



City of Cleveland Heights

Detailed Engineering Evaluation

Water Utility Optimization

AWWA Free Water Audit Software: Reporting Worksheet

WAS v5.0
American Water Works Association
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Water Audit Report for: **City of Cleveland Heights**
Reporting Year: **2013** | **1/2013 - 12/2013**

Please enter data in the white cells below. Where available, metered values should be used; if metered values are unavailable please estimate a value. Indicate your confidence in the accuracy of the input data by grading each component (n/a or 1-10) using the drop-down list to the left of the input cell. Hover the mouse over the cell to obtain a description of the grades.

All volumes to be entered as: MILLION GALLONS (US) PER YEAR

To select the correct data grading for each input, determine the highest grade where the utility meets or exceeds all criteria for that grade and all grades below it.

WATER SUPPLIED

<----- Enter grading in column 'E' and 'J' ----->

Volume from own sources:	+	?	n/a		MG/Yr	+	?				
Water imported:	+	?	3	3,149,000	MG/Yr	+	?	1			
Water exported:	+	?	1	52,000	MG/Yr	+	?	1			

WATER SUPPLIED: **3,145,473** MG/Yr

Master Meter and Supply Error Adjustments

Pcnt:	Value:		

Enter negative % or value for under-registration
Enter positive % or value for over-registration

AUTHORIZED CONSUMPTION

Billed metered:	+	?	4	1,196,592	MG/Yr		
Billed unmetered:	+	?	n/a		MG/Yr		
Unbilled metered:	+	?	3	20,000	MG/Yr		
Unbilled unmetered:	+	?		39,318	MG/Yr		

Default option selected for Unbilled unmetered - a grading of 5 is applied but not displayed

AUTHORIZED CONSUMPTION: **1,255,910** MG/Yr

WATER LOSSES (Water Supplied - Authorized Consumption) **1,889,563** MG/Yr

Apparent Losses

Unauthorized consumption:	+	?		7,864	MG/Yr		
Customer metering inaccuracies:	+	?	3	45,564	MG/Yr		
Systematic data handling errors:	+	?	3	215,000	MG/Yr		

Default option selected for unauthorized consumption - a grading of 5 is applied but not displayed

Apparent Losses: **268,428** MG/Yr

Real Losses (Current Annual Real Losses or CARL)

Real Losses = Water Losses - Apparent Losses: **1,621,135** MG/Yr

WATER LOSSES: **1,889,563** MG/Yr

NON-REVENUE WATER

NON-REVENUE WATER: **1,948,881** MG/Yr

= Water Losses + Unbilled Metered + Unbilled Unmetered

SYSTEM DATA

Length of mains:	+	?	3	170.0	miles
Number of active AND inactive service connections:	+	?	4	15,925	
Service connection density:	+	?		94	conn./mile main

Are customer meters typically located at the curbside or property line? No Yes

Average length of customer service line: **20.0** ft (length of service line, beyond the property boundary, that is the responsibility of the utility)

Average operating pressure: **85.0** psi

COST DATA

Total annual cost of operating water system:	+	?	4	\$13,018,449	\$/Year
Customer retail unit cost (applied to Apparent Losses):	+	?	6	\$7.00	\$/100 cubic feet (ccf)
Variable production cost (applied to Real Losses):	+	?	10	\$4,348.00	\$/Million gallons <input type="checkbox"/> Use Customer Retail Unit Cost to value real losses

WATER AUDIT DATA VALIDITY SCORE:

***** YOUR SCORE IS: 40 out of 100 *****

A weighted scale for the components of consumption and water loss is included in the calculation of the Water Audit Data Validity Score

PRIORITY AREAS FOR ATTENTION:

Based on the information provided, audit accuracy can be improved by addressing the following components:

- 1: Water imported
- 2: Billed metered
- 3: Unbilled metered



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AWWA Free Water Audit Software:
System Attributes and Performance Indicators

Water Audit Report for: **City of Cleveland Heights**
Reporting Year: **2013** 1/2013 - 12/2013

***** YOUR WATER AUDIT DATA VALIDITY SCORE IS: 40 out of 100 *****

System Attributes:

Apparent Losses:	268,428	MGYr
+ Real Losses:	1,621,135	MGYr
= Water Losses:	1,889,563	MGYr
? Unavoidable Annual Real Losses (UARL):	116.68	MGYr
Annual cost of Apparent Losses:	\$2,513,283	
Annual cost of Real Losses:	\$7,048,695	Valued at Variable Production Cost

Return to Reporting Worksheet to change this assumption

Performance Indicators:

Financial:

- Non-revenue water as percent by volume of Water Supplied: **62.0%**
- Non-revenue water as percent by cost of operating system: **75.4%** (Real Losses valued at Variable Production Cost)

Operational Efficiency:

- Apparent Losses per service connection per day: **46.18** gallons/connection/day
- Real Losses per service connection per day: **278.90** gallons/connection/day
- Real Losses per length of main per day*: **N/A**
- Real Losses per service connection per day per psi pressure: **3.28** gallons/connection/day/psi

From Above, Real Losses = Current Annual Real Losses (CARL): **1,621.14** million gallons/year

? Infrastructure Leakage Index (ILI) [CARL/UARL]: **13.89**

* This performance indicator applies for systems with a low service connection density of less than 32 service connections/mile of pipeline



City of Cleveland Heights

Detailed Engineering Evaluation Water Utility Optimization

AWWA Free Water Audit Software: <u>Water Balance</u>			
Water Audit Report for: City of Cleveland Heights			
Reporting Year: 2013		1/2013 - 12/2013	
Data Validity Score: 40			
Water Exported	185,751	Billed Water Exported	
Own Sources (Adjusted for known errors)	0.000	Billed Authorized Consumption	1,196,592
		Authorized Consumption	1,196,592
Water Supplied	3,145,473	Unbilled Authorized Consumption	59,318
		Unbilled Metered Consumption	20,000
		Unbilled Unmetered Consumption	39,318
		Unauthorized Consumption	7,864
Water Imported	3,331,224	Apparent Losses	268,428
		Customer Metering Inaccuracies	45,564
		Systematic Data Handling Errors	215,000
		Leakage on Transmission and/or Distribution Mains	Not broken down
Water Losses	1,889,563	Leakage and Overflows at Utility's Storage Tanks	Not broken down
		Leakage on Service Connections	Not broken down
		Revenue Water	1,196,592
		Non-Revenue Water (NRW)	1,948,881

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AWWA Free Water Audit Software v5.0

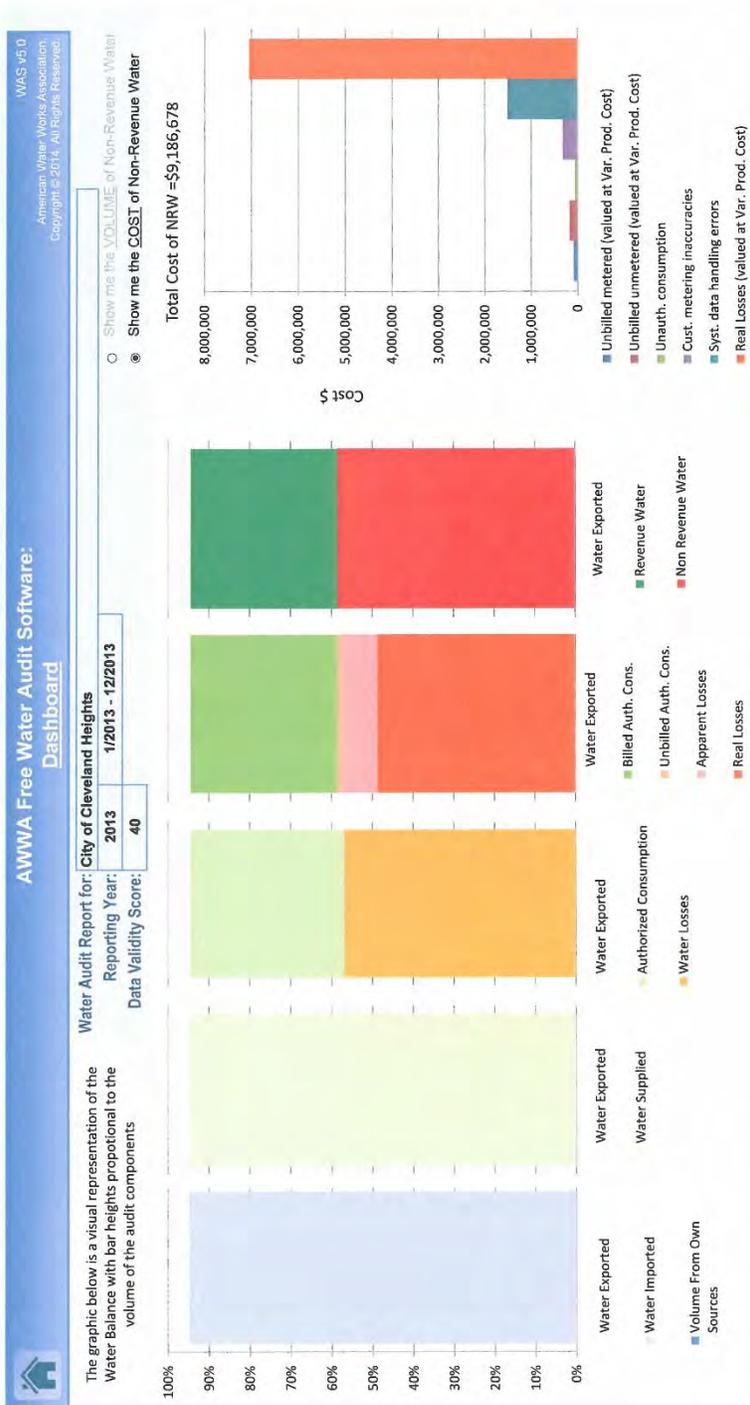
Water Balance 3



City of Cleveland Heights

Detailed Engineering Evaluation

Water Utility Optimization





City of Cleveland Heights Detailed Engineering Evaluation Water Utility Optimization

AWWA Free Water Audit Software: Grading Matrix

The grading assigned to each audit component and the corresponding recommended improvements and actions are highlighted in yellow. Audit accuracy is likely to be improved by prioritizing those items shown in red.

Grading >>>	1	2	3	4	5	6	7	8	9	10
Volume from own sources	Less than 25% of water production sources are metered, measuring other sources estimated. No regular meter calibration conducted.	25% - 50% of metered production sources are metered. Meter calibration conducted.	50% - 75% of metered production sources are metered. Meter calibration conducted.	75% - 75% of metered production sources are metered. Meter calibration conducted.	At least 75% of metered production sources are metered. Meter calibration conducted.	At least 75% of metered production sources are metered. Meter calibration conducted.	100% of metered production sources are metered. Meter calibration conducted.	100% of metered production sources are metered. Meter calibration conducted.	100% of metered production sources are metered. Meter calibration conducted.	100% of metered production sources are metered. Meter calibration conducted.
Improvements to attain higher meter accuracy (component)	Organize and launch efforts to collect data for determining volume from own sources.	No automatic dialing of production volumes, day readings are not balanced across the water distribution system; tank storage volume component and arithmetic gross/retent data are not.	Use automatic dialing of production volumes, day readings are not balanced across the water distribution system; tank storage volume component and arithmetic gross/retent data are not.	Use automatic dialing of production volumes, day readings are not balanced across the water distribution system; tank storage volume component and arithmetic gross/retent data are not.	Use automatic dialing of production volumes, day readings are not balanced across the water distribution system; tank storage volume component and arithmetic gross/retent data are not.	Use automatic dialing of production volumes, day readings are not balanced across the water distribution system; tank storage volume component and arithmetic gross/retent data are not.	Use automatic dialing of production volumes, day readings are not balanced across the water distribution system; tank storage volume component and arithmetic gross/retent data are not.	Use automatic dialing of production volumes, day readings are not balanced across the water distribution system; tank storage volume component and arithmetic gross/retent data are not.	Use automatic dialing of production volumes, day readings are not balanced across the water distribution system; tank storage volume component and arithmetic gross/retent data are not.	Use automatic dialing of production volumes, day readings are not balanced across the water distribution system; tank storage volume component and arithmetic gross/retent data are not.
Volume from own sources (meter, meter and supply error adjustment)	Review information on meters and paper records of measured values and determine if accurate data error cannot be determined.	Review information on meters and paper records of measured values and determine if accurate data error cannot be determined.	Review information on meters and paper records of measured values and determine if accurate data error cannot be determined.	Review information on meters and paper records of measured values and determine if accurate data error cannot be determined.	Review information on meters and paper records of measured values and determine if accurate data error cannot be determined.	Review information on meters and paper records of measured values and determine if accurate data error cannot be determined.	Review information on meters and paper records of measured values and determine if accurate data error cannot be determined.	Review information on meters and paper records of measured values and determine if accurate data error cannot be determined.	Review information on meters and paper records of measured values and determine if accurate data error cannot be determined.	Review information on meters and paper records of measured values and determine if accurate data error cannot be determined.
Improvements to attain higher meter accuracy (component)	Develop a plan to measure flow data on a daily basis to determine if accurate data error cannot be determined.	Develop a plan to measure flow data on a daily basis to determine if accurate data error cannot be determined.	Develop a plan to measure flow data on a daily basis to determine if accurate data error cannot be determined.	Develop a plan to measure flow data on a daily basis to determine if accurate data error cannot be determined.	Develop a plan to measure flow data on a daily basis to determine if accurate data error cannot be determined.	Develop a plan to measure flow data on a daily basis to determine if accurate data error cannot be determined.	Develop a plan to measure flow data on a daily basis to determine if accurate data error cannot be determined.	Develop a plan to measure flow data on a daily basis to determine if accurate data error cannot be determined.	Develop a plan to measure flow data on a daily basis to determine if accurate data error cannot be determined.	Develop a plan to measure flow data on a daily basis to determine if accurate data error cannot be determined.
Volume from own sources (meter, meter and supply error adjustment)	Least than 25% of metered production sources are metered. Meter calibration conducted.	25% - 50% of metered production sources are metered. Meter calibration conducted.	50% - 75% of metered production sources are metered. Meter calibration conducted.	75% - 75% of metered production sources are metered. Meter calibration conducted.	At least 75% of metered production sources are metered. Meter calibration conducted.	At least 75% of metered production sources are metered. Meter calibration conducted.	100% of metered production sources are metered. Meter calibration conducted.	100% of metered production sources are metered. Meter calibration conducted.	100% of metered production sources are metered. Meter calibration conducted.	100% of metered production sources are metered. Meter calibration conducted.
Volume from own sources (meter, meter and supply error adjustment)	Least than 25% of metered production sources are metered. Meter calibration conducted.	25% - 50% of metered production sources are metered. Meter calibration conducted.	50% - 75% of metered production sources are metered. Meter calibration conducted.	75% - 75% of metered production sources are metered. Meter calibration conducted.	At least 75% of metered production sources are metered. Meter calibration conducted.	At least 75% of metered production sources are metered. Meter calibration conducted.	100% of metered production sources are metered. Meter calibration conducted.	100% of metered production sources are metered. Meter calibration conducted.	100% of metered production sources are metered. Meter calibration conducted.	100% of metered production sources are metered. Meter calibration conducted.

