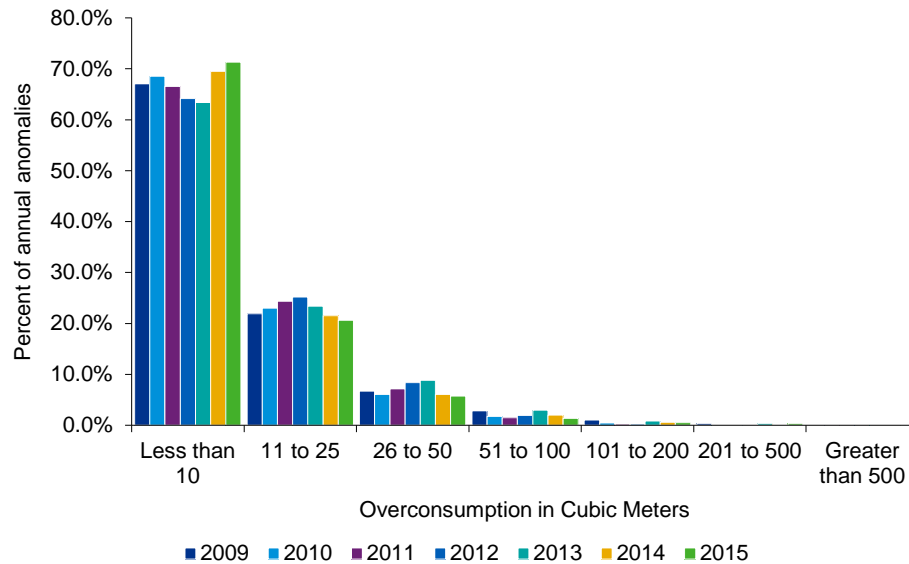
Conclusion

Based on the analysis performed there are no distinct patterns in water consumption that are out of the ordinary for the City from 2009 to 2015.

4.1.4   Meter Telemetry

As described in section 3.1.1, there are four different telemetry devices that are used to collect meter readings from 8,124 residences in the City. Figure 9 shows the number of residences that utilize each telemetry device, as well as the average consumption anomaly for those residence. Overall the data does not suggest that any single telemetry device may lead to a higher consumption reading.

Figure 9: Telemetry Device and Average Consumption Anomaly (2009 to 2015)

Telemetry Device	Number of accounts	Average consumption anomaly (cubic meters)
AR5001	1,503	4.5
AR5002	1,390	4.9
MXU	3,327	5.6
VGB	1,904	6.1
Total	**8,124**	**5.2**

Figure 10 depicts the correlation between the telemetry devices and all accounts that experienced a consumption anomaly between 2009 and 2015. Based on the analysis none of telemetry devices appear to lead to higher overconsumption readings.

Figure 10: Telemetry and Consumption Anomalies (2009 to 2015)
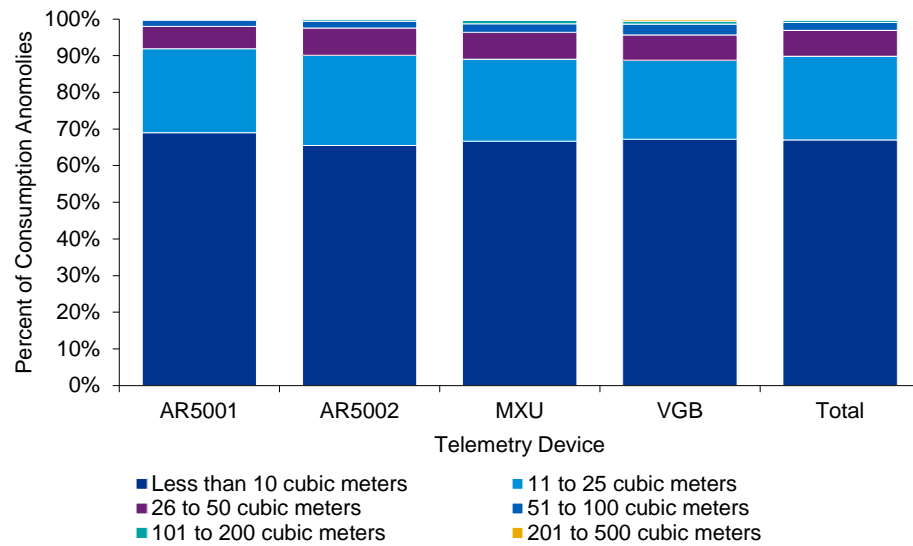
Figure 11 depicts the correlation between the telemetry devices, disputed accounts, and non-disputed accounts between 2009 and 2015. As previously noted, the City provided us with the details of 27 complaints that it had received regarding overstatements of consumption from residents. The orange line displays the percentage of disputed accounts relative to the total number of accounts associated with that telemetry device.

Figure 11: Telemetry, Disputed vs. Non-Disputed Accounts (2009 to 2015)
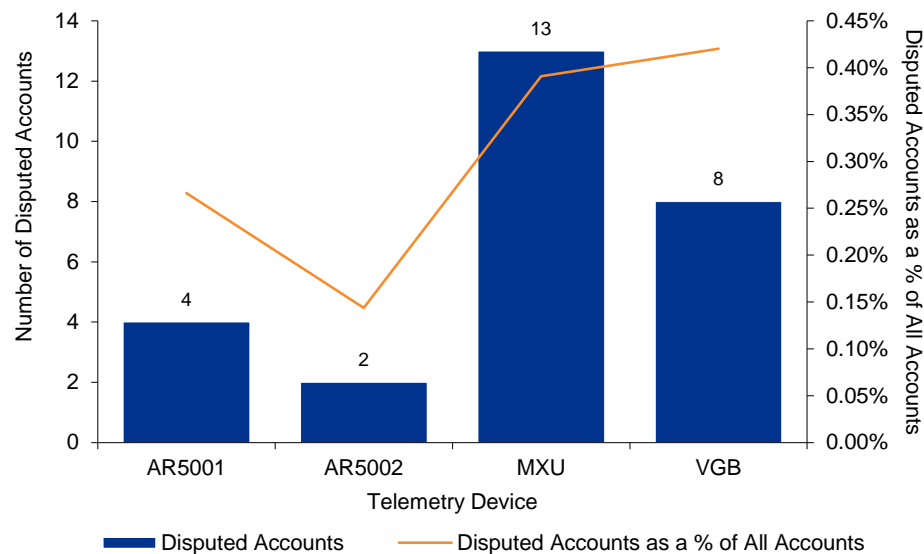
Conclusion

Based on the analysis completed consumption anomalies do not appear to be related to the type of telemetry used. The number of consumption anomalies among disputed accounts follows a similar pattern to non-disputed accounts.

