This presentation premiered at WaterSmart Innovations

watersmartinnovations.com







WSI 2019

Asheville Takes Commercial Meter Testing Program to Next Level for Real Payback



Relevant Roles:

Chair, AWWA Water Loss Software Subcommittee Chair, North American Water Loss Conference IWA Water Loss Specialist Group, Management Committee Director of Water Efficiency, Cavanaugh

Will Jernigan, P.E. will.jernigan@cavanaughsolutions.com

CAVANAUGH

Stewardship Through Innovation

Economic Optimization for Large Meter Testing Program

Testing Plan Testing Data Testing Outcomes Master List

Dashboard

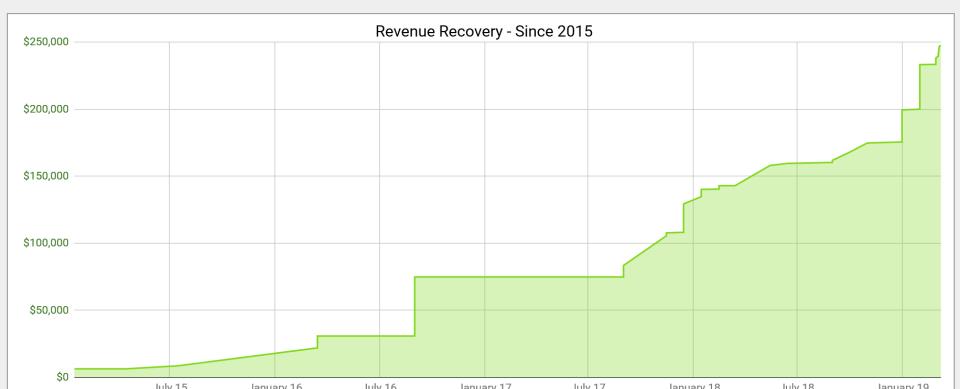
City of Asheville Large Meter Testing Program

CAVANAUGH Stewardship Through Innovation

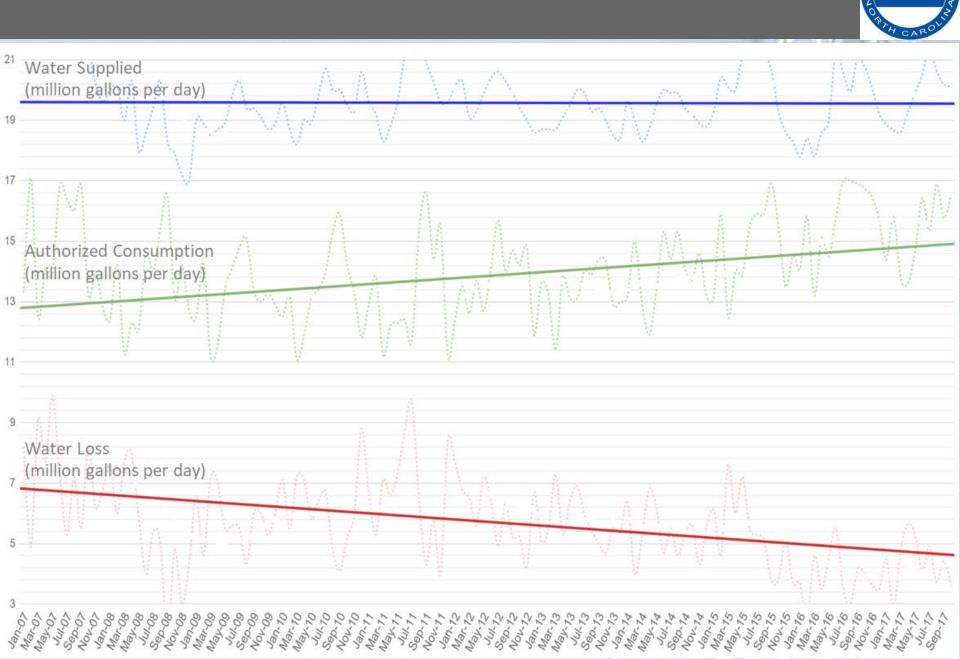
	2019
Total meters to test this year	146
Target year to date	103
Meters tested year to date	48
Percent of target year to date	47%

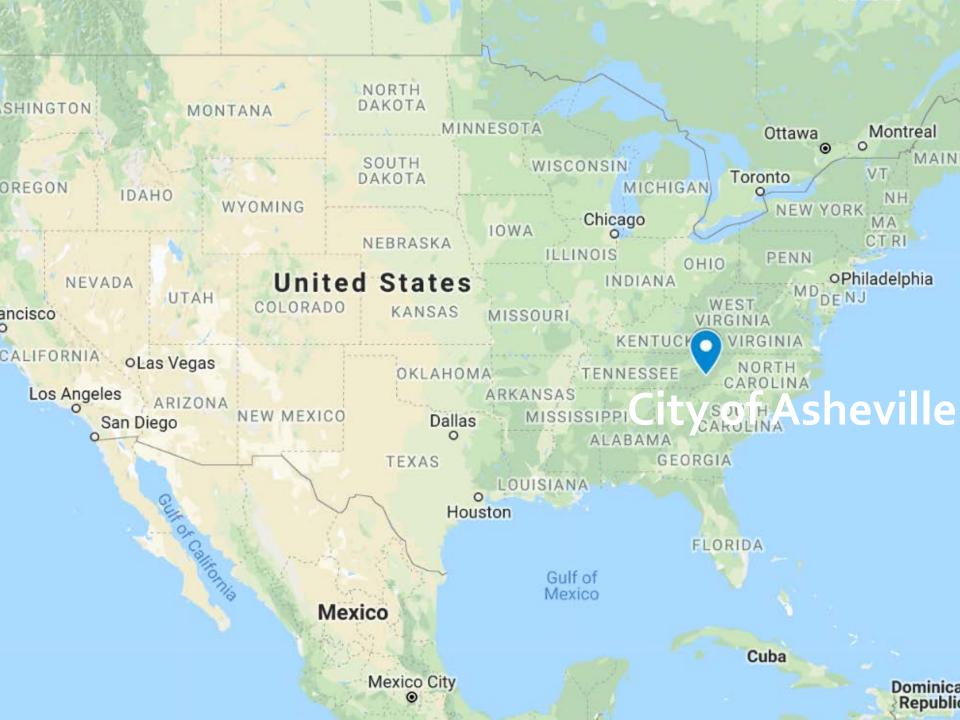
Since 2015

63 Meters identified for remedy Revenue recovery to date \$247,503



Cost-Effective Sustainability

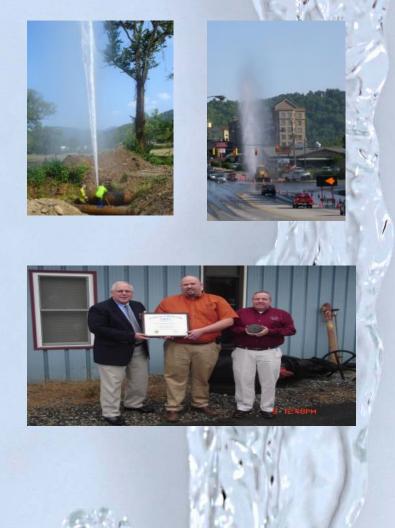




City of Asheville

What Led Asheville to a NRW Program?