Grading Matrix 3

AWWA Free Water Audit Software v5.0



City of Cleveland Heights Detailed Engineering Evaluation Water Utility Optimization

Grading >>>	n/a	1	2	3	4	5	6	7	8	9	10
COST DATA											
Total annual cost of operating water system		Reasonably maintained, but accounting records are not up-to-date. The major portion of water system operating costs are generating costs a	Conditions between 2 and 4	Electronic, industry-standard cost accounting system in place. However, data is often known to be incorrect by utility personnel, and at least once a year by CP&A.	Conditions between 4 and 6	Reliable electronic, industry-standard cost accounting system in place, with annual utility personnel, and at least once a year by CP&A.	Conditions between 3 and 10	Reliable electronic, industry-standard cost accounting system in place, with annual utility personnel, and at least once a year by CP&A.	Conditions between 3 and 10	Reliable electronic, industry-standard cost accounting system in place, with annual utility personnel, and at least once a year by CP&A.	Conditions between 3 and 10
Improvements to allow higher rate grading for "cold Annual Cost" component		Quarterly available records, include new financial accounting and audit basic cost data of most important operating functions	Implement an electronic cost-accounting system, structure accounting and reporting standards for water utilities	To qualify for 5 Establish process for periodic internal audit of water system operating costs, including water production costs	To qualify for 6 Establish process for periodic internal audit of water system operating costs, including water production costs	To qualify for 6 Establish process for periodic internal audit of water system operating costs, including water production costs	To qualify for 6 Establish process for periodic internal audit of water system operating costs, including water production costs	To qualify for 6 Establish process for periodic internal audit of water system operating costs, including water production costs	To qualify for 6 Establish process for periodic internal audit of water system operating costs, including water production costs	To qualify for 6 Establish process for periodic internal audit of water system operating costs, including water production costs	To qualify for 6 Establish process for periodic internal audit of water system operating costs, including water production costs
Customer production cost (excludes Apparent Losses)		Automated, on-line water rate structure is used, with periodic updates to reflect changes in rates and operations. The actual computerized water rate structure and published water rate structure, and if reasonably accurate copies of the water rate structure, and if reasonably accurate copies of the water rate structure, are available to all customers	Dated, comprehensive water rate structure is used, with periodic updates to reflect changes in rates and operations. The actual computerized water rate structure and published water rate structure, and if reasonably accurate copies of the water rate structure, are available to all customers	Straightforward water rate structure is used, but not updated in several years. The actual computerized water rate structure and published water rate structure, and if reasonably accurate copies of the water rate structure, are available to all customers	Simple, straightforward water rate structure is used, but not updated in several years. The actual computerized water rate structure and published water rate structure, and if reasonably accurate copies of the water rate structure, are available to all customers	Simple, straightforward water rate structure is used, but not updated in several years. The actual computerized water rate structure and published water rate structure, and if reasonably accurate copies of the water rate structure, are available to all customers	Simple, straightforward water rate structure is used, but not updated in several years. The actual computerized water rate structure and published water rate structure, and if reasonably accurate copies of the water rate structure, are available to all customers	Simple, straightforward water rate structure is used, but not updated in several years. The actual computerized water rate structure and published water rate structure, and if reasonably accurate copies of the water rate structure, are available to all customers	Simple, straightforward water rate structure is used, but not updated in several years. The actual computerized water rate structure and published water rate structure, and if reasonably accurate copies of the water rate structure, are available to all customers	Simple, straightforward water rate structure is used, but not updated in several years. The actual computerized water rate structure and published water rate structure, and if reasonably accurate copies of the water rate structure, are available to all customers	Simple, straightforward water rate structure is used, but not updated in several years. The actual computerized water rate structure and published water rate structure, and if reasonably accurate copies of the water rate structure, are available to all customers
Improvements to allow higher rate grading for "Customer Retail Cost" component		Customer production cost (excludes Apparent Losses)	Customer production cost (excludes Apparent Losses)	Customer production cost (excludes Apparent Losses)	Customer production cost (excludes Apparent Losses)	Customer production cost (excludes Apparent Losses)	Customer production cost (excludes Apparent Losses)	Customer production cost (excludes Apparent Losses)	Customer production cost (excludes Apparent Losses)	Customer production cost (excludes Apparent Losses)	Customer production cost (excludes Apparent Losses)
Variable production cost (excludes "cold Annual Cost" component)		Notes of the water utility enter the unit production cost into the reporting system. Workbooks show a profit of 10%	Notes of the water utility enter the unit production cost into the reporting system. Workbooks show a profit of 10%	Notes of the water utility enter the unit production cost into the reporting system. Workbooks show a profit of 10%	Notes of the water utility enter the unit production cost into the reporting system. Workbooks show a profit of 10%	Notes of the water utility enter the unit production cost into the reporting system. Workbooks show a profit of 10%	Notes of the water utility enter the unit production cost into the reporting system. Workbooks show a profit of 10%	Notes of the water utility enter the unit production cost into the reporting system. Workbooks show a profit of 10%	Notes of the water utility enter the unit production cost into the reporting system. Workbooks show a profit of 10%	Notes of the water utility enter the unit production cost into the reporting system. Workbooks show a profit of 10%	Notes of the water utility enter the unit production cost into the reporting system. Workbooks show a profit of 10%
Improvements to allow higher rate grading for "Variable Production Cost" component		Quarterly available records, include new procedures to regularly collect and report on important operating functions	Quarterly available records, include new procedures to regularly collect and report on important operating functions	Quarterly available records, include new procedures to regularly collect and report on important operating functions	Quarterly available records, include new procedures to regularly collect and report on important operating functions	Quarterly available records, include new procedures to regularly collect and report on important operating functions	Quarterly available records, include new procedures to regularly collect and report on important operating functions	Quarterly available records, include new procedures to regularly collect and report on important operating functions	Quarterly available records, include new procedures to regularly collect and report on important operating functions	Quarterly available records, include new procedures to regularly collect and report on important operating functions	Quarterly available records, include new procedures to regularly collect and report on important operating functions



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AWWA Free Water Audit Software: Customer Service Line Diagrams

Average Length of Customer Service Line

The three figures shown on this worksheet display the assignment of the Average Length of Customer Service Line, L_p , for the three most common piping configurations.

Figure 1 shows the configuration of the water meter outside of the customer building next to the curb stop valve. In this configuration $L_p = 0$ since the distance between the curb stop and the customer metering point is essentially zero.

Figure 2 shows the configuration of the customer water meter located inside the customer building, where L_p is the distance from the curb stop to the water meter.

Figure 3 shows the configuration of an unmetered customer building, where L_p is the distance from the curb stop to the first point of customer water consumption, or, more simply, the building line.

In any water system the L_p will vary notably in a community of different structures, therefore the average L_p value is used and this should be approximated or calculated if a sample of service line measurements has been gathered.

[Click for more information](#)

Figure 1**Typical house connection: Meter at curb stop**

Figure 2**Typical house connection: Meter inside property**

Figure 3**Typical house connection: Unmetered**



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Detailed Engineering Evaluation

Water Utility Optimization

AWWA Free Water Audit Software: Definitions	
Item Name	Description
<p>Apparent Losses</p> <p>Find</p>	<p>= unauthorized consumption + customer metering inaccuracies + systematic data handling errors</p> <p>Apparent Losses include all types of inaccuracies associated with customer metering (worn meters as well as improperly sized meters or wrong type of meter for the water usage profile) as well as systematic data handling errors (meter reading, billing, archiving and reporting), plus unauthorized consumption (theft or illegal use).</p> <p>NOTE: Over-estimation of Apparent Losses results in under-estimation of Real Losses. Under-estimation of Apparent Losses results in over-estimation of Real Losses.</p>
<p>AUTHORIZED CONSUMPTION</p> <p>Find</p>	<p>= billed water exported + billed metered + billed unmetered + unbilled metered + unbilled unmetered consumption</p> <p>The volume of metered and/or unmetered water taken by registered customers, the water utility's own uses, and uses of others who are implicitly or explicitly authorized to do so by the water utility, for residential, commercial, industrial and public-minded purposes.</p> <p>Typical retail customers' consumption is tabulated usually from established customer accounts as billed metered consumption, or - for unmetered customers - billed unmetered consumption. These types of consumption, along with billed water exported, provide revenue potential for the water utility. Be certain to tabulate the water exported volume as a separate component and do not "double-count" it by including in the billed metered consumption component as well as the water exported component.</p> <p>Unbilled authorized consumption occurs typically in non-account uses, including water for fire fighting and training, flushing of water mains and sewers, street cleaning, watering of municipal gardens, public fountains, or similar public-minded uses. Occasionally these uses may be metered and billed (or charged a flat fee), but usually they are unmetered and unbilled. In the latter case, the water auditor may use a default value to estimate this quantity, or implement procedures for the reliable quantification of these uses. This starts with documenting usage events as they occur and estimating the amount of water used in each event. (See Unbilled unmetered consumption)</p>
<p>View Service Connection Diagram</p> <p>Average length of customer service line</p> <p>Find</p>	<p>This is the average length of customer service line, Lp, that is owned and maintained by the customer: from the point of ownership transfer to the customer water meter, or building line (if unmetered). The quantity is one of the data inputs for the calculation of Unavoidable Annual Real Losses (UARL), which serves as the denominator of the performance indicator: Infrastructure Leakage Index (ILI). The value of Lp is multiplied by the number of customer service connections to obtain a total length of customer owned piping in the system. The purpose of this parameter is to account for the unmetered service line infrastructure that is the responsibility of the customer for arranging repairs of leaks that occur on their lines. In many cases leak repairs arranged by customers take longer to be executed than leak repairs arranged by the water utility on utility-maintained piping. Leaks run longer - and lose more water - on customer-owned service piping, than utility owned piping.</p> <p>If the customer water meter exists near the ownership transfer point (usually the curb stop located between the water main and the customer premises) this distance is zero because the meter and transfer point are the same. This is the often encountered configuration of customer water meters located in an underground meter box or "pit" outside of the customer's building. The Free Water Audit Software asks a "Yes/No" question about the meter at this location. If the auditor selects "Yes" then this distance is set to zero and the data grading score for this component is set to 10.</p> <p>If water meters are typically located inside the customer premise/building, or properties are unmetered, it is up to the water auditor to estimate a system-wide average Lp length based upon the various customer land parcel sizes and building locations in the service area. Lp will be a shorter length in areas of high density housing, and a longer length in areas of low density housing and varied commercial and industrial buildings. General parcel demographics should be employed to obtain a composite average Lp length for the entire system.</p> <p>Refer to the "Service Connection Diagram" worksheet for a depiction of the service line/metering configurations that typically exist in water utilities. This worksheet gives guidance on the determination of the Average Length, Lp, for each configuration.</p>
<p>Average operating pressure</p> <p>Find</p>	<p>This is the average pressure in the distribution system that is the subject of the water audit. Many water utilities have a calibrated hydraulic model of their water distribution system. For these utilities, the hydraulic model can be utilized to obtain a very accurate quantity of average pressure. In the absence of a hydraulic model, the average pressure may be approximated by obtaining readings of static water pressure from a representative sample of fire hydrants or other system access points evenly located across the system. A weighted average of the pressure can be assembled; but be sure to take into account the elevation of the fire hydrants, which typically exist several feet higher than the level of buried water pipelines. If the water utility is compiling the water audit for the first time, the average pressure can be approximated, but with a low data grading. In subsequent years of auditing, effort should be made to improve the accuracy of the average pressure quantity. This will then qualify the value for a higher data grading.</p>
<p>Billed Authorized Consumption</p>	<p>All consumption that is billed and authorized by the utility. This may include both metered and unmetered consumption. See "Authorized Consumption" for more information.</p>
<p>Billed metered consumption</p> <p>Find</p>	<p>All metered consumption which is billed to retail customers, including all groups of customers such as domestic, commercial, industrial or institutional. It does NOT include water supplied to neighboring utilities (water exported) which is metered and billed. Be sure to subtract any consumption for exported water sales that may be included in these billing roles. Water supplied as exports to neighboring water utilities should be included only in the Water Exported component. The metered consumption data can be taken directly from billing records for the water audit period. The accuracy of yearly metered consumption data can be refined by including an adjustment to account for customer meter reading lag time since not all customer meters are read on the same day of the meter reading period. However additional analysis is necessary to determine the lag time adjustment value, which may or may not be significant.</p>
<p>Billed unmetered consumption</p> <p>Find</p>	<p>All billed consumption which is calculated based on estimates or norms from water usage sites that have been determined by utility policy to be left unmetered. This is typically a very small component in systems that maintain a policy to meter their customer population. However, this quantity can be the key consumption component in utilities that have not adopted a universal metering policy. This component should NOT include any water that is supplied to neighboring utilities (water exported) which is unmetered but billed. Water supplied as exports to neighboring water utilities should be included only in the Water Exported component.</p>