4.1.5   Age of Meters

The current meters used by residents of the City were installed between 1990 and 2015. Figure 12 shows how this breaks down across active accounts; approximately 45% of meters were installed prior to 2000, 30% between 2000 and 2010 and the remaining 25% within the past 5 years.

In addition Figure 12 also depicts the number of disputed accounts and when their meters were installed. Where there is no strong correlation to the meter year installed, it would appear that meters installed in 2007 and 2015 represented almost one-third of all disputed accounts;

Figure 12: Meter Install Year and Disputed Accounts
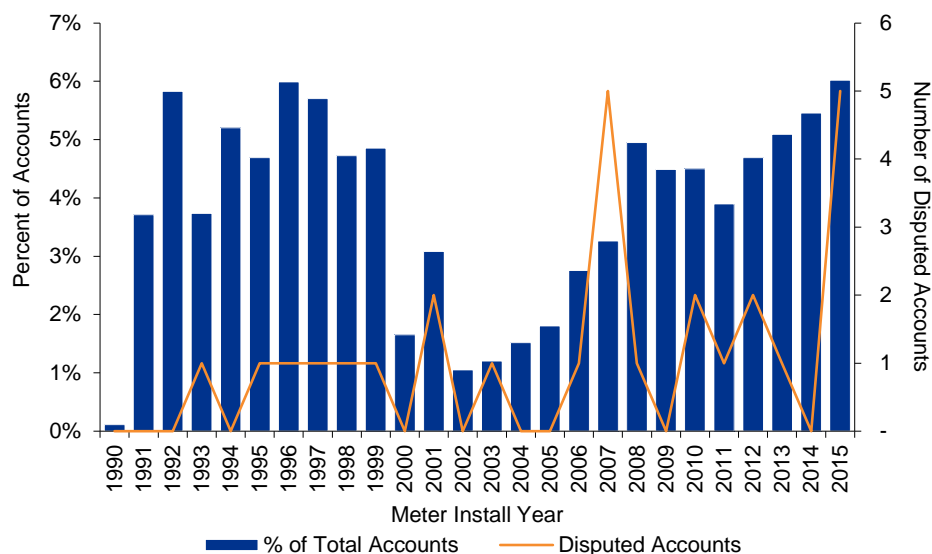
To determine whether this was a more pervasive issue, we analyzed all accounts that experienced a consumption anomaly against when their meter was installed. Figure 13 depicts the results of this analysis; approximately 54% of consumption anomalies came from meters that were installed prior to 2000, 32% from meters that were installed between 2000 and 2010 and the remaining 14% from meters installed within the past 5 years. There is no strong correlation between the year a meter was installed and a consumption anomalies.

Figure 13: Meter Install Year and Consumption Anomalies (2009 to 2015)
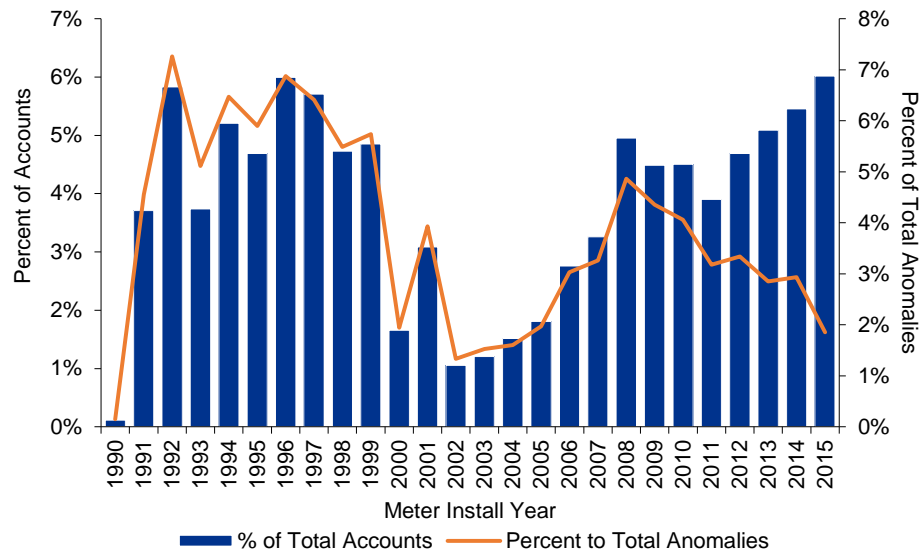
Conclusion

Based on the analysis completed consumption anomalies do not appear to be related to the age of the meters. The number of consumption anomalies among disputed accounts follows a similar pattern to non-disputed accounts.

4.1.6   Geographic Locations

To assess whether the disputed accounts are geographically related, these accounts were mapped according to location, and the billing period of the dispute in Figure 14.