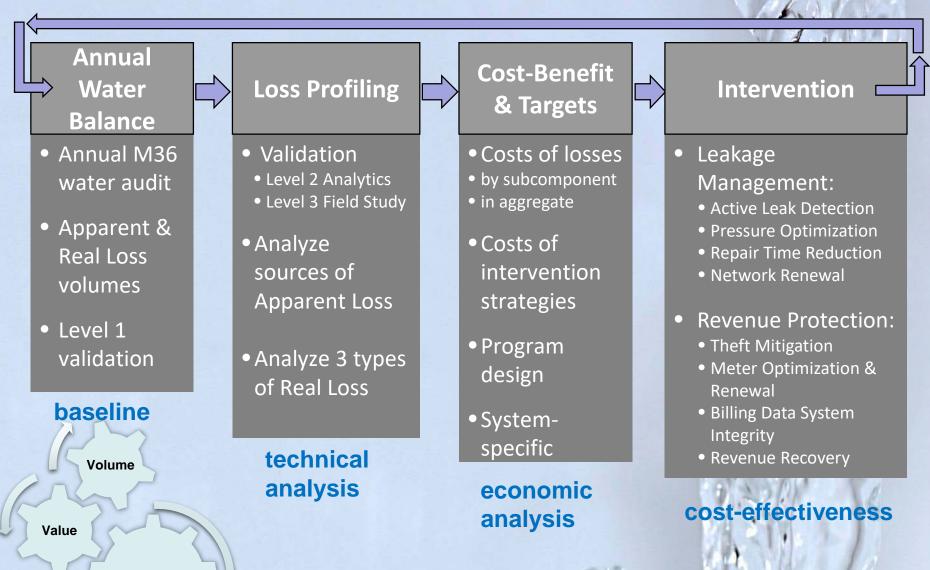
- News Headlines:
 - Millions spent on leaky
 Asheville water system
 - An audit of the system's water use in 2002-03 found the city produced 21.5 million gallons of treated water a day but lost 6.4 million gallons a day.
- Leaks, leaks, & more leaks:
- Lack of meter maintenance:
- The Perfect environment and perfect need for a NRW program



The AWWA M36 Method: Economic Intervention



Stewardship Through Innovation



Validity



R. L. P

A Team Based Approach

- Audit Input Team
- Valve & Leak Team
- Unbilled Customer Team
- Customer Service Team
- Metering Team
- Pressure Management Team



Historic Large Meter Testing Program

METERING

Established in 2012 -Size based meter selections -Testing methods – multi flow ranges -Field apparatus Described in the AWWA M6 Manual