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Item Name	Description
<p>Customer metering inaccuracies</p> <p>Find</p>	<p>Apparent water losses caused by the collective under-registration of customer water meters. Many customer water meters gradually wear as large cumulative volumes of water are passed through them over time. This causes the meters to under-register the flow of water. This occurrence is common with smaller residential meters of sizes 5/8-inch and 3/4 inch after they have registered very large cumulative volumes of water, which generally occurs only after periods of years. For meters sized 1-inch and larger - typical of multi-unit residential, commercial and industrial accounts - meter under-registration can occur from wear or from the improper application of the meter, i.e. installing the wrong type of meter or the wrong size of meter, for the flow pattern (profile) of the consumer. For instance, many larger meters have reduced accuracy at low flows. If an oversized meter is installed, most of the time the routine flow will occur in the low flow range of the meter, and a significant portion of it may not be registered. It is important to properly select and install all meters, but particularly large customer meters, size 1-inch and larger.</p> <p>The auditor has two options for entering data for this component of the audit. The auditor can enter a percentage under-registration (typically an estimated value), this will apply the selected percentage to the two categories of metered consumption to determine the volume of water not recorded due to customer meter inaccuracy. Note that this percentage is a composite average inaccuracy for all customer meters in the entire meter population. The percentage will be multiplied by the sum of the volumes in the Billed Metered and Unbilled Metered components. Alternatively, if the auditor has substantial data from meter testing activities, he or she can calculate their own loss volumes, and this volume may be entered directly.</p> <p>Note that a value of zero will be accepted but an alert will appear asking if the customer population is unmetered. Since all metered systems have some degree of inaccuracy, a positive value should be entered. A value of zero in this component is valid only if the water utility does not meter its customer population.</p>
<p>Customer retail unit cost</p> <p>Find</p>	<p>The Customer Retail Unit Cost represents the charge that customers pay for water service. This unit cost is applied routinely to the components of Apparent Loss, since these losses represent water reaching customers but not (fully) paid for. Since most water utilities have a rate structure that includes a variety of different costs based upon class of customer, a weighted average of individual costs and number of customer accounts in each class can be calculated to determine a single composite cost that should be entered into this cell. Finally, the weighted average cost should also include additional charges for sewer, storm water or biosolids processing, but only if these charges are based upon the volume of potable water consumed.</p> <p>For water utilities in regions with limited water resources and a questionable ability to meet the drinking water demands in the future, the Customer Retail Unit Cost might also be applied to value the Real Losses; instead of applying the Variable Production Cost to Real Losses. In this way, it is assumed that every unit volume of leakage reduced by leakage management activities will be sold to a customer.</p> <p>Note: the Free Water Audit Software allows the user to select the units that are charged to customers (either \$/1,000 gallons, \$/hundred cubic feet, or \$/1,000 litres) and automatically converts these units to the units that appear in the "WATER SUPPLIED" box. The monetary units are United States dollars, \$.</p>
<p>Infrastructure Leakage Index (ILI)</p> <p>Find</p>	<p>The ratio of the Current Annual Real Losses (Real Losses) to the Unavoidable Annual Real Losses (UARL). The ILI is a highly effective performance indicator for comparing (benchmarking) the performance of utilities in operational management of real losses.</p>
<p>Length of mains</p> <p>Find</p>	<p>Length of all pipelines (except service connections) in the system starting from the point of system input metering (for example at the outlet of the treatment plant). It is also recommended to include in this measure the total length of fire hydrant lead pipe. Hydrant lead pipe is the pipe branching from the water main to the fire hydrant. Fire hydrant leads are typically of a sufficiently large size that is more representative of a pipeline than a service connection. The average length of hydrant leads across the entire system can be assumed if not known, and multiplied by the number of fire hydrants in the system, which can also be assumed if not known. This value can then be added to the total pipeline length. Total length of mains can therefore be calculated as:</p> <p>Length of Mains, miles = (total pipeline length, miles) + [((average fire hydrant lead length, ft) x (number of fire hydrants)) / 5,280 ft/mile]</p> <p>or</p> <p>Length of Mains, kilometres = (total pipeline length, kilometres) + [((average fire hydrant lead length, metres) x (number of fire hydrants)) / 1,000 metres/kilometre]</p>
<p>NON-REVENUE WATER</p> <p>Find</p>	<p>= Apparent Losses + Real Losses + Unbilled Metered Consumption + Unbilled Unmetered Consumption. This is water which does not provide revenue potential to the utility.</p>
<p>Number of active AND inactive service connections</p> <p>Find</p>	<p>Number of customer service connections, extending from the water main to supply water to a customer. Please note that this includes the actual number of distinct piping connections, including fire connections, whether active or inactive. This may differ substantially from the number of customers (or number of accounts). Note: this number does not include the pipeline leads to fire hydrants - the total length of piping supplying fire hydrants should be included in the "Length of mains" parameter.</p>
<p>Real Losses</p> <p>Find</p>	<p>Physical water losses from the pressurized system (water mains and customer service connections) and the utility's storage tanks, up to the point of customer consumption. In metered systems this is the customer meter, in unmetered situations this is the first point of consumption (stop tap/tap) within the property. The annual volume lost through all types of leaks, breaks and overflows depends on frequencies, flow rates, and average duration of individual leaks, breaks and overflows.</p>
<p>Revenue Water</p>	<p>Those components of System Input Volume that are billed and have the potential to produce revenue.</p>
<p>Service Connection Density</p> <p>Find</p>	<p>= number of customer service connections / length of mains</p>



City of Cleveland Heights

Detailed Engineering Evaluation

Water Utility Optimization

Item Name	Description
<p>Systematic data handling errors</p> <p>Find</p>	<p>Apparent losses caused by accounting omissions, errant computer programming, gaps in policy, procedure, and permitting/activation of new accounts; and any type of data lapse that results in under-stated customer water consumption in summary billing reports.</p> <p>Systematic Data Handling Errors result in a direct loss of revenue potential. Water utilities can find "lost" revenue by keying on this component.</p> <p>Utilities typically measure water consumption registered by water meters at customer premises. The meter should be read routinely (ex: monthly) and the data transferred to the Customer Billing System, which generates and sends a bill to the customer. Data Transfer Errors result in the consumption value being less than the actual consumption, creating an apparent loss. Such error might occur from illegible and mis-recorded hand-written readings compiled by meter readers, inputting an incorrect meter register unit conversion factor in the automatic meter reading equipment, or a variety of similar errors.</p> <p>Apparent losses also occur from Data Analysis Errors in the archival and data reporting processes of the Customer Billing System. Inaccurate estimates used for accounts that fail to produce a meter reading are a common source of error. Billing adjustments may award customers a rightful monetary credit, but do so by creating a negative value of consumption, thus under-stating the actual consumption. Account activation lapses may allow new buildings to use water for months without meter readings and billing. Poor permitting and construction inspection practices can result in a new building lacking a billing account, a water meter and meter reading; i.e., the customer is unknown to the utility's billing system.</p> <p>Close auditing of the permitting, metering, meter reading, billing and reporting processes of the water consumption data trail can uncover data management gaps that create volumes of systematic data handling error. Utilities should routinely analyze customer billing records to detect data anomalies and quantify these losses. For example, a billing account that registers zero consumption for two or more billing cycles should be checked to explain why usage has seemingly halted. Given the revenue loss impacts of these losses, water utilities are well-justified in providing continuous oversight and timely correction of data transfer errors & data handling errors.</p> <p>If the water auditor has not yet gathered detailed data or assessment of systematic data handling error, it is recommended that the auditor apply the default value of 0.25% of the Billed Authorized Consumption volume. However, if the auditor has investigated the billing system and its controls, and has well validated data that indicates the volume from systematic data handling error is substantially higher or lower than that generated by the default value, then the auditor should enter a quantity that was derived from the utility investigations and select an appropriate grading. Note: negative values are not allowed for this audit component. If the auditor enters zero for this component then a grading of 1 will be automatically assigned.</p>
<p>Total annual cost of operating the water system</p> <p>Find</p>	<p>These costs include those for operations, maintenance and any annually incurred costs for long-term upkeep of the drinking water supply and distribution system. It should include the costs of day-to-day upkeep and long-term financing such as repayment of capital bonds for infrastructure expansion or improvement. Typical costs include employee salaries and benefits, materials, equipment, insurance, fees, administrative costs and all other costs that exist to sustain the drinking water supply. Depending upon water utility accounting procedures or regulatory agency requirements, it may be appropriate to include depreciation in the total of this cost. This cost should not include any costs to operate wastewater, biosolids or other systems outside of drinking water.</p>
<p>Unauthorized consumption</p> <p>Find</p>	<p>Includes water illegally withdrawn from fire hydrants, illegal connections, bypasses to customer consumption meters, or tampering with metering or meter reading equipment; as well as any other ways to receive water while thwarting the water utility's ability to collect revenue for the water. Unauthorized consumption results in uncaptured revenue and creates an error that understates customer consumption. In most water utilities this volume is low and, if the water auditor has not yet gathered detailed data for these loss occurrences, it is recommended that the auditor apply a default value of 0.25% of the volume of water supplied. However, if the auditor has investigated unauthorized occurrences, and has well validated data that indicates the volume from unauthorized consumption is substantially higher or lower than that generated by the default value, then the auditor should enter a quantity that was derived from the utility investigations. Note that a value of zero will not be accepted since all water utilities have some volume of unauthorized consumption occurring in their system.</p> <p>Note: if the auditor selects the default value for unauthorized consumption, a data grading of 5 is automatically assigned, but not displayed on the Reporting Worksheet.</p>
<p>Unavoidable Annual Real Losses (UARL)</p> <p>Find</p>	<p>UARL (gallons/day)=(5.41Lm + 0.15Nc + 7.5Lc) xP, or UARL (litres/day)=(18.0Lm + 0.8Nc + 25.0Lc) xP</p> <p>where: Lm = length of mains (miles or kilometres) Nc = number of customer service connections Lp = the average distance of customer service connection piping (feet or metres) (see the Worksheet "Service Connection Diagram" for guidance on determining the value of Lp) Lc = total length of customer service connection piping (miles or km) Lc = Nc X Lp (miles or kilometres) P = Pressure (psi or metres)</p> <p>The UARL is a theoretical reference value representing the technical low limit of leakage that could be achieved if all of today's best technology could be successfully applied. It is a key variable in the calculation of the Infrastructure Leakage Index (ILI). Striving to reduce system leakage to a level close to the UARL is usually not needed unless the water supply is unusually expensive, scarce or both.</p> <p>NOTE: The UARL calculation has not yet been proven as fully valid for very small, or low pressure water distribution systems. If, in gallons per day: (Lm x 32) + Nc < 3000 or P < 35psi in litres per day: (Lm x 20) + Nc < 3000 or P < 25m then the calculated UARL value may not be valid. The software does not display a value of UARL or ILI if either of these conditions is true.</p>



City of Cleveland Heights

Detailed Engineering Evaluation

Water Utility Optimization

Item Name	Description												
Unbilled Authorized Consumption <input type="button" value="Find"/>	<p>All consumption that is unbilled, but still authorized by the utility. This includes Unbilled Metered Consumption + Unbilled Unmetered Consumption. See "Authorized Consumption" for more information. For Unbilled Unmetered Consumption, the Free Water Audit Software provides the auditor the option to select a default value if they have not audited unmetered activities in detail. The default calculates a volume that is 1.25% of the Water Supplied volume. If the auditor has carefully audited the various unbilled, unmetered, authorized uses of water, and has established reliable estimates of this collective volume, then he or she may enter the volume directly for this component, and not use the default value.</p>												
Unbilled metered consumption <input type="button" value="Find"/>	<p>Metered consumption which is authorized by the water utility, but, for any reason, is <u>deemed by utility policy</u> to be unbilled. This might for example include metered water consumed by the utility itself in treatment or distribution operations, or metered water provided to civic institutions free of charge. It does <u>not</u> include water supplied to neighboring utilities (water exported) which may be metered but not billed.</p>												
Unbilled unmetered consumption <input type="button" value="Find"/>	<p>Any kind of Authorized Consumption which is neither billed or metered. This component typically includes water used in activities such as fire fighting, flushing of water mains and sewers, street cleaning, fire flow tests conducted by the water utility, etc. In most water utilities it is a small component which is very often substantially overestimated. It does NOT include water supplied to neighboring utilities (water exported) which is unmetered and unbilled – an unlikely case. This component has many sub-components of water use which are often tedious to identify and quantify. Because of this, and the fact that it is usually a small portion of the water supplied, it is recommended that the auditor apply the default value, which is 1.25% of the Water Supplied volume. Select the default percentage to enter this value.</p> <p>If the water utility <u>has</u> carefully audited the unbilled, unmetered activities occurring in the system, and has well validated data that gives a value substantially higher or lower than the default volume, then the auditor should enter their own volume. However the default approach is recommended for most water utilities.</p> <p>Note that a value of zero is not permitted, since all water utilities have some volume of water in this component occurring in their system.</p>												
Units and Conversions	<p>The user may develop an audit based on one of three unit selections:</p> <ol style="list-style-type: none"> 1) Million Gallons (US) 2) Megalitres (Thousand Cubic Metres) 3) Acre-feet <p>Once this selection has been made in the instructions sheet, all calculations are made on the basis of the chosen units. Should the user wish to make additional conversions, a unit converter is provided below (use drop down menus to select units from the yellow unit boxes):</p> <div style="text-align: center;"> <table border="1" style="margin: auto;"> <tr> <td>Enter Units:</td> <td>Convert From...</td> <td>=</td> <td>Converts to....</td> </tr> <tr> <td style="text-align: center;">1</td> <td style="text-align: center;">Million Gallons (US)</td> <td></td> <td style="text-align: center;">3.06888329</td> </tr> <tr> <td></td> <td></td> <td></td> <td style="text-align: center;">Acre-feet</td> </tr> </table> <p>(conversion factor = 3.06888328973723)</p> </div>	Enter Units:	Convert From...	=	Converts to....	1	Million Gallons (US)		3.06888329				Acre-feet
Enter Units:	Convert From...	=	Converts to....										
1	Million Gallons (US)		3.06888329										
			Acre-feet										
Use of Option Buttons	<p>To use the default percent value choose this button</p> <p>To enter a value choose this button and enter the value in the cell to the right</p> <div style="text-align: center;"> </div> <p>NOTE: For Unbilled Unmetered Consumption, Unauthorized Consumption and Systematic Data Handling Errors, a recommended default value can be applied by selecting the Percent option. The default values are based on fixed percentages of Water Supplied or Billed Authorized Consumption and are recommended for use in this audit unless the auditor has well validated data for their system. Default values are shown by purple cells, as shown in the example above.</p> <p>If a default value is selected, the user does not need to grade the item; a grading value of 5 is automatically applied (however, this grade will not be displayed).</p>												
Variable production cost (applied to Real Losses) <input type="button" value="Find"/>	<p>The cost to produce and supply the next unit of water (e.g., \$/million gallons). This cost is determined by calculating the summed unit costs for ground and surface water treatment and all power used for pumping from the source to the customer. It may also include other miscellaneous unit costs that apply to the production of drinking water. It should also include the unit cost of bulk water purchased as an import if applicable.</p> <p>It is common to apply this unit cost to the volume of Real Losses. However, if water resources are strained and the ability to meet future drinking water demands is in question, then the water auditor can be justified in applying the Customer Retail Rate to the Real Loss volume, rather than applying the Variable Production Cost.</p> <p>The Free Water Audit Software applies the Variable Production costs to Real Losses by default. However, the auditor has the option on the Reporting Worksheet to select the Customer Retail Cost as the basis for the Real Loss cost evaluation if the auditor determines that this is warranted.</p>												
Volume from own sources <input type="button" value="Find"/>	<p>The volume of water withdrawn (abstracted) from water resources (rivers, lakes, streams, wells, etc) controlled by the water utility, and then treated for potable water distribution. Most water audits are compiled for utility retail water distribution systems, so this volume should reflect the amount of treated drinking water that entered the distribution system. Often the volume of water measured at the effluent of the treatment works is slightly less than the volume measured at the raw water source, since some of the water is used in the treatment process. Thus, it is useful if flows are metered at the effluent of the treatment works. If metering exists only at the raw water source, an adjustment for water used in the treatment process should be included to account for water consumed in treatment operations such as filter backwashing, basin flushing and cleaning, etc. If the audit is conducted for a wholesale water agency that sells untreated water, then this quantity reflects the measure of the raw water, typically metered at the source.</p>												