Figure 14: Geographic Dispersion of Disputed Accounts

Colours indicate the billing cycle disputed:

- 8/31/2015
- 6/30/2015
- 10/31/2015
- 12/31/2015
- 2/28/2015
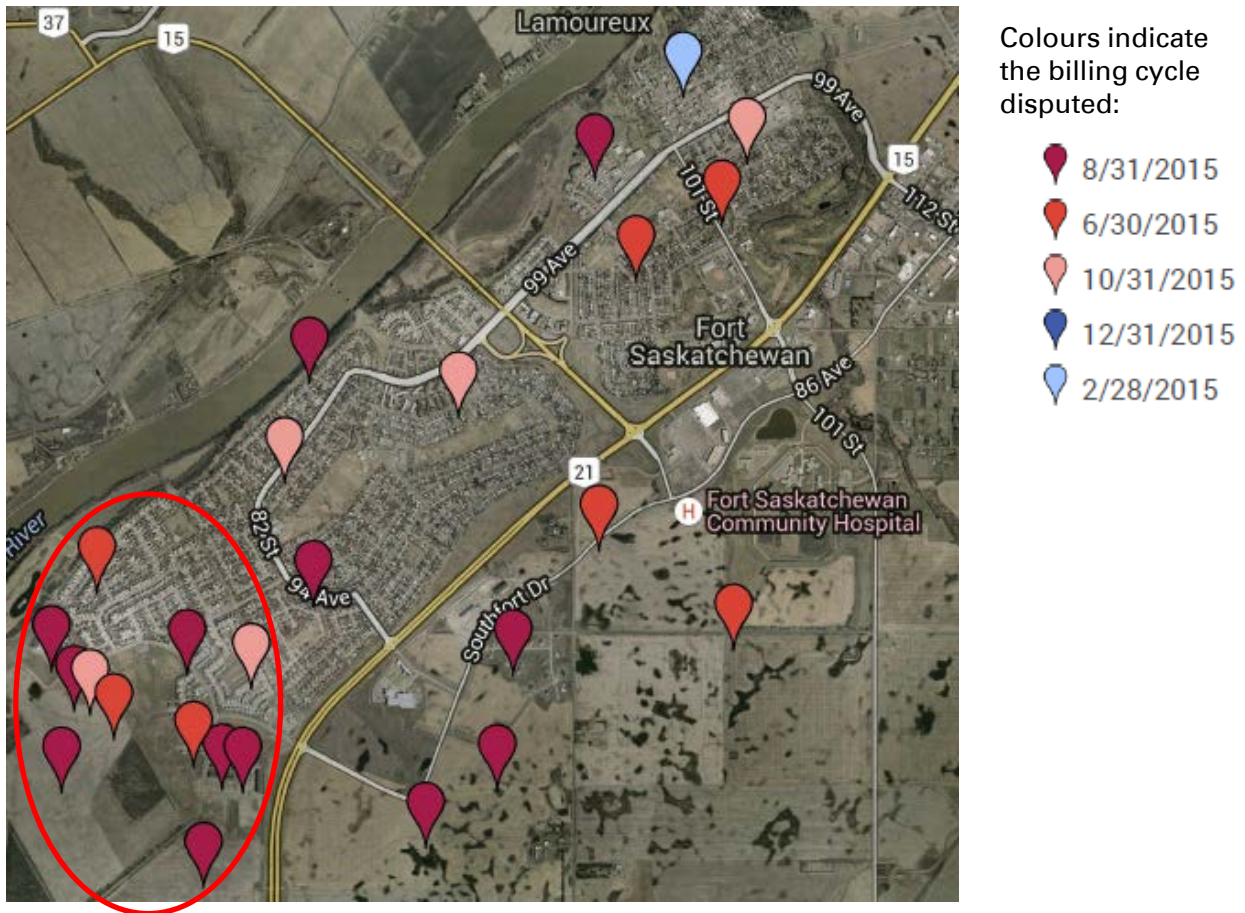
Image courtesy of Google

The July-August 2015 billing period experienced the greatest number of disputed accounts. In addition, there are potential geographic concentrations of disputes. Based on the satellite image (Figure 14), these appear to be in locations where there are newer developments.

To provide further insight into the location assessment of the disputes, the meter install year was also mapped geographically (Figure 15). It does not appear that there is a correlation between the year of installation and the geographic location for the disputes. In the southwest corner of the map, there is a slight concentration of disputes from meters installed in 2007.

Figure 15: Geographic Dispersion of Disputed Accounts by Meter Install Year

The July-August 2015 billing period saw the highest historical consumption in Fort Saskatchewan, and also saw the most complaints of any single billing period. This map in Figure 16 shows the 50 accounts with the highest consumption over this time period. There is a notable cluster of high consumption in the southeast portion of the City. While some disputed accounts were among these top consumers, high consumption did not correlate strongly with disputed accounts.

Figure 16: Geographic Dispersion of High Consumption Accounts (July-August 2015)
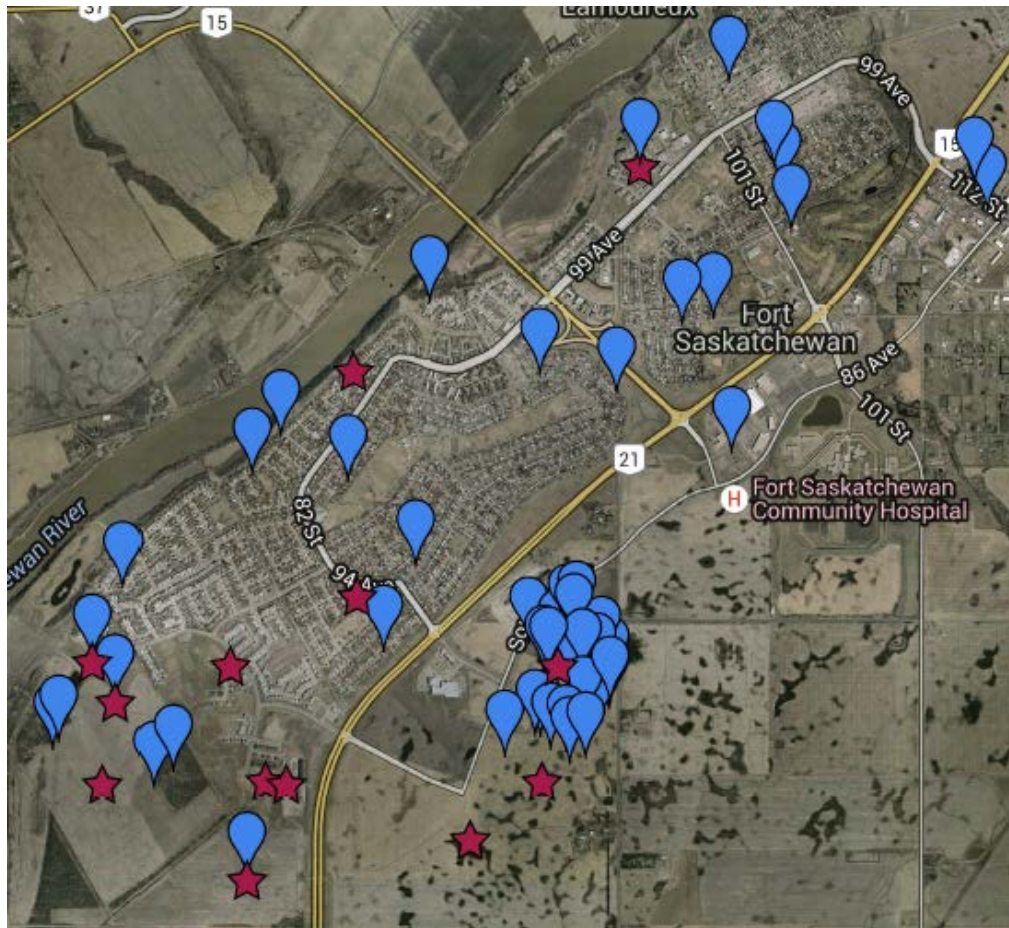
NOTE: Stars on the above map represent disputed accounts.