DETECTOR MODEL W-1250







Water Meters— Selection, Installation, Testing, and Maintenance







MG per Year Gal/connection/day Leakage Index

Value

\$ per Year\$ per ConnectionEconomic Loss Index

Validity

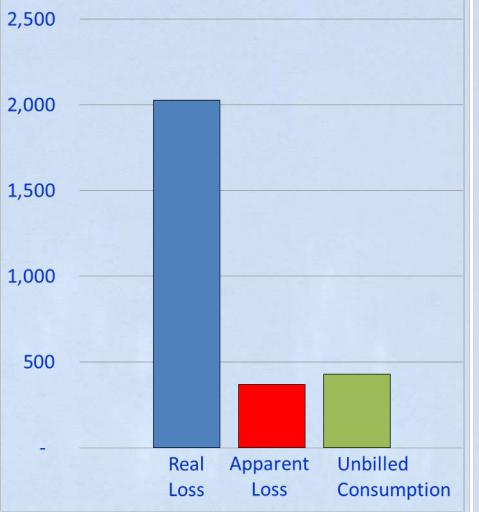
3-V

Volume

Water Audit Data Validity Score 95% Confidence Limits Key Data Input Grades

Volume



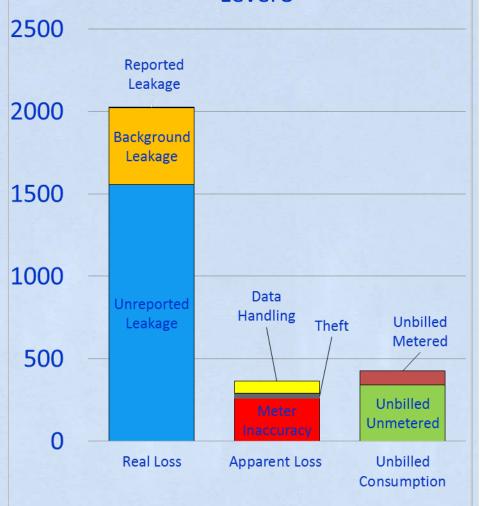


Value



Volume

NRW Components - By Volume (MG) Level 3



Value





Value Level 3

Meter Inaccuracy Meter Inaccuracy

R. P. H.



Value Level 4

Small Meter Inaccuracy

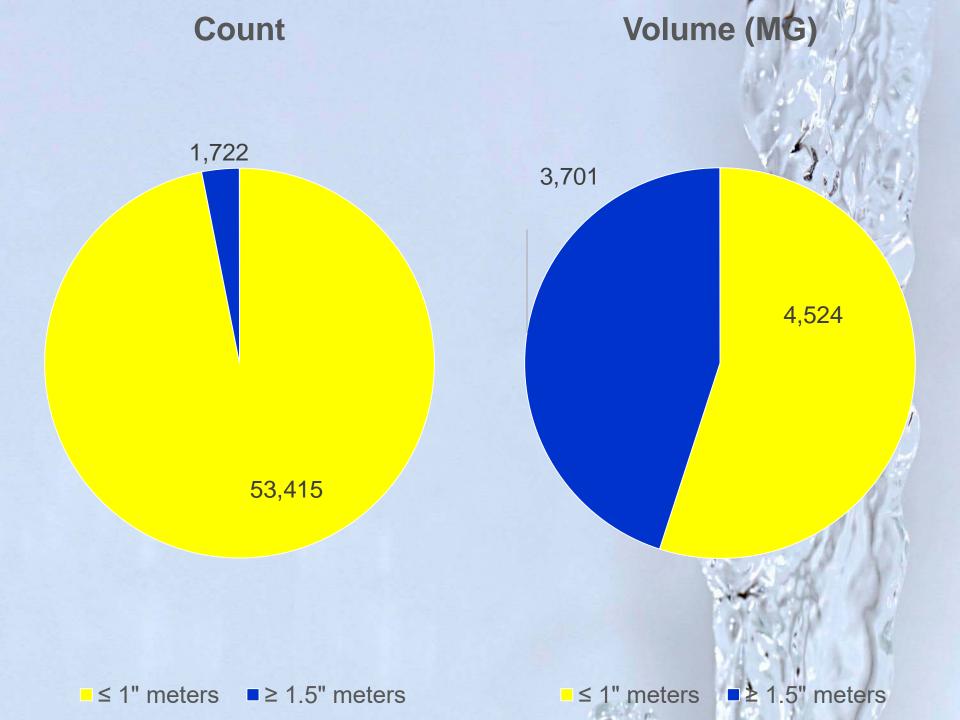
Large Meter Inaccuracy

Meter Inaccuracy

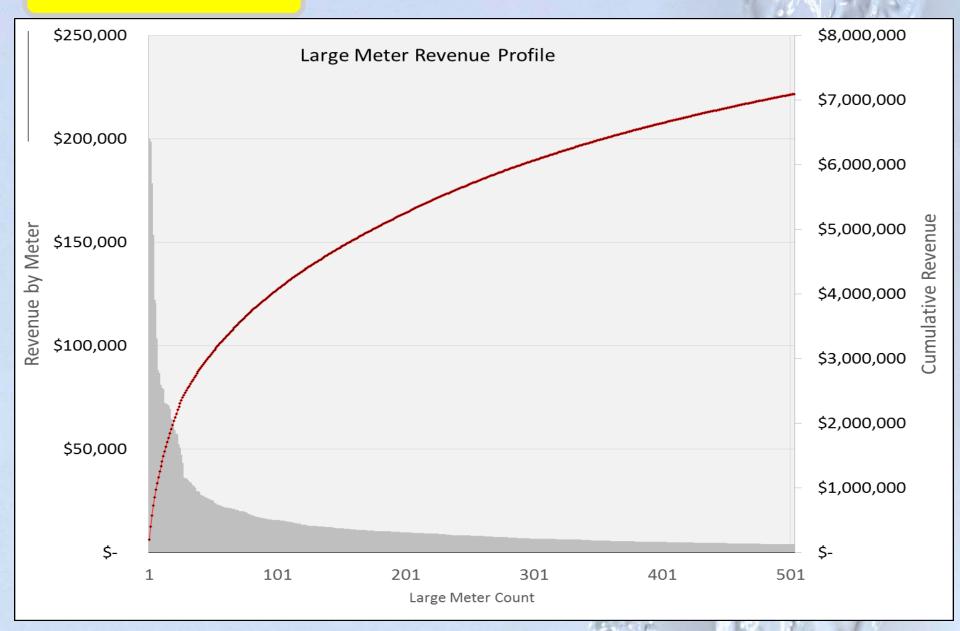
ivieter

Meter Mis-Application

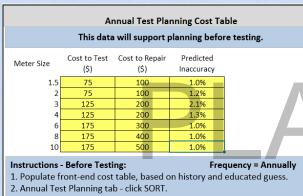
Sec. 2



Economic Optimization for Large Meter Testing Program



Economic Optimization for Large Meter Testing Program



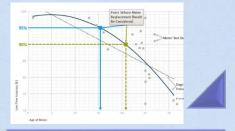
That is your work plan for meters to be tested in the next 12 months.
 Note those with SEMI-ANNUAL test frequency should be tested twice in the year.



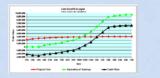
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Economic Optimization for Large Meter Testing Program

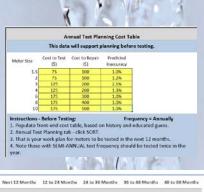


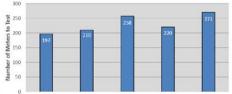
Compilation/ analysis of historical test results



Prediction of costs & benefits from historic perspective Generate annual test planning list with optimization model

1.17





5 Year Testing Outlay

Economic Optimization for Large Meter Testing Program



Monthly testing activities & raw data recorded



Run filters for datalog list, collect datalogs to true-up flow weightings Populate weighted test results into optimization model to get simple payback analysis Generate actionable meters to work order system for repair/replacement

Economic Optimization for Large Meter Testing Program

Master List Testing Plan Testing Data

Testing Outcomes

Dashboard

Economic Optimization for Large Meter Testing Program

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Master List Testing Plan Testing Data Testing Outcomes