City of Cleveland Heights

Detailed Engineering Evaluation

Water Utility Optimization

Item Name	Description
Volume from own sources; Master meter and supply error adjustment <input type="button" value="Find"/>	An estimate or measure of the degree of inaccuracy that exists in the master (production) meters measuring the annual Volume from own Sources, and any error in the data trail that exists to collect, store and report the summary production data. This adjustment is a weighted average number that represents the collective error for all master meters for all days of the audit year and any errors identified in the data trail. Meter error can occur in different ways. A meter or meters may be inaccurate by under-registering flow (did not capture all the flow), or by over-registering flow (overstated the actual flow). Data error can occur due to data gaps caused by temporary outages of the meter or related instrumentation. All water utilities encounter some degree of inaccuracy in master meters and data errors in archival systems are common; thus a value of zero should not be entered. Enter a negative percentage or value for metered data under-registration; or, enter a positive percentage or value for metered data over-registration.
Water exported <input type="button" value="Find"/>	The Water Exported volume is the bulk water conveyed and sold by the water utility to neighboring water systems that exists outside of their service area. Typically this water is metered at the custody transfer point of interconnection between the two water utilities. Usually the meter(s) are owned by the water utility that is selling the water; i.e. the exporter. If the water utility who is compiling the annual water audit sells bulk water in this manner, they are an exporter of water. Note: The Water Exported volume is sold to wholesale customers who are typically charged a wholesale rate that is different than retail rates charged to the retail customers existing within the service area. Many state regulatory agencies require that the Water Exported volume be reported to them as a quantity separate and distinct from the retail customer billed consumption. For these reasons - and others - the Water Exported volume is always quantified separately from Billed Authorized Consumption in the standard water audit. Be certain not to "double-count" this quantity by including it in both the Water Exported box and the Billed Metered Consumption box of the water audit Reporting Worksheet. This volume should be included only in the Water Exported box.
Water exported: Master meter and supply error adjustment <input type="button" value="Find"/>	An estimate or measure of the volume in which the Water Exported volume is incorrect. This adjustment is a weighted average that represents the collective error for all of the metered and archived exported flow for all days of the audit year. Meter error can occur in different ways. A meter may be inaccurate by under-registering flow (did not capture all the flow), or by over-registering flow (overstated the actual flow). Error in the metered, archived data can also occur due to data gaps caused by temporary outages of the meter or related instrumentation. All water utilities encounter some degree of error in their metered data, particularly if meters are aged and infrequently tested. Occasional errors also occur in the archived data. Thus, a value of zero should not be entered. Enter a negative percentage or value for metered data under-registration; or enter a positive percentage or value for metered data over-registration. If regular meter accuracy testing is conducted on the meter(s) - which is usually conducted by the water utility selling the water - then the results of this testing can be used to help quantify the meter error adjustment. Corrections to data gaps or other errors found in the archived data should also be included as a portion of this meter error adjustment.
Water imported <input type="button" value="Find"/>	The Water Imported volume is the bulk water purchased to become part of the Water Supplied volume. Typically this is water purchased from a neighboring water utility or regional water authority, and is metered at the custody transfer point of interconnection between the two water utilities. Usually the meter(s) are owned by the water supplier selling the water to the utility conducting the water audit. The water supplier selling the bulk water usually charges the receiving utility based upon a wholesale water rate.
Water imported: Master meter and supply error adjustment <input type="button" value="Find"/>	An estimate or measure of the volume in which the Water Imported volume is incorrect. This adjustment is a weighted average that represents the collective error for all of the metered and archived imported flow for all days of the audit year. Meter error can occur in different ways. A meter may be inaccurate by under-registering flow (did not capture all the flow), or by over-registering flow (overstated the actual flow). Error in the metered, archived data can also occur due to data gaps caused by temporary outages of the meter or related instrumentation. All water utilities encounter some level of meter inaccuracy, particularly if meters are aged and infrequently tested. Occasional errors also occur in the archived metered data. Thus, a value of zero should not be entered. Enter a negative percentage or value for metered data under-registration; or, enter a positive percentage or value for metered data over-registration. If regular meter accuracy testing is conducted on the meter(s) - which is usually conducted by the water utility selling the water - then the results of this testing can be used to help quantify the meter error adjustment.
WATER LOSSES <input type="button" value="Find"/>	= apparent losses + real losses Water Losses are the difference between Water Supplied and Authorized Consumption. Water losses can be considered as a total volume for the whole system, or for partial systems such as transmission systems, pressure zones or district metered areas (DMA); if one of these configurations are the basis of the water audit.

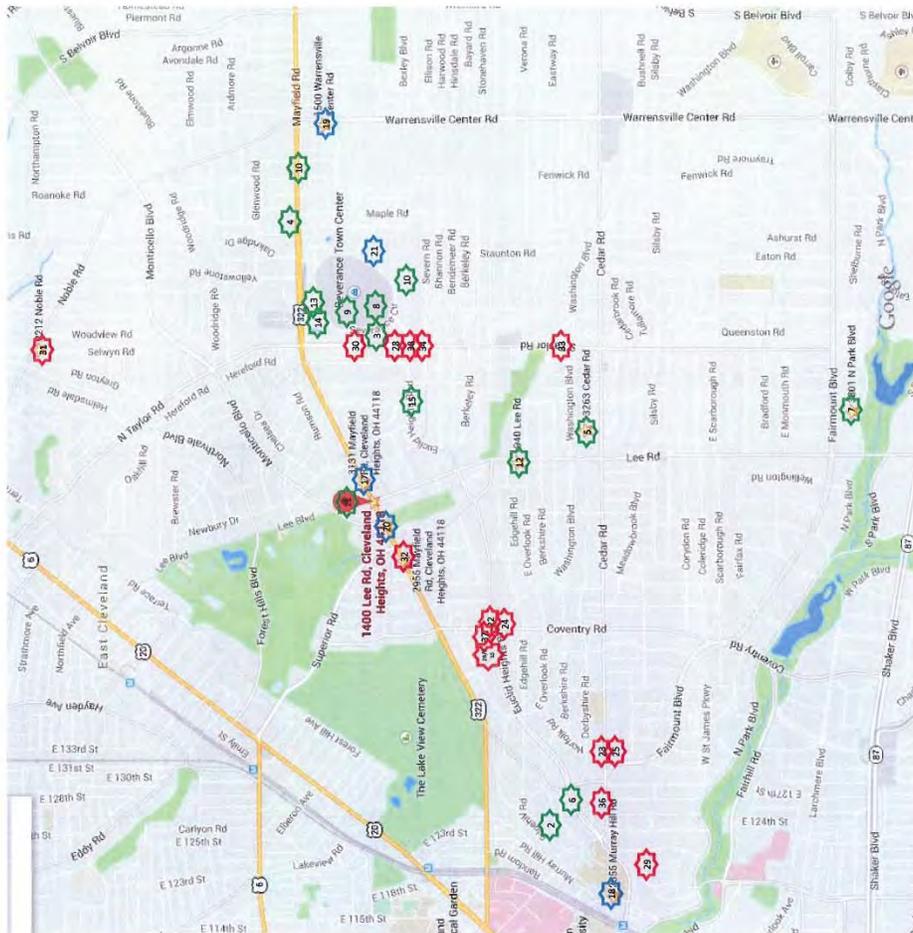


City of Cleveland Heights

Detailed Engineering Evaluation

Water Utility Optimization

ID	Address	Street
1	10	SEVERNANCE CIRCLE
2	2300	OVERLOOK
3	30	SEVERNANCE CIRCLE
4	3739	MAYFIELD
5	13363	CEDAR
6	2375	EUCOLID HTS
7	3301	NORTH PARK
8	3460	MAYFIELD
9	3628	MAYFIELD
10	3882	MAYFIELD
11	2455	LEE
12	1940	LEE
13	500	SEVERNANCE PLAGE LANE
14	40	SEVERNANCE CIRCLE
15	3321	EUCOLID HTS
16	1400	CLEVELAND HTS (See: Rd#292)
17	3131	MAYFIELD
18	2355	MURRAY HILL
19	1500	WARRENSVILLE CTR
20	3027	MAYFIELD
21	5	SEVERNANCE CIRCLE
22	1893	COVENTRY
23	12506	CEDAR
24	1895	COVENTRY
25	12504	CEDAR
26	2731	LANCASHIRE
27	2729	LANCASHIRE
28	1655	S TAYLOR
29	1855	CHESTNUT HILLS
30	2531	N TAYLOR
31	2212	NOBLE
32	2955	MAYFIELD
33	2047	S TAYLOR
34	1659	S TAYLOR
35	2739	LANCASHIRE
36	12381	CEDAR
37	1854	COVENTRY
38	1657	S TAYLOR