The map in Figure 17 shows the 50 accounts with the highest consumption anomalies, compared to their historical average. There is a notable cluster of high consumption anomalies (20 of 50) in the southeast portion of the City. While some disputed accounts were among those with the highest spikes, high spikes in consumption did not correlate strongly with disputed accounts.

Figure 17: Geographic Dispersion of High Consumption Anomalies (2009 to 2015)
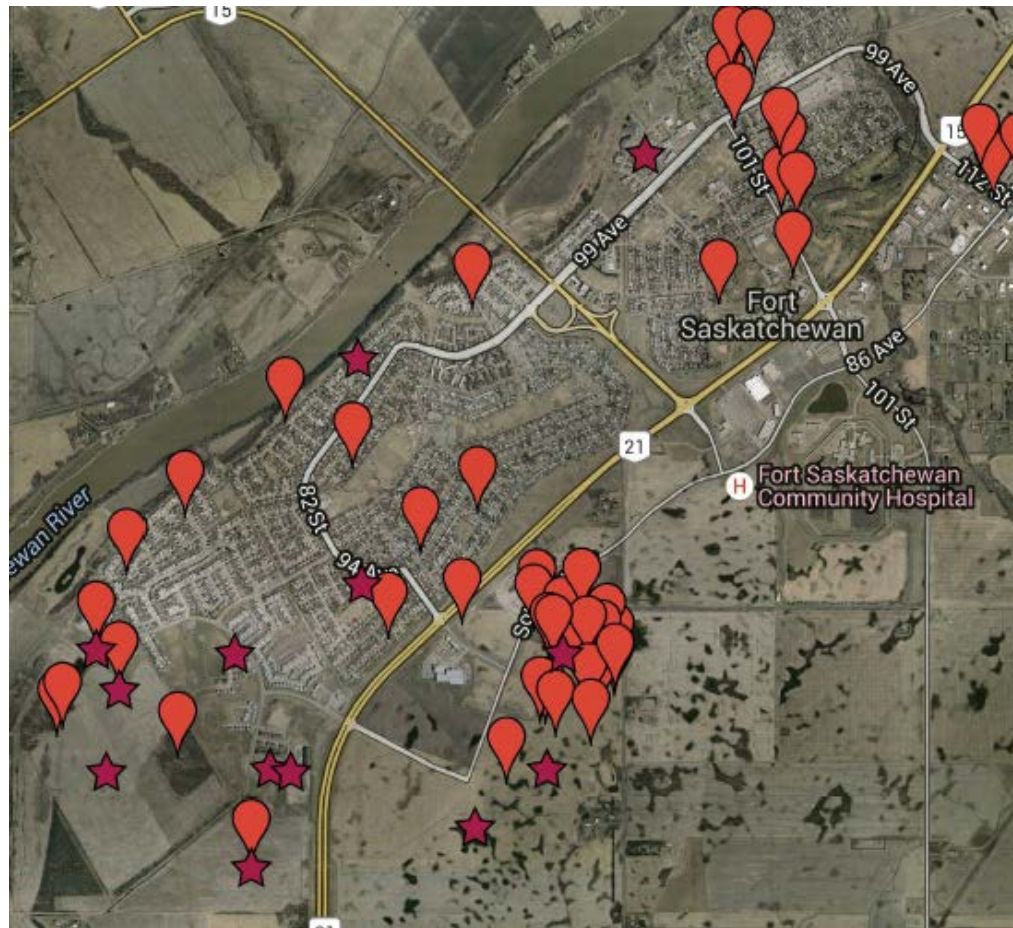
NOTE: Stars on the above map represent disputed accounts.

Conclusion

Based on the analysis completed it does not appear that water consumption anomalies have a relationship to the geographic location of a residence.

4.1.7   Consumption Anomalies and Disputed Accounts

As previously noted, the City provided us with the details of 27 complaints that it had received regarding disputed accounts.

We compared these disputed accounts against all of the consumption anomalies in Figure 18.