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12643064 SCHOLDINGS INC 2 10161 1000 2320267 200 KENSINGTON PL ASHE RM 1076 2/2/15 11946034 MRALTYLLC 139038 1000 2287521 4 2 AIRPORT RD ARDN RM 822 5/16/12 5/76/12 70252567 MALTYLRCALLOURLE FOREST 6 101338 1000 2202885 25 OLD SHOALS RD ASHE MN 1076 2/5/18 5/77.72 12948582 OWN OF BRETMORE FOREST 6 101138 1000 2020285 2511 SHOALS RD ASHE MN 1076 2/5/18 5/77.72 12900219 MGLES WAREHOUSE 6 101148 1000 2020783 71 MOUNT CARMEL RD ASHE WH 1076 2013-02-07 5/75.02 13802567 MOODER WAREHOUSE 6 101198 1000 2020847 100 UNINEL RD ASHE WH 1076 2013-02-07 5/66.02 12948581 MUELES WAREHOUSE 6 101598 1000 2020847 100 UNINEL RD </td <td>11459732</td> <td>DEERFIELD EPIS HOME</td> <td>2</td> <td>1175118</td> <td>10000</td> <td>2130275</td> <td>1617 HENDERSONVILLE RD</td> <td>ASHE</td> <td>RM</td> <td>877</td> <td>8/1/12</td> <td>\$80,234</td>	11459732	DEERFIELD EPIS HOME	2	1175118	10000	2130275	1617 HENDERSONVILLE RD	ASHE	RM	877	8/1/12	\$80,234
11946034 MREALTYLLC 2 1139038 1000 2287521 42 AIRPORT RD ARDN RM 822 5/16/12 5/76/12 70252567 DAY INTERNATIONAL 4 1010958 10000 2028287 25 OLD SHOALS RD ASHE MN 1076 2/5/18 5/77.72 12948582 FOWN OF BLEIMORE FOREST 6 101138 10000 2028385 1025 HENDERSONVILLE RD ASHE WH 1076 2/5/18 5/77.72 1290219 NGLES WAREHOUSE 6 101194 10000 2028373 721 MOUNT CARMEL RD ASHE WH 1074 2/5/18 5/7.72 13802356 MOODEIN WAREHOUSE 6 101194 10000 2028737 721 MOUNT CARMEL RD ASHE WH 1074 2/5-07 5/6,62 5/7,52 13802356 MOODEIN WAREHOUSE 6 101194 10000 202847 1100 TUNNEL RD ASHE WH 1076 5/6,62 12948581 GVENS ESTATE 6 101198 10000 202847 3 D WESLEY DR ASHE RM 1076 5/6,12 5/6,12 </td <td>70131941</td> <td>SOUTHEASTERN CONTAINER INC</td> <td>4</td> <td>1160758</td> <td>10000</td> <td>2123855</td> <td>1250 SAND HILL RD</td> <td>CDLR</td> <td>MN</td> <td>1074</td> <td>1/10/06</td> <td>\$79,897</td>	70131941	SOUTHEASTERN CONTAINER INC	4	1160758	10000	2123855	1250 SAND HILL RD	CDLR	MN	1074	1/10/06	\$79,897
70252567 AVENTERNATIONAL 4 1010958 10000 2028287 25 OLD SHOALS RD ASHE MN 1076 2/5/18 577.75 12948582 TOWN OF BILLMORE FOREST 6 1011338 10000 2028385 1025 HENDERSONVILLE RD ASHE WH 1076 2013-02-07 577.52 12900219 INCLES WAREHOUSE 6 1011948 10000 2028519 2913 US 70 HWY BMTN CM 1076 3/8/12 577.52 13802356 WOODFIN WATER DISTRICT 6 1592708 10000 202847 1100 TUNNEL RD ASHE WH 1076 193-06-07 \$668,57 12948581 OVENES ESTATE 6 1011798 10000 202847 3 D WESLEY DR ASHE RM 1076 5/6/12 \$66,23 12948581 OVENES ESTATE 6 1011768 10000 202070 300 LONG SHOALS RD ASHE RM 1076 5/6/12 \$66,23 12962739 CCC FOREST AT BUTMORE PARKLLC 6 101076	12643064	BSC HOLDINGS INC	2	101611	10000	2320267	200 KENSINGTON PL	ASHE	RM	1076	2/2/15	\$79,879
12948582 OWN OF BILTMORE FOREST 6 1011338 1000 2028385 1025 HENDERSONVILLE RD ASHE WH 1076 2013-02-07 \$\$77,52 12900219 NGLES WAREHOUSE 6 1011338 1000 2028519 2913 US 70 HWY BMTN CM 1076 3/8/12 \$\$77,52 13802356 WOODFIN WATER DISTRICT 6 1592708 1000 2028737 721 MOUNT CARMEL RD ASHE WH 1074 2013-07-29 \$\$69,50 31955074 IS VETERANS HOSPITAL 6 1011598 10000 202847 100 TUNNEL RD ASHE WH 1074 2013-07-29 \$\$66,87 12948581 OVENS ESTATE 6 101198 10000 2028347 3 D WESLEY DR ASHE RM 1076 \$\$66,87 12948581 OVENS ESTATE 6 101768 10000 2028347 3 D WESLEY DR ASHE RM 1076 \$\$66,27 12947984 OVENS ESTATE 166 101768 10000 2126767 1QU	11946034	M REALTY LLC	2	1139038	10000	2287521	42 AIRPORT RD	ARDN	RM	822	5/16/12	\$78,169
12900219 NGLES WAREHOUSE 6 1011948 10000 2028519 2913 US 70 HWY BMTN CM 1076 3/8/12 \$777,50 13802356 MOODEN WATER DISTRICT 6 1592708 10000 20287873 721 MOUNT CARMEL RD ASHE WH 1074 2013-07-29 \$69,50 31955074 JS VETERANS HOSPITAL 6 101198 10000 2028447 1100 TUNNEL RD ASHE WH 1076 193-06-07 \$66,87 12948581 JSVENS ESTATE 6 101198 10000 2028347 3 D WESLEY DR ASHE RM 1076 \$66,27 12962739 CCC FOREST AT BILTMORE PARK LLC 6 1010768 10000 2028347 3 D WESLEY DR ASHE RM 1076 \$5/6/12 \$66,27 12962739 CCC FOREST AT BILTMORE PARK LLC 6 1010768 10000 2126767 1QUALITY WAY FLET CM 1010 1/23/12 \$62,167 31900050 MINI GROVE PARK INN LLC 4 106518 10000 18498 29 MACON AVE ASHE CM 1074 4/22/93	70252567	DAY INTERNATIONAL	4	1010958	10000	2028287	25 OLD SHOALS RD	ASHE	MN	1076	2/5/18	\$77,737