House No.	Street	Meter Size	Account#	Meter Serial#	Found Meter #	Brand	Model	Type	Test Date	Low Flow	Low Acc.	Int Flow	Int Acc	Max flow	Max Acc	Weighted Average	Reading	Units	Comments
3479	MONTICELLO	5/8	3070635	19921112	92883716	Badger	RCDL 25	Disp.	11/19/14	0.25	100.1	2	100.3	15	99.9	100.21%			No Register, Meter tested within AWWA accuracy limits.
888	ELBON	5/8	3080230	19921114	92882105	Badger	RCDL 25	Disp.	11/19/14	0.25	99.5	2	100.1	15	100.1	100.01%			No Register, Meter tested within AWWA accuracy limits.
3637	ATHERSTONE	5/8	3140535	19930105	92944281	Badger	RCDL 25	Disp.	11/19/14	0.25	99.5	2	100.1	15	100.2	100.03%			No Register, Meter tested within AWWA accuracy limits.
1670	BELMAR	5/8	2071190	19930202	42008118	Badger	RCDL 25	Disp.	11/19/14	0.25	99.6	2	100.1	15	100	100.01%			No Register, Meter tested within AWWA accuracy limits.
3504	BENDEMEER	5/8	1038840	19930427	93140954	Badger	RCDL 25	Disp.	11/19/14	0.25	99.8	2	100	15	100.2	100.00%			No Register, Meter tested within AWWA accuracy limits.
3251	BERKSHIRE	5/8	2190175	19930313	92882757	Badger	RCDL 25	Disp.	11/19/14	0.25	99.4	2	100.8	15	100.4	100.53%			No Register, Meter tested within AWWA accuracy limits.
3718	MT LAUREL	5/8	3151490	19921229	92881755	Badger	RCDL 25	Disp.	11/19/14	0.25	99.9	2	100.4	15	100.2	100.30%			No Register, Meter tested within AWWA accuracy limits.
2123	ROSSMOOR	5/8	2092735	19930728	93527361	Badger	RCDL 25	Disp.	11/19/14	0.25	99.6	2	100.3	15	100.2	100.18%			No Register, Meter tested within AWWA accuracy limits.
2453	KINGSTON	5/8	1090315	19930428	93253488	Badger	RCDL 25	Disp.	11/21/14	0.25	99.6	2	100.6	15	100.1	100.38%			No Register, Meter tested within AWWA accuracy limits.
3365	MEADOWBROOK	5/8	1143215	19930624	92941711	Badger	RCDL 25	Disp.	11/21/14	0.25	98.9	2	100.2	15	99.5	99.90%			No Register, Meter tested within AWWA accuracy limits.
3711	LONGWOOD COURT	5/8	2054759	20060607	17543366	Badger	RCDL 25	Disp.	11/21/14	0.25	99.9	2	100.1	15	100.1	100.07%			No Register, Meter tested within AWWA accuracy limits.
13698	CEDAR	5/8	1136330	19930605	92286747	Badger	RCDL 25	Disp.	11/21/14	0.25	100.2	2	100.1	15	99.8	100.07%			No Register, Meter tested within AWWA accuracy limits.
1258	CLEVELAND HTS	5/8	3021630	19921114	92883583	Badger	RCDL 25	Disp.	11/21/14	0.25	99.6	2	100.2	15	100.7	100.19%			No Register, Meter tested within AWWA accuracy limits.
3555	MEADOWBROOK	5/8	1144775	19930611	93457960	Badger	RCDL 25	Disp.	11/21/14	0.25	99.4	2	100	15	99.8	99.88%			No Register, Meter tested within AWWA accuracy limits.
780	WOODVIEW	5/8	3183070	19930914	93583867	Badger	RCDL 25	Disp.	11/21/14	0.25	100.1	2	100.1	15	100	100.09%			No Register, Meter tested within AWWA accuracy limits.
967	SELWYN	5/8	3210615	19930120	92942490	Badger	RCDL 25	Disp.	11/21/14	0.25	98.9	2	100.2	15	99.8	99.95%			No Register, Meter tested within AWWA accuracy limits.
3586	BLANCHE	5/8	2180895	19930311	93457701	Badger	RCDL 25	Disp.	11/19/14	0.25	99.4	2	100.2	15	100.1	100.07%			No Register, Meter tested within AWWA accuracy limits.
1080	ELBON	5/8	3181050	19921209	92881989	Badger	RCDL 25	Disp.	11/21/14	0.25	99.7	2	100.3	15	99.8	100.14%			No Register, Meter tested within AWWA accuracy limits.
3051	ESSEX	5/8	1161775	19930529	93265394	Badger	RCDL 25	Disp.	11/19/14	0.25	99.8	2	100.2	15	100	100.11%			No Register, Meter tested within AWWA accuracy limits.
3315	HYDE PARK	5/8	2163875	19930320	93139600	Badger	RCDL 25	Disp.	11/21/14	0.25	99.4	2	100.1	15	98.4	99.74%			No Register, Meter tested within AWWA accuracy limits.
3967	NORTHAMPTON	5/8	3102575	19921112	92883684	Badger	RCDL 25	Disp.	11/21/14	0.25	99.6	2	100.8	15	100.3	100.55%			No Register, Meter tested within AWWA accuracy limits.
16268	OAKHILL	5/8	3300170	19940623	93508395	Badger	RCDL 25	Disp.	11/21/14	0.25	98.4	2	100.2	15	99.6	99.84%			No Register, Meter tested within AWWA accuracy limits.
1163	OXFORD	5/8	3091395	19921119	92883415	Badger	RCDL 25	Disp.	11/19/14	0.25	100.1	2	100	15	9.8	86.49%			No Register, Meter tested within AWWA accuracy limits.
3605	FENLEY	5/8			92882011	Badger	RCDL 25	Disp.	11/19/14	0.25	99.4	2	100.2	15	100.3	100.10%			No Register, Meter tested within AWWA accuracy limits.
3266	BERKELEY	5/8	2190250	19930319	93139576	Badger	RCDL 25	Disp.	11/19/14	0.25	99.3	2	100.2	15	100	100.04%	100677	CF	Meter tested within AWWA accuracy limits.
3834	BERKELEY	5/8	2192830	19930513	93257740	Badger	RCDL 25	Disp.	11/19/14	0.25	99.4	2	100.1	15	100	99.98%			No Register, Meter tested within AWWA accuracy limits.
3631	BLANCHE	5/8	2181175	19930325	93140242	Badger	RCDL 25	Disp.	11/19/14	0.25	98.6	2	100.2	15	100.1	99.95%	90290	CF	Meter tested within AWWA accuracy limits.
2382	RINARD	5/8	1108030	19930903	93539089	Badger	RCDL 25	Disp.	11/21/14	0.25	96.4	2	100.3	15	100.1	99.69%	139207	CF	Meter tested within AWWA accuracy limits.
2654	EXETER	5/8	108255002	93253729	93253728	Badger	RCDL 25	Disp.	11/19/14	0.25	99.2	2	100.2	15	100.1	100.04%			No Register, Meter tested within AWWA accuracy limits.
1156	OXFORD	5/8			92883545	Badger	RCDL 25	Disp.	11/19/14	0.25	99.6	2	100.2	15	99.9	100.07%	139412	CF	Meter tested within AWWA accuracy limits.
3061	YORKSHIRE	5/8	211549500	92941421	92941421	Badger	RCDL 25	Disp.	11/19/14	0.25	97.4	2	99.8	15	100.4	99.53%			No Register, Meter tested within AWWA accuracy limits.
865	QUARRY	5/8	305521500	92883683	92883683	Badger	RCDL 25	Disp.	11/21/14	0.25	98.4	2	100.3	15	99.6	99.91%	200376	CF	Meter tested within AWWA accuracy limits.
3465	MEADOWBROOK	5/8			93265871	Badger	RCDL 25	Disp.	11/21/14	0.25	98.9	2	100.9	15	99.6	100.41%	118999	CF	Meter tested within AWWA accuracy limits.
1594	S. TAYLOR	5/8			34581800	Badger	RCDL 25	Disp.	11/19/14	0.25	99.8	2	100.1	15	99.6	99.98%	15357	CF	Meter tested within AWWA accuracy limits.
3090	YORKSHIRE	5/8			92942849	Badger	RCDL 25	Disp.	11/19/14	0.25	99.8	2	99.7	15	100.4	99.82%			No Register, Meter tested within AWWA accuracy limits.
3202	RUMSON	5/8	329213001		92942674	Badger	RCDL 25	Disp.	11/21/14	0.25	99.9	2	100.1	15	100.1	100.07%			No Register, Meter tested within AWWA accuracy limits.
1034	RENFIELD	5/8	306419001		93527289	Badger	RCDL 25	Disp.	11/21/14	0.25	99.6	2	100.4	15	99.8	100.19%			No Register, Meter tested within AWWA accuracy limits.
1112	WOODVIEW	5/8	318445001		92943783	Badger	RCDL 25	Disp.	11/21/14	0.25	99.8	2	100	15	100	99.97%	136521	CF	Meter tested within AWWA accuracy limits.
2311	NOBLE	5/8	327067501		92942100	Badger	RCDL 25	Disp.	11/21/14	0.25	97.4	2	100.1	15	99.9	99.67%	109747	CF	Meter tested within AWWA accuracy limits.
2952	SOMERTON	5/8	208321000		92943486	Badger	RCDL 25	Disp.	11/21/14	0.25	100.2	2	100.1	15	100	100.10%	141470	CF	Meter tested within AWWA accuracy limits.
1158	CLEVELAND HTS BLVD	5/8	302121000		92883104	Badger	RCDL 25	Disp.	11/21/14	0.25	100.3	2	100.2	15	99.8	100.16%	107361	CF	Meter tested within AWWA accuracy limits.
3652	BURBRIDGE	5/8	314109000		92882730	Badger	RCDL 25	Disp.	11/21/14	0.25	99.5	2	100.1	15	100.4	100.06%			No Register, Meter tested within AWWA accuracy limits.
1000	PEMBROOK	5/8	317035000		92881527	Badger	RCDL 25	Disp.	11/21/14	0.25	100.1	2	100.4	15	99.8	100.27%	60092	CF	Meter tested within AWWA accuracy limits.
999	ELBON	5/8	318065504		92942616	Badger	RCDL 25	Disp.	11/21/14	0.25	99.4	2	100.2	15	100.2	100.08%			No Register, Meter tested within AWWA accuracy limits.
3744	LOWELL	5/8	310015001		93265475	Badger	RCDL 25	Disp.	11/19/14	0.25	100.1	2	100.1	15	100.1	100.10%			No Register, Meter tested within AWWA accuracy limits.
2207	JACKSON	5/8	128429500		93517868	Badger	RCDL 25	Disp.	11/19/14	0.25	99.7	2	100.2	15	100.1	100.11%			No Register, Meter tested within AWWA accuracy limits.
3794	SEVERN	5/8	220209000		93140163	Badger	RCDL 25	Disp.	11/19/14	0.25	99.6	2	100.2	15	99.4	99.99%	104614	CF	Meter tested within AWWA accuracy limits.
3410	RUMSON	5/8	329261003		93053983	Badger	RCDL 25	Disp.	11/21/14	0.25	98.6	2	100.1	15	100.1	99.88%	65503	CF	Meter tested within AWWA accuracy limits.
3118	EAST OVERLOOK	5/8	126387002		93505290	Badger	RCDL 25	Disp.	11/21/14							0.00%	30497	CF	Broken freeze plate, unable to test
3779	LOWELL	5/8	310049501		92830959	Badger	RCDL 25	Disp.	11/19/14	0.25	100.1	2	100.2	15	99.8	100.13%			No Register, Meter tested within AWWA accuracy limits.
	SHOP	5/8			92881677	Badger	RCDL 25	Disp.	11/21/14	0.25	99.4	2	100.3	15	100	100.12%			No Register, Meter tested within AWWA accuracy limits.
	SHOP	5/8			92941188	Badger	RCDL 25	Disp.	11/21/14	0.25	99.6	2	100.1	15	99.5	99.94%			No Register, Meter tested within AWWA accuracy limits.
	SHOP	5/8			93883500	Badger	RCDL 25	Disp.	11/21/14	0.25	99.8	2	100.3	15	100	100.18%			No Register, Meter tested within AWWA accuracy limits.
	SHOP	5/8			96881679	Badger	RCDL 25	Disp.	11/21/14	0.25	98.6	2	100.1	15	99.1	99.73%			No Register, Meter tested within AWWA accuracy limits.
	SHOP	5/8			92944157	Badger	RCDL 25	Disp.	11/21/14	0.25	98.5	2	100.3	15	99.8	99.96%			No Register, Meter tested within AWWA accuracy limits.
	SHOP	5/8			93527272	Badger	RCDL 25	Disp.	11/21/14	0.25	100	2	100.3	15	100.2	100.24%			No Register, Meter tested within AWWA accuracy limits.
	SHOP	5/8			93053196	Badger	RCDL 25	Disp.	11/21/14	0.25	98.8	2	100.2	15	100.1	99.98%			No Register, Meter tested within AWWA accuracy limits.



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CLEVELAND HEIGHTS ANOMALY AND METER TEST RECOMMENDATIONS

8-inch Meters

*Check all 8-inch (non-fire) meters [low usage, are they sized correctly]?

Table 1: 8-inch (Non-fire) Meter

Acct#	Size	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Sparks
2020055	8		132	122	122	75	95	43	41	55	58	199	180	196	
2021015	8		0	0	0	0	0	0	0	0	0	0	0	0	
2054560	8		330	372	355	434	417	362	357	366	391	380	397	347	
2054637	8		10	19	8	9	8	10	9	7	8	10	9	10	
2058000	8		0	0	0	0	0	0	0	0	0	0	0	0	

ACCOUNT #	NO.	LOCATION	COMMENTS
2020055	2375	MURRAY HILL	[Master Credit meter?]
2021015	11981	CARLTON Road	[Master Credit meter?]
2054560	3500	MAYFIELD Road	Appears to be for the cemetery although does not reference a connection to this street address. Appears to be reasonable flow characteristics
2054637	3	SEVERANCE CIRCLE	Very low flow for an 8-inch meter. Expect this is not really an 8-inch meter if correctly assigned. Supplies one small office. Check location and size before testing
2058000	1673	S TAYLOR Road	[Master meter?]

6-inch Meters

Table 2: 6-inch Meters

Acct#	Size	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Sparks
2020015	6		120	200	300	400	400	400	400	1269	1456	378	154	129	
2053160	6		290	224	194	246	352	241	292	260	319	313	258	215	
2053755	6		846	721	955	621	922	980	967	751	678	455	381	372	
2054638	6		115	152	168	83	51	50	52	56	51	61	74	161	
2294060	6		405	423	320	309	281	311	300	275	286	229	279	258	
2294170	6		0	0	0	0	0	0	0	0	0	0	0	0	

ACCOUNT #	NO.	LOCATION	COMMENTS
2020015			The consumption from Sept 13 to Feb 14 is too rounded. Why is this? Also the highest usage is in the winter months. Check meter.
2054638	5	SEVERANCE CIRCLE	This appears to have a declining usage although this is mainly in the winter suggesting it is used for irrigation. The 20year flow to current flow is 10* This is a multi-

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City of Cleveland Heights

Detailed Engineering Evaluation

Water Utility Optimization

MEMORANDUM

PAGE 2

			story office building. 51% Occupancy Aug 2014. 100K SF. No landscaping so appears odd to have summer increase. Check size etc.
2294170	1826	WARRENSVILLE CTR Road	This is in South Euclid and looks like it might supply the golf course. Just make sure it is not to be billed by CH.

4-inch Meters

Table 3: 4-inch Meters

Acct#	Size	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Sparks
1052715	4	92	305	278	225	92	85	72	83	98	78	142	151		
1133275	4	121	113	1	0	0	0	0	0	0	0	0	65		
1133395	4	254	205	406	517	510	380	775	590	520	331	435	287		
2010215	4	687	673	862	468	271	205	195	197	211	239	306	502		
2025030	4	798	963	860	846	819	680	891	988	897	825	772	644		
2055115	4	709	553	266	0	0	0	0	0	0	0	0	0		
2121590	4	46	7	35	45	66	31	104	46	38	35	36	6		
2130290	4	27	25	19	20	17	16	20	20	24	26	19	26		
2250550	4	129	141	5	0	0	0	0	0	0	0	144	187		
2284355	4	8	6	6	9	19	16	15	16	19	17	13	6		
3011375	4	83	78	72	97	74	89	78	80	82	103	66	94		
3012385	4	742	777	718	795	760	766	790	747	793	749	745	674		

ACCOUNT #	NO.	LOCATION	COMMENTS
1133275	13221	CEDAR Road	Sudden drop off in usage for this meter. Very close to the school playing fields. Lots of work being done in this area, but should the meter be off?
2055115	3739	MAYFIELD Road	This is an apartment complex. It appears as though the large usage stopped in Nov 2013.
2130290	2490	LEE Blvd (? Could be Lee Road)	Low usage (10% of average). Is this inaccurate, incorrectly multiplied or undersized? This is Rockefeller Pointe an Office building. Approx. 60000SF of 100K was not rented in Jan 2013, may have no tenants
2250550	1740	CUMBERLAND Road	This is the pool. The usage stops each winter. Just check that it is working correctly next spring.
2284355	1541	WILMAR	This meter has very low usage (but still usage) for a 4-inch meter. Check accuracy and fixed zeros. This may be for the golf course (Oakwood Country Club) as it is near the front entrance. This facility was just up for sale... and recently purchased. There is new development about to take place so it is possible that this meter is no longer needed at the current size.

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City of Cleveland Heights

Detailed Engineering Evaluation

Water Utility Optimization

MEMORANDUM

PAGE 3

3-inch Meters

Table 4: 3-inch Meters

Acct#	Size	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul
1037042	3		3	5	8	10	10	7	7	6	8	14	9	10
1154410	3		6	21	30	30	30	18	17	77	24	18	26	10
2014435	3		45	61	101	109	150	59	151	94	91	107	68	112
2054640	3			79	69	76	56	58	66	60	66	68	70	110
2054680	3		109	109	107	117	112	108	114	102	108	93	77	78
2054715	3		25	43	39	33	28	23	24	27	33	29	30	22
2056560	3		0	0	0	0	75	97	90	80	86	79	82	75
2057998	3		125	124	121	129	118	121	123	117	131	119	124	115
2058034	3		305	386	438	153	51	44	36	39	59	130	145	
2058046	3		101	92	64	68	84	60	51	43	52	71	77	78
2094495	3		115	56	0	0	0	0	0	0	0	0	12	68
2094655	3		18	11	0	0	0	0	0	0	0	0	0	0
2130210	3		32	33	23	13	6	1	3	2	1	2	0	0
2130255	3		114	127	104	129	111	124	131	103	119	120	126	129
2132540	3		202	124	141	117	91	93	100	82	86	81	90	120
2270900	3		0	0	0	0	0	0	0	0	0	0	0	0
2291160	3		40	39	35	34	37	34	40	30	36	35	38	37
3012377	3		41	34	35	30	32	34	30	26	32	34	28	33
3022380	3		105	122	127	95	108	80	89	78	88	80	91	124
3055995	3		0	0	0	0	0	0	0	0	0	0	0	0

ACCOUNT #	NO.	LOCATION	COMMENTS
1037042	3244	FAIRMOUNT Boulevard	Low flow for 3-inch meter. Check where this is supplying.
1154410	2178	STILLMAN	Communion of Saints School is at 2160 Stillman. This appears to be relatively low flow, possible, but low.
2094495	14539	SUPERIOR	Appears to be some kind of covered warehouse. Check that it should only show usage in the summer
2094655	14575	SUPERIOR	Possibly Cain Park. Is it just an irrigation meter
3055995	1015	QUARRY	Denison park including Soccer fields. Unlikely to be zero use... May not be billable, but check meter is working.
2270900	1700	CREST Road	Millikin Early Childhood Center. Reasonably sized facility with 120 students, appears to be operational. Should be some flow

19 meters are recommended for initial site visit and possible testing.