Figure 18: Consumption Anomalies and Disputed Accounts (2009 to 2015)
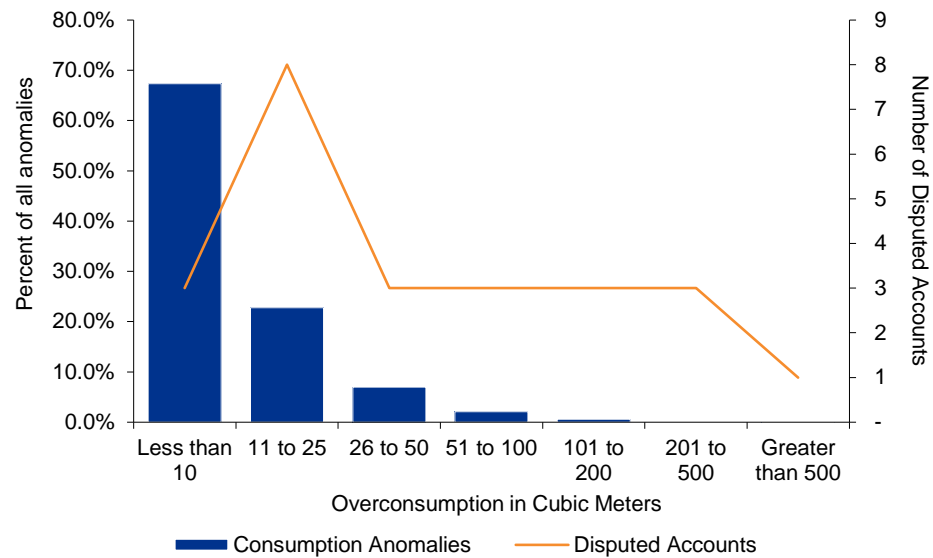
The magnitude of the disputed accounts varies significantly. While it appears that some of the disputed accounts are typical consumption fluctuations, when compared to the proportion of other accounts, others are more significant. It should be noted that the majority of consumption anomalies between 2009 and 2015 were not disputed, yet some have a significant variance from their historical average.

Conclusion

Based on the analysis completed it does not appear that water consumption anomalies have a relationship to the disputed accounts.

5   Jurisdictional Review

Our jurisdictional review focused on comparing the practices of several other Alberta municipalities to the City (population 24,040), including the Town of High Level (population 3,823), City of Leduc (population 29,304) and City of Medicine Hat (population 63,018). The table below outlines how each of these municipalities addresses different aspects of water metering and consumption processes and provides information on leading practices (leveraging radio frequency technology) that may also be considered by the City.

5.1   Key Practices

Town of High Level - Dispute Resolution System

High Level utilizes Radio Frequency Read technology for their water metering and consumption processes. They have found that the capability of their technology assists in the resolution of consumption disputes.

Their technology allows for 90 days of consumption information to be stored directly in the meter system. If a customer raises a dispute, High Level can show the resident their consumption levels from the past 90 days directly from their own meters. This has been found to pro-actively resolve disputes and allow residents to be more aware of consumption levels, as well as water conservation.

City of Leduc: Testing in an Offline System

Leduc performs a unique test within its billing system. It utilizes two system environments, one that is live, and another in a test format (i.e. will not alter account, billing, or consumption information).

This test is performed as often as 6 to 7 times a year when there is a software update or any similar occurrence that may result in technical issues occurring. It may also be run to ensure that operations are consistently tested across a prolonged period of time.

Leduc performs a sample batch in the test environment to flag abnormal consumption amounts or other technical abnormalities, which would depict an issue in the software upgrade, such as a rate being dropped off, or some other similar occurrence.

This process is performed to ensure the validity of the billing software and ensure that invoices are accurate and consistent throughout software updates and changes. Leduc noted that this testing process is highly useful in identifying potential errors pro-actively, before the billing invoices are sent out and are utilized not only in the water metering and billing processes, but across all of their utilities.

City of Medicine Hat: Consolidated Utility Services Utilizing AMI Technology

Medicine Hat is utilizing a new method of delivering utilities that is not traditionally offered by Canadian municipalities. Its Automated Metering project utilizes smart meters, those with two way interactions between the meter reading device and the centralized system, which consolidates electric, water, and gas services for all utility customers.

The company utilizes a system to administer its meter data management (MDM). This system provides advanced analytic solutions from raw consumption data. The meters on a residence also have multiple alarms configured (i.e. to identify backflow, reverse flow, empty pipe etc.).

Medicine Hat also has a unique monthly billing process, as managed through its fibre optic radio transmission technology. Centrally located towers inside the city limits are able to retrieve the data into its MDM system, and once validated, it is transmitted to a service management system.

The City is divided into 20 sections called cycles; each cycle is read on a different day of each month. The utility bill is calculated, printed and mailed to the resident 5 to 7 working days after the meters are read. As a result, the time of the month the bill is received will depend on where the resident is located in the City.

5.2   Meter Properties & Technology

Leading Practice	Radio Frequency Read technology is considered to be the most advanced and accurate means of obtaining meter reads. This technology includes: ■ Automated Meter Reading (AMR): Mobile meter reading, efficient reading with monthly data. ■ Advanced Metering Infrastructure (AMI): Fixed network reading, with daily or hourly data. ■ Advanced Metering Analytics (AMA): Power analytics based software platform / fixed network meter reading (can provide meaningful and proactive information - system can be configured to send notifications to operators or customers). Advanced software from the Radio Frequency Read technology also provides capabilities for a municipality to access meter consumption history with hourly and daily consumption logs available online to both the customer and to the municipality. This offers the following benefits: ■ Pro-active leak monitoring ■ Vacant account notification ■ Conservation incentives for customers ■ Information on planned/unplanned outages. In addition, having a customer-facing portal regarding water meter consumption can help to reduce calls and complaints, and increase the efficiency of the overall water metering and consumption process.
City of Fort Saskatchewan	■ Approximately half of the City's meters utilize Radio Frequency Read technology (AMA) ■ This telemetry system has 99.5% to 100% read accuracy.

Town of High Level	■ Utilizes Radio Frequency Read technology (AMI) and all systems are equipped with radio frequency technology
	■ Meters capture daily consumption data and store it for up to 90 days.
	■ Due to the ability to capture frequent consumption readings, the system has the ability to detect leaks sooner.
	■ This telemetry system has a 99.5% to 100% read accuracy.
City of Leduc	■ Utilizes Radio Frequency Read technology (AMI)
	■ Its online system provides day-to-day monitoring of metering, with pro-active leak and consumption monitoring
	■ This telemetry system has a 99.5% to 100% read accuracy.
City of Medicine Hat	■ Utilizes Radio Frequency Read technology to collect readings for all utilities, including water, electric, and gas meters.
	■ Capabilities to capture hourly and daily consumption, which can be viewed anytime by the customer online.
	■ The meter has multiple alarms configured (backflow, reverse flow, empty pipe, and leak detection capabilities).
	■ This telemetry system has a 99.5% to 100% read accuracy.