13802356 WOODFIN WATER DISTRICT 6 1592708 10000 2027873 721 MOUNT CARMEL RD ASHE WH 1074 2013-07-29 \$69,50 31955074 IS VETERANS HOSPITAL 6 1011598 10000 2028447 1100 TUNNEL RD ASHE HS 1076 1993-06-07 \$66,87 12948581 GIVENS ESTATE 6 101198 10000 2028347 3 D WESLEY DR ASHE RM 1076 \$66,87 12962739 CCC FOREST AT BIT MORE PARK LLC 6 1010768 10000 20216767 1QUALITY WAY RM 1076 5/6/12 \$66,23 31900050 GININ GROVE PARK INN LLC 4 116528 10000 2126767 1QUALITY WAY FLET CM 1010 1/23/12 \$62,164 31900050 GININ GROVE PARK INN LLC 4 10609 18498 290 MACON AVE ASHE RM 1074 4/22/93 \$61,77 17845204 ARCADIA FARMS INC 4 1165138 10000 2185697 9 RIDE	12948582	TOWN OF BILTMORE FOREST	6	1011338	10000	2028385	1025 HENDERSONVILLE RD	ASHE	WH	1076	2013-02-07	\$77,522
31955074 US VETERANS HOSPITAL Image: mark start	12900219	INGLES WAREHOUSE	6	1011948	10000	2028519	2913 US 70 HWY	BMTN	CM	1076	3/8/12	\$77,501
12948581 GVENS ESTATE 6 101119 1000 2028347 3 D WESLEY DR ASHE RM 1076 566,23 12962739 CCC FOREST AT BILTMORE PARK LLC 6 1010768 1000 29070 300 LONG SHOALS RD ASHE RM 1076 5/6/12 \$66,23 70247984 CONTINENTAL TEVES 4 1166528 10000 2126767 1 QUALITY WAY FLET CM 1010 1/23/12 \$62,162 31900050 OMNI GROVE PARK INNILLC 4 1009128 10000 18498 290 MACON AVE ASHE CM 1074 4/22/93 \$61,77 17845204 ARCADIA FARMS INC 4 1165138 10000 2185697 9 TRIDENT DR ARDN CM 1076 3/12/18 \$58,74 13845003 OMNI GROVE PARK INNILLC 8 1009108 10000 18498 29 N COUNTRY CLUB RD ASHE CM 1074 2/18/15 \$57,71 11459718 HUSING HOTELS 2 1010218 10000 2149407 380 HANSEL AVE ASHE CM 442 8/6/12 \$56,17 <	13802356	WOODFIN WATER DISTRICT	6	1592708	10000	2027873	721 MOUNT CARMEL RD	ASHE	WH	1074	2013-07-29	\$69,509
12962739 CCC FOREST AT BILTMORE PARK LLC 6 1010768 1000 29070 300 LONG SHOALS RD ASHE RM 1076 5/6/12 \$64,52 70247984 CONTINENTAL TEVES 4 1166528 10000 2126767 1 QUALITY WAY FLET CM 1010 1/23/12 \$62,16 31900050 OMNEGROVE PARK INFILIC 4 1009128 10000 18498 290 MACON AVE ASHE CM 1074 4/22/93 \$61,77 17845204 ARCADIA FARMS INC 4 1165138 10000 2185697 9 TRIDENT DR ARDN CM 1076 3/12/18 \$58,74 13845003 OMNEGROVE PARK INFILIC 6 1009108 10000 18498 29 N COUNTRY CLUB RD ASHE CM 1074 2/18/15 \$58,74 13845003 OMNEGROVE PARK INFILIC 6 10000 2184907 380 HANSELAVE ASHE CM 1074 2/18/15 \$57,71 11459718 HULSING HOTELS 2 1010218 10000 2149407 380 HANSELAVE ASHE CM 442 8/6/12 \$56,17 </td <td>31955074</td> <td>U S VETERANS HOSPITAL</td> <td>6</td> <td>1011598</td> <td>10000</td> <td>2028447</td> <td>1100 TUNNEL RD</td> <td>ASHE</td> <td>HS</td> <td>1076</td> <td>1993-06-07</td> <td>\$66,870</td>	31955074	U S VETERANS HOSPITAL	6	1011598	10000	2028447	1100 TUNNEL RD	ASHE	HS	1076	1993-06-07	\$66,870
70247984 CONTINENTAL TEVES 4 1166528 10000 2126767 1 QUALITY WAY FLET CM 1010 1/23/12 \$62,16 31900050 OMNEGROVE PARKINELLC 4 1009128 10000 18498 290 MACON AVE ASHE CM 1074 4/22/93 \$61,77 17845204 ARCADIA FARMS INC 4 1165138 10000 2185697 9 TRIDENT DR ARDN CM 1076 3/12/18 \$58,74 13845003 OMNEGROVE PARKINELLC 8 1009108 10000 18498 29 N COUNTRY CLUB RD ASHE CM 1074 2/18/15 \$557,71 11459718 HULSING HOTELS 2 1010218 10000 2149407 380 HANSEL AVE ASHE CM 442 8/6/12 \$556,17	12948581	GIVENS ESTATE	6	1011198	10000	2028347	3 D WESLEY DR	ASHE	RM	1076		\$66,230
31900050 OMNI GROVE PARK INN LLC 4 1009128 10000 18498 290 MACON AVE ASHE CM 1074 4/22/93 \$\$61,77 17845204 ARCADIA FARMS INC 4 1165138 10000 2185697 9 TRIDENT DR ARDN CM 1076 3/12/18 \$\$58,74 13845003 OMNI GROVE PARK INN LLC 8 1009108 10000 18498 29 N COUNTRY CLUB RD ASHE CM 1074 2/18/15 \$\$57,71 11459718 HULSING HOTELS 2 1010218 10000 2149407 380 HANSEL AVE ASHE CM 442 8/6/12 \$\$56,17	12962739	CCC FOREST AT BILTMORE PARK LLC	6	1010768	10000	29070	300 LONG SHOALS RD	ASHE	RM	1076	5/6/12	\$64,522
17845204 ARCADIA FARMS INC 4 1165138 10000 2185697 9 TRIDENT DR ARDN CM 1076 3/12/18 \$58,74 13845003 OMNI GROVE PARK INN LLC 8 1009108 10000 18498 29 N COUNTRY CLUB RD ASHE CM 1074 2/18/15 \$57,71 11459718 HULSING HOTELS 2 1010218 10000 2149407 380 HANSEL AVE ASHE CM 442 8/6/12 \$56,17	70247984	CONTINENTAL TEVES	4	1166528	10000	2126767	1 QUALITY WAY	FLET	CM	1010	1/23/12	\$62,169
13845003 OMNI GROVE PARK INN LLC Image: Marcine M	31900050	OMNI GROVE PARK INN LLC	4	1009128	10000	18498	290 MACON AVE	ASHE	CM	1074	4/22/93	\$61,773
11459718 HULSING HOTELS 2 1010218 10000 2149407 380 HANSEL AVE ASHE CM 442 8/6/12 \$56,17	17845204	ARCADIA FARMS INC	4	1165138	10000	2185697	9 TRIDENT DR	ARDN	CM	1076	3/12/18	\$58,746
	13845003	OMNI GROVE PARK INN LLC	8	1009108	10000	18498	29 N COUNTRY CLUB RD	ASHE	CM	1074	2/18/15	\$57,715
12642971 CLERRA NEVADA BREMING CO	11459718	HULSING HOTELS	2	1010218	10000	2149407	380 HANSEL AVE	ASHE	CM	442	8/6/12	\$56,179
	12642971	SIERRA NEVADA BREWING CO	2	101457	10000	20509			MN	823	7/16/14	\$54,987