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City of Cleveland Heights
 Detailed Engineering Evaluation
 Water Utility Optimization

M.E. SIMPSON COMPANY, INC. - Technical Services
COMPOUND / TURBINE / DISP. METER TEST REPORT

Client : ESG - Cleveland Heights, OH Premises: _____
 Account name : Kaiser Hospital Account no. : 3012375
 Building Name: Kaiser Hospital Meter no.: _____
 Address: 10 SEVERANCE CIRCLE Reg ID : _____
 Meter location : dual meter pit, south side of bldg. in grass AMR ID: 83511304
 Meter size : 4 Brand: Badger - RCRDLL II Type: Turbine S/N: 43021066
 Test port: Yes Bypass: Yes Inlet valve : Yes Outlet valve: Yes Data ID: 1

READINGS

Confined Space: Yes O2 Level: 20.9 Gas Present: None Ok to Enter: Yes Supervisor: Matt S. Brown
 Meter Reading Upon Arrival T/H: 003566[00] L: _____ FM: _____ Units: Cubic Feet
 Meter Reading After Post Test T/H: _____ L: _____ FM: _____ Units: _____
 Remote Reading Upon Arrival T/H: _____ L: _____ FM: _____ Units: _____

TEST AND REPAIR DATA

Tested: 11/10/14 10:00 AM By: Matt B. & Eric M. Repaired: _____ By: _____
 Upon Arrival - Meter Sealed Bypass Sealed Upon Departure - Meter Sealed Bypass Sealed

TESTS	Test Results			Post Test Results		
	Flow Rate GPM	Allowable Test Accuracy	Actual Test Accuracy	Flow Rate GPM	Allowable Post Test Accuracy	Actual Post Test Accuracy
Compound						
Minimum		97 - 103			95 - 103	
Below C.O.						
Change Over		90 - 103			90 - 103	
Above C.O.						
Intermediate		97 - 103			97 - 103	
Maximum		97 - 103			97 - 103	

Turb./Disp.	Flow Rate GPM	Allowable Test Accuracy	Actual Test Accuracy	Flow Rate GPM	Allowable Post Test Accuracy	Actual Post Test Accuracy
	Start	6		75		
Minimum	15	98.5 - 101.5	99		98.5 - 101.5	
Intermediate	100	98.5 - 101.5	99.5		98.5 - 101.5	
Maximum	310	98.5 - 101.5	101.5		98.5 - 101.5	

TEST AND REPAIR COMMENTS

The meter tested within accuracy limits derived from AWWA M6. We recommend a 4" compound meter be installed in the meter setting.



City of Cleveland Heights
 Detailed Engineering Evaluation
 Water Utility Optimization

M.E. SIMPSON COMPANY, INC. - Technical Services
 COMPOUND / TURBINE / DISP. METER TEST REPORT

Client : ESG - Cleveland Heights, OH Premises: _____
 Account name : Waldorf Towers Apartments Account no. : 2025030
 Building Name: Waldorf Towers Apartments Meter no.: _____
 Address: 2300 OVERLOOK Reg ID : _____
 Meter location : BV/255' N 2ND HYD S EDGEHILL - Vault front of building by sign AMR ID: 84012744
 Meter size : 4 Brand: Badger - RCRDLL II Type: Turbine S/N: 43466885
 Test port: Yes Bypass: Yes Inlet valve : Yes Outlet valve: Yes Data ID: 2

READINGS

Confined Space: Yes O2 Level: 20.9 Gas Present: None Ok to Enter: Yes Supervisor: **Matt S. Brown**
 Meter Reading Upon Arrival T/H: 026281[00] L: _____ FM: _____ Units: Cubic Feet
 Meter Reading After Post Test T/H: _____ L: _____ FM: _____ Units: _____
 Remote Reading Upon Arrival T/H: _____ L: _____ FM: _____ Units: _____

TEST AND REPAIR DATA

Tested: 11/11/14 11:45 AM By: Matt B. & Eric M. Repaired: _____ By: _____
 Upon Arrival - Meter Sealed Bypass Sealed Upon Departure - Meter Sealed Bypass Sealed

TESTS	Test Results			Post Test Results		
	Flow Rate GPM	Allowable Test Accuracy	Actual Test Accuracy	Flow Rate GPM	Allowable Post Test Accuracy	Actual Post Test Accuracy
Compound						
Minimum		97 - 103			95 - 103	
Below C.O.						
Change Over		90 - 103			90 - 103	
Above C.O.						
Intermediate		97 - 103			97 - 103	
Maximum		97 - 103			97 - 103	

Turb./Disp.	Flow Rate GPM	Allowable Test Accuracy	Actual Test Accuracy	Flow Rate GPM	Allowable Post Test Accuracy	Actual Post Test Accuracy
	Start	8		80		
Minimum	15	98.5 - 101.5	99.8		98.5 - 101.5	
Intermediate	100	98.5 - 101.5	101.2		98.5 - 101.5	
Maximum	300	98.5 - 101.5	101.4		98.5 - 101.5	

TEST AND REPAIR COMMENTS

The meter tested within accuracy limits derived from AWWA M6. There needs to be a 4" compound meter installed in the setting.



City of Cleveland Heights
Detailed Engineering Evaluation
Water Utility Optimization

M.E. SIMPSON COMPANY, INC. - Technical Services
COMPOUND / TURBINE / DISP. METER TEST REPORT

Client : ESG - Cleveland Heights, OH Premises: _____
 Account name : Kensington Apartments Account no. : 3012385
 Building Name: Kensington Apartments Meter no.: _____
 Address: 30 SEVERANCE CIRCLE Reg ID : _____
 Meter location : 79' S 5TH HYD S MAYFIELD - Off Taylor Street AMR ID: 83511346
 Meter size : 4 Brand: Badger - RCRDLL II Type: Turbine S/N: 43021067
 Test port: Yes Bypass: Yes Inlet valve : Yes Outlet valve: Yes Data ID: 3

READINGS

Confined Space: Yes O2 Level: 20.1 Gas Present: None Ok to Enter: Yes Supervisor: Matt S. Brown
 Meter Reading Upon Arrival T/H: 025501(00) L: _____ FM: _____ Units: Cubic Feet
 Meter Reading After Post Test T/H: 025603(00) L: _____ FM: _____ Units: Cubic Feet
 Remote Reading Upon Arrival T/H: _____ L: _____ FM: _____ Units: _____

TEST AND REPAIR DATA

Tested: 11/10/14 12:00 PM By: Matt B. & Eric M. Repaired: 11/10/14 1:30 PM By: Matt B. & Eric M.
 Upon Arrival - Meter Sealed Bypass Sealed Upon Departure - Meter Sealed Bypass Sealed

TESTS	Test Results			Post Test Results		
Compound	Flow Rate GPM	Allowable Test Accuracy	Actual Test Accuracy	Flow Rate GPM	Allowable Post Test Accuracy	Actual Post Test Accuracy
Minimum		97 - 103			95 - 103	
Below C.O.						
Change Over		90 - 103			90 - 103	
Above C.O.						
Intermediate		97 - 103			97 - 103	
Maximum		97 - 103			97 - 103	

Turb./Disp.	Flow Rate GPM	Allowable Test Accuracy	Actual Test Accuracy	Flow Rate GPM	Allowable Post Test Accuracy	Actual Post Test Accuracy
Start	x		x	8		75
Minimum	15	98.5 - 101.5	98	15	98.5 - 101.5	99
Intermediate	100	98.5 - 101.5	99	100	98.5 - 101.5	101
Maximum	325	98.5 - 101.5	0	350	98.5 - 101.5	101.5

TEST AND REPAIR COMMENTS

The meter failed to test within accuracy limits derived from AWWA M6. We recommend a 4" compound meter be install in this meter setting. While testing the high flow test debris got stuck in the rotor of the turbine. We opened the meter up and cleaned out the debris and retested. The meter retested within accuracy limits derived from AWWA M6.



City of Cleveland Heights
Detailed Engineering Evaluation
Water Utility Optimization

M.E. SIMPSON COMPANY, INC. - Technical Services
COMPOUND / TURBINE / DISP. METER TEST REPORT

Client : <u>ESG - Cleveland Heights, OH</u>	Premises: _____
Account name : <u>Heights Garden Apartments</u>	Account no. : <u>2055115</u>
Building Name: <u>Heights Garden Apartments</u>	Meter no.: _____
Address: <u>3739 MAYFIELD</u>	Reg ID : _____
Meter location : <u>BV--43' W 1ST HYD E CLEVE HTS - Vault on Mayfield by bus stop</u>	AMR ID: <u>84013136</u>
Meter size : <u>4</u> Brand: <u>Badger - RCRDLL II</u> Type: <u>Turbine</u> S/N: <u>43466837</u>	
Test port: <u>Yes</u> Bypass: <u>Yes</u> Inlet valve : <u>Yes</u> Outlet valve: <u>Yes</u> Data ID: <u>4</u>	

READINGS

Confined Space: <u>Yes</u> O2 Level: <u>20.9</u> Gas Present: <u>None</u> Ok to Enter: <u>Yes</u> Supervisor: <u>Matt S. Brown</u>
Meter Reading Upon Arrival T/H: <u>013387[00]</u> L: _____ FM: _____ Units: <u>Cubic Feet</u>
Meter Reading After Post Test T/H: <u>013388[00]</u> L: _____ FM: _____ Units: <u>Cubic Feet</u>
Remote Reading Upon Arrival T/H: _____ L: _____ FM: _____ Units: _____

TEST AND REPAIR DATA

Tested: <u>11/12/14 9:45 AM</u> By: <u>Matt B. & Eric M.</u> Repaired: <u>11/12/14 11:00 AM</u> By: <u>Matt B. & Eric M.</u>
Upon Arrival - Meter Sealed <input type="checkbox"/> Bypass Sealed <input type="checkbox"/> Upon Departure - Meter Sealed <input type="checkbox"/> Bypass Sealed <input type="checkbox"/>

TESTS	Test Results			Post Test Results		
	Flow Rate GPM	Allowable Test Accuracy	Actual Test Accuracy	Flow Rate GPM	Allowable Post Test Accuracy	Actual Post Test Accuracy
Compound						
Minimum		97 - 103			95 - 103	
Below C.O.						
Change Over		90 - 103			90 - 103	
Above C.O.						
Intermediate		97 - 103			97 - 103	
Maximum		97 - 103			97 - 103	

Turb./Disp.	Flow Rate GPM	Allowable Test Accuracy	Actual Test Accuracy	Flow Rate GPM	Allowable Post Test Accuracy	Actual Post Test Accuracy
	Start	6		0	6	
Minimum	15	98.5 - 101.5	0	15	98.5 - 101.5	100.5
Intermediate	100	98.5 - 101.5	0	100	98.5 - 101.5	103
Maximum	200	98.5 - 101.5	0	200	98.5 - 101.5	108

TEST AND REPAIR COMMENTS

The meter failed to test within accuracy limits derived from AWWA M6. We opened the meter up and cleaned debris from measuring element (turbine). The meter then was over registering on the high flow tests. The outlet valve needs replace because it leaks through at .8 gpm. We recommend a 4" compound meter be installed in this meter setting. There is no way to seal the bypass valve because the handle is broken.



City of Cleveland Heights
 Detailed Engineering Evaluation
 Water Utility Optimization

M.E. SIMPSON COMPANY, INC. - Technical Services
COMPOUND / TURBINE / DISP. METER TEST REPORT

Client : ESG - Cleveland Heights, OH Premises: _____
 Account name : Cleveland Heights High School Account no. : 1133395
 Building Name: Cleveland Heights High School Meter no.: _____
 Address: 13263 CEDAR Reg ID : _____
 Meter location : Basement boiler room AMR ID: _____
 Meter size : 4 Brand: Badger - RCRDLL II Type: Turbine S/N: 36309263
 Test port: No Bypass: Yes Inlet valve : Yes Outlet valve: Yes Data ID: 5

READINGS

Confined Space: No O2 Level: _____ Gas Present: _____ Ok to Enter: Yes Supervisor: Matt S. Brown
 Meter Reading Upon Arrival T/H: 002382[00] L: _____ FM: _____ Units: Cubic Feet
 Meter Reading After Post Test T/H: _____ L: _____ FM: _____ Units: _____
 Remote Reading Upon Arrival T/H: _____ L: _____ FM: _____ Units: _____

TEST AND REPAIR DATA

Tested: 11/11/14 2:45 PM By: Matt B. & Eric M. Repaired: _____ By: _____
 Upon Arrival - Meter Sealed Bypass Sealed Upon Departure - Meter Sealed Bypass Sealed

TESTS	Test Results			Post Test Results		
	Flow Rate GPM	Allowable Test Accuracy	Actual Test Accuracy	Flow Rate GPM	Allowable Post Test Accuracy	Actual Post Test Accuracy
Compound						
Minimum		97 - 103			95 - 103	
Below C.O.						
Change Over		90 - 103			90 - 103	
Above C.O.						
Intermediate		97 - 103			97 - 103	
Maximum		97 - 103			97 - 103	

Turb./Disp.	Test Results			Post Test Results		
	Flow Rate GPM	Allowable Test Accuracy	Actual Test Accuracy	Flow Rate GPM	Allowable Post Test Accuracy	Actual Post Test Accuracy
Turb./Disp.						
Start						
Minimum		98.5 - 101.5			98.5 - 101.5	
Intermediate		98.5 - 101.5			98.5 - 101.5	
Maximum		98.5 - 101.5			98.5 - 101.5	

TEST AND REPAIR COMMENTS

There is no way to seal the bypass valve. There is no test port in this meter setting. There is no place to install a test port after the meter and before the outlet valve. The meter is piped valve to valve. We recommend a 4" compound meter be installed in this meter setting. During the 20 minutes we were there the meter only registered 2 cubic feet.



City of Cleveland Heights
 Detailed Engineering Evaluation
 Water Utility Optimization

M.E. SIMPSON COMPANY, INC. - Technical Services
COMPOUND / TURBINE / DISP. METER TEST REPORT

Client : ESG - Cleveland Heights, OH Premises: _____
 Account name : Margaret Wagner Apartments Account no. : 2010215
 Building Name: Margaret Wagner Apartments Meter no.: _____
 Address: 2375 EUCLID HTS Reg ID : _____
 Meter location : 9'E 2ND HYD W LENNOX AMR ID: 84720872
 Meter size : 4 Brand: Badger - RCRDLL II Type: Turbine S/N: 43883229
 Test port: Yes Bypass: Yes Inlet valve : Yes Outlet valve: Yes Data ID: 6

READINGS

Confined Space: Yes O2 Level: 20.9 Gas Present: None Ok to Enter: Yes Supervisor: Matt S. Brown
 Meter Reading Upon Arrival T/H: 009332[00] L: _____ FM: _____ Units: Cubic Feet
 Meter Reading After Post Test T/H: _____ L: _____ FM: _____ Units: _____
 Remote Reading Upon Arrival T/H: _____ L: _____ FM: _____ Units: _____

TEST AND REPAIR DATA

Tested: 11/11/14 2:00 PM By: Matt B. & Eric M. Repaired: _____ By: _____
 Upon Arrival - Meter Sealed Bypass Sealed Upon Departure - Meter Sealed Bypass Sealed

TESTS	Test Results			Post Test Results		
	Compound	Flow Rate GPM	Allowable Test Accuracy	Actual Test Accuracy	Flow Rate GPM	Allowable Post Test Accuracy
Minimum		97 - 103			95 - 103	
Below C.O.						
Change Over		90 - 103			90 - 103	
Above C.O.						
Intermediate		97 - 103			97 - 103	
Maximum		97 - 103			97 - 103	

Turb./Disp.	Flow Rate GPM	Allowable Test Accuracy	Actual Test Accuracy	Flow Rate GPM	Allowable Post Test Accuracy	Actual Post Test Accuracy
	Start	8		80		
Minimum	15	98.5 - 101.5	101		98.5 - 101.5	
Intermediate	100	98.5 - 101.5	102.5		98.5 - 101.5	
Maximum	350	98.5 - 101.5	103		98.5 - 101.5	

TEST AND REPAIR COMMENTS

The meter failed to test within accuracy limits derived from AWWA M6. The plastic piping that was connected to the test port broke when we were removing the test port. The plastic pipe was connected to the test port fitting. The inlet and out valves turn extremely hard. The meter is over registering on the high flow test. We recommend that the inlet valve, outlet valve, and meter be replaced. We recommend a 4" compound meter be installed in this setting.