Overall Observations

■ In comparison to other municipalities, The City does not have the capability to monitor daily metering for its residents

■ Many other municipalities are utilizing AMI rather than AMA technology

5.3 Operations and Maintenance

Leading Practice	AMI and AMA systems, with continuous network monitoring, reduce the need for reports to uncover maintenance issues and act as a pro-active means to capture maintenance issues before they translate into issues with consumption reflected on invoices.
	The utilization of map-based maintenance management has the potential to create efficiencies; the GPS tracking of meter coordinates offers accessible information to all operators from any mobile device.
	Advanced systems have the capacity to automatically generate and upload 'to-do' lists into the operator's field devices, allowing for efficient management and

	prioritization of work orders and effective maintenance training. Advanced systems include both paper and electronic tracking.
City of Fort Saskatchewan	■ Telemetry devices utilized currently include handheld proximity guns, as well as vehicle mounted devices that have the ability to capture meter reads. ■ Handheld reads can take a couple of weeks to obtain, but radio reads can be delivered in several days. ■ Estimates are used if no actual read detected. ■ Only actionable interactions on a meter (e.g. replacement, repair) are captured by the work order system, there is no additional interaction tracking. ■ Meters are assessed (and replaced) after two consecutive billing periods of an identified meter malfunction, if the problem is not rectified.
Town of High Level	■ Vehicle mounted device captures reads in 5 hours. ■ Software creates routes, capture meter reads, and is transferred to a billing system. ■ Estimates are used if no actual read detected. ■ Paper system is used to track meter interactions.
City of Leduc	■ Utilizes an online read collection system that pulls meter readings from centralized towers on the 19th of every month. ■ Meters are changed every 20 years. ■ Maintenance is managed manually. A new asset management system is being implemented over the next couple of years. ■ A special test is performed 6 to 7 times a year (after software updates) to ensure the validity of the invoiced amounts in a 'test' environment; this assists in catching issues before invoices are sent out.
City of Medicine Hat	■ Water, gas, and electric consumption information is submitted electronically to various towers throughout the City. ■ The municipality is divided into 20 sections called cycles. Each cycle is read on a different day of each month. The utility bill is calculated, printed and mailed to the resident 5 to 7 working days after the meters are read. As a result, the time of the month the bill is received will depend on where the resident is located in the City. ■ While the readings are highly accurate, occasions may arise when a reading is unable to be gathered and an estimate is used.

Overall Observations

■ There are a variety of billing practices in use – most generate monthly invoices which are system generated

■ Majority of meter reading is automated, rather than requiring the use of handheld devices

5.4   Resource Management

Leading Practice	Radio Frequency Read systems that automatically capture and upload information from continuous network monitoring provides proactive analytics that reduce the need for reports and manual reviews. This also increases the likelihood of capturing a leak before it results in unusually high consumption levels and provides effective consumption monitoring from a customer perspective. This pro-active approach assists in the reduction of customer complaints.
City of Fort Saskatchewan	■ A detailed manual review process is undertaken to ensure consistency and accuracy of meter reads and consumption levels ■ A single staff performs the meter reading and consumption process, however other staff are cross-trained, to provide assistance if required.
Town of High Level	■ The detailed consumption data from R900 meter technology reduces the need for extensive manual review. ■ A single staff performs the meter reading and consumption process, however other staff are cross-trained, to provide assistance if required.
City of Leduc	■ Billing software includes a check for abnormal consumption amounts, including any strange pluses / minuses in the account's activity. ■ There are two full time staff that work in the consumption allocation process (for all utilities), with a third resource on call if needed. ■ Utilities are managed together, there is no separate staff for each utility
City of Medicine Hat	■ Detailed consumption data managed by the system provides advanced analytics and reduces the need for manual review. ■ System is used for multiple utility services and bills for electric, gas, water, sewer, solid waste and recycling. ■ There is a staff of 10 that perform operations from meter reading, consumption reflected on invoicing, payments and reporting processes, along with systems support.
Overall Observations ■ System generated checks are a common method used to identify anomalies in metering consumption, etc. ■ Municipalities have begun to consolidate their utility metering and consumption processes into a single functional unit to utilize common systems and staff to deliver	

5.5 Customer Services Capabilities

Leading Practice	Leaks and water losses occur in any water system, but appropriate technology can help municipalities and residents reduce the potential for unauthorized water losses. AMI/AMA technology can utilize 'logger' devices deployed on main water valves or consumer homes, which can detect leaks through acoustic vibrations. AMA software can provide real-time customer notifications of leak conditions, as well as provide consumption information, which can reduce overall consumption. This helps to pro-actively prevent disputes from occurring
City of Fort Saskatchewan	■ Resident will call to register complaints or receive consumption information. ■ Online access is available to view customer accounts.
Town of High Level	■ Technology installed in meters gathers consumption data for a 90 day period which can be shown to a customer and used to resolve disputes. ■ Technology also has leak detection capabilities; staff are able to proactively rectify leaks by system monitored accounts and notifications to a resident.
City of Leduc	■ Uses online payment services for utilities. ■ An online system provides staff with the ability to monitor consumption anomalies and leaks, pro-actively mitigating potential costly accidents.
City of Medicine Hat	■ Administers meter data management program, allowing for proactive and analytic solutions from the meter reading data collected. ■ An online service allows for customers to pay utilities online, view their hourly / daily consumption, and submit meter readings through a portal. ■ A system captures data through a service order functionality. This system manages and tracks all aspects of work performed for customers.
Overall Observations ■ Municipalities have begun to offer customer portals for consumption readings, billings and payments	

6   Recommendations

Based on our assessment and the data analysis completed, we found no issues that would create a situation where the City has made an error and a residential account has been overbilled for consumption.

However, during the course of our review a number of opportunities were presented to us. The following outlines the recommendations that we believe the City should consider to improve its water meter and consumption processes, controls and customer service.

Additional Testing of Subsequent Billing Periods

As our review of controls was limited to a single billing period, the City should consider **conducting additional testing** of subsequent billing periods to confirm the effectiveness of its estimate processes.