Economic Optimization for Large Meter Testing Program

Master List Testing Plan Testing Data Testing Outcomes

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Ŧ	Met \Xi	Account =	Service	Customer \Xi	Address =	City 📼	Custon =	Cycle \Xi	Meter Install D =	Annual Consum	Testing Frequency (Y \Xi	Testing Status	Ŧ	Test Date
70264057	4	1010438	10000	2028157	220 DEAVERVIEW RD	ASHE	MN	1074	1/0/00	\$168,477	semi-annual	Tested Once	-	1/8/19
70144051	8	1414948	10000	2192553	155 JACOB HOLM WAY	CDLR	MN	638	8/1/05	\$151,414	semi-annual	Tested Once	+	3/20/19
31955073	6	1009848	10000	2028019	509 BILTMORE AVE	ASHE	HS	1074	1/0/00	\$139,837	semi-annual	Not Testable	•	
14845033	8	1010078	10000	2028069	240 MEADOW RD	ASHE	CM	1074	2015-05-14	\$127,688	annual	Not Tested	*	
28140183	6	1010648	10000	2155269	1301 SAND HILL RD	ASHE	MN	1074	2015-03-13	\$122,430	semi-annual	Not Tested	*	
28140179	6	1031768	10000	12859	91 CRAVEN ST	ASHE	CM	1074	2015-12-08	\$119,245	semi-annual	Not Tested	-	
31957408	3	1009258	10000	2027873	721 WEAVERVILLE RD	ASHE	WН	1074	1992-11-04	\$96,512	semi-annual	Not Testable	•	NO TE
11958851	2	1414948	10000	2192553	155 JACOB HOLM WAY	CDLR	MN	638	8/15/12	\$90,855	semi-annual	Tested Once	•	3/20/19
31911534	6	1011928	10000	2028515	225 W STATE ST	BMTN	WН	1076	1993-05-06	\$88,006	annual	Tested Once	•	1/7/19
1426605	6	1009268	10000	2027875	721 OLD MARSHALL HWY	ASHE	CM	1074	2004-05-03	\$86,247	annual	Not Testable	•	
70240598	4	1009838	10000	2028017	428 BILTMORE AVE	ASHE	HS	1074	2011-02-28	\$81,774	semi-annual	Tested Once	-	2/26/19
11459732	2	1175118	10000	2130275	1617 HENDERSONVILLE RD	ASHE	RM	877	2012-08-01	\$80,234	semi-annual	Tested Once	•	1/9/19
70131941	4	1160758	10000	2123855	1250 SAND HILL RD	CDLR	MN	1074	2006-01-10	\$79,897	semi-annual	Not Testable	•	
12643064	2	101611	10000	2320267	200 KENSINGTON PL	ASHE	RM	1076	2015-02-02	\$79,879	semi-annual	Tested Once	•	1/9/19
11946034	2	1139038	10000	2287521	42 AIRPORT RD	ARDN	RM	822	5/16/12	\$78,169	semi-annual	Not Tested	-	
70252567	4	1010958	10000	2028287	25 OLD SHOALS RD	ASHE	MN	1076	2018-02-05	\$77,737	annual	Tested Once	•	3/19/19
12948582	6	1011338	10000	2028385	1025 HENDERSONVILLE RD	ASHE	WН	1076	2013-02-07	\$77,522	annual	Tested Once	•	3/21/19
12900219	6	1011948	10000	2028519	2913 US 70 HWY	BMTN	CM	1076	2012-03-08	\$77,501	annual	Not Testable	•	
13802356	6	1592708	10000	2027873	721 MOUNT CARMEL RD	ASHE	WН	1074	7/29/13	\$69,509	annual	Not Testable	•	
31955074	6	1011598	10000	2028447	1100 TUNNEL RD	ASHE	HS	1076	6/7/93	\$66,870	annual	Tested Once	-	3/28/19
12948581	6	1011198	10000	2028347	3 D WESLEY DR	ASHE	RM	1076	1/0/00	\$66,230	annual	Not Testable	•	
12962739	6	1010768	10000	29070	300 LONG SHOALS RD	ASHE	RM	1076	2012-05-06	\$64,522	annual	Tested Once	•	3/19/19
70247984	4	1166528	10000	2126767	1 QUALITY WAY	FLET	CM	1010	2012-01-23	\$62,169	annual	Not Testable	•	
31900050	4	1009128	10000	18498	290 MACON AVE	ASHE	CM	1074	1993-04-22	\$61,773	annual	Not Tested	-	
17845204	4	1165138	10000	2185697	9 TRIDENT DR	ARDN	CM	1076	2018-03-12	\$58,746	annual	Tested Once	•	4/1/19
13845003	8	1009108	10000	18498	29 N COUNTRY CLUB RD	ASHE	CM	1074	2015-02-18	\$57,715	2 years	Not Tested	~	
11459718	2	1010218	10000	2149407	380 HANSEL AVE	ASHE	СМ	442	2012-08-06	\$56,179	semi-annual	Tested Once	•	12/12/18
12642971	2	101457	10000	20509		MILL	MN	823	2014-07-16	\$54,987	semi-annual	Tested Once	•	10/22/18
16172160	1.5	1168128	10000	2288047	9 TRIDENT DR	ARDN	CM	634	2016-08-11	\$52,125	annual	Tested Once	•	4/29/19
										Anna anna				0.00110

Economic Optimization for Large Meter Testing Program

Master List Testing Plan Testing Data Testing Outcomes

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Asheville M	eter Testing Program: Data (enter white ce						LOW 1						LOW 2			
serial #	customer	address	test date	Flow Profile Complete (AVL)	Analysis & Outcomes Complete (CAV)	Average Meter Accuracy	Preliminary Revenue Recovery	test rate (gpm)	meter volume (cf)	tester volume (cf)	tester accuracy (from TAG)	meter accuracy	test rate (gpm)	meter volume (cf)	tester volume (cf)	
70244263	AUREL RIDGE PROPERTY OWNERS	0 SUGAR MAPLE DR	3/15/16	Yes 👻	Yes 👻	#DIV/0!	\$0					tbd				
12643052		5000 DAVIS GREY DR	1/27/17	Yes 👻	Yes 👻	93.47%	\$1,334	34	10.2	10	100.60%	102.61%				
11946034 I		42 AIRPORT RD	9/7/17	Dismiss 🔻	n/a 🔻	101.95%	Tested Over	5	1	1	100.80%	100.80%	10	10.2	10	
16172160 (9 TRIDENT DR	9/22/17	Dismiss 🔻	n/a 🔻	101.25%	Tested Over	5	5.1	5	100.80%	102.82%	10	10	10	
12643064 I		200 KENSINGTON PL	9/25/17	Dismiss 🥆	n/a 🔻	101.93%	Tested Over	5	5	5	100.80%	100.80%				
70281299		200 KENSINGTON PL	9/25/17	No 🔻	n/a 🔻	101.35%	Tested Over	70	48.5	50	99.60%	96.61%				
70247984 (1 QUALITY WAY	9/27/17	Dismiss 🔻	n/a 🔻	99.68%	\$196	15	10.04	10	100.20%	100.60%				
70248717		100 VISTA BLVD	9/28/17	No 🔻	n/a 🔻	99.20%	\$57	10	14.96	15	100.20%	99.93%				
10961006		372 DEPOT ST	11/3/17	No 🔻	n/a 🔻	101.25%	Tested Over	1	1	1	100.60%	100.60%	10	10.2	10	
70084385		400 BROADPOINTE DR	11/3/17	Dismiss 🔻	n/a 🔻	98.31%	\$237	5	5.14	5	100.80%	103.62%				
70002760 (100 CIMARRON DR	11/9/17	No 🔻	n/a 🔻	101.59%	Tested Over	5	9.9	10	100.80%	99.79%				
12948581 (3 D WESLEY DR	11/9/17	Yes 🔻	Yes 🔻	52.09%	\$31,733	25	0	10	101.20%	0.00%				
1426605 (721 OLD MARSHALL HWY	11/14/17	Dismiss 🔻	n/a 🔻	101.75%	Tested Over	1	2	2	101.00%	101.00%	5	10	10	
70175645		54 CLUBSIDE DR	11/14/17	No 🔻	n/a 🔻	99.57%	\$97	1	0.95	1	100.60%	95.57%	5	10	10	
70298235 \$		120 ROBERTS LAKE CIR	11/16/17	No 🔻	n/a 🔻	98.43%	\$25	1	1	1	100.70%	100.70%	10	4.9	5	
70084465		890 BREVARD RD	11/16/17	Dismiss 🔻	n/a 🔻	99.25%	\$133	1	1	1	100.70%	100.70%				
31931267		550 NEW AIRPORT RD	11/17/17	No 🔻	n/a 🥆	101.42%	Tested Over	1	0.96	1	100.80%	96.77%				
11459398		1 CLUBWOOD CT	11/17/17	Dismiss 🔻	n/a 🔻	99.81%	\$37	1	1	1	100.60%	100.60%	5	4.9	5	
70190776		1869 HENDERSONVILLE RD	11/17/17	Dismiss 🥆	n/a 🔻	99.79%	\$37	1	0.99	1	100.70%	99.69%				
70149388 I		88 TUNNEL RD	11/22/17	No 🔻	n/a 🔻	100.95%	Tested Over	1	1	1	100.70%	100.70%				
31977266		204 TUNNEL RD	11/27/17	No 🔻	n/a 🔻	98.91%	\$209	1	0.91	1	100.60%	91.55%				
70167558		42 TUNNEL RD	12/4/17	No 🔻	n/a 🥆	100.50%	Tested Over	1	0.95	1	100.70%	95.67%				
70182574 (1 VERDE VISTA CIR	12/4/17	Dismiss 🔻	n/a 🔻	102.46%	Tested Over	1	1	1	100.60%	100.60%				
70240598		428 BILTMORE AVE	12/4/17	Dismiss 🔻	n/a 🔻	97.05%	\$2,414	1	0.93	1	100.60%	93.56%				
11459722		1968 HENDERSONVILLE RD	12/6/17	No 🔻	n/a 🔻	101.30%	Tested Over	1	1	1	100.60%	100.60%				
70177730		1 ROCKY RIDGE RD	12/6/17	No 🔻	n/a 🔻	98.91%	\$218	1	0.94	1	100.70%	94.66%				
13840114		9 TRIDENT DR	12/7/17	No 🔻	n/a 🔻	101.63%	Tested Over	5	5.2	5	100.80%	104.83%	10	12.8	13	
11058850	IONTECITO NORTHVIEW I LO		12/7/17	Vac v	Vac 🔻	88 08%	\$4.919	1	0.5	1	100.60%	50 30%				