City of Cleveland Heights
 Detailed Engineering Evaluation
 Water Utility Optimization

M.E. SIMPSON COMPANY, INC. - Technical Services
COMPOUND / TURBINE / DISP. METER TEST REPORT

Client : ESG - Cleveland Heights, OH Premises: _____
 Account name : Beaumont High School Account no. : 1052715
 Building Name: Beaumont High School Meter no.: _____
 Address: 3301 NORTH PARK Reg ID : _____
 Meter location : BV/150' E 4TH HYD E LEE AMR ID: 3227
 Meter size : 4 Brand: Badger - RCRDLL II Type: Turbine S/N: 36270684
 Test port: Yes Bypass: Yes Inlet valve : Yes Outlet valve: Yes Data ID: 7

READINGS

Confined Space: Yes O2 Level: 20.9 Gas Present: None OK to Enter: Yes Supervisor: Matt S. Brown
 Meter Reading Upon Arrival T/H: 009254[00] L: _____ FM: _____ Units: Cubic Feet
 Meter Reading After Post Test T/H: _____ L: _____ FM: _____ Units: _____
 Remote Reading Upon Arrival T/H: _____ L: _____ FM: _____ Units: _____

TEST AND REPAIR DATA

Tested: 11/11/14 7:00 AM By: Matt B. & Eric M. Repaired: _____ By: _____
 Upon Arrival - Meter Sealed Bypass Sealed Upon Departure - Meter Sealed Bypass Sealed

TESTS	Test Results			Post Test Results		
	Flow Rate GPM	Allowable Test Accuracy	Actual Test Accuracy	Flow Rate GPM	Allowable Post Test Accuracy	Actual Post Test Accuracy
Compound						
Minimum		97 - 103			95 - 103	
Below C.O.						
Change Over		90 - 103			90 - 103	
Above C.O.						
Intermediate		97 - 103			97 - 103	
Maximum		97 - 103			97 - 103	

Turb./Disp.	Flow Rate GPM	Allowable Test Accuracy	Actual Test Accuracy	Flow Rate GPM	Allowable Post Test Accuracy	Actual Post Test Accuracy
	Start	7		50		
Minimum	15	98.5 - 101.5	99.8		98.5 - 101.5	
Intermediate	100	98.5 - 101.5	101.3		98.5 - 101.5	
Maximum	160	98.5 - 101.5	100.4		98.5 - 101.5	

TEST AND REPAIR COMMENTS

The meter tested within accuracy limits derived from AWWA M6. We obtained a maximum flow of 160 gpm from the test port. There needs to be a 4" compound meter installed in this meter setting.



City of Cleveland Heights
Detailed Engineering Evaluation
Water Utility Optimization

M.E. SIMPSON COMPANY, INC. - Technical Services
COMPOUND / TURBINE / DISP. METER TEST REPORT

Client : ESG - Cleveland Heights, OH Premises: _____
 Account name : Home Depot Account no. : 2058034
 Building Name: Home Depot Meter no.: _____
 Address: 3460 MAYFIELD Reg ID : _____
 Meter location : In sprinkler room in back of building AMR ID: 3580996
 Meter size : 3 Brand: Badger - RCRDLL II Type: Turbine S/N: None
 Test port: No Bypass: No Inlet valve : Yes Outlet valve: Yes Data ID: 8

READINGS

Confined Space: No O2 Level: _____ Gas Present: _____ Ok to Enter: Yes Supervisor: Matt S. Brown
 Meter Reading Upon Arrival T/H: 020849[00] L: _____ FM: _____ Units: Cubic Feet
 Meter Reading After Post Test T/H: _____ L: _____ FM: _____ Units: _____
 Remote Reading Upon Arrival T/H: _____ L: _____ FM: _____ Units: _____

TEST AND REPAIR DATA

Tested: 11/12/14 12:30 PM By: Matt B. & Eric M. Repaired: _____ By: _____
 Upon Arrival - Meter Sealed Bypass Sealed Upon Departure - Meter Sealed Bypass Sealed

TESTS	Test Results			Post Test Results		
	Flow Rate GPM	Allowable Test Accuracy	Actual Test Accuracy	Flow Rate GPM	Allowable Post Test Accuracy	Actual Post Test Accuracy
Compound						
Minimum		97 - 103			95 - 103	
Below C.O.						
Change Over		90 - 103			90 - 103	
Above C.O.						
Intermediate		97 - 103			97 - 103	
Maximum		97 - 103			97 - 103	

Turb./Disp.	Flow Rate GPM	Allowable Test Accuracy	Actual Test Accuracy	Flow Rate GPM	Allowable Post Test Accuracy	Actual Post Test Accuracy
	Start					
Minimum		98.5 - 101.5			98.5 - 101.5	
Intermediate		98.5 - 101.5			98.5 - 101.5	
Maximum		98.5 - 101.5			98.5 - 101.5	

TEST AND REPAIR COMMENTS

There is no serial number anywhere on this meter. This meter is untestable in current setting due to no test port. This meter is oversized and needs replaced with a 3" compound meter. We watched the dial on the register for 15 minutes a meter registered 7.5 gallons of water during that time. We even flushed all the toilets and sinks in the men's bathroom.



City of Cleveland Heights
Detailed Engineering Evaluation
Water Utility Optimization

M.E. SIMPSON COMPANY, INC. - Technical Services
COMPOUND / TURBINE / DISP. METER TEST REPORT

Client : ESG - Cleveland Heights, OH	Premises: _____
Account name : Dave's Supermarket	Account no. : 2057998
Building Name: Dave's Supermarket	Meter no.: _____
Address: 3628 MAYFIELD	Reg ID : _____
Meter location : Upper level by mechanical room	AMR ID: 83503317
Meter size : 3	Brand: Badger - T-Series
Type: Turbine	S/N: 16899017
Test port: No	Bypass: Yes
Inlet valve: Yes	Outlet valve: Yes
Data ID: 9	

READINGS

Confined Space: No	O2 Level: _____	Gas Present: _____	Ok to Enter: Yes	Supervisor: <u>Matt S. Brown</u>
Meter Reading Upon Arrival	T/H: 030654[0]	L: _____	FM: _____	Units: Cubic Feet
Meter Reading After Post Test	T/H: _____	L: _____	FM: _____	Units: _____
Remote Reading Upon Arrival	T/H: _____	L: _____	FM: _____	Units: _____

TEST AND REPAIR DATA

Tested: 11/12/14 2:00 PM	By: Matt B. & Eric M.	Repaired: _____	By: _____
Upon Arrival - Meter Sealed <input type="checkbox"/>	Bypass Sealed <input type="checkbox"/>	Upon Departure - Meter Sealed <input checked="" type="checkbox"/>	Bypass Sealed <input checked="" type="checkbox"/>

TESTS	Test Results			Post Test Results		
	Compound	Flow Rate GPM	Allowable Test Accuracy	Actual Test Accuracy	Flow Rate GPM	Allowable Post Test Accuracy
Minimum		97 - 103			95 - 103	
Below C.O.						
Change Over		90 - 103			90 - 103	
Above C.O.						
Intermediate		97 - 103			97 - 103	
Maximum		97 - 103			97 - 103	

Turb./Disp.	Test Results			Post Test Results		
	Turb./Disp.	Flow Rate GPM	Allowable Test Accuracy	Actual Test Accuracy	Flow Rate GPM	Allowable Post Test Accuracy
Start						
Minimum		98.5 - 101.5			98.5 - 101.5	
Intermediate		98.5 - 101.5			98.5 - 101.5	
Maximum		98.5 - 101.5			98.5 - 101.5	

TEST AND REPAIR COMMENTS

This meter is not testable due to no test port in setting. This meter was purchased without the test port pre-installed. There is a flat spot on the meter where the test port should be. We recommend a 3" compound meter be installed in this setting. The meter registered 35 gallons in 15 minutes while observing register dial.



City of Cleveland Heights
 Detailed Engineering Evaluation
 Water Utility Optimization

M.E. SIMPSON COMPANY, INC. - Technical Services
COMPOUND / TURBINE / DISP. METER TEST REPORT

Client : ESG - Cleveland Heights, OH Premises: _____
 Account name : Oakwood Gardens Account no. : 20-5656-0
 Building Name: Oakwood Gardens Meter no.: _____
 Address: 3882 MAYFIELD Reg ID : _____
 Meter location : ON WILMAR--64' S OF MAYFIELD IN VAULT AMR ID: 86143009
 Meter size : 3 Brand: Badger - T-Series Type: Turbine S/N: 46626988
 Test port: Yes Bypass: Yes Inlet valve : Yes Outlet valve: Yes Data ID: 10

READINGS

Confined Space: Yes O2 Level: 20.8 Gas Present: None Ok to Enter: Yes Supervisor: Matt S. Brown
 Meter Reading Upon Arrival T/H: 001284[0] L: _____ FM: _____ Units: Cubic Feet
 Meter Reading After Post Test T/H: _____ L: _____ FM: _____ Units: _____
 Remote Reading Upon Arrival T/H: _____ L: _____ FM: _____ Units: _____

TEST AND REPAIR DATA

Tested: 11/01/14 10:00 AM By: Matt B. & Eric M. Repaired: _____ By: _____
 Upon Arrival - Meter Sealed Bypass Sealed Upon Departure - Meter Sealed Bypass Sealed

TESTS	Test Results			Post Test Results		
	Flow Rate GPM	Allowable Test Accuracy	Actual Test Accuracy	Flow Rate GPM	Allowable Post Test Accuracy	Actual Post Test Accuracy
Compound						
Minimum		97 - 103			95 - 103	
Below C.O.						
Change Over		90 - 103			90 - 103	
Above C.O.						
Intermediate		97 - 103			97 - 103	
Maximum		97 - 103			97 - 103	

Turb./Disp.	Flow Rate GPM	Test Accuracy		Flow Rate GPM	Post Test Accuracy	
		Allowable Test Accuracy	Actual Test Accuracy		Allowable Post Test Accuracy	Actual Post Test Accuracy
Start	4		90			
Minimum	8	98.5 - 101.5	99		98.5 - 101.5	
Intermediate	100	98.5 - 101.5	105		98.5 - 101.5	
Maximum	300	98.5 - 101.5	103.3		98.5 - 101.5	

TEST AND REPAIR COMMENTS

The meter failed to test within accuracy limits derived from AWWA M6. There is no way to seal the bypass valve, the ha is broken off. There needs to be a 3" compound meter installed in this setting. No way to seal the meter. The inlet and outlet vlaves have packing leaks while turning. This meter is registering high on the higher flow tests.



City of Cleveland Heights
 Detailed Engineering Evaluation
 Water Utility Optimization

M.E. SIMPSON COMPANY, INC. - Technical Services
COMPOUND / TURBINE / DISP. METER TEST REPORT

Client : ESG - Cleveland Heights, OH Premises: _____
 Account name : Apartments 2455 Lee Account no. : 2130255
 Building Name: Apartments 2455 Lee Meter no.: _____
 Address: 2455 LEE Reg ID : _____
 Meter location : 109' N 2ND HYD N MAYFIELD - Vault south of entrance AMR ID: 4061981
 Meter size : 3 Brand: Badger - RCRDLL II Type: Turbine S/N: None
 Test port: Yes Bypass: Yes Inlet valve : Yes Outlet valve: Yes Data ID: 11

READINGS

Confined Space: Yes O2 Level: 20.8 Gas Present: None Ok to Enter: Yes Supervisor: Matt S. Brown
 Meter Reading Upon Arrival T/H: 009791[00] L: _____ FM: _____ Units: Cubic Feet
 Meter Reading After Post Test T/H: _____ L: _____ FM: _____ Units: _____
 Remote Reading Upon Arrival T/H: _____ L: _____ FM: _____ Units: _____

TEST AND REPAIR DATA

Tested: 11/12/14 2:30 PM By: Matt B. & Eric M. Repaired: _____ By: _____
 Upon Arrival - Meter Sealed Bypass Sealed Upon Departure - Meter Sealed Bypass Sealed

TESTS	Test Results			Post Test Results			
	Compound	Flow Rate GPM	Allowable Test Accuracy	Actual Test Accuracy	Flow Rate GPM	Allowable Post Test Accuracy	Actual Post Test Accuracy
Minimum			97 - 103			95 - 103	
Below C.O.							
Change Over			90 - 103			90 - 103	
Above C.O.							
Intermediate			97 - 103			97 - 103	
Maximum			97 - 103			97 - 103	

Turb./Disp.	Flow Rate GPM	Allowable Test Accuracy	Actual Test Accuracy	Flow Rate GPM	Allowable Post Test Accuracy	Actual Post Test Accuracy
	Start					
Minimum		98.5 - 101.5			98.5 - 101.5	
Intermediate		98.5 - 101.5			98.5 - 101.5	
Maximum		98.5 - 101.5			98.5 - 101.5	

TEST AND REPAIR COMMENTS

There is no serial number on this meter anywhere. This meter is untestable due to the valves not being operable. We cannot move the bypass valve with a wrench and hammer. The inlet and outlet valves turn slightly but extremely hard with wrench and hammer. We recommend all valves and meter be replaced in this meter setting. We recommend a 3" compound meter.