Implement a Customer Inquiry System

Currently the City does not have a system for collecting data or tracking customer interactions, including complaints about high bills / consumption. As a result, there is currently no complete record of accounts that may have disputed bills in the past.

As such, the City should consider implementing a system that would assist it to record customer inquiries, including complaints. This type of technology would allow the City to better record actions taken to address the inquiry, provide an automated work flow and enable a resident to view the status of their inquiry as it is resolved or addressed.

Report Utilization

The City should work on configuring its systems to generate reports that would alleviate the need to complete manual reviews of consumption and utility levy's.

Diamond should be configured to generate high / low consumption reports. Currently, the parameters of the reports are not configured properly to do this; as a result a large number of accounts (approximately 80 to 90% of all accounts), which does not currently add any value into the review process. If these parameters were defined to reflect the accounts with actual outliers, this could reduce the time involved in the manual review and reasonability check process, as well as reduce the potential for accounts to be mistakenly overlooked.

Diamond should be configured to identify utility levy anomalies. Currently, the Accounting Clerk manually reviews the utility levies for abnormal amounts. To provide assistance in this process, reports should be calibrated identifying outliers.

Strengthen Controls

As a result of our findings for the controls that we observed and tested (see section 3.1 and 3.2), KPMG recommends the following modifications:

■   Review of report by another team member: The water metering and consumption processes are performed by a single Accounting Clerk (excluding the field work completed by the Operators).

A significant amount of time is invested in manual review processes. The majority of these reviews are subject to reasonability tests, contingent upon one individual to apply them consistently. Once an Accounting Clerk has addressed all of necessary accounts on a report used to flag anomalies, a clean report should be given to another team member for their review. The addition of another review by an additional staff could help to ensure consistency and confirm the accuracy of the reasonability check processes.

■ Tracking of reviews by Accounting Clerk: A recurring theme among the processes observed is that there is a lack of tracking completion of several processes. The City's processes have been designed to minimize errors, but have not been designed with a view of documenting their completion. This lack of paper-trail in a process could be addressed through a "control checklist" that the City could complete during each metering and billing cycle. This checklist would help to:

– Act as a reminder and tracker to support task tracking.

– Act a record of tasks performed to facilitate teaching the duties to another employee.

– Act as an item that can be reviewed by a Supervisor or another team member to provide oversight to the Accounting Clerk's role.

Frequency of Meter Readings and Invoiced Consumption

The City should consider a change to the frequency in its meter readings and invoiced consumption. Currently readings and invoices are completed on a bi-monthly basis, while other municipalities are completing meter readings on a more frequent basis and invoicing their residents on a monthly basis. While this is not expected to address potential overstatements of consumption as reflected in invoices, it will allow the City to more proactively monitor consumption patterns and address disputes closer to when they may occur.

Metering Technology

Based on the scan of other jurisdictions, it appears that the City's metering technology may not be optimal. The City may wish to consider what if any changes it could make to reduce the use of manual processes (e.g. handheld guns) and increase the use of system-driven processes and automated radio frequency readings.

Documentation of Policies and Processes

The City should **document its policies and processes** to calculate consumption estimates. This should include guidance on the estimate in relation to a resident's mean consumption.

Appendix 1   Process Maps

Load Meter Guns

```
Load meter guns → Open Gun Sheet spreadsheet to current billing period tab → Export each of the 19 routes one at a time for Gun AR5001 one at a time to the Gun Sheet spreadsheet → Export each of the 12 routes one at a time for Gun AR5002 to the Gun Sheet spreadsheet → Export the 1 route for MXU (labelled VXU001 in Diamond) → Export the 1 route for VGB (labelled VGB002 in Diamond)

In AutoRead clear the VXU001, import, and load data to load the gun. VGB data stick must be in USB port. ← In AutoRead clear the VGB002, import, and load data to load the gun. VGB data stick must be in USB port. ← On Gun Sheet spreadsheet record a) the date the guns were loaded and b) the number of meters from AutoRead. ← Check for load errors and address ← In AutoRead clear the AR5002, import, and load data to load the gun. Gun must be in cradle. ← In AutoRead clear the AR5001, import, and load data to load the gun. Gun must be in cradle.

Check for load errors and address → On Gun Sheet spreadsheet record a) the date the guns were loaded and b) the number of meters from AutoRead. → Print Route 33 sheet and Route 33 jail sheet for the operators → Operators pick up guns, VGB data stick and Route 33 sheets
```

Unload Meter Guns

```
Unload meter guns → Receive guns/stick from operators → Export meter data from guns/devices into AutoRead. → Generate meter route reports (export and save to shared drive) for Gun AR5001, Gun AR5002, and VGB/MXU → Backup and save the meter route reports into the system
```

Sensus Meter Reports

Meter Report Sensus

Walk Route Reports: For guns AR5001 and AR5002. Run the following reports from AutoRead and take the specified actions for each:

Walk Report A: Low Exception Report (no action required)

Walk Report B: Confirm with operators why the accounts are marked for the Marked Location Report

Walk Report C: Master Route Report (no action required)

Walk Report D: The Multiple Read Report depicts the accounts for which multiple readings appear. This is checked and adjusted manually in the AutoRead.

Walk Report E: Confirm that the Non-Read Exception Report and the Non-Read Report from Diamond match

Walk Report F: The Register Malfunction Report depicts readings where a digit was not able to be read. This requires a manual staff estimate in AutoRead.

Walk Report G: The Route Note Report contains notes that explain why the operator could not obtain a reading. Action needed to rectify the issue and provide a staff estimate for this period.

Walk Report H: "Route Statistical Summary" report (no action)

Walk Report I: "Route Title" Page (no action)

Walk Report J: The MXU Worksheet delivers detailed information on no-read meters. This information is typically given to the operators.

Radio Route Reports: for the VGB/MXU systems. Run the following reports from AutoRead and take the specified actions for each:

Radio Report A: AMR Master Route Report (no action)

Radio Report B: MXU Status Report (no action)

Radio Report C: Compare MXU Worksheet to Non Read Exception Report and ensure values are on worksheet.