Economic Optimization for Large Meter Testing Program

Master List Testing Plan Testing Data

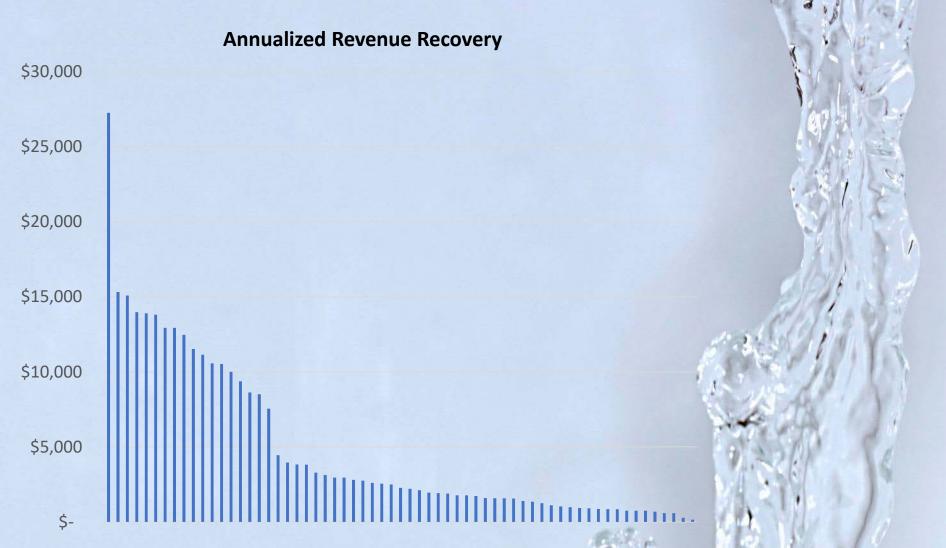
Testing Outcomes

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Serial # \Xi	Customer 👳	Address .	Revenue 😇	Final Composite 🚽 Avg.	Potential Revenue ≂ Recovery	Cost of	Simple - Payback	Action Required	Annualized Revenue Recovery
28140014	BATTERY PARK SENIOR HOUSING	1 BATTLE SQ	\$709	97.5%	\$18	\$1,700	95.9	NO ACTION	\$0
1245335	GSA FINANCE DIV UTILITIES	208 OTIS ST	\$302	92.6%	\$22	\$1,700	76.1	NO ACTION	\$0
70144051	JACOB HOLM INDUSTRIES AMERICA	155 JACOB HOLM WAY	\$151,414	99.7%	\$454	\$1,700	3.7	NO ACTION	\$0
50120058	WINDSOR CAPITAL GROUP INC	31 WOODFIN ST	\$2,748	95.0%	\$137	\$1,700	12.4	NO ACTION	\$0
70246499	SOUTHERN CONCRETE MATERIAL	240 MEADOW RD	\$1,383	88.3%	\$162	\$1,700	10.5	NO ACTION	\$0
70246500	OMNI GROVE PARK INN LLC	29 N CHARLOTTE ST	\$279	87.4%	\$35	\$1,700	48.4	NO ACTION	\$0
70129221	COURTSIDE CONDOS	200 RACQUET CLUB RD	\$-	92.6%	#VALUE!	\$1,700		NO ACTION	\$0
70149383	MILKCO INC	599 DEAVERVIEW RD	\$841	97.4%	\$22	\$1,700	77.7	NO ACTION	\$0
70002762	WARREN WILSON COLLEGE	123 LOWER COLLEGE RD	\$-	94.5%	#VALUE!	\$1,700		NO ACTION	\$0
11459647	THE LAURELS OF GREENTREE RDGE	70 SWEETEN CREEK RD	\$12,228	96.1%	\$481	\$1,700	3.5	NO ACTION	\$0
31960547	GOLDELM AT ASHEVILLE LLC	1680 HENDERSONVILLE RD	\$26,299	94.0%	\$1,578	\$1,700	1.1	REPLACE	\$1,578
13945523	CARMEL RIDGE APARTMENTS	2 CARMEL RIDGE CIR	\$18,170	95.0%	\$909	\$1,700	1.9	REPLACE	\$909
70175645	BEAVERDAM RUN CONDO ASSOC	54 CLUBSIDE DR	\$22,679	90.0%	\$2,268	\$1,700	0.7	REPLACE	\$2,268
12948581	GIVENS ESTATE	3 D WESLEY DR	\$66,230	79.0%	\$13,908	\$1,700	0.1	REPLACE	\$13,908
31977266	SOUTH ASHEVILLE HOTEL ASSOC	204 TUNNEL RD	\$19,244	93.0%	\$1,347	\$1,500	1.1	REPLACE	\$1,347
11958850	MONTECITO NORTHVIEW LLC	1000 VISTA LAKE DR	\$40,402	99.3%	\$283	\$500	1.8	REPLACE	\$283
31955073	MISSION HOSPITAL	509 BILTMORE AVE	\$139,837	90.0%	\$13,984	\$7,500	0.5	REPLACE	\$13,984
11459628	RCG SKYLAND LLC	30 ALLEN AVE	\$10,939	65.0%	\$3,829	\$500	0.1	REPLACE	\$3,829
28140179	NEW BELGIUM BREWING CO.	91 CRAVEN ST	\$119,245	96.8%	\$3,816	\$1,700	0.4	REPLACE	\$3,816
70189808	ASHEVILLE HOUSING AUTH	50 WILBAR AVE	\$14,796	99.0%	\$148	\$250	1.7	REPLACE	\$148
70218343	SUMMIT HOTEL TRS 123 LLC	151 HAYWOOD ST	\$14,063	86.6%	\$1,884	\$1,500	0.8	REPLACE	\$1,884
31940283	LAUREL OF ASHEWOOD MANOR	100 RICEVILLE RD	\$513	92.7%	\$37	\$500	13.4	NO ACTION	\$0
16172159	M REALTY LLC	160 BRADLEY BRANCH RD	\$17,298	20.2%	\$13,811	\$1,700	0.1	REPLACE	\$13,811
31960547	GOLDELM AT ASHEVILLE LLC	1680 HENDERSONVILLE RD	\$26,299	94.0%	\$1,578	\$1,700	1.1	REPLACE	\$1,578
70296188	THE AVALON APARTMENTS	10 AVALON DR	\$102	93.8%	\$6	\$1,700	266.7	NO ACTION	\$0
16172160	C K S PACKAGING INC	9 TRIDENT DR	\$52,125	99%	\$521	\$1,700	3.3	NO ACTION	\$0
11459580	60 N. MARKET CONDO	60 N MARKET ST	\$5,067	99%	\$51	\$1,700	33.6	NO ACTION	\$0
11150500			A7 700	000/	A77	A4 700		NO AOTION	