City of Cleveland Heights
Detailed Engineering Evaluation
Water Utility Optimization

M.E. SIMPSON COMPANY, INC. - Technical Services
COMPOUND / TURBINE / DISP. METER TEST REPORT

Client : <u>ESG - Cleveland Heights, OH</u>	Premises: _____
Account name : <u>Zagara's Market</u>	Account no. : <u>2132540</u>
Building Name: <u>Zagara's Market</u>	Meter no.: _____
Address: <u>1940 LEE</u>	Reg ID : _____
Meter location : <u>Back of store by fire protection system</u>	AMR ID: <u>5885821</u>
Meter size : <u>3</u>	Brand: <u>Badger - T-Series</u>
	Type: <u>Turbine</u>
	S/N: <u>17845862</u>
Test port: <u>No</u>	Bypass: <u>Yes</u>
Inlet valve: <u>Yes</u>	Outlet valve: <u>Yes</u>
	Data ID: <u>12</u>

READINGS

Confined Space: <u>No</u>	O2 Level: _____	Gas Present: _____	Ok to Enter: <u>Yes</u>	Supervisor: <u>Matt S. Brown</u>
Meter Reading Upon Arrival	T/H: <u>020483[00]</u>	L: _____	FM: _____	Units: <u>Cubic Feet</u>
Meter Reading After Post Test	T/H: _____	L: _____	FM: _____	Units: _____
Remote Reading Upon Arrival	T/H: _____	L: _____	FM: _____	Units: _____

TEST AND REPAIR DATA

Tested: <u>11/11/14 3:30 PM</u>	By: <u>Matt B. & Eric M.</u>	Repaired: _____	By: _____
Upon Arrival - Meter Sealed <input type="checkbox"/>	Bypass Sealed <input type="checkbox"/>	Upon Departure - Meter Sealed <input checked="" type="checkbox"/>	Bypass Sealed <input checked="" type="checkbox"/>

TESTS	Test Results			Post Test Results		
	Flow Rate GPM	Allowable Test Accuracy	Actual Test Accuracy	Flow Rate GPM	Allowable Post Test Accuracy	Actual Post Test Accuracy
Compound						
Minimum		97 - 103			95 - 103	
Below C.O.						
Change Over		90 - 103			90 - 103	
Above C.O.						
Intermediate		97 - 103			97 - 103	
Maximum		97 - 103			97 - 103	

Turb./Disp.	Flow Rate GPM	Allowable Test Accuracy	Actual Test Accuracy	Flow Rate GPM	Allowable Post Test Accuracy	Actual Post Test Accuracy
	Start					
Minimum		98.5 - 101.5			98.5 - 101.5	
Intermediate		98.5 - 101.5			98.5 - 101.5	
Maximum		98.5 - 101.5			98.5 - 101.5	

TEST AND REPAIR COMMENTS

There is no test port on this meter. The flat area where the test port should be is not there. This new style turbine meter was ordered without a test port. We watched the dial on the meter for 5 to 7 minutes, the dial never registered any water. We recommend a 3" compound meter be installed in this setting.



City of Cleveland Heights
 Detailed Engineering Evaluation
 Water Utility Optimization

M.E. SIMPSON COMPANY, INC. - Technical Services
COMPOUND / TURBINE / DISP. METER TEST REPORT

Client : ESG - Cleveland Heights, OH Premises: _____
 Account name : Severance Place Apartments Account no. : 2054680
 Building Name: Severance Place Apartments Meter no.: _____
 Address: 500 SEVERANCE PLACE LANE Reg ID : _____
 Meter location : Vault on Mayfield by bus stop AMR ID: 83428679
 Meter size : 3 Brand: Badger - RCRDLL II Type: Turbine S/N: 41753019
 Test port: Yes Bypass: No Inlet valve : Yes Outlet valve: Yes Data ID: 13

READINGS

Confined Space: Yes O2 Level: 20.9 Gas Present: None Ok to Enter: Yes Supervisor: Matt S. Brown
 Meter Reading Upon Arrival T/H: 004034[00] L: _____ FM: _____ Units: Cubic Feet
 Meter Reading After Post Test T/H: _____ L: _____ FM: _____ Units: _____
 Remote Reading Upon Arrival T/H: _____ L: _____ FM: _____ Units: _____

TEST AND REPAIR DATA

Tested: 11/12/14 8:30 AM By: Matt B. & Eric M. Repaired: _____ By: _____
 Upon Arrival - Meter Sealed Bypass Sealed Upon Departure - Meter Sealed Bypass Sealed

TESTS	Test Results			Post Test Results		
Compound	Flow Rate GPM	Allowable Test Accuracy	Actual Test Accuracy	Flow Rate GPM	Allowable Post Test Accuracy	Actual Post Test Accuracy
Minimum		97 - 103			95 - 103	
Below C.O.						
Change Over		90 - 103			90 - 103	
Above C.O.						
Intermediate		97 - 103			97 - 103	
Maximum		97 - 103			97 - 103	

Turb./Disp.	Flow Rate GPM	Allowable Test Accuracy	Actual Test Accuracy	Flow Rate GPM	Allowable Post Test Accuracy	Actual Post Test Accuracy
Start	x		x			
Minimum	8	98.5 - 101.5	102		98.5 - 101.5	
Intermediate	100	98.5 - 101.5	105		98.5 - 101.5	
Maximum	300	98.5 - 101.5	110		98.5 - 101.5	

TEST AND REPAIR COMMENTS

The meter failed to test within accuracy limits derived from AWWA M6. The valves in this setting do not shut down. We tested the meter and it was over registering and we believe this is due to the valves not shutting down completely. We recommend the inlet valve and the outlet valves be replaced along with a 3" compound meter installed in this setting.



City of Cleveland Heights
 Detailed Engineering Evaluation
 Water Utility Optimization

M.E. SIMPSON COMPANY, INC. - Technical Services
COMPOUND / TURBINE / DISP. METER TEST REPORT

Client : ESG - Cleveland Heights, OH Premises: _____
 Account name : City Hall / Police Department Account no. : 2054640
 Building Name: City Hall / Police Department Meter no.: _____
 Address: 40 SEVERANCE CIRCLE Reg ID : _____
 Meter location : Vault in front by hydrant in grass AMR ID: 83428183
 Meter size : 3 Brand: Badger - RCRDLL II Type: Turbine S/N: 41753017
 Test port: Yes Bypass: No Inlet valve : Yes Outlet valve: Yes Data ID: 14

READINGS

Confined Space: Yes O2 Level: 20.9 Gas Present: None Ok to Enter: Yes Supervisor: Matt S. Brown
 Meter Reading Upon Arrival T/H: 001297[00] L: _____ FM: _____ Units: Cubic Feet
 Meter Reading After Post Test T/H: _____ L: _____ FM: _____ Units: _____
 Remote Reading Upon Arrival T/H: _____ L: _____ FM: _____ Units: _____

TEST AND REPAIR DATA

Tested: 11/11/14 9:00 AM By: Matt B. & Eric M. Repaired: _____ By: _____
 Upon Arrival - Meter Sealed Bypass Sealed Upon Departure - Meter Sealed Bypass Sealed

TESTS	Test Results			Post Test Results		
	Flow Rate GPM	Allowable Test Accuracy	Actual Test Accuracy	Flow Rate GPM	Allowable Post Test Accuracy	Actual Post Test Accuracy
Compound						
Minimum		97 - 103			95 - 103	
Below C.O.						
Change Over		90 - 103			90 - 103	
Above C.O.						
Intermediate		97 - 103			97 - 103	
Maximum		97 - 103			97 - 103	

Turb./Disp.	Flow Rate GPM	Allowable Test Accuracy	Actual Test Accuracy	Flow Rate GPM	Allowable Post Test Accuracy	Actual Post Test Accuracy
	Start	4		80		
Minimum	8	98.5 - 101.5	100.1		98.5 - 101.5	
Intermediate	100	98.5 - 101.5	100.4		98.5 - 101.5	
Maximum	270	98.5 - 101.5	100.2		98.5 - 101.5	

TEST AND REPAIR COMMENTS

The meter tested within accuracy limits derived from AWWA M6. There needs to be a 3" compound meter in this setting. We obtained a maximum flow of 270 gpm from the test port.



City of Cleveland Heights
 Detailed Engineering Evaluation
 Water Utility Optimization

M.E. SIMPSON COMPANY, INC. - Technical Services
COMPOUND / TURBINE / DISP. METER TEST REPORT

Client : ESG - Cleveland Heights, OH Premises: _____
 Account name : 3321 Euclid Heights Account no. : 2014435
 Building Name: 3321 Euclid Heights Meter no.: _____
 Address: 3321 EUCLID HTS Reg ID : _____
 Meter location : BV 143'N OF HYD IN FRONT OF AMR ID: 81416554
 Meter size : 1.5" Brand: Badger - 120 Type: Displacement S/N: 36260409
 Test port: Yes Bypass: Yes Inlet valve : Yes Outlet valve: Yes Data ID: 15

READINGS

Confined Space: Yes O2 Level: 20.8 Gas Present: None OK to Enter: Yes Supervisor: Matt S. Brown
 Meter Reading Upon Arrival T/H: 020232[0] L: _____ FM: _____ Units: Cubic Feet
 Meter Reading After Post Test T/H: _____ L: _____ FM: _____ Units: _____
 Remote Reading Upon Arrival T/H: _____ L: _____ FM: _____ Units: _____

TEST AND REPAIR DATA

Tested: 11/13/14 10:00 AM By: Matt B. & Eric M. Repaired: _____ By: _____
 Upon Arrival - Meter Sealed Bypass Sealed Upon Departure - Meter Sealed Bypass Sealed

TESTS	Test Results			Post Test Results		
Compound	Flow Rate GPM	Allowable Test Accuracy	Actual Test Accuracy	Flow Rate GPM	Allowable Post Test Accuracy	Actual Post Test Accuracy
Minimum		97 - 103			95 - 103	
Below C.O.						
Change Over		90 - 103			90 - 103	
Above C.O.						
Intermediate		97 - 103			97 - 103	
Maximum		97 - 103			97 - 103	

Turb./Disp.	Flow Rate GPM	Allowable Test Accuracy	Actual Test Accuracy	Flow Rate GPM	Allowable Post Test Accuracy	Actual Post Test Accuracy
Start	x		x			
Minimum	1.5	95 - 101	99.2		95 - 101	
Intermediate	8	98.5 - 101.5	99.4		98.5 - 101.5	
Maximum	50	98.5 - 101.5	100.1		98.5 - 101.5	

TEST AND REPAIR COMMENTS

The meter tested within accuracy limits derived from AWWA M6.



City of Cleveland Heights
 Detailed Engineering Evaluation
 Water Utility Optimization

M.E. SIMPSON COMPANY, INC. - Technical Services
COMPOUND / TURBINE / DISP. METER TEST REPORT

Client : ESG - Cleveland Heights, OH Premises: _____
 Account name : Oaks Condo Account no. : 3022380
 Building Name: Oaks Condo Meter no.: _____
 Address: 1400 CLEVELAND HTS Reg ID : _____
 Meter location : Vault in front of 1418 AMR ID: 3153306
 Meter size : 3 Brand: Badger - RCRDLL II Type: Turbine S/N: None
 Test port: Yes Bypass: Yes Inlet valve : Yes Outlet valve: Yes Data ID: 16

READINGS

Confined Space: Yes O2 Level: 20.5 Gas Present: None Ok to Enter: Yes Supervisor: Matt S. Brown
 Meter Reading Upon Arrival T/H: 017334[00] L: _____ FM: _____ Units: Cubic Feet
 Meter Reading After Post Test T/H: _____ L: _____ FM: _____ Units: _____
 Remote Reading Upon Arrival T/H: _____ L: _____ FM: _____ Units: _____

TEST AND REPAIR DATA

Tested: 11/13/14 11:00 AM By: Matt B. & Eric M. Repaired: _____ By: _____
 Upon Arrival - Meter Sealed Bypass Sealed Upon Departure - Meter Sealed Bypass Sealed

TESTS	Test Results			Post Test Results		
	Compound	Flow Rate GPM	Allowable Test Accuracy	Actual Test Accuracy	Flow Rate GPM	Allowable Post Test Accuracy
Minimum		97 - 103			95 - 103	
Below C.O.						
Change Over		90 - 103			90 - 103	
Above C.O.						
Intermediate		97 - 103			97 - 103	
Maximum		97 - 103			97 - 103	

Turb./Disp.	Flow Rate GPM	Allowable Test Accuracy	Actual Test Accuracy	Flow Rate GPM	Allowable Post Test Accuracy	Actual Post Test Accuracy
Start	4		50			
Minimum	8	98.5 - 101.5	99.1		98.5 - 101.5	
Intermediate	100	98.5 - 101.5	99.3		98.5 - 101.5	
Maximum	200	98.5 - 101.5	101.2		98.5 - 101.5	

TEST AND REPAIR COMMENTS

The meter tested within accuracy limits derived from AWWA M6. We only obtained 200 gpm from the test port. We recommend that a 3" compound meter be installed in this setting. There is no serial number anywhere on this meter.



City of Cleveland Heights
 Detailed Engineering Evaluation
 Water Utility Optimization

M.E. SIMPSON COMPANY, INC. - Technical Services
COMPOUND / TURBINE / DISP. METER TEST REPORT

Client : ESG - Cleveland Heights, OH Premises: _____
 Account name : Nursing Center Account no. : 2053755
 Building Name: Nursing Center Meter no.: _____
 Address: 3131 MAYFIELD Reg ID : _____
 Meter location : Vault at entrance AMR ID: 84012745
 Meter size : 6 Brand: Badger - RCRDLL II Type: Turbine S/N: 43466884
 Test port: Yes Bypass: Yes Inlet valve : Yes Outlet valve: Yes Data ID: 17

READINGS

Confined Space: Yes O2 Level: 20.9 Gas Present: None Ok to Enter: Yes Supervisor: Matt S. Brown
 Meter Reading Upon Arrival T/H: 024014[00] L: _____ FM: _____ Units: Cubic Feet
 Meter Reading After Post Test T/H: _____ L: _____ FM: _____ Units: _____
 Remote Reading Upon Arrival T/H: _____ L: _____ FM: _____ Units: _____

TEST AND REPAIR DATA

Tested: 11/14/14 11:00 AM By: Matt B. & Eric M. Repaired: _____ By: _____
 Upon Arrival - Meter Sealed Bypass Sealed Upon Departure - Meter Sealed Bypass Sealed

TESTS	Test Results			Post Test Results		
	Flow Rate GPM	Allowable Test Accuracy	Actual Test Accuracy	Flow Rate GPM	Allowable Post Test Accuracy	Actual Post Test Accuracy
Compound						
Minimum		97 - 103			95 - 103	
Below C.O.						
Change Over		90 - 103			90 - 103	
Above C.O.						
Intermediate		97 - 103			97 - 103	
Maximum		97 - 103			97 - 103	

Turb./Disp.	Flow Rate GPM	Allowable Test Accuracy	Actual Test Accuracy	Flow Rate GPM	Allowable Post Test Accuracy	Actual Post Test Accuracy
	Start	18		85		
Minimum	30	98.5 - 101.5	98		98.5 - 101.5	
Intermediate	125	98.5 - 101.5	95		98.5 - 101.5	
Maximum	300	98.5 - 101.5	95		98.5 - 101.5	

TEST AND REPAIR COMMENTS

The meter failed to test within accuracy limits derived from AWWA M6. We recommend a 6" compound meter be install in this setting.