Radio Report D: Confirm that the Non-Read Exception Report and the Non-Read Report from Diamond match

Radio Report E: The Non-Route Exception Report identifies meters that do not belong in the route.

Radio Report F: The Register Malfunction Report depicts readings where a digit was not able to be read. This requires a manual staff estimate in AutoRead.

Radio Report G: Operators to confirm if list from "Register Mismatch" Report are touch or radio reads.

Radio Report H: "Route Statistical Summary" Report (no action)

Radio Report I: "Route Title Page" (no action)

Radio Report J: Update meter ID's from "Meter ID Mismatch" Report in Diamond

Import Meter Reads into Diamond

Import Meter Reads into Diamond (Entire process completed for each of four telemetry readers)

→ In Diamond, select transaction, then utility, then meter import

→ Create batch number – Each reader device (AR5001, AR5002, VGB, MXU) is imported as a separate batch.

→ Import meter reads into Diamond

→ Check error report and correct any errors highlighted

Run 'zero consumption', "no read", and "turnover" reports

Review meter reads and reports for abnormal reads.
Low Consumption Check: Manually check all readings below 3 cm3, access account history and verify whether there is a pattern of low consumption. If no pattern and low consumption is >2 months, make note on report

Zero Consumption Report: Access account history, verify pattern of zero consumption; it no pattern and zero consumption is > 2 months, make note on report

No Read Report: Access account history, take average on 6 reads (no outliers), add average consumption to previous read, and label as staff estimate.

Turnover Report: Confirm if turnover is valid, and if not determine why the meter went backwards.

→ Re-run reports and verify No Read Report is empty and Turnover Report has only valid turnovers.

→ Verify readings: manually check that all abnormal readings are resolved

→ Group and save with other readings for the month in the folder

→ Proceed to next batch (repeat process). If all four batches complete, proceed to Manual Reads.

Manual Reads

Manual Reads

→ Open Diamond and enter account number receiving manual read

→ Input the manual read value and identify whether the read was received from an operator or phoned in by customer

→ Change meter read date to date of next scheduled read, save and exit.

Generate Utility Levy

```
Generate Utility Levy → Post Work Orders for the Billing Period: → List outstanding work order by route and sort by batch number. Filter for work orders relevant to the current billing period. → Enter information from PDF work orders received by the operators into the work order entries in Diamond → Readings and information from the Work Orders over-ride the readings collected → Check Reports
```

```
Reports: Access in Diamond. ← Validate No Meters report and enter estimates of meter reads if accounts appear. ← Save the No Actual Read report in the meter issues under estimates folder. ← Validate System Estimates and enter estimate of accounts that appear. ← Validate no-reads and enter estimate if accounts appear. ← Smartlist: Enter Smartlist, through Diamond Software and UP Opt Exceptions Detail
```

```
Update "UT Accounts- no print" report: if accounts appear, designate as primary occupant. → Update "UT Accounts- Zero Premises" report: If accounts appear enter the number of premises. → Generate City Levy: → Enter transactions, and utility, to access billing batches → Enter required information for the City for the billing period. → Review accounts to ensure they are zero, except Bowling Alley and Family Center
```

```
Enter required information for the billing period. ← Enter transactions, and utility, to access billing batches ← Generate Utility Levy: ← Send to senior accountant and City contacts ← Open the services code report and verify service codes ← Print and save to City folder.
```

```
Review accounts to ensure no amounts are abnormal. → Print and save to Utility folder for the month. → Open the services code report and verify service codes → Send to senior accountant → In Diamond, click print and check on print utility levy, save pdf of utility bills to city folder created. → Print utility bills
```

```
Print utility bills → Enter account numbers from work order in Diamond, change status to active.
```

Appendix 2   **Documents Reviewed**

- Metering Information System Manual (AutoRead) Documents
    - Section 1 Introduction
    - Section 2 Before Using AutoRead
    - Section 3 Elements of the Process Routes Screen
    - Section 4 Handheld Process Routes
    - Section 5a Vehicle Process Routes
    - Section 5b Procedures for Loading Vehicle Routes
    - Section 6a Process Routes Functions
    - Section 6b Loading and Reading Process Flow Chart
    - Section 7 Additional Route Processing Options and Details
    - Section 8 Polling Devices
    - Section 9 Reports
    - Section 10 Troubleshooting Incorrect Meter IDs

- Process Overview Documents
    - Generate Utility Levy Active
    - Importing Meter Reads into Diamond
    - Loading Guns
    - Manual Reads
    - Meter Reports Sensus
    - Unload Meter Guns
    - Billing System Information (Diamond)

- Process / System Reports
    - Gun Sheet 2016
    - AMR Master Route Report VGB
    - MXY Worksheet Report VGB
    - Non Read Exception Report VGB
    - Non Route Exception Report VGB
    - Route Statistical Summary Report VGB
    - Route Title Page VGB
    - VGB Jan / Feb 2016 No Reads Report
    - VGB Jan / Feb 2016 Turnover Report
    - VGB Jan / Feb 2016 Zero Consumption Report
    - VGB Meter Read Jan Feb 2016

- Data
    - 2014 2015 Meter Repairs
    - 2015 Water Commission Purchase
    - Bulk Water Consumption
    - COFS 7 Year Metered
    - Meter Inventory as of Jan 15/2016
    - Meter Replacement from Jan 1 / 2008 – Jan 15 / 2016
    - New Water Consumption Levy Report
    - U_Levy Service Code Report
    - W075 Consumption Report
    - W075 Utility Service History Detail Account
    - WMF Consumption Report

- WMF Utility Service History Detail Account
- Diamond No Read Reports for AR5001,AR5002, VGB, MXU for the following dates:
  - August 2015
  - December 2015
  - June 2015
  - October 2015
- Diamond No Actual Read Report for the following dates:
  - December 2015
  - June 2015
  - August 2015

Individuals Interviewed

As part of our data gathering, we obtained process information and materials from the following individuals:

- Accounting Clerk II – Utilities

- Utility Services Manager

- Billing Clerk

- General Manager

- Director, Infrastructure Management

- Chief Financial Officer

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