Economic Optimization for Large Meter Testing Program

Master List Testing Plan Testing Data Testing Outcomes



Economic Optimization for Large Meter Testing Program

Master List Testing Plan Testing Data

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Dashboard

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City of Asheville Large Meter Testing Program

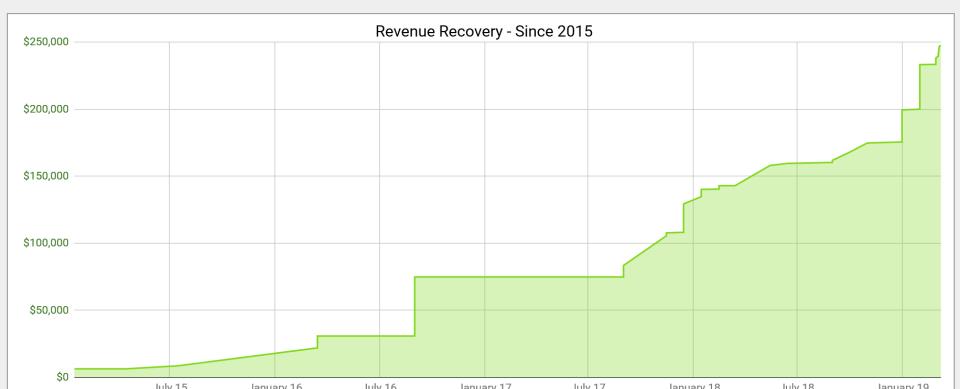
Stewardship Through Innovation

CAVANAUGH

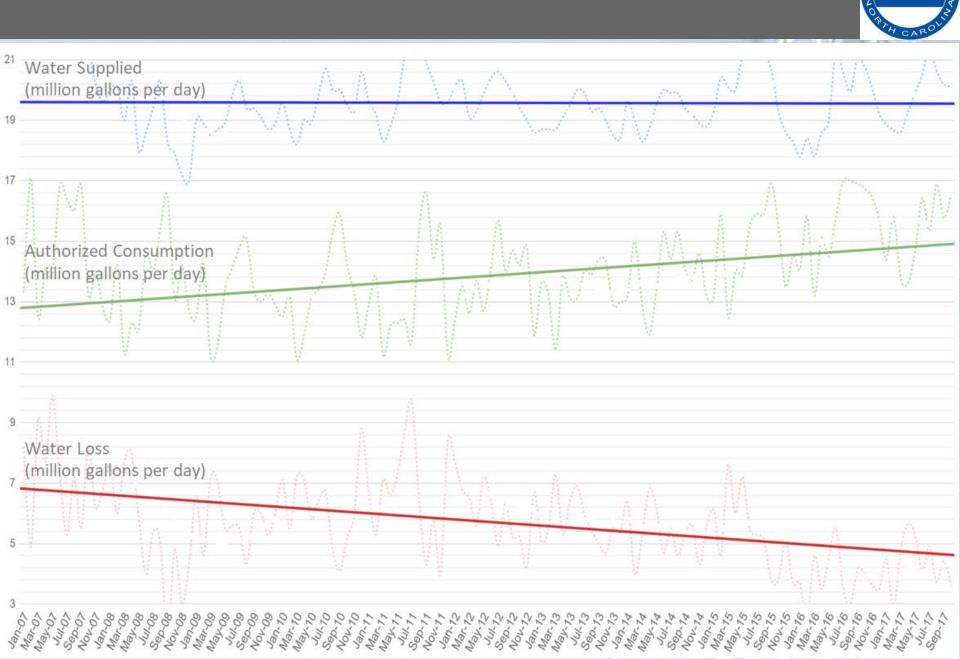
	2019
Total meters to test this year	146
Target year to date	103
Meters tested year to date	48
Percent of target year to date	47%

Since 2015

Meters identified for remedy 63 Revenue recovery to date \$247,503



Cost-Effective Sustainability



Frank Talk

- It takes a village
- It takes time
- Visible tracking is essential
- Revenue-driven intervention







American Water Works Association

NORTH AMERICAN WATER LOSS2019

NASHVILLE, TENNESSEE DECEMBER 3-5

Registration is Open!

www.awwa.org/waterloss

With Support From:







Local Host:



Kentucky/Tennessee Section





WSI 2019

Asheville Takes Commercial Meter Testing Program to Next Level for Real Payback



Relevant Roles:

Chair, AWWA Water Loss Software Subcommittee Chair, North American Water Loss Conference IWA Water Loss Specialist Group, Management Committee Director of Water Efficiency, Cavanaugh

Will Jernigan, P.E. will.jernigan@cavanaughsolutions.com